LTPP Information Management System
IMS Quality Control Checks

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Federal Highway Administration
Turner-Fairbank Highway Research Center
Office of Infrastructure Research and Development
6300 Georgetown Pike
McLean, Virginia 22101-2296

U.S. Department of Transportation **Long-Term Pavement Performance**
Federal Highway Administration *Serving your need for durable pavements*

1.0 **INTRODUCTION……** 1-1
1.1 LTPP PROGRAM OVERVIEW 1-1
1.2 THE LTPP DATABASE 1-1
1.3 LTPP DATA AND DATA QUALITY 1-2
1.4 QC/QA PLAN FOR LTPP DATA 1-2
1.5 INTERPRETING RECORD STATUS 1-4
1.6 DOCUMENT ORGANIZATION 1-5

2.0 **INVENTORY QC PROGRAMS……**2-1

2.1 LEVEL 1 2-1
A. Initial Level 2-1
B. Dependency Checks 2-1
C. Minimum Data Elements 2-4
D. Expanded Range Checks 2-6
E. Intramodular Checks 2-12

3.0 **MATERIALS TESTING QC PROGRAMS .....** 3-1

3.1 LEVEL 1 3-1
A. Initial Level 3-1
B. Dependency Checks..... 3-1
C. Minimum Data Elements 3-1
D. Expanded Range Checks 3-12
E. Intramodular Checks 3-64

4.0 **PROFILE QC PROGRAMS .....** 4-1

4.1 LEVEL 1 4-1
A. Initial Level 4-1
B. Dependency Checks 4-1
C. Minimum Data Elements..... 4-1
D. Expanded Range Checks..... 4-1
E. Intramodular Checks 4-2

5.0 **DEFLECTION QC PROGRAMS .....** 5-1

5.1 LEVEL 1 5-1
A. Initial Level 5-1
B. Dependency Checks 5-1
C. Minimum Data Elements 5-1
D. Expanded Range Checks 5-4
E. Intramodular Checks 5-7
5.2 MANUAL UPGRADE GUIDELINES 5-27

6.0 **TRANSVERSE PROFILE AND RUTTING QC PROGRAMS .....** 6-1

6.1 LEVEL 1 6-1
A. Initial Level 6-1
B. Dependency Checks 6-1
C. Minimum Data Elements..... 6-1
D. Expanded Range Checks 6-2
E. Intramodular Checks 6-5

7.0 **SURFACE DISTRESS QC PROGRAMS** 7-1

7.1 LEVEL 1 7-1
A. Initial Level 7-1
B. Dependency Checks 7-1
C. Minimum Data Elements 7-1
D. Expanded Range Checks 7-8
E. Intramodular Checks 7-17

8.0 **FRICTION QC PROGRAMS** 8-1

8.1 LEVEL 1 8-1
A. Initial Level 8-1
B. Dependency Checks 8-1
C. Minimum Data Elements 8-1
D. Expanded Range Checks 8-1
E. Intramodular Checks 8-2

9.0 **MAINTENANCE QC PROGRAMS** 9-1

9.1 LEVEL 1 9-1
A. Initial Level 9-1
B. Dependency Checks 9-1
C. Minimum Data Elements 9-1
D. Expanded Range Checks 9-2
E. Intramodular Checks 9-4

10.0 **REHABILITATION QC PROGRAMS** 10-1

10.1 LEVEL 1 10-1
A. Initial Level 10-1
B. Dependency Checks 10-1
C. Minimum Data Elements 10-1
D. Expanded Range Checks 10-9
E. Intramodular Checks 10-24

11.0 **TRAFFIC QC PROGRAMS** 11-1

11.1 LEVEL 1 11-1
A. Initial Level 11-1
B. Dependency Checks 11-1
C. Minimum Data Elements 11-1
D. Expanded Range Checks 11-3
E. Intramodular Checks 11-7
11.2 MANUAL UPGRADE GUIDELINES 11-24

12.0 **CLIMATIC QC PROGRAMS** 12-1

12.1 LEVEL 1 12-1
A. Initial Level 12-1
B. Dependency Checks 12-1
C. Minimum Data Elements 12-1
D. Expanded Range Checks 12-2
E. Intramodular Checks 12-6

13.0 **SPS1 CONSTRUCTION** 13-1

13.1 LEVEL 1 13-1
A. Initial Level 13-1
B. Dependency Checks 13-1
C. Minimum Data Elements 13-6
D. Expanded Range Checks 13-7
E. Intramodular Checks 13-11

14.0 **SPS2 CONSTRUCTION** 14-1

14.1 LEVEL 1 14-1
A. Initial Level 14-1
B. Dependency Checks 14-1
C. Minimum Data Elements 14-4
D. Expanded Range Checks 14-6
E. Intramodular Checks 14-12

15.0 **SPS3 CONSTRUCTION** 15-1

15.1 LEVEL 1 15-1
A. Initial Level 15-1
B. Dependency Checks 15-1
C. Minimum Data Elements 15-4
D. Expanded Range Checks 15-5
E. Intramodular Checks 15-9

16.0 **SPS4 CONSTRUCTION** 16-1

16.1 LEVEL 1 16-1
A. Initial Level 16-1
B. Dependency Checks 16-1
C. Minimum Data Elements 16-1
D. Expanded Range Checks 16-4
E. Intramodular Checks 16-12

17.0 **SPS5 CONSTRUCTION** 17-1

17.1 LEVEL 1 17-1
A. Initial Level 17-1
B. Dependency Checks 17-1
C. Minimum Data Elements 17-4
D. Expanded Range Checks 17-5
E. Intramodular Checks 17-8

18.0 **SPS6 CONSTRUCTION** 18-1

18.1 LEVEL 1 18-1
A. Initial Level 18-1
B. Dependency Checks 18-1
C. Minimum Data Elements 18-4

D. Expanded Range Checks 18-6
E. Intramodular Checks 18-12

19.0 **SPS7 CONSTRUCTION** 19-1

19.1 LEVEL 1 19-1
A. Initial Level 19-1
B. Dependency Checks 19-1
C. Minimum Data Elements 19-4
D. Expanded Range Checks 19-6
E. Intramodular Checks 19-10

20.0 **SPS8 CONSTRUCTION** 20-1

20.1 LEVEL 1 20-1
A. Initial Level 20-1
B. Dependency Checks 20-1
C. Minimum Data Elements 20-4
D. Expanded Range Checks 20-7
E. Intramodular Checks 20-13

21.0 **SPS9 CONSTRUCTION** 21-1

21.1 LEVEL 1 21-1
A. Initial Level 21-1
B. Dependency Checks 21-1
C. Minimum Data Elements 21-1
D. Expanded Range Checks 21-4
E. Intramodular Checks 21-26

22.0 **SMP QC PROGRAMS** 22-1

22.1 LEVEL 1 22-1
A. Initial Level 22-1
B. Dependency Checks 22-1
C. Minimum Data Elements 22-1
D. Expanded Range Checks 22-5
E. Intramodular Checks 22-10

23.0 **AWS QC PROGRAMS** 23-1

23.1 LEVEL 1 23-1
A. Initial Level 23-1
B. Dependency Checks 23-1
C. Minimum Data Elements 23-1
D. Expanded Range Checks 23-2
E. Intramodular Checks 23-4

24.0 **DLR QC PROGRAMS** 24-1

24.1 LEVEL 1 24-1
A. Initial Level 24-1

B. Dependency Checks 24-1
C. Minimum Data Elements 24-1
D. Expanded Range Checks 24-4
E. Intramodular Checks 24-7

25.0 **ADMINISTRATION TABLES QC PROGRAMS** 25-1

25.1 LEVEL 1 25-1
A. Initial Level 25-1
B. Dependency Checks 25-1
C. Minimum Data Elements 25-1
D. Expanded Range Checks 25-2
E. Intramodular Checks 25-2
25.2 *Guidelines for setting RS fields in the EXPERIMENT_SECTION table* 25-7

26.0 **SPS MISCELLANEOUS** 26-1

26.1 LEVEL 1 26-1
A. Initial Level 26-1
B. Dependency Checks 26-1
C. Minimum Data Elements 26-4
D. Expanded Range Checks 26-4
E. Intramodular Checks 26-5

27.0 **DRAINAGE QC PROGRAMS** 27-1

27.1 LEVEL 1 27-1
A. Initial Level 27-1
B. Dependency Checks 27-1
C. Minimum Data Elements 27-1
D. Expanded Range Checks 27-2
E. Intramodular Checks 27-2

28.0 **GROUND PENETRATING RADAR (GPR) QC PROGRAMS** 28-1

28.1 LEVEL 1 28-1
A. Initial Level 28-1
B. Dependency Checks 28-1
C. Minimum Data Elements 28-1
D. Expanded Range Checks 28-2
E. Intramodular Checks 28-2

APPENDIX A. TEST SECTION DESIGNATIONS A-1
A.1 General Pavement Studies A-1
A.2 Specific Pavement Studies ..... A-**Error! Bookmark not defined.**

APPENDIX B. TABLE OF UNITS B-1

APPENDIX C. DATABASE CONSTRAINTS BY MODULE C-1
Constraints for the Administration (ADM) Module C-1
Constraints for the Automated Weather Station (AWS) Module C3
Constraints for the Climate (CLM) Module C-5

Constraints for the Dynamic Load Response (DLR) Module C-8
Constraints for the Ground Penetrating Radar (GPR) Module C-11
Constraints for the Inventory (INV) Module C-12
Constraints for the Maintenance (MNT) Module C-16
Constraints for the Monitoring (MON) Module C-20
Constraints for the Rehabilitation (RHB) Module C-29
Constraints for the Seasonal Monitoring (SMP) Module C-40
Constraints for the General SPS Information (SPS) Module C-46
Constraints for the SPS1 Construction (SPS1) Module C-47
Constraints for the SPS2 Construction (SPS1) Module C-49
Constraints for the SPS3 Construction (SPS1) Module C-53
Constraints for the SPS4 Construction (SPS1) Module C-56
Constraints for the SPS5 Construction (SPS1) Module C-61
Constraints for the SPS6 Construction (SPS1) Module C-63
Constraints for the SPS7 Construction (SPS1) Module C-67
Constraints for the SPS8 Construction (SPS1) Module C-71
Constraints for the SPS9 Construction (SPS1) Module C-75
Constraints for the Traffic (TRF) Module C-81
Constraints for the Materials Testing (TST) Module C-86

APPENDIX D. DATABASE CODE DEFINITIONS D-1

	Chapter	Last Revision
1.0	INTRODUCTION	November 2011
2.0	INVENTORY QC PROGRAMS	January 2008
3.0	MATERIALS TESTING QC PROGRAMS	October 2009
4.0	PROFILE QC PROGRAMS	December 2007
5.0	DEFLECTION QC PROGRAMS	December 2007
6.0	TRANSVERSE PROFILE AND RUTTING QC PROGRAMS	December 2007
7.0	SURFACE DISTRESS QC PROGRAMS	November 2011
8.0	FRICTION QC PROGRAM	December 2007
9.0	MAINTENANCE QC PROGRAMS	May 2008
10.0	REHABILITATION QC PROGRAMS	December 2007
11.0	TRAFFIC QC PROGRAMS	August 2009
12.0	CLIMATIC QC PROGRAMS	July 2008
13.0	SPS1 CONSTRUCTION	December 2007
14.0	SPS2 CONSTRUCTION	December 2007
15.0	SPS3 CONSTRUCTION	January 2008
16.0	SPS4 CONSTRUCTION	December 2007
17.0	SPS5 CONSTRUCTION	December 2007
18.0	SPS6 CONSTRUCTION	July 2008
19.0	SPS7 CONSTRUCTION	July 2008
20.0	SPS8 CONSTRUCTION	December 2007
21.0	SPS9 CONSTRUCTION	May 2008
22.0	SMP QC PROGRAMS	August 2008
23.0	AWS QC PROGRAMS	December 2007
24.0	DLR QC PROGRAMS	December 2007
25.0	EXPERIMENT_SECTION and MON_CATEGORY QC PROGRAMS	December 2007
26.0	SPS MISCELLANEOUS	January 2008
27.0	DRAINAGE QC PROGRAMS	June 2009
28.0	GPR QC PROGRAMS	December 2007

Appendix A:	Test Section Designations	December 2007
Appendix B:	Table of Units	December 2007
Appendix C:	Database Constraints by Module	October 2009
Appendix D:	Database Code Definitions	October 2009

1.0 INTRODUCTION

1.1 LTPP Program Overview

During the early 1980s, the Transportation Research Board (TRB) of the National Research Council, under the sponsorship of the Federal Highway Administration (FHWA) and with the cooperation of the American Association of State Highway and Transportation Officials (AASHTO), undertook a Strategic Transportation Research Study (STRS) of the deterioration of the Nation's highway and bridge infrastructure system. The study recommended that a Strategic Highway Research Program (SHRP) be initiated to focus research and development activities on improving highway transportation. The study report, published in 1984 as TRB Special Report 202, *America's Highways, Accelerating the Search for Innovation*, recommended six strategic research areas. The Long-Term Pavement Performance (LTPP) Program was one of these areas. During 1985 and 1986, independent contractors developed detailed research plans for SHRP. The detailed research plans were published in may 1986 as a TRB report entitled *Strategic Highway Research Program-Research Plans.*

The LTPP program was envisioned as a comprehensive program to satisfy a wide range of pavement information needs. It draws on technical knowledge of pavements currently available and seeks to develop models that will better explain how pavements perform. It also seeks to gain knowledge of the specific effects on pavement performance of various design features, traffic and environment, materials, construction quality, and maintenance practices. As sufficient data become available, analyses are conducted to provide better performance prediction models for use in pavement design and management; better understanding of the effects of many variables on pavement performance; and new techniques for pavement design, construction, and rehabilitation.

1.2 The LTPP Database

Over its lifetime, the LTPP Project has amassed a large volume of data. These data are maintained on the FHWA's LTPP Information Management System (IMS). The IMS is composed of the Pavement Performance Database (PPDB), and the Ancillary Information Management System (AIMS). The PPDB, is warehoused as a relational Oracle database consisting of carefully designed tables and data elements that are populated through data entry screens and data loader programs. The AIMS is a collection of mostly electronic formatted data and information collected to populate the PPDB. It includes raw and processed data files from field data collection equipment, documents, software, photos, videos, maps, and more.

This document focuses on the automated quality data checks applied to data loaded into the PPDB. This data is released to the public annually. Tables no longer included in the public release remain listed in this document for historical purposes.

The PPDB is organized by data module. Tables in the database are grouped and named based on the type of data they contain. This organization reflects the modularity of the LTPP data. This allows for convenient dissemination and use since many analysts are interested in only a subset of the LTPP data. The data modules contained in the PPDB are listed alphabetically in Table 1. This table provides a brief description of each data module, the associated QC Manual chapter, and the table prefix that is used to label related tables in the database.

1.3 LTPP Data and Data Quality

LTPP data are collected and processed by four regional contractors and a central technical support services contractor (TSSC). The regional contractors have primary responsible for construction and monitoring data for test sections in their region. They load the data into the regional databases, known as the Regional Information Management System (RIMS) or the regional PPDB. Data from the regional databases are uploaded to the central database for consolidation and periodic release to the public. The central TSSC is responsible for collection and processing of climate data for all test sections and dynamic load response data from the SPS2 site in North Carolina. The central TSSC is also responsible for reviewing data collected and processed by the regions and providing database software and programming for operation of the LTPP databases.

From the outset of the LTPP Program, data quality has been considered of paramount importance. Procedures for collecting and processing data were developed and updated over time to promote consistency across regional contractors, laboratories, equipment operators, participating highway agencies, etc. To reinforce these procedures, automated data checks were programmed into the PPDB to detect data anomalies, possible data input errors, referential integrity of integrated data storage structures, and logical relationships between related data elements.

1.4 QC/QA Plan for LTPP Data

The LTPP data quality control/quality assurance (QC/QA) plan follows the logical steps starting with data collection, initial review, data load processing, post-load automated data checks, and review of data upload and processing results.

1. **Data Collection**: Procedures for collecting data are documented in separate publications for data contained each module of the PPDB. These procedures are intended to promote uniformity, accuracy, and quality. For equipment measurements, quality control procedures include routine calibrations, data checks during acquisition, and data checks prior to database loading.

2. **Initial Data Review:** Data are supplied in both electronic and paper formats from participating highway agencies and as measured by contractor field crews. Regional engineers review all data prior to input into the regional databases to check for errors related to field operations, procedures, equipment operations, transcription, etc. The initial data review is intended to catch obvious data collection errors prior to entry into the database. Procedure charts document data management procedures and collection guides are used as references. A formal QC/QA procedure is used by all regional contractors that document all aspects of data collection, processing, and checks.

   In addition, some data are preprocessed before they are entered into the database. For example, the ProQual software is used to check profile data in the field and to flag data anomalies according to: (1) an actual pavement feature, (2) the result of equipment malfunction, or (3) unexplained. PADIAS software performs some QC/QA checks before surface distress data are loaded. The FWDSCAN program is a preprocessor for FWD files. Traffic data is analyzed and summarized before it is loaded into the regional PPDB.

3. **Data Load Checks:** Checks are programmed into the PPDB system to identify errors as data are entered. These checks include mandatory, logic, range, data verification, and other miscellaneous checks. Some checks are performed in the data entry forms, some in the data loader programs, and some are enforced by the database structure/definitions. Examples are provided below:

Verification checks essentially refer to a system-wide QC/QA feature employed to verify that a given STATE_CODE and SHRP_ID combination is a valid LTPP section and that it has not been released from the program. Data entry is restricted in every module to only valid LTPP sections.

Mandatory checks are enforced automatically by the Oracle® database since all key fields (and some others) are defined as NOT NULL. That means that Oracle® will not allow a record to be entered into a table unless each NOT NULL field has a value. Additionally, other fields may be required under certain conditions. In these cases the forms will either require input or will invoke an audible warning and message that the field should be entered.

Range checks ensure that numeric field values fall within a defined range. Some ranges are absolute, e.g., in a sieve analysis, the value must be greater than zero and less than 100 percent passing. Other ranges are warnings, e.g., a lane width is expected to be between 10 and 15. If a number outside of this range is entered, an audible warning and a message is invoked so that the person entering the data may double check the number. Some data fields require input from a list of coded values. For these fields, the data entry form verifies the input value against database tables storing these codes. Undefined codes cannot be entered.

Logic checks are dispersed throughout the system and are intended to ensure data compatibility across tables. For example, if test results for a Bulk Specific Gravity Test on an asphalt core are being entered, the input form checks that the core sample tested matches a core that has already been entered into the database from the field sampling data sheets. Data loader programs perform similar checks before inserting records into related tables.

Construction number (CN) checks fall into the category of miscellaneous checks. As a data record is loaded or input into the database, a CN is assigned to it to indicate the pavement structure of the section at the time the data was collected. This number is determined by comparing various input values with information in the database, usually dates or field sets. Before the automated QC checks are run, a series of SQL scripts are run to update all CNs in the database. The CN is a critical element in some of the automated checks.

4. **Automated Data Checks:** Once data are input into the PPDB, automated data checks are performed. The results of the automated QC process are stored in a coded field named RECORD_STATUS. Originally, five categories of checks (levels A - E) were programmed as described below. Currently, most data modules have only three categories of checks: levels C, D and E.

    a. All data records begin at level A. Originally, random checks of data were performed to ensure correct data transfer from regional databases to central database. This is currently done by comparing record counts before and after a data transfer to the central PPDB. This does not cause a change in record status.
    b. Originally, a set of dependency checks were performed to ensure that basic essential section information had been recorded in the PPDB. These checks have been incorporated into the E level checks for most modules, but still exist for some tables in the TST module.
    c. A minimum data search is performed for critical elements. For example, Inventory data should contain the coordinates of the section, friction data should contain the skid number, and rehabilitation data should have a code entered to

identify each work type activity. In some cases, these checks are implemented by defining the data elements as NOT NULL fields. Without values for these fields, a record cannot be stored.

d. Range checks are applied to certain fields to identify data values that fall outside an expected range.
e. Intramodular checks are employed to verify the consistency of data within a data module. For example, a level E check could be used to verify that there is the correct number of child records to support a master record. Or, a level E check could be used to examine the relationship between fields containing the minimum, mean, and maximum specific gravities of a material. These checks are similar to the logic checks programmed into the system as discussed in item 3.

QC programs are coded for each data module in the PPDB. Some modules have one QC program with all checks included; other modules require multiple programs to implement all checks. For a given module, the QC programs are run consecutively beginning with level B, if applicable. Each record must pass B level checks before it is promoted to a "B" status that is recorded in the RECORD_STATUS field.

All records passing the level B checks are candidates for level C promotion. Once a record passes level C checks, it is assigned a RECORD_STATUS of "C" and is a candidate for level D promotion. This process continues through the level E checks.

The QC programs provide output that shows which records do not pass each check. Once the programs are completed, the regional contractors review the output and resolve any data errors possible. Often, the data entered is accurate and legitimate, but does not pass a QC check. When this occurs, a manual upgrade of the record status can be performed. The QC process should be completed before data is transferred to the central PPDB.

1.5 Interpreting Record Status

Once data has been uploaded to the central PPDB, it becomes available for distribution to the public. Records completing the QC process with a level E status can mean any of the following:

Records have passed all of the data checks.
Records may have failed some data checks; however, they have been manually upgraded after inspection and data editing.
Records may contain errors that have not been detected by the current data review process.

Records with a status of less than E have either not completed the QC process or were left at a lower level of record status because they contained a flaw.

The QC checks applied to LTPP data are limited. It is not possible to inspect all of the data for all types of potential anomalies. As the program evolves and improvements are made to the QC checks, some data previously classified as level E may be reclassified to a lower status.

LTPP data users assume the responsibility for conclusions based on interpretation of data collected by the LTPP program. Level E data should not be considered more reliable than non-level E data. Likewise, non-level E data should not be considered less reliable than level E data. The record status for non-level E data can be used as an indicator of potential issues for these data.

1.6 Document Organization

The remaining chapters of this manual document the automated data checks programmed to be performed on each table in the PPDB. Chapters are organized by data module, and data checks are organized by level (A - E) within each chapter. The level A subsection is used as a placeholder, since there are no automated checks associated with this level. The level B subsection is a placeholder in most chapters where the associated level B checks have been incorporated into level E. Currently all data modules have level C, D, and E checks.

Table 1. Alphabetical Listing of Data Types in PPDB

Data Module*	Table Name Prefix	QC Manual Chapter	Description
Administration	NA	25	This module contains database definition tables, static lookup tables, and metadata tables. The EXPERIMENT_SECTION table contains basic section information and drives most database activities. QC checks are only defined for EXPERIMENT_SECTION, MON_CATEGORY, and SECTION_COORDINATES.
Automated Weather Station	AWS	23	This module contains data collected by the LTPP program from automated weather stations installed on some SPS projects.
Climate	CLM	12	This module contains data collected from offsite weather stations that are used to compute a simulated virtual weather station for LTPP test sections or project sites. Data in this module are updated at 5-year intervals.
Deflection/FWD	MON_DEFL	5	Deflection is a submodule of Monitoring data. It contains data from FWD tests.
Distress	MON_DIS	7	Distress is a submodule of Monitoring data. It contains distress survey data from both manual and film-based (PADIAS) surveys.
Drainage	MON_ DRAIN	27	Drainage is a submodule of Monitoring data. It contains the general site conditions and the results of the inspections of the edge drain system video from selected SPS 1 and 2 project sites.
Dynamic Load Response	DLR	24	This module contains dynamic load response instrumentation data from SPS test sections located in North Carolina and Ohio.

Data Module*	Table Name Prefix	QC Manual Chapter	Description
Friction	MON_ FRICTION	8	Friction is a submodule of Monitoring data. It contains friction measurements taken by participating highway agencies.
Ground Penetrating Radar	GPR	28	This module contains the results of ground penetrating radar measurements of layer thickness performed on a subset of SPS test sections.
Inventory	INV	2	This module contains inventory information for all GPS test sections and for SPS sections originally classified in maintenance and rehabilitation experiments. Tables in this module contain information such as the location of the test section and structure information supplied by the owning State or Provincial agency.
Maintenance	MNT	9	This module contains information on maintenance-type treatments reported by a highway agency that were applied to a test section.
Materials Sampling and Testing	TST	3	This module contains field and laboratory materials testing data.
Profile (Longitudinal)	MON_ PROFILE	4	Longitudinal profile is a submodule of Monitoring data. It contains data collected by an automated profiler or by manual dipstick measurements.
Profile (Transverse)/ RUT	MON_ T_PROF	6	Transverse profile is a submodule of Monitoring data. It contains both transverse profile data and computed transverse profile distortion indices (rut depth) from manual dipstick measurements or the optical Pavement Distress Analysis System (PADIAS) method.
Rehabilitation	RHB	10	This module contains information on rehabilitation treatments.
Seasonal Monitoring Program	SMP	22	This module contains SMP-specific data, such as the onsite air temperature and precipitation data, subsurface temperature and moisture content data, and frost-related measurements.

Data Module*	Table Name Prefix	QC Manual Chapter	Description
SPS Construction	SPS1, SPS2, ..., SPS9, SPS	13 - 21, 26	This module contains construction data for each SPS experiment (1 - 9); a chapter is dedicated to each. There is also a module/chapter for general SPS information.
Traffic	TRF	11	This module contains traffic load, classification, and volume data in the lane the LTPP test section is located. One subset of the module (TRF_MEPDG tables) includes computed parameters that have data summarized for use with the new pavement design guide. A second subset (TRF_ESAL) includes computed ESAL values for the LTPP lane based on available materials and monitored traffic loading data.

***Bolded Data Types comprise the Monitoring data module.**

The appendices to this document contain reference information. Appendix A contains a discussion of test section designations, including a description of GPS and SPS sections and a list of the non-supplemental, or core, sections for each SPS experiment. Appendix B contains a list of units used throughout this document. Appendix C contains a list of database enforced constraints defined in the PPDB. This list indicates which database elements are defined as not null (must be defined for every record), which are part of a primary key (noted with an asterisk), and which are coded values. Coded value lists are provided in Appendix D.

2.0 INVENTORY QC PROGRAMS

2.1 Level 1

Data is present in **INV_*** tables for pavements which were in service at the time of their acceptance into the LTPP program. Data is present on a section basis for GPS experiments. Data representative of an SPS project prior to maintenance or rehabilitation is present if there is no GPS section linked as a control section on the project. Since the information on SPS projects is for pre-construction conditions, only one entry will exist under the project level ID to represent all sections on the project prior to treatment. A project level ID ends in 00. The tables in which such SHRP_IDs are expected are **INV_AGE**, **INV_GENERAL**, **INV_ID** and **INV_LAYER**. Depending on the data collection guidelines for a particular SPS project, data may exist in other **INV_*** tables.

A. Initial Level

Records in the IMS are at Level A when they first enter the system and are set back to A when changes are made to a given record or to selected related records.

B. Dependency Checks

These checks verify that it is possible for a given section or project to have data in the indicated table. Note that for SPS projects, unless there is a significant variation in subgrade or base materials, all data, except for layering, is entered at the PROJECT level. SPS9 projects are the only ones for which there is no section specification data at all.

INV_ADMIX, EXPERIMENT_SECTION
For matching STATE_CODE, SHRP_ID and CONSTRUCTION_NO = 1 in EXPERIMENT_SECTION, either GPS_SPS = 'G' and EXPERIMENT_NO in (3, 4, 5, 7A, 9), or GPS_SPS='S' and EXPERIMENT_NO in (4, 6, 7, 9A, 9P) and **INV**_*.SHRP_ID ends in '00'.

INV_AGE, EXPERIMENT_SECTION
For matching STATE_CODE, SHRP_ID and CONSTRUCTION_NO = 1 in EXPERIMENT_SECTION, either GPS_SPS = 'G' and EXPERIMENT_NO in (1, 2, 3, 4, 5, 6A, 7A, 9), or GPS_SPS = 'S' and EXPERIMENT_NO in (4, 5, 6, 7, 9A, 9P) and **INV**_*.SHRP_ID ends in '00'.

INV_AGGR_COMP, EXPERIMENT_SECTION
For matching STATE_CODE, SHRP_ID and CONSTRUCTION_NO = 1 in EXPERIMENT_SECTION, either GPS_SPS = 'G' and EXPERIMENT_NO in (1, 2, 3, 4, 5, 6A, 7A, 9), or GPS_SPS = 'S' and EXPERIMENT_NO in (4, 5, 6, 7, 9A, 9P) and **INV**_*.SHRP_ID ends in '00'.

INV_AGGR_DUR, EXPERIMENT_SECTION
For matching STATE_CODE, SHRP_ID and CONSTRUCTION_NO = 1 in EXPERIMENT_SECTION, either GPS_SPS = 'G' and EXPERIMENT_NO in (1, 2, 3, 4, 5, 6A, 7A, 9), or GPS_SPS = 'S' and EXPERIMENT_NO in (4, 5, 6, 7, 9A, 9P) and **INV**_*.SHRP_ID ends in '00'.

INV_DEICE_SITE_DATA, EXPERIMENT_SECTION
For matching STATE_CODE, SHRP_ID and CONSTRUCTION_NO = 1 in **EXPERIMENT_SECTION**, GPS_SPS = 'G' and EXPERIMENT_NO in (1, 2, 3, 4, 5, 6A, 7A, 9).

INV_DEICE_TYPES, EXPERIMENT_SECTION
For matching STATE_CODE, SHRP_ID and CONSTRUCTION_NO = 1 in **EXPERIMENT_SECTION**, GPS_SPS = 'G' and EXPERIMENT_NO in (1, 2, 3, 4, 5, 6A, 7A, 9).

INV_GENERAL, EXPERIMENT_SECTION
For matching STATE_CODE, SHRP_ID and CONSTRUCTION_NO = 1 in **EXPERIMENT_SECTION**, either GPS_SPS = 'G' and EXPERIMENT_NO in (1, 2, 3, 4, 5, 6A, 7A, 9), or GPS_SPS = 'S' and EXPERIMENT_NO in (4, 5, 6, 7, 9A, 9P) and **INV**_*.SHRP_ID ends in '00'.

INV_GRADATION, EXPERIMENT_SECTION
For matching STATE_CODE, SHRP_ID and CONSTRUCTION_NO = 1 in **EXPERIMENT_SECTION**, either GPS_SPS = 'G' and EXPERIMENT_NO in (1, 2, 3, 4, 5, 6A, 7A, 9), or GPS_SPS = 'S' and EXPERIMENT_NO in (4, 5, 6, 7, 9A, 9P) and **INV**_*.SHRP_ID ends in '00'.

INV_ID, EXPERIMENT_SECTION
For matching STATE_CODE, SHRP_ID and CONSTRUCTION_NO = 1 in **EXPERIMENT_SECTION**, either GPS_SPS = 'G' and EXPERIMENT_NO in (1, 2, 3, 4, 5, 6A, 7A, 9), or GPS_SPS = 'S' and EXPERIMENT_NO in (4, 5, 6, 7, 9A, 9P) and **INV**_*.SHRP_ID ends in '00'.

INV_LAYER, EXPERIMENT_SECTION
For matching STATE_CODE, SHRP_ID and CONSTRUCTION_NO = 1 in **EXPERIMENT_SECTION**, either (GPS_SPS = 'G' and EXPERIMENT_NO in (1, 2, 3, 4, 5, 6A, 7A, 9), or (GPS_SPS = 'S' and EXPERIMENT_NO in (4, 5, 6, 7)), or (GPS_SPS = 'S' and EXPERIMENT_NO in (9A, 9P) and **INV**_*.SHRP_ID ends in '00').

INV_MAJOR_IMP, EXPERIMENT_SECTION
For matching STATE_CODE, SHRP_ID and CONSTRUCTION_NO = 1 in **EXPERIMENT_SECTION**, either GPS_SPS = 'G' and EXPERIMENT_NO in (1, 2, 3, 4, 5, 6A, 7A, 9), or GPS_SPS = 'S' and EXPERIMENT_NO in (4, 5, 6, 7, 9A, 9P) and **INV**_*.SHRP_ID ends in '00'.

INV_MODIFIER, EXPERIMENT_SECTION
For matching STATE_CODE, SHRP_ID and CONSTRUCTION_NO = 1 in **EXPERIMENT_SECTION**, either GPS_SPS = 'G' and EXPERIMENT_NO in (1, 2, 3, 4, 5, 6A, 7A, 9), or GPS_SPS = 'S' and EXPERIMENT_NO in (4, 5, 6, 7, 9A, 9P) and **INV**_*.SHRP_ID ends in '00'.

INV_PCC_JOINT, EXPERIMENT_SECTION
For matching STATE_CODE, SHRP_ID and CONSTRUCTION_NO = 1 in **EXPERIMENT_SECTION,** either GPS_SPS = 'G' and EXPERIMENT_NO in (3, 4, 5, 7A, 9), or GPS_SPS = 'S' and EXPERIMENT_NO in (4, 6, 7, 9A, 9P) and **INV**_*.SHRP_ID ends in '00'.

INV_PCC_MIXTURE, EXPERIMENT_SECTION
For matching STATE_CODE, SHRP_ID and CONSTRUCTION_NO = 1 in **EXPERIMENT_SECTION**, either GPS_SPS = 'G' and EXPERIMENT_NO in (3, 4, 5, 7A, 9), or GPS_SPS = 'S' and EXPERIMENT_NO in (4, 6, 7, 9A, 9P) and **INV**_*.SHRP_ID ends in '00'.

INV_PCC_STEEL, EXPERIMENT_SECTION

For matching STATE_CODE, SHRP_ID and CONSTRUCTION_NO = 1 in **EXPERIMENT_SECTION**, either GPS_SPS = 'G' and EXPERIMENT_NO in (3, 4, 5, 7A, 9), or GPS_SPS = 'S' and EXPERIMENT_NO in (4, 6, 7, 9A, 9P) and **INV**_*.SHRP_ID ends in '00'.

INV_PCC_STRENGTH, EXPERIMENT_SECTION
For matching STATE_CODE, SHRP_ID and CONSTRUCTION_NO = 1 in **EXPERIMENT_SECTION**, either GPS_SPS = 'G' and EXPERIMENT_NO in (3, 4, 5, 7A, 9), or GPS_SPS = 'S' and EXPERIMENT_NO in (4, 6, 7, 9A, 9P) and **INV**_*.SHRP_ID ends in '00'.

INV_PMA, EXPERIMENT_SECTION
For matching STATE_CODE, SHRP_ID and CONSTRUCTION_NO = 1 in **EXPERIMENT_SECTION**, either GPS_SPS = 'G' and EXPERIMENT_NO in (1, 2, 3, 4, 5, 6A, 7A, 9), or GPS_SPS = 'S' and EXPERIMENT_NO in (4, 5, 6, 7, 9A, 9P) and **INV**_*.SHRP_ID ends in '00'.

INV_PMA_ASPHALT, EXPERIMENT_SECTION
For matching STATE_CODE, SHRP_ID and CONSTRUCTION_NO = 1 in **EXPERIMENT_SECTION**, either GPS_SPS = 'G' and EXPERIMENT_NO in (1, 2, 3, 4, 5, 6A, 7A, 9), or GPS_SPS = 'S' and EXPERIMENT_NO in (4, 5, 6, 7, 9A, 9P) and **INV**_*.SHRP_ID ends in '00'.

INV_PMA_COMPACTION, EXPERIMENT_SECTION
For matching STATE_CODE, SHRP_ID and CONSTRUCTION_NO = 1 in **EXPERIMENT_SECTION**, either GPS_SPS = 'G' and EXPERIMENT_NO in (1, 2, 3, 4, 5, 6A, 7A, 9), or GPS_SPS = 'S' and EXPERIMENT_NO in (4, 5, 6, 7, 9A, 9P) and **INV**_*.SHRP_ID ends in '00'.

INV_PMA_CONSTRUCTION, EXPERIMENT_SECTION
For matching STATE_CODE, SHRP_ID and CONSTRUCTION_NO = 1 in **EXPERIMENT_SECTION**, either GPS_SPS = 'G' and EXPERIMENT_NO in (1, 2, 3, 4, 5, 7A, 9), or GPS_SPS = 'S' and EXPERIMENT_NO in (4, 5, 6, 7, 9A, 9P) and **INV**_*.SHRP_ID ends in '00'.

INV_PMA_ORIG_MIX, EXPERIMENT_SECTION
For matching STATE_CODE, SHRP_ID and CONSTRUCTION_NO = 1 in **EXPERIMENT_SECTION**, either GPS_SPS = 'G' and EXPERIMENT_NO in (1, 2, 3, 4, 5, 6A, 7A, 9), or GPS_SPS = 'S' and EXPERIMENT_NO in (4, 5, 6, 7, 9A, 9P) and **INV**_*.SHRP_ID ends in '00'.

INV_PMA_ROLLER, EXPERIMENT_SECTION
For matching STATE_CODE, SHRP_ID and CONSTRUCTION_NO = 1 in **EXPERIMENT_SECTION**, either GPS_SPS = 'G' and EXPERIMENT_NO in (1, 2, 3, 4, 5, 6A, 7A, 9), or GPS_SPS = 'S' and EXPERIMENT_NO in (4, 5, 6, 7, 9A, 9P) and **INV**_*.SHRP_ID ends in '00'.

INV_SHOULDER, EXPERIMENT_SECTION
For matching STATE_CODE, SHRP_ID and CONSTRUCTION_NO = 1 in **EXPERIMENT_SECTION**, either GPS_SPS = 'G' and EXPERIMENT_NO in (1, 2, 3, 4, 5, 6A, 7A, 9), or GPS_SPS = 'S' and EXPERIMENT_NO in (4, 5, 6, 7, 9A, 9P) and **INV**_*.SHRP_ID ends in '00'.

INV_STABIL, EXPERIMENT_SECTION
For matching STATE_CODE, SHRP_ID and CONSTRUCTION_NO = 1 in **EXPERIMENT_SECTION**, either GPS_SPS = 'G' and EXPERIMENT_NO in (1, 2, 3, 4, 5, 6A, 7A, 9), or GPS_SPS = 'S' and EXPERIMENT_NO in (4, 5, 6, 7, 9A, 9P) and **INV**_*.SHRP_ID ends in '00'.

INV_SUBGRADE, EXPERIMENT_SECTION
For matching STATE_CODE, SHRP_ID and CONSTRUCTION_NO = 1 in **EXPERIMENT_SECTION**, either GPS_SPS = 'G' and EXPERIMENT_NO in (1, 2, 3, 4, 5, 6A, 7A, 9), or GPS_SPS = 'S' and EXPERIMENT_NO in (4, 5, 6, 7, 9A, 9P) and **INV**_*.SHRP_ID ends in '00'.

INV_UNBOUND, EXPERIMENT_SECTION
For matching STATE_CODE, SHRP_ID and CONSTRUCTION_NO = 1 in **EXPERIMENT_SECTION**, either GPS_SPS = 'G' and EXPERIMENT_NO in (1, 2, 3, 4, 5, 6A, 7A, 9), or GPS_SPS = 'S' and EXPERIMENT_NO in (4, 5, 6, 7, 9A, 9P) and **INV**_*.SHRP_ID ends in '00'.

C. Minimum Data Elements

Tables and accompanying fields that must be included in a data record are identified below. Explanations are provided for those fields having certain conditions as to when they are required (i.e., X = always; * = conditionally).

Table	Field	Condition
INV_ADMIX	LAYER_NO	X
INV_AGE[1]	CONSTRUCTION_DATE	X
	FINAL_NO_LANES	* (SPS projects only)
	ORIGINAL_NO_LANES	* (SPS projects only)
	TRAFFIC_OPEN_DATE	X
INV_AGGR_COMP	AGGR_COMP_PERCENT	X
	LAYER_NO	X
INV_AGGR_DUR	LAYER_NO	X
INV_DEICE_SITE_DATA	FREQ_DEICE_APPL	X
	FREQ_SNOW_REMOVAL	X
INV_DEICE_TYPES	No Level C Checks	
INV_GENERAL[2]	LANE_NO	X
	LANE_WIDTH	X
	NO_OF_LANES	* (SPS projects only)
	PAVEMENT_TYPE	X
	SUB_DRAINAGE_TYPE	X
INV_GRADATION	LAYER_NO	X
INV_ID[3]	COUNTY	X

[1] No manual upgrades allowed for dates.

[2] Manual upgrades possible for NO_OF_LANES only.

	ELEVATION	X
	FUNCTIONAL_CLASS	X
INV_LAYER[3]	DESCRIPTION	X
	MATERIAL_TYPE	X
	MEAN_THICKNESS	* - except when DESCRIPTION = 7
INV_MAJOR_IMP	No Level C Checks	
INV_MODIFIER	ASPHALT_MODIFIER_QTY	X
	LAYER_NO	X
INV_PCC_JOINT	AVG_CONTRACTION_SPACING	X
	LAYER_NO	X
INV_PCC_MIXTURE	ENTRAINED_AIR_MEAN	X
	LAYER_NO	X
	MIX_DESIGN_CEMENT	X
	MIX_DESIGN_WATER	X
INV_PCC_STEEL	DESIGN_PERCENT_LONG_STEEL	* - only if MATERIAL_TYPE = 5 or 6 and Experiment is 4, 5, 7A, or 9
	LAYER_NO	X
	REINFORCING_TYPE	* - only if MATERIAL_TYPE = 5 or 6 and Experiment is 4, 5, 7A, or 9
INV_PCC_STRENGTH	COMP_STRENGTH_AGE	* either the age field or the mean field is required
	COMP_STRENGTH_MEAN	* either the age field or the mean field is required
	FLEXURAL_STRENGTH_AGE	* either the age, mean, or type is required
	FLEXURAL_STRENGTH_MEAN	* either the age, mean, or type is required
	FLEXURAL_STRENGTH_TYPE	* either the age, mean, or type is required
	LAYER_NO	X
INV_PMA	LAYER_NO	X
INV_PMA_ASPHALT	ASPHALT_GRADE	X
	LAYER_NO	X
INV_PMA_COMPACTION	LAYER_NO	X

[3] No manual upgrades allowed.

INV_PMA_CONSTRUCTION	LAYER_NO	X
INV_PMA_ORIG_MIX	ANTISTRIP_AGENT_TYPE	X
	ASPHALT_CONTENT_MEAN	X
	LAYER_NO	X
	PCT_AIR_VOIDS_MEAN	X
	SAMPLE_TYPE	X
INV_PMA_ROLLER	LAYER_NO	X
INV_SHOULDER	SH_SURFACE_TYPE	X
INV_STABIL	LAYER_NO	X
INV_SUBGRADE	LAYER_NO	X
INV_UNBOUND	AASHTO_SOIL_CLASS	X
	LAYER_NO	X

D. Expanded Range Checks

Expanded range checks are applied to certain fields to identify data element values that fall outside an expected range. Field names are listed below the bolded table name.

Table	Units	Range
INV_ADMIX		
LAYER_NO		1 – 20
INV_AGGR_COMP		
LAYER_NO		1 – 20
INV_AGE		
CONSTRUCTION_DATE[4]		1956 - 1981
FINAL_NO_LANES		1 – 6
LANE_ADDED_NO		null, 1 – 2
ORIGINAL_NO_LANES[5]		1 – 6
TRAFFIC_OPEN_DATE[6]		1960 - 1991
YEAR_WIDENED[6]		null (SPS project only, not supplementals)

[4] SPS projects only

[5] Null valued SPS projects should be manually upgraded.

[6] SPS projects only

INV_DEICE_SITE_DATA

FREQ_DEICE_APPL		1 - 3
FREQ_SNOW_REMOVAL		1 - 3

INV_DEICE_TYPES

DEICE_DISCONTINUED		1 - 5
DEICE_TYPE		1 - 5
YEAR_DEICE_DISCONTINUED	yr	> 1987

INV_GENERAL

LANE_NO[6]		1
LANE_WIDTH	ft	10 - 15
NO_OF_LANES		1 - 6
SUB_DRAINAGE_TYPE[6]		1 - 7

INV_GRADATION

LAYER_NO		1 - 20

INV_ID

ELEVATION	ft	-290 - 12000
FUNCTIONAL_CLASS[6]		1, 2, 11, 12, 14

INV_LAYER

DESCRIPTION		1 - 11
MATERIAL_TYPE		1 - 85

DESCRIPTION	MATERIAL_TYPE	MIN_THICKNESS MEAN_THICKNESS MAX_THICKNESS STD_DEV_ THICKNESS
1	4, 5, 6	3.0 - 10.0
1	1	0.8 - 5.0
2	all	0.1 - 2.0
3	4, 5, 6	6.0 - 13.0
3	1	0.8 - 20.0
4,5	all	0.0 - 24.0
6	all	0.0 - 48.0
8	all	0.1 - 6.0

INV_MAJOR_IMP

MAJOR_IMP_COST	1000s of $	0 - 999
MAJOR_IMP_QUANTITY		0 - 99999
MAJOR_IMP_THICKNESS	In	0.0 - 50.0

MAJOR_IMP_TYPE		1 - 53
INV_MODIFIER		
ASPHALT_MODIFIER_QTY	%	0.0 - 20.0
ASPHALT_MODIFIER_TYPE		1 - 27
LAYER_NO		1 - 20
INV_PCC_JOINT		
AVG_CONTRACTION_SPACING	ft	0.0 - 150.0
BUILT_IN_EXPANSION_SPACING	ft	40 - 1000
DOWEL_DISTANCE	in	0.0 - 48.0
DOWEL_LENGTH	in	10 - 40
DOWEL_MLTD_SPACING	in	6 - 24
JOINT_SKEWNESS	ft/lane	0.0 - 5.0
LAYER_NO		1 - 20
LONG_SEAL_RESVR_DEPTH	in	0.25 - 5.00[7]
LONG_SEAL_RESVR_WIDTH	in	0.10 - 1.50[8]
ROUND_DOWEL_DIAMETER	in	0.00 - 2.50
SH_TRAFFIC_SEAL_RESVR_DEPTH	in	0.00 - 5.00
SH_TRAFFIC_SEAL_RESVR_WIDTH	in	0.00 - 2.50
SH_TRAFFIC_TIE_BARS_DIAMETER	in	0.10 - 3.00
SH_TRAFFIC_TIE_BARS_LENGTH	in	12 - 60
SH_TRAFFIC_TIE_BARS_SPACING	in	12 - 72
TIE_BAR_DIAMETER	in	0.30 - 3.00
TIE_BAR_LENGTH	in	18 - 60
TIE_BAR_SPACING	in	12.0 - 60.0
TRANS_SEAL_RESVR_DEPTH	in	0.10 - 2.50
TRANS_SEAL_RESVR_WIDTH	in	0.10 - 1.50
INV_PCC_MIXTURE		
COARSE_AGGR_BULK_SPEC_GRAVITY		1.500 - 2.900
ENTRAINED_AIR_MAX	%	4.0 - 10.0
ENTRAINED_AIR_MEAN	%	2.0 - 8.0
ENTRAINED_AIR_MIN	%	0.0 - 6.0
FINE_AGGR_BULK_SPEC_GRAVITY		1.500 - 3.200
LAYER_NO		1 - 20
MIX_DESIGN_WATER	lb/cu yd.	50 - 400
SLUMP_MAX	in	0.5 - 5.0
SLUMP_MEAN	in	0.5 - 5.0
SLUMP_MIN	in	0.5 - 5.0
SLUMP_STD_DEV	in	0.00 - 2.00
INV_PCC_STEEL		
DEPTH_TO_REINFORCEMENT	in	2.0 - 8.0
DESIGN_PERCENT_LONG_STEEL	%	0.20 - 1.00
LAYER_NO		1 - 20
LONG_BAR_DIAMETER	in	0.10 - 1.50
LONG_BAR_SPACING	in	6.0 - 60.0
REINFORCE_YIELD_STRENGTH	ksi	20.0 - 99.9
STEEL_LAP_LENGTH	in	6 - 72

[7] If butt or keyed joints were used without a seal and reservoir, enter 0.00 for LONG_SEAL_RESVR_DEPTH and LONG_SEAL_RESVR_WIDTH and perform manual upgrades.

TRANSVERSE_BAR_DIAMETER	in	0.00 - 3.00
TRANSVERSE_BAR_SPACING	in	6.0 - 48.0

INV_PCC_STRENGTH

COMP_STRENGTH_AGE	days	1 - 120
COMP_STRENGTH_MAX	psi	1000 - 10000
COMP_STRENGTH_MEAN	psi	1000 - 10000
COMP_STRENGTH_MIN	psi	1000 - 10000
COMP_STRENGTH_STD_DEV	psi	0 - 750
ELASTIC_MOD_MAX	ksi	500 - 7800
ELASTIC_MOD_MEAN	ksi	500 - 5000
ELASTIC_MOD_MIN	ksi	500 - 5000
ELASTIC_MOD_STD_DEV	ksi	0 - 2000
FLEXURAL_STRENGTH_AGE	days	0 - 120
FLEXURAL_STRENGTH_MAX	psi	200 - 3000
FLEXURAL_STRENGTH_MEAN	psi	200 - 3000
FLEXURAL_STRENGTH_MIN	psi	200 - 3000
FLEXURAL_STRENGTH_STD_DEV	psi	0.0 - 500.0
LAYER_NO		1 - 20
TENSILE_STRENGTH_AGE	days	1 - 60
TENSILE_STRENGTH_MAX	psi	200 - 1000
TENSILE_STRENGTH_MEAN	psi	200 - 1000
TENSILE_STRENGTH_MIN	psi	100 - 1000
TENSILE_STRENGTH_STD_DEV	psi	0 - 300

INV_PMA

AGGR_COMB_BULK_SPEC		1.500 - 3.000
COARSE_AGGR_BULK_SPEC		1.500 - 2.900
EFFECTIVE_SPEC_GRAVITY		1.500 - 3.000
FINE_AGGR_BULK_SPEC		1.500 - 3.200
GEOL_CLASS_COARSE_AGGR		1 - 22
LAYER_NO		1 - 20
MINERAL_FILLER		1 - 5
MINERAL_FILLER_BULK_SPEC		1.500 - 3.200

INV_PMA_ASPHALT

ASPHALT_GRADE		1 - 40
ASPHALT_SPECIFIC_GRAVITY		0.900 - 1.100
LAB_PENETRATION_77	.1 mm	20 - 400
LAB_RING_BALL_SOFTENING_PT	deg F	50 - 500
LAB_VISCOSITY_140	poise	500 - 10,000
LAB_VISCOSITY_275	centistokes	100.00 - 1200.00
LAYER_NO		1 - 20
ORIG_ASPHALT_VISCOSITY_140	poise	100 - 6,000
ORIG_ASPHALT_VISCOSITY_275	centistokes	50.00 - 1500.00
ORIG_DUCTILITY_77	cm	8 - 175
ORIG_PENETRATION_77	.1 mm	10 - 500
ORIG_RING_BALL_SOFTENING_PT	deg F	50 - 500

INV_PMA_COMPACTION

COMPACTED_THICK	in	0.7 - 8.0
CURING_PERIOD	days	0 - 3

LAYER_NO		1 - 20
MEAN_AIR_TEMP	deg F	30 - 120

INV_PMA_CONSTRUCTION

LAYDOWN_TEMP_MAX	deg F	100 - 350
LAYDOWN_TEMP_MEAN	deg F	100 - 350
LAYDOWN_TEMP_MIN	deg F	100 - 350
LAYDOWN_TEMP_STD_DEV	deg F	0 - 350
LAYER_NO		1 - 20
MEAN_MIXING_TEMP	deg F	100 - 350

INV_PMA_ORIG_MIX

ANTISTRIP_AGENT_AMOUNT	%	0.0 - 10.0
ASPHALT_CONTENT_MAX	%	2.0 - 15.0
ASPHALT_CONTENT_MEAN	%	2.0 - 15.0
ASPHALT_CONTENT_MIN	%	2.0 - 15.0
ASPHALT_CONTENT_STD_DEV	%	0.00 - 4.00
BULK_SPEC_GRAVITY_MAX		1.750 - 2.750
BULK_SPEC_GRAVITY_MEAN		1.600 - 2.600
BULK_SPEC_GRAVITY_MIN		1.600 - 2.600
BULK_SPEC_GRAVITY_STD_DEV		0.000 - 0.500
EFFECTIVE_ASPHALT_CONTENT	%	0.0 - 20.0
HVEEM_STABILITY		15 - 90
LAYER_NO		1 - 20
MARSHALL_FLOW	.01 in	3 - 30
MARSHALL_STABILITY	lb	300 - 9000
MAX_SPEC_GRAVITY		1.500 - 3.200
PCT_AIR_VOIDS_MAX	%	0.3 - 20.0
PCT_AIR_VOIDS_MEAN	%	0.3 - 20.0
PCT_AIR_VOIDS_MIN	%	0.0 - 12.0
PCT_AIR_VOIDS_STD_DEV	%	0.00 - 6.00
TENSILE_STRENGTH_RATIO		0.3 - 1.3

INV_PMA_ROLLER

LAYER_NO		1 - 20
ROLLER_FREQ	vib/min	1000 - 5000
ROLLER_GROSS_WT	tons	5.0 - 35.0
ROLLER_SPEED	mph	0.1 - 20.0
ROLLER_TIRE_PRES	psi	50 - 500

INV_SHOULDER

SH_BASE_THICKNESS	in	0.0 - 20.0
SH_JOINT_SKEWNESS	ft	0.0 - 4.0
SH_PAVED_WIDTH	ft	0 - 12
SH_PCC_AVG_JOINT_SPACING	ft	0 - 15
SH_SURFACE_THICKNESS	in	0.0 - 25.0

INV_STABIL

LAYER_NO		1 - 20
STABIL_AGENT_PERCENT	%	0.0 - 20.0

INV_SUBGRADE

AASHTO_SOIL_CLASS		1 - 12
AVG_RATE_HEAVE	mm/day	0.0 - 30.0
CALIFORNIA_BEARING_RATIO		2 - 60
COMPACTIVE_ENERGY_OTHER	ft-lbs/cu in	5.0 - 50.0
IN_SITU_DRY_DEN_MEAN	%	50 - 150
IN_SITU_DRY_DEN_PCF_MEAN	pcf	90 - 200
IN_SITU_MOISTURE_DW_MEAN	%	10.0 - 50.0
IN_SITU_MOISTURE_OPT_MEAN	%	50.0 - 150.0
LAB_DENSITY_MAX	pcf	80.0 - 150.0
LAB_DENSITY_MIN	pcf	70.0 - 140.0
LAYER_NO		1 - 20
MAXIMUM_LAB_DRY_DENSITY	pcf	50 - 150
OPTIMUM_LAB_MOISTURE_CONTENT	%	0.0 - 30.0
PLASTICITY_INDEX		0 - 70
RELATIVE_DENSITY_MEAN	%	50.0 - 150.0
RESISTANCE		0 - 100
SUBGRADE_REACTION_MODULUS	pci	20 - 500

INV_UNBOUND

CALIFORNIA_BEARING_RATIO		10 - 80
COMPACTIVE_ENERGY	ft-lbs/cu in	5.0 - 50.0
COMP_STRENGTH_MEAN	psi	50 - 2000
IN_SITU_DRY_DEN_MEAN	pcf	75 - 200
IN_SITU_MOISTURE_MEAN	%	0 - 35
LAYER_NO		1 - 20
MAX_LAB_DRY_DENSITY	pcf	75 - 160
MODULUS_SUBGRADE_REACTION	pci	50 - 700
OPTIMUM_LAB_MOISTURE	%	0.0 - 30.0
PLASTIC_LIMIT		0 - 20
RESISTANCE		20 - 100

E. Intramodular Checks

Each E-type check is separated by a single line. In general, each bullet represents a procedure, action, etc., of the check.

Table: INV_ADMIX

- If ADMIXTURE_TYPE = 12 or 13, then ADMIXTURE_TYPE_OTHER must have a value

  Error Message: INV_ADMIX-E-1, If ADMIXTURE_TYPE = 12 or 13, then ADMIXTURE_TYPE_OTHER must be NON-NULL.

- If ADMIXTURE_TYPE != 12 or 13, then ADMIXTURE_TYPE_OTHER must be null

  Error Message: INV_ADMIX-E-1b, If ADMIXTURE_TYPE <> 12 or 13, then ADMIXTURE_TYPE_OTHER must be NULL.

- An equivalent LAYER_NO should exist in **INV_LAYER** with DESCRIPTION = 1, 3 with MATERIAL_TYPE = 4 - 8, 17 - 20, 38, 39 or DESCRIPTION = 5, 6 with MATERIAL_TYPE = 27, 37 - 39, 44, 49

  Error Message: INV_ADMIX-E-2, An equivalent LAYER_NO should exist in INV_LAYER with DESCRIPTION = 1 or 3 with MATERIAL_TYPE = 4 - 8, 17 - 20, 38, 39 or DESCRIPTION = 5, 6 with MATERIAL_TYPE = 27, 37 - 39, 44, 49.

Table: INV_AGE

- CONSTRUCTION_DATE <= TRAFFIC_OPEN_DATE

  Error Message: INV_AGE-E-1 TRAFFIC_OPEN_DATE >= CONSTRUCTION_DATE.

Table: INV_AGGR_COMP

- An equivalent LAYER_NO should exist in **INV_LAYER** with DESCRIPTION = 1, 3, or 5 with MATERIAL_TYPE = 4 - 8, 17 - 20, 38, 39 or DESCRIPTION = 1, 3 - 6, 8, 9 with MATERIAL_TYPE = 1 - 3, 13, 14, 28, 29, 31, 32, 34, 35, 46, 78, 80, 84, 85

  Error Message: INV_AGGR_COMP-E-1, An equivalent LAYER_NO should exist in INV_LAYER with DESCRIPTION = 1, 3, or 5 with MATERIAL_TYPE= 4 - 8, 17 - 20, 38, 39 or DESCRIPTION = 1, 3 - 6, 8, 9 with MATERIAL_TYPE = 1 - 3, 13, 14, 28, 29, 31, 32, 34, 35, 46, 78, 80, 84, 85.

Table: INV_AGGR_DUR

- An equivalent LAYER_NO should exist in **INV_LAYER** with DESCRIPTION = 1, 3, or 5 with MATERIAL_TYPE = 4 - 8, 17 - 20, 38, 39 or DESCRIPTION = 1, 3 - 6, 8, 9 with MATERIAL_TYPE = 1 - 3, 13, 14, 28, 29, 31, 32, 34, 35, 46, 78, 80, 84, 85

  Error Message: INV_AGGR_DUR-E-1, An equivalent LAYER_NO should exist in INV_LAYER with DESCRIPTION = 1, 3, or 5 with MATERIAL_TYPE= 4 - 8, 17 - 20, 38, 39 or DESCRIPTION = 1, 3 - 6, 8, 9 with MATERIAL_TYPE = 1 - 3, 13, 14, 28, 29, 31, 32, 34, 35, 46, 78, 80, 84, 85.

Table: INV_DEICE_SITE_DATA

No Level E Checks

Table: INV_DEICE_TYPES

- When DEICE_TYPE = 5, DEICE_TYPE_OTHER must be non-null

  Error Message: INV_DEICE_TYPES-E-1, If DEICE_TYPE = 5 then DEICE_TYPE_OTHER must be non-null.

- If DEICE_DISCONTINUED exists, then YEAR_DEICE_DISCONTINUED must exist

Error Message: INV_DEICE_TYPES-E-2, If DEICE_DISCONTINUED exists then YEAR_DEICE_DISCONTINUED must be non-null.

Table: INV_GENERAL

- For a given STATE_CODE and SHRP_ID, refer to the **EXPERIMENT_SECTION** table (for a given STATE_CODE, SHRP_ID and CONSTRUCTION_NO = 1) and EXPERIMENT_NO to ensure that EXPERIMENT_NO, PAVEMENT_TYPE, and the top layer of the pavement are compatible with **INV_LAYER**

EXPERIMENT_NO	PAVEMENT_TYPE	DESCRIPTION	MATERIAL_TYPE
1	1	3	1
2	2, 7	3	1
3	11, 14, 17, 20, 23	3	4
4	12, 15, 18, 21, 24	3	5
5	13, 16, 19, 22, 25	3	6
6A	3	1	1
7A	28, 29, 30	1	1
9	31 – 39	1	4 - 6

- If PAVEMENT_TYPE not in above list, give error message of Invalid Pavement Type

- If PAVEMENT_TYPE = 10 or 49, it does not pass the check and the record can only be upgraded manually with a comment added in the comments table

- If SPS 5 project, PAVEMENT_TYPE = 1, 2, 7 (not supplementals)

  Error message: **INV_GENERAL-**E-104: {STATE_CODE, SHRP_ID} pavement type {PAVEMENT_TYPE} invalid for experiment.

- If SPS 6 project, PAVEMENT_TYPE = 17, 18, 20, 21, 23, 24, 28, 29, 51, 52 (not supplementals)

  Error message: **INV_GENERAL**-E-104: {STATE_CODE, SHRP_ID} pavement type {PAVEMENT_TYPE} invalid for experiment.

- If SPS 7 project, PAVEMENT_TYPE = 17 - 25 (not supplementals)

  Error message: **INV_GENERAL-**E-104: {STATE_CODE, SHRP_ID} pavement type {PAVEMENT_TYPE} invalid for experiment.

Table: INV_GENERAL, INV_LAYER

- For a given STATE_CODE and SHRP_ID, refer to the **EXPERIMENT_SECTION** table (for a given STATE_CODE, SHRP_ID and CONSTRUCTION_NO=1 and GPS_SPS and EXPERIMENT_NO), to ensure that EXPERIMENT, PAVEMENT_TYPE, and the top layer of the pavement are compatible with **INV_LAYER**. All checks but those for SPS5, 6 and 7 are one to one. For SPS5, 6 and 7, since the data in **INV_LAYER** is supposed to be entered at the section rather than the project level, the checks should be one to many.

EXPERIMENT	PAVEMENT_TYPE	DESCRIPTION	MATERIAL_TYPE
G1	1	3	1
G2	2, 7	3	1
G3	11, 14, 17, 20, 23	3	4
G4	12, 15, 18, 21, 24	3	5
G5	13, 16, 19, 22, 25	3	6
G6A	3	1	1
G7A	28, 29, 30	1	1
G9	31 – 39	1	4 – 6
S4	17, 20, 23	3	4
S4	18, 21, 24	3	5
S4	17, 18	5	22 - 26, 39 – 41
S4	20, 21	5	28 - 36, 46
S4	23, 24	5	27, 37, 38, 42 -44
S5	1	5	22 - 26, 39 – 42
S5	2	5	28 - 36, 46
S5	7	5	27, 37, 38, 43, 44
S6	17, 20, 23, 28, 51	3	4
S6	18, 21, 24, 29, 52	3	5
S6	17, 18	5	22 - 26, 39 – 41
S6	20, 21	5	28 - 36, 46
S6	23, 24	5	27, 37, 38, 42 – 44
S6	28, 29, 51, 52	1	1
S7	17, 20, 23, 28, 51	3	4
S7	18, 21, 24, 29, 52	3	5
S7	19, 22, 25, 30, 53	3	6
S7	17, 18, 19	5	22 - 26, 39 – 41
S7	20, 21, 22	5	28 - 36, 46
S7	23	5	27, 37, 38, 42 – 44
S7	24, 25	5	27, 37, 38, 42, 44
S7	28 - 30, 51 – 53	1	1
S9A, S9P	1	1	1
S9A, S9P	1, 2	3	1

EXPERIMENT	PAVEMENT_TYPE	DESCRIPTION	MATERIAL_TYPE
S9A, S9P	3	1, 4, 9	1, 2
S9A, S9P	17	3	4
S9A, S9P	18, 24	3	5
S9A, S9P	19	3	5

Ensure that PAVEMENT_TYPE is in the above list (not supplementals).

Error message: **INV_GENERAL-**E-101: {STATE_CODE, SHRP_ID} has invalid pavement type {PAVEMENT_TYPE}.

- If PAVEMENT_TYPE = 10 or 49, it does not pass the check and the record can only be upgraded manually with a comment added in the comments table

  Error message: **INV_GENERAL-**E-102: {STATE_CODE} PAVEMENT_TYPE {PAVEMENT_TYPE} requires comment in COMMENTS_GENERAL with upgrade.

- If SUB_DRAINAGE_TYPE = 7, then SUB_DRAINAGE_TYPE_OTHER must be non-null

  Error message: **INV_GENERAL-**E-103: {STATE_CODE, SHRP_ID} SUB_DRAINAGE_TYPE {SUB_DRAINAGE_TYPE} requires entry in SUB_DRAINAGE_TYPE_OTHER.

- If PAVEMENT_TYPE not valid for Experiment, record does not pass check

  Error Message: **INV_GENERAL-**E-104: Invalid PAVEMENT_TYPE {PAVEMENT_TYPE} for {EXPERIMENT}.

Table: INV_GRADATION

No Level E Checks

Table: INV_ID

- Matching records must not exist in SPS_ID

  Error Message: INV_ID-E-1, matching records must not exist in SPS_ID.

Table: INV_LAYER

All GPS[8]

DESCRIPTION	MATERIAL_TYPE	MIN_THICKNESS MEAN_THICKNESS MAX_THICKNESS STD_DEV_THICKNESS
1	4, 5, 6	3.0 - 10.0
1	1	0.8 - 5.0
2	All	0.1 - 2.0
3	4, 5, 6	6.0 - 13.0
3	1	0.8 - 20.0
4, 5	All	0.0 - 24.0
6	All	0.0 - 48.0
8	All	0.1 - 6.0

- Ensure that MIN_THICKNESS <= MEAN_THICKNESS <= MAX_THICKNESS
- Ensure that STD_DEV_THICKNESS <= 0.5 * (MAX_THICKNESS - MIN_THICKNESS)

Conditions 1 and 2, below, apply to all of the following tables containing GPS experiment-specific checks on DESCRIPTION and MATERIAL_TYPE.

1. The DESCRIPTION code must exist unless proceeded by an “if”.
2. The MATERIAL_TYPE is associated only with the DESCRIPTION that is on the same line of the table.

For sections in the GPS1 Experiment, refer to INV_LAYER:

- Check for the following:

DESCRIPTION	MATERIAL_TYPE
2	71 - 73, 81, 83
9	2
3	1
4	28
5	22, 23, 41
6	22 - 26 or 41 - 43
7	22 - 26 or 41 - 43

- A layer with a DESCRIPTION = 7 must be the first layer (LAYER_NO = 1)

[8] This check moved from Level D section due to the relational and conditional nature of the check to be consistent with specifications guidelines. The code does not need to be modified for GPS at the present time. Checks of this type for SPS projects, however, should be in the Level E QC.

- There cannot be two layers with a DESCRIPTION = 3
- There cannot be two layers with a DESCRIPTION = 5
- There cannot be two layers with a DESCRIPTION = 7
- The uppermost or top layer [MAX(LAYER_NO)] of a pavement structure must have: DESCRIPTION = 2, 3 or 9
- A DESCRIPTION = 4 must not be designated for a layer below a layer(s) with DESCRIPTION = 5 or 6
- A DESCRIPTION = 6 must not be placed above a layer(s) with DESCRIPTION = 5
- A DESCRIPTION = 4 must not be placed directly below a layer(s) with DESCRIPTION = 2 or 9
- A layer with a DESCRIPTION = 9 cannot be placed directly above a layer with a DESCRIPTION = 2
- A DESCRIPTION = 1 (overlay) cannot exist in GPS1
- A DESCRIPTION = 11 (embankment) cannot exist in GPS1

For sections in the GPS2 Experiment, refer to INV_LAYER:

- Check for the following:

DESCRIPTION	MATERIAL_TYPE
2	71 - 73, 81, 83
9	2, 71 - 73
3	1
4	28
5	27 - 39, 42 - 44, 46
6	22 - 26 or 41 - 43
7	51 - 65

- A layer with a DESCRIPTION = 7 must be the first layer (LAYER_NO = 1)
- There cannot be two layers with a DESCRIPTION = 3
- There cannot be two layers with a DESCRIPTION = 5
- There cannot be two layers with a DESCRIPTION = 7
- The uppermost or top layer of a pavement structure must have: DESCRIPTION = 2, 3 or 9
- A DESCRIPTION = 4 must not be designated for a layer below a layer(s) with DESCRIPTION = 5 or 6

- A DESCRIPTION = 6 must not be designated for a layer above a layer(s) with DESCRIPTION = 5
- A DESCRIPTION = 9 must not be designated for a layer directly above a layer(s) with DESCRIPTION = 2
- A DESCRIPTION = 1 (overlay) cannot exist in GPS2
- A DESCRIPTION = 11 (embankment) cannot exist in GPS2

For sections in the GPS3 Experiment, refer to INV_LAYER:

- Check for the following:

DESCRIPTION	MATERIAL_TYPE
3	4
2	71 - 73, 81, 83
5	22 - 24, 26 - 44, 46
6	22 – 44, 46
7	51 - 65

- A layer with a DESCRIPTION = 7 must be the first layer (LAYER_NO = 1)
- There cannot be two layers with a DESCRIPTION = 3
- There cannot be two layers with a DESCRIPTION = 5
- There cannot be two layers with a DESCRIPTION = 7
- The uppermost or top layer of a pavement structure must have a DESCRIPTION = 3
- If a section has DESCRIPTION = 2, then a layer with DESCRIPTION = 5, must exist directly below the layer with DESCRIPTION = 2
- A DESCRIPTION = 6 must not be designated for a layer above a layer(s) with DESCRIPTION = 5
- A DESCRIPTION = 1 (overlay) cannot exist in GPS3
- A DESCRIPTION = 4 (asphalt binder below asphalt surface) cannot exist in GPS3
- A DESCRIPTION = 11 (embankment) cannot exist in GPS3

For sections in the GPS4 Experiment, refer to INV_LAYER:

- Check for the following:

DESCRIPTION	MATERIAL_TYPE
3	5
2	71 - 73, 81, 83
5	22 - 24, 26 - 44, 46

DESCRIPTION	MATERIAL_TYPE
6	22 – 44, 46
7	51 - 65

- A layer with a DESCRIPTION = 7 must be the first layer (LAYER_NO = 1)
- There cannot be two layers with a DESCRIPTION = 3
- There cannot be two layers with a DESCRIPTION = 5
- There cannot be two layers with a DESCRIPTION = 7
- If a section has DESCRIPTION = 7, MATERIAL_TYPE = 51 - 56, then a layer with DESCRIPTION = 5, MATERIAL_TYPE = 22 - 24, 26 - 44, or 46 must exist or a layer with DESCRIPTION = 6, MATERIAL_TYPE = 22 - 24, 26 - 44, or 46 must exist
- If a section has DESCRIPTION = 2, then a layer with DESCRIPTION = 5, must exist directly below the layer with DESCRIPTION = 2
- The uppermost or top layer of a pavement structure must have a DESCRIPTION = 3
- A DESCRIPTION = 6 must not be designated for a layer above a layer(s) with DESCRIPTION = 5
- A DESCRIPTION = 1 (overlay) cannot exist in GPS4
- A DESCRIPTION = 4 (asphalt binder below asphalt surface) cannot exist in GPS4
- A DESCRIPTION = 11 (embankment) cannot exist in GPS4

For sections in the GPS5 Experiment, refer to INV_LAYER:

- Check for the following:

DESCRIPTION	MATERIAL_TYPE
3	6
5	22 - 24, 26 - 44, 46
6	22 – 44, 46
7	51 - 65

- A layer with a DESCRIPTION = 7 must be the first layer (LAYER_NO=1)
- If a section has DESCRIPTION = 7, MATERIAL_TYPE = 51 - 56, then a layer with DESCRIPTION = 5, MATERIAL_TYPE = 22 - 24, 26 - 44, or 46 must exist or a layer with DESCRIPTION = 6, MATERIAL_TYPE = 22 - 24, 26 - 44, or 46 must exist
- There cannot be two layers with a DESCRIPTION = 3
- There cannot be two layers with a DESCRIPTION = 5
- There cannot be two layers with a DESCRIPTION = 7

- The uppermost or top layer of a pavement structure must have a DESCRIPTION = 3
- A DESCRIPTION = 6 must not be designated for a layer above a layer(s) with DESCRIPTION = 5
- A DESCRIPTION = 1 (overlay) cannot exist in GPS5
- A DESCRIPTION = 4 (asphalt binder below asphalt surface) cannot exist in GPS5
- A DESCRIPTION = 11 (embankment) cannot exist in GPS5

For sections in the GPS6A Experiment, refer to INV_LAYER:

- Check for the following:

DESCRIPTION	MATERIAL_TYPE
2	71 - 73, 81, 83
9	2
1	1
8	74, 75, 77
3	1
4	28
5	22, 23, 27 - 39, 41 - 44, 46
6	22 - 26, 41 - 43
7	51 - 65

- A layer with a DESCRIPTION = 7 must be the first layer (LAYER_NO = 1)
- There cannot be two layers with a DESCRIPTION = 1
- There cannot be two layers with a DESCRIPTION = 3
- There cannot be two layers with a DESCRIPTION = 5
- There cannot be two layers with a DESCRIPTION = 7
- With a DESCRIPTION = 1 there must be an underlying layer with a DESCRIPTION= 3
- The uppermost or top layer of a pavement structure must have a DESCRIPTION = 1, 2, 9, or 10
- If DESCRIPTION = 4, that layer cannot be below a layer with DESCRIPTION = 5 or 6
- DESCRIPTION = 9 must not be designated directly above a DESCRIPTION = 10
- DESCRIPTION = 6 must not be designated for a layer above a DESCRIPTION = 5
- MEAN_THICKNESS of overlay must exceed 0.8 inch for DESCRIPTION = 1
- A DESCRIPTION = 11 (embankment) cannot exist in GPS6A

For sections in the GPS7A Experiment, refer to INV_LAYER:

- Check for the following:

DESCRIPTION	MATERIAL_TYPE
2	71 - 73, 81, 83
9	2, 71 - 73
1	1
8	74, 75, 77
3	4 - 6
4	28
5	22 - 24, 26 - 44, 46
6	22 - 24, 26 - 44, 46
7	51 - 65

- A layer with a DESCRIPTION = 7 must be the first layer (LAYER_NO = 1)
- If a section has DESCRIPTION = 7, MATERIAL_TYPE = 51 - 65, then a layer with DESCRIPTION = 5, MATERIAL_TYPE = 22 - 44, or 46 must exist or a layer with DESCRIPTION = 6, MATERIAL_TYPE = 22 - 44, or 46 must exist
- There cannot be two layers with a DESCRIPTION = 1
- There cannot be two layers with a DESCRIPTION = 3
- There cannot be two layers with a DESCRIPTION = 5
- There cannot be two layers with a DESCRIPTION = 7
- With a DESCRIPTION = 1 there must be an underlying layer with a DESCRIPTION = 3
- The uppermost (top layer) of a pavement must have a DESCRIPTION = 1, 2, 9 or 10
- A DESCRIPTION = 9 must not be designated directly above DESCRIPTION = 10
- A DESCRIPTION = 6 must not be designated above a DESCRIPTION = 5
- MEAN_THICKNESS of overlay must exceed 0.8 inch for DESCRIPTION = 1
- A DESCRIPTION = 11 (embankment) cannot exist in GPS7A

For sections in the GPS-9 Experiment, refer to INV_LAYER:

- Check for the following:

DESCRIPTION	MATERIAL TYPE
1	4 – 6
8	71, 77, 78, 79, 80, 85

DESCRIPTION	MATERIAL TYPE
3	4 – 6
5	22 - 24, 26 - 44, or 46
6	21 – 44
7	51 – 65

- A layer with a DESCRIPTION = 7 must be the first layer (LAYER_NO = 1)
- There cannot be two layers with a DESCRIPTION = 1
- There cannot be two layers with a DESCRIPTION = 3
- There cannot be two layers with a DESCRIPTION = 5
- There cannot be two layers with a DESCRIPTION = 7
- With a DESCRIPTION = 1 there must be an underlying layer with a DESCRIPTION = 3
- The uppermost or top layer of a pavement structure must have a DESCRIPTION = 1
- A DESCRIPTION = 6 must not be designated for a layer above a layer(s) with DESCRIPTION = 5
- A DESCRIPTION = 4 cannot exist in GPS-9
- A DESCRIPTION = 11 (embankment) cannot exist in GPS-9

All SPS4, 5, 6, 7 and -9:

(Not supplementals)

DESCRIPTION	MATERIAL_TYPE	MIN_THICKNESS MEAN_THICKNESS MAX_THICKNESS STD_DEV_THICKNESS
2	71 - 73, 81 – 83	0.1 - 1.5
5	22 - 46	3.0 - 24.0
6	22 – 46	4.0 - 47.9
7	51 – 65	null
9	2	0.0 - 2.5
10	11, 12, 71 - 73, 81 – 84	0.0 - 2.0

Error message **INV_LAYER-**E-107

- For non-null values of the variables MIN_THICKNESS <= MEAN_THICKNESS <=

MAX_THICKNESS

Error message **INV_LAYER**-E-117

- For non-null values of the variables STD_DEV_THICKNESS <= 0.5 * (MAX_THICKNESS - MIN_THICKNESS)

  Error message **INV_LAYER-**E-118

Conditions 1 and 2, below, apply to all of the following tables containing SPS experiment-specific checks on DESCRIPTION and MATERIAL_TYPE.

1. The DESCRIPTION code must exist unless preceded by an "if".

2. The MATERIAL_TYPE is associated only with the DESCRIPTION that is on the same line of the table.

For projects in the SPS4 Experiment:

(Not supplementals)

DESCRIPTION	MATERIAL_TYPE	MIN_THICKNESS MEAN_THICKNESS MAX_THICKNESS STD_DEV_THICKNESS
3	4, 5	6.0 - 13.0

Error message: **INV_LAYER-**E-107

- The top layer can only have a DESCRIPTION = 2, 3, 9, 10 (not supplementals)

  Error message: **INV_LAYER-**E-101

- A layer with DESCRIPTION = 3, 4, 5, 6, or 7 must not be above a layer with DESCRIPTION = 2

  Error message: **INV_LAYER-**E-103

- A layer with DESCRIPTION = 4, 5, 6, or 7 must not be above a layer with DESCRIPTION = 3

  Error message: **INV_LAYER-**E-103

- A layer with DESCRIPTION = 5, 6, or 7 must not be above a layer with DESCRIPTION = 4

  Error message: **INV_LAYER-**E-103

- A layer with DESCRIPTION = 6 or 7 must not be above a layer with DESCRIPTION = 5

  Error message: **INV_LAYER-**E-103

- A layer with DESCRIPTION = 7 must not be above a layer with DESCRIPTION = 6

  Error message: **INV_LAYER-**E-103

- For LAYER_NO = 1, the DESCRIPTION must always = 7

  Error message: **INV_LAYER-**E-105

- There must be a layer with a DESCRIPTION of 3

  Error message: **INV_LAYER-**E-110

- There must be a layer with a DESCRIPTION of 5

  Error message: **INV_LAYER-**E-111

- There cannot be two layers with a DESCRIPTION = 3

  Error message: **INV_LAYER-**E-112

- There cannot be two layers with a DESCRIPTION = 5

  Error message: **INV_LAYER-**E-112

- There cannot be two layers with a DESCRIPTION = 7

  Error message: **INV_LAYER**-E-112

- The uppermost or top layer of a pavement structure must have a DESCRIPTION = 3 (not supplementals)

  Error message: **INV_LAYER-**E-116

- If a section has DESCRIPTION = 2, then a layer with DESCRIPTION = 5 must exist directly below the layer with DESCRIPTION = 2 (not supplementals)

  Error message: **INV_LAYER-**E-119

- A DESCRIPTION = 6 must not be designated above a layer(s) with DESCRITION = 5

  Error message: **INV_LAYER-**E-103

- A DESCRIPTION = 1 (overlay) cannot exist in SPS4 (not supplementals)

  Error message: **INV_LAYER-**E-109

- A DESCRIPTION = 11 (embankment) cannot exist in SPS4 (not supplementals)

  Error message: **INV_LAYER-**E-121

For projects in the SPS5 Experiment:

(Not supplementals)

DESCRIPTION	MATERIAL_TYPE	MIN_THICKNESS MEAN_THICKNESS MAX_THICKNESS	STD_DEV_THICKNESS
3	1	0.0 - 10.0	0.0 - 10.0
If 4 (below 3)	1	1.0 - 10.0	0.0 - 10.0

Error message: **INV_LAYER-**E-107

- The top layer can only have a DESCRIPTION = 2, 3, 9, 10 (not supplementals)

  Error message: **INV_LAYER-**E-101

- A layer with DESCRIPTION = 3, 4, 5, 6, 7, or 8 must not be above a layer with DESCRIPTION = 2

  Error message: **INV_LAYER-**E-103

- A layer with DESCRIPTION = 3, 4, 5, 6,7, 8, or 11 must not be above a layer with DESCRIPTION = 9

  Error message: **INV_LAYER-**E-103

- A layer with DESCRIPTION = 3, 4, 5, 6, 7, or 8 must not be above a layer with DESCRIPTION = 10

  Error message: **INV_LAYER-**E-103

- A layer with DESCRIPTION = 4, 5, 6, or 7 must not be above a layer with DESCRIPTION = 3

  Error message: **INV_LAYER-**E-103

- A layer with DESCRIPTION = 5, 6, or 7 must not be above a layer with DESCRIPTION = 4

  Error message: **INV_LAYER-**E-103

- A layer with DESCRIPTION = 6 or 7 must not be above a layer with DESCRIPTION = 5

  Error message: **INV_LAYER-**E-103

- A layer with DESCRIPTION = 7 must not be above a layer with DESCRIPTION = 6 or 11

  Error message: **INV_LAYER-**E-103

- A layer with DESCRIPTION = 1 or 4 cannot be above a layer with DESCRIPTION = 9 and MEAN_THICKNESS > 0 (not supplementals)

  Error message: **INV_LAYER-**E-104

- For LAYER_NO = 1, the DESCRIPTION must always equal 7

  Error message: **INV_LAYER-**E-105

- There cannot be a layer with a DESCRIPTION = 1 (not supplementals)

  Error message: **INV_LAYER-**E-109

- There must be a layer with a DESCRIPTION of 3

  Error message: **INV_LAYER-**E-110

- There must be a layer with a DESCRIPTION of 5

  Error message: **INV_LAYER-**E-111

- There cannot be two layers with a DESCRIPTION of 3

  Error message: **INV_LAYER-**E-112

- There cannot be two layers with a DESCRIPTION of 5

  Error message: **INV_LAYER-**E-112

- There cannot be two layers with a DESCRIPTION of 7

  Error message: **INV_LAYER-**E-112

- There cannot be two layers with a DESCRIPTION of 9

  Error message: **INV_LAYER-**E-112

For projects in the SPS6 Experiment:

(Not supplementals)

DESCRIPTION	MATERIAL_TYPE	MIN_THICKNESS MEAN_THICKNESS MAX_THICKNESS STD_DEV_THICKNESS
3	4, 5	7.0 - 13.0
If 4	1	0.0 - 10.0
If 8	74 – 84	0.1 - 6.0

Error message: **INV_LAYER-**E-107

- The top layer must have DESCRIPTION of 1, 2, 3, 9, or 10

  Error message: **INV_LAYER-**E-122

- A layer with DESCRIPTION = 1 cannot be above a layer with DESCRIPTION = 1 and MEAN_THICKNESS greater than 0 (not supplementals)

  Error message: **INV_LAYER-**E-104

- A layer with DESCRIPTION = 3, 4, 5, 6, 7, or 8 must not be above a layer with DESCRIPTION = 1

  Error message: **INV_LAYER-**E-103

- A layer with DESCRIPTION = 1, 3, 5, 6, 7, or 8 must not be above a layer with DESCRIPTION = 2

  Error message: **INV_LAYER-**E-103

- A layer with DESCRIPTION = 1 or 4 cannot be above a layer with DESCRIPTION = 9 and MEAN_THICKNESS > 0 (not supplementals)

  Error message: **INV_LAYER-**E-104

- A layer with DESCRIPTION = 3, 4, 5, 6, 7, or 8 must not be above a layer with DESCRIPTION = 9

  Error message: **INV_LAYER-**E-103

- A layer with DESCRIPTION = 3, 5, 6, 7, or 8 must not be above a layer with DESCRIPTION = 10

  Error message: **INV_LAYER-**E-103

- A layer with DESCRIPTION = 5, 6, or 7 must not be above a layer with DESCRIPTION = 3

  Error message: **INV_LAYER-**E-103

- A layer with DESCRIPTION = 4 must not be above a layer with DESCRIPTION = 3

  Error message: **INV_LAYER-**E-103

- A layer with DESCRIPTION = 6 or 7 must not be above a layer with DESCRIPTION = 5

  Error message: **INV_LAYER-**E-103

- A layer with DESCRIPTION = 7 cannot be above a layer with DESCRIPTION = 6

  Error message: **INV_LAYER-**E-103

- For LAYER_NO = 1, the DESCRIPTION must always equal 7

  Error message: **INV_LAYER-**E-105

- A layer with a DESCRIPTION of 3 must exist

  Error message: **INV_LAYER-**E-110

- A layer with a DESCRIPTION of 5 must exist

  Error message: **INV_LAYER-**E-111

- There must be a layer with a DESCRIPTION = 5 immediately below a layer with a DESCRIPTION = 3

Error message: **INV_LAYER-**E-108

- There cannot be two layers with a DESCRIPTION of 3

  Error message: **INV_LAYER-**E-112

- There cannot be two layers with a DESCRIPTION of 5

  Error message: **INV_LAYER-**E-112

- There cannot be two layers with a DESCRIPTION of 7

  Error message: **INV_LAYER-**E-112

- There cannot be two layers with a DESCRIPTION of 9

  Error message: **INV_LAYER-**E-112

- A DESCRIPTION = 11 (embankment) cannot exist (not supplementals)

  Error message: **INV_LAYER-**E-121

For projects in the SPS7 Experiment:

(Not supplementals)

DESCRIPTION	MATERIAL_TYPE	MIN_THICKNESS MEAN_THICKNESS MAX_THICKNESS STD_DEV_THICKNESS
3	4, 5, 6	7.0 - 13.0
If 4	1	0.0

Error message: **INV_LAYER-**E-107

- A layer with DESCRIPTION = 3, 4, 5, 6, 7, or 8 must not be above a layer with DESCRIPTION = 1

  Error message: **INV_LAYER-**E-103

- A layer with DESCRIPTION = 1, 3, 4, 5, 6, 7, or 8 must not be above a layer with DESCRIPTION = 2

  Error message: **INV_LAYER-**E-103

- A layer with DESCRIPTION = 3, 5, 6, 7, or 8 must not be above a layer with DESCRIPTION = 9 or 10

  Error message: **INV_LAYER-**E-103

- A layer with DESCRIPTION = 5, 6 or 7 must not be above a layer with DESCRIPTION = 3

Error message: **INV_LAYER-**E-103

- A layer with DESCRIPTION = 3 must not be above a layer with DESCRIPTION = 4

  Error message: **INV_LAYER-**E-103

- A layer with DESCRIPTION = 6 or 7 must not be above a layer with DESCRIPTION = 5

  Error message: **INV_LAYER-**E-103

- A layer with DESCRIPTION = 7 must not be above a layer with DESCRIPTION = 6

  Error message: **INV_LAYER-**E-103

- There must be a layer with DESCRIPTION = 5 directly beneath the layer with DESCRIPTION = 3

  Error message: **INV_LAYER-**E-108

- A layer with DESCRIPTION = 1 cannot have a MEAN_THICKNESS > 0 (not supplementals)

  Error message: **INV_LAYER-**E-113

- A layer with DESCRIPTION = 1 or 4 cannot be above a layer with DESCRIPTION = 9 and MEAN_THICKNESS > 0 (not supplementals)

  Error message: **INV_LAYER-**E-104

- For LAYER_NO = 1, the DESCRIPTION must always equal 7

  Error message: **INV_LAYER-**E-105

- A layer with a DESCRIPTION of 3 must exist

  Error message: **INV_LAYER-**E-110

- A layer with a DESCRIPTION of 5 must exist

  Error message: **INV_LAYER-**E-111

- There cannot be two layers with a DESCRIPTION of 3

  Error message: **INV_LAYER-**E-112

- There cannot be two layers with a DESCRIPTION of 5

  Error message: **INV_LAYER-**E-112

- There cannot be two layers with a DESCRIPTION of 7

  Error message: **INV_LAYER-**E-112

- There cannot be two layers with a DESCRIPTION of 9 with a MEAN_THICKNESS > 0

  Error message: **INV_LAYER-**E-114

- A DESCRIPTION = 11 (embankment) cannot exist (not supplementals)

  Error message: **INV_LAYER-**E-121

For projects in the SPS9 Experiment:

(Not supplementals)

DESCRIPTION	MATERIAL_TYPE	MIN_THICKNESS MEAN_THICKNESS MAX_THICKNESS STD_DEV_THICKNESS
3	1, 4, 5, 6	0.0 - 13.0
4	1	0.0 - 10.0
11	51 - 65	4.0 - 47.9

  Error message: **INV_LAYER-**E-107

- The top layer must have DESCRIPTION of 3 or a DESCRIPTION = 1 or 9 with a MEAN_THICKNESS = 0

  Error message: **INV_LAYER-**E-122

- A layer with DESCRIPTION = 6, 7, or 11 cannot be above a layer with DESCRIPTION = 3 or 5

  Error message: **INV_LAYER-**E-103

- A layer with DESCRIPTION = 5, 6, 7, or 11 cannot be above a layer with DESCRIPTION = 4

  Error message: **INV_LAYER-**E-103

- A layer with DESCRIPTION = 7 or 11 cannot be above a layer with DESCRIPTION = 6 or 8

  Error message: **INV_LAYER-**E-103

- A layer with DESCRIPTION = 3 - 8 or 11 cannot be above a layer with DESCRIPTION = 9

  Error message: **INV_LAYER-**E-103

- A layer with DESCRIPTION = 7 cannot be above a layer with DESCRIPTION = 11

  Error message: **INV_LAYER0**E-103

- For LAYER_NO = 1, the DESCRIPTION must always equal 7

  Error message: **INV_LAYER-**E-105

- There must be a layer with a DESCRIPTION of 3

Error message: **INV_LAYER**-E-110

- There cannot be two layers with a DESCRIPTION of 3

  Error message: **INV_LAYER**-E-112

- There must be a layer with a DESCRIPTION of 4 or 5 directly beneath the layer with a DESCRIPTION of 3

  Error message: **INV_LAYER-**E-115

- There must be a layer with a DESCRIPTION of 5

  Error message: **INV_LAYER**-E-111

- There cannot be two layers with a DESCRIPTION of 5

  Error message: **INV_LAYER**-E-112

- There cannot be two layers with a DESCRIPTION of 7

  Error message: **INV_LAYER**-E-112

- There cannot be two layers with a DESCRIPTION of 9

  Error message: **INV_LAYER**-E-112

Summary of INV_LAYER Error messages:

E-101: {STATE_CODE, SHRP_ID, LAYER_NO} description {DESCRIPTION} is invalid for top layer

E-103: {STATE_CODE, SHRP_ID, LAYER_NO, DESCRIPTION} layer not allowed above layer {LAYER_NO-1} with description {DESCRIPTION (LAYER_NO-1)}

E-104: {STATE_CODE, SHRP_ID, LAYER_NO, DESCRIPTION} above a layer {LAYER_NO-1} with DESCRIPTION {DESCRIPTION} and MEAN_THICKNESS {MEAN_THICKNESS} > 0.

E-105: {STATE_CODE, SHRP_ID} LAYER_NO = 1 must have DESCRIPTION = 7 not {DESCRIPTION}

E-107: {STATE_CODE, SHRP_ID} a mismatch between two or more of description {DESCRIPTION}, material {MATERIAL_TYPE}, mean thickness {MEAN_THICKNESS}, min thickness {MIN_THICKNESS}, max thickness {MAX_THICKNESS}, SD thickness {STD_DEV_THICKNESS}

E-108: {STATE_CODE, SHRP_ID} layer_no {LAYER_NO-1} must be base layer not {DESCRIPTION} below original surface.

E-109: {STATE_CODE, SHRP_ID} no overlay allowed layer_no {LAYER_NO} invalid description {DESCRIPTION}

E-110: {STATE_CODE, SHRP_ID} missing original surface layer

E-111: {STATE_CODE, SHRP_ID} missing base layer

E-112: {STATE_CODE, SHRP_ID} layer_no {LAYER_NOa} and layer_no {LAYER_NOb} both description {DESCRIPTION}

E-113: {STATE_CODE, SHRP_ID, LAYER_NO} overlay must have a thickness = 0 not {MEAN_THICKNESS below overlay {LAYER_NO+1}

E-114: {STATE_CODE, SHRP_ID} layer_no {LAYER_NOa} and layer_no {LAYER_NOb} both non-zero thickness friction courses

E-115: {STATE_CODE, SHRP_ID} layer_no {LAYER_NO} description {DESCRIPTION} not 5 or 6 below layer_no {LAYER_NO+1} original surface

E-116: {STATE_CODE, SHRP_ID, LAYER_NO} top layer must be original surface not description {DESCRIPTION}

E-117: {STATE_CODE, SHRP_ID, LAYER_NO} invalid relation thicknesses min {MIN_THICKNESS} <= mean {MEAN_THICKNESS} <= max {MAX_THICKNESS}

E-118: {STATE_CODE, SHRP_ID, LAYER_NO} Std Dev {STD_DEV_THICKNESS} should be <= 0.5 * {MAX_THICKNESS} - {MIN_THICKNESS}

E-119: {STATE_CODE, SHRP_ID} layer_no {LAYER_NO} seal coat requires base layer for layer {LAYER_NO-1} below not description {DESCRIPTION}

E-120: {STATE_CODE, SHRP_ID} layer_no {LAYER_NO} interlay requires DESCRIPTION = 5 or 6 above as layer_no = {LAYER_NO+1} not description {DESCRIPTION}

E-121: {STATE_CODE, SHRP_ID} no embankment allowed layer_no {LAYER_NO} invalid description {DESCRIPTION}

E-122: {STATE_CODE, SHRP_ID, LAYER_NO} top layer invalid description {DESCRIPTION}

Table: INV_MAJOR_IMP

No Level E Checks

Table: INV_MODIFIER

- An equivalent LAYER_NO should exist in **INV_LAYER** with DESCRIPTION = 1, 3 - 6, 8, or 9, MATERIAL_TYPE = 1 - 3, 9, 10, 28 - 46, 78, 80, 81, or 84

  Error Message: INV_MODIFIER-E-1, An equivalent LAYER_NO should exist in INV_LAYER with DESCRIPTION = 1, 3 - 6, 8 or 9 with MATERIAL_TYPE = 1 - 3, 9, 10, 28 - 46, 78, 80, 81, 84.

Table: INV_PCC_JOINT

- An equivalent LAYER_NO should exist in **INV_LAYER** with DESCRIPTION = 1, 3, or 5 with MATERIAL_TYPE = 4 - 6, 38

Error Message: INV_PCC_JOINT-E-1, An equivalent LAYER_NO should exist in INV_LAYER with DESCRIPTION = 1, 3 - 6, 8 or 9 with MATERIAL_TYPE = 1 - 3, 9, 10, 28 - 46, 78, 80, 81, 84.

Table: INV_PCC_MIXTURE

- An equivalent LAYER_NO should exist in **INV_LAYER** with DESCRIPTION = 1, 3, or 5 with MATERIAL_TYPE = 4 - 6, 38

  Error Message: INV_PCC_MIXTURE-E-1, An equivalent LAYER_NO should exist in INV_LAYER with DESCRIPTION = 1, 3, 5 with MATERIAL_TYPE = 4 - 6, 38.

- Ensure that SLUMP_MIN $\leq$ SLUMP_MEAN $\leq$ SLUMP_MAX

  Error Message: INV_PCC_MIXTURE-E-2, SLUMP_MIN <= SLUMP_MEAN <= SLUMP_MAX.

- Ensure that SLUMP_STD_DEV $\leq$ 0.5 * (SLUMP_MAX - SLUMP_MIN)

  Error Message: INV_PCC_MIXTURE-E-3, SLUMP_STD_DEV <= 0.5 * (SLUMP_MAX - SLUMP_MIN).

- Ensure that ENTRAINED_AIR_MIN $\leq$ ENTRAINED_AIR_MEAN $\leq$ ENTRAINED_AIR_MAX

  Error Message: INV_PCC_MIXTURE-E-4, ENTRAINED_AIR_MIN <= ENTRAINED_AIR_MEAN <= ENTRAINED_AIR_MAX.

Table: INV_PCC_STEEL

- An equivalent LAYER_NO should exist in **INV_LAYER** with DESCRIPTION = 1, 3, or 5 with MATERIAL_TYPE = 5, 6

  Error Message: INV_PCC_STEEL-E-1, An equivalent LAYER_NO should exist in INV_LAYER with DESCRIPTION = 1, 3, 5 with MATERIAL_TYPE = 5, 6.

- Must not have an entry in INV_PCC_STEEL for GPS3

  Error Message: INV_PCC_STEEL-E-2, Must not have an entry in INV_PCC_STEEL for GPS-3.

- Must have REINFORCING_TYPE between 1 and 3 for GPS4 or GPS5

  Error Message: INV_PCC_STEEL-E-3, Must have REINFORCING_TYPE between 1 and 3 for GPS-4 and 5.

Table: INV_PCC_STRENGTH

- An equivalent LAYER_NO should exist in **INV_LAYER** with DESCRIPTION = 1, 3, or 5 with MATERIAL_TYPE = 4 - 6

  Error Message: INV_PCC_STRENGTH-E-1, An equivalent LAYER_NO should exist in INV_LAYER with DESCRIPTION = 1, 3, 5 with MATERIAL_TYPE = 4 - 6.

- Ensure that ELASTIC_MOD_MIN ≤ ELASTIC_MOD_MEAN ≤ ELASTIC_MOD_MAX

  Error Message: INV_PCC_STRENGTH-E-2, The following relationship must exist: ELASTIC_MOD_MIN <= ELASTIC_MOD_MEAN <= ELASTIC_MOD_MAX.

- Ensure that ELASTIC_MOD_STD_DEV ≤ 0.5 * (ELASTIC_MOD_MAX - ELASTIC_MOD_MIN)

  Error Message: INV_PCC_STRENGTH-E-3, ELASTIC_MOD_STD_DEV must be <= 0.5 * (ELASTIC_MOD_MAX - ELASTIC_MOD_MIN).

- Ensure that FLEXURAL_STRENGTH_MIN ≤ FLEXURAL_STRENGTH_MEAN ≤ FLEXURAL_STRENGTH_MAX

  Error Message: INV_PCC_STRENGTH-E-4, The following relationship must exist: FLEXURAL_STENGTH_MIN <= FLEXURAL_STENGTH_MEAN <= FLEXURAL_STENGTH_MAX.

- Ensure that FLEXURAL_STRENGTH_STD_DEV ≤ 0.5 * (FLEXURAL_STRENGTH_MAX - FLEXURAL_STRENGTH_MIN)

  Error Message: INV_PCC_STRENGTH-E-5, FLEXURAL_STENGTH_STD_DEV <= 0.5 * (FLEXURAL_STENGTH_MAX - FLEXURAL_STENGTH_MIN).

- Ensure that COMP_STRENGTH_MIN ≤ COMP_STRENGTH_MEAN ≤ COMP_STRENGTH_MAX

  Error Message: INV_PCC_STRENGTH-E-6, The following relationship must exist: COMP_STRENGTH_MIN <= COMP_STRENGTH_MEAN <= COMP_STRENGTH_MAX.

- Ensure that COMP_STRENGTH_STD_DEV ≤ 0.5 * (COMP_STRENGTH_MAX - COMP_STRENGTH_ MIN)

  Error Message: INV_PCC_STRENGTH-E-7, COMP_STENGTH_STD_DEV <= 0.5 * (COMP_STENGTH_MAX - COMP_STENGTH_MIN).

- Ensure that TENSILE_STRENGTH_MIN ≤ TENSILE_STRENGTH_MEAN ≤ TENSILE_STRENGTH_MAX

  Error Message: INV_PCC_STRENGTH-E-8, The following relationship must exist: TENSILE_STRENGTH_MIN <= TENSILE_STRENGTH_MEAN <= TENSILE_STRENGTH_MAX.

- Ensure that TENSILE_STRENGTH_STD_DEV ≤ 0.5 * (TENSILE_STRENGTH_MAX - TENSILE_STRENGTH_MIN)

  Error Message: INV_PCC_STRENGTH-E-9, TENSILE_STRENGTH_STD_DEV <= 0.5 * (TENSILE_STRENGTH_MAX - TENSILE_STRENGTH_MIN).

- Ensure that COMP_STRENGTH_MAX ≥ FLEXURAL_STRENGTH_MAX ≥ TENSILE_STRENGTH_MAX

Error Message: INV_PCC_STRENGTH-E-10, The following relationship must exist: COMP_STRENGTH_MAX >= FLEXURAL_STRENGTH_MAX >= TENSILE_STRENGTH_MAX.

- Ensure that COMP_STRENGTH_MIN ≥ FLEXURAL_STRENGTH_MIN ≥ TENSILE_STRENGTH_MIN

  Error Message: INV_PCC_STRENGTH-E-11, The following relationship must exist: COMP_STRENGTH_MIN >= FLEXURAL_STRENGTH_MIN >= TENSILE_STRENGTH_MIN.

- Ensure that COMP_STRENGTH_MEAN ≥ FLEXURAL_STRENGTH_MEAN ≥ TENSILE_STRENGTH_MEAN

  Error Message: INV_PCC_STRENGTH-E-12, The following relationship must exist: COMP_STRENGTH_MEAN >= FLEXURAL_STRENGTH_MEAN >= TENSILE_STRENGTH_MEAN.

Table: INV_PMA

- An equivalent LAYER_NO should exist in **INV_LAYER** with DESCRIPTION = 1, 3 - 6, 8, or 9, MATERIAL_TYPE = 1 - 3, 9, 10, 28 - 46, 78, 80, 81, or 84

  Error Message: INV_PMA-E-1, An equivalent LAYER_NO should exist in INV_LAYER with DESCRIPTION = 1, 3 - 6, 8 or 9 with MATERIAL_TYPE = 1 - 3, 9, 10, 28 - 46, 78, 80, 81, 84.
- If MINERAL_FILLER = 5, then MINERAL_FILLER_OTHER should have a value

  Error Message: INV_PMA-E-2, If MINERAL_FILLER = 5, then MINERAL_FILLER_OTHER should have a value.

Table: INV_PMA_ASPHALT

- A LAYER_NO should exist in **INV_LAYER** with DESCRIPTION = 1, 3 - 6, 8, or 9, MATERIAL_TYPE = 1 - 3, 9, 10, 28 - 46, 78, 80, 81, or 84

  Error Message: INV_PMA_ASPHALT-E-1, An equivalent LAYER_NO should exist in INV_LAYER with DESCRIPTION = 1, 3 - 6, 8 or 9 with MATERIAL_TYPE = 1 - 3, 9, 10, 28 - 46, 78, 80, 81, 84.

- If ASPHALT_GRADE = 17, 35, or 41, then ASPHALT_GRADE_OTHER should have a value

  Error Message: INV_PMA_ASPHALT-E-2, If ASPHALT_GRADE = 17, 35 or 41, then ASPHALT_GRADE_OTHER should have a value.

- If SOURCE = 77 then SOURCE_OTHER should have a value

  Error Message: INV_PMA_ASPHALT-E-3, If SOURCE = 77, then SOURCE_OTHER should have a value.

- Ensure that ORIG_ASPHALT_VISCOSITY_140 > ORIG_ASPHALT_VISCOSITY_275

  Error Message: INV_PMA_ASPHALT-E-4, ORIG_ASPHALT_VISCOSITY_140 > ORIG_ASPHALT_VISCOSITY_275.

- Ensure that ORIG_PENETRATION_77 > ORIG_PENETRATION_39

  Error Message: INV_PMA_ASPHALT-E-5, ORIG_PENETRATION_77 > ORIG_PENETRATION_39.

- Ensure that ORIG_DUCTILITY_77 > ORIG_DUCTILITY_39

  Error Message: INV_PMA_ASPHALT-E-6, ORIG_DUCTILITY_77 > ORIG_DUCTILITY_39.

- Ensure that LAB_VISCOSITY_140 > LAB_VISCOSITY_275

  Error Message: INV_PMA_ASPHALT-E-7, LAB_VISCOSITY_140 > LAB_VISCOSITY_275.

- Ensure that LAB_PENETRATION_77 > LAB_PENETRATION_39

  Error Message: INV_PMA_ASPHALT-E-8, LAB_PENETRATION_77 > LAB_PENETRATION_39.

- Ensure that LAB_DUCTILITY_77 > LAB_DUCTILITY_39

  Error Message: INV_PMA_ASPHALT-E-9, LAB_DUCTILITY_77 > LAB_DUCTILITY_39.

Table: INV_PMA_COMPACTION

- An equivalent LAYER_NO should exist in **INV_LAYER** with DESCRIPTION = 1, 3 - 6, 8, or 9, MATERIAL_TYPE = 1 - 3, 9, 10, 28 - 46, 78, 80, 81, or 84

  Error Message: INV_PMA_COMPACTION-E-1, An equivalent LAYER_NO should exist in INV_LAYER with DESCRIPTION = 1, 3 - 6, 8 or 9 with MATERIAL_TYPE = 1 - 3, 9, 10, 28 - 46, 78, 80, 81, 84.

Table: INV_PMA_CONSTRUCTION

- An equivalent LAYER_NO should exist in **INV_LAYER** with DESCRIPTION = 1, 3 - 6, 8, or 9, MATERIAL_TYPE = 1 - 3, 9, 10, 28, 29, 31, 32, 34, 35, 46, 77, 78, 80, or 84

  Error Message: INV_PMA_CONSTRUCTION-E-1, An equivalent LAYER_NO should exist in INV_LAYER with DESCRIPTION = 1, 3 - 6, 8 or 9 with MATERIAL_TYPE = 1 - 3, 9, 10, 28, 29, 31, 32, 34, 35, 46, 77, 78, 80, 84.

- Ensure that LAYDOWN_TEMP_MIN $\leq$ LAYDOWN_TEMP_MEAN $\leq$ LAYDOWN_TEMP_MAX

  Error Message: INV_PMA_CONSTRUCTION-E-2, LAYDOWN_TEMP_MIN <= LAYDOWN_TEMP_MEAN <= LAYDOWN_TEMP_MAX.

- Ensure that LAYDOWN_TEMP_STD_DEV $\leq$ 0.5 * (LAYDOWN_TEMP_MAX - LAYDOWN_TEMP_MIN)

  Error Message: INV_PMA_CONSTRUCTION-E-3, LAYDOWN_TEMP_STD_DEV <= 0.5 * (LAYDOWN_TEMP_MAX - LAYDOWN_TEMP_MIN).

Table: INV_PMA_ORIG_MIX

- An equivalent LAYER_NO should exist in **INV_LAYER** with DESCRIPTION = 1, 3 - 6, 8, or 9, MATERIAL_TYPE = 1 - 3, 9, 10, 28 - 35, 46, 77, 78, 80, 81, or 84

  Error Message: INV_PMA_ORIG_MIX-E-1, An equivalent LAYER_NO should exist in INV_LAYER with DESCRIPTION = 1, 3 - 6, 8 or 9 with MATERIAL_TYPE = 1 - 3, 9, 10, 28, 29, 31, 32, 34, 35, 46, 77, 78, 80, 84.

- If ANTISTRIP_AGENT_TYPE = 70, then ANTISTRIP_AGENT_TYPE_OTHER must have a value

  Error Message: INV_PMA_ORIG_MIX-E-2, In INV_PMA_ORIG_MIX, if antistrip_agent_type = 70 then ANTISTRIP_AGENT_TYPE_OTHER must be non-null.

- Ensure that BULK_SPEC_GRAVITY_MIN $\leq$ BULK_SPEC_GRAVITY_MEAN $\leq$ BULK_SPEC_GRAVITY_MAX

- Ensure that BULK_SPEC_GRAVITY_STD_DEV $\leq$ 0.5 * (BULK_SPEC_GRAVITY_MAX - BULK_SPEC_GRAVITY_MIN)

- Ensure that ASPHALT_CONTENT_MIN $\leq$ ASPHALT_CONTENT_MEAN $\leq$ ASPHALT_CONTENT_MAX

- Ensure that ASPHALT_CONTENT_STD_DEV $\leq$ 0.5 * (ASPHALT_CONTENT_MAX - ASPHALT_CONTENT_MIN)

- Ensure that PCT_AIR_VOIDS_MIN $\leq$ PCT_AIR_VOIDS_MEAN $\leq$ PCT_AIR_VOIDS_MAX

- Ensure that PCT_AIR_VOIDS_STD_DEV $\leq$ 0.5 * (PCT_AIR_VOIDS_MAX - PCT_AIR_VOIDS_MIN)

- Ensure that MAX_SPEC_GRAVITY > BULK_SPEC_GRAVITY_MAX

Table: INV_PMA_ROLLER

- An equivalent LAYER_NO should exist in **INV_LAYER** with DESCRIPTION = 1, 3 - 6, 8, or 9, MATERIAL_TYPE = 1 - 3, 9, 10, 28, 29, 31, 32, 34, 35, 46, 77, 78, 80, 84

Table: INV_SHOULDER

No Level E checks.

Table: INV_STABIL

- If STABIL_AGENT_TYPE = 8, then STABIL_AGENT_TYPE_OTHER must have a value

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Tables: INV_STABIL, INV_LAYER

- For matching STATE_CODE, SHRP_ID, LAYER_NO, check that the STABIL_AGENT_TYPE in INV_STABIL conforms with MATERIAL_TYPE from **INV_LAYER** as follows:

(INV_STABIL) STABIL_AGENT_TYPE	**(INV_LAYER)** MATERIAL_TYPE
1	28 - 36, 39, 46
2, 3	30, 33, 46
4	27, 37, 38, 43, 49
5	42
6, 7	44

Table: INV_SUBGRADE

- Ensure that IN_SITU_DRY_DEN_MIN ≤ IN_SITU_DRY_DEN_MEAN ≤ IN_SITU_DRY_DEN_MAX
- Ensure that IN_SITU_DRY_DEN_STD_DEV ≤ 0.5 * (IN_SITU_DRY_DEN_MAX - IN_SITU_DRY_DEN_MIN)
- Ensure that IN_SITU_MOISTURE_DW_MIN ≤ IN_SITU_MOISTURE_DW_MEAN ≤ IN_SITU_MOISTURE_DW_MAX
- Ensure that IN_SITU_MOISTURE_DW_STD_DEV ≤ 0.5 * (IN_SITU_MOISTURE_DW_MAX - IN_SITU_MOISTURE_DW_MIN)
- Ensure that IN_SITU_MOISTURE_OPT_MIN ≤ IN_SITU_MOISTURE_OPT_MEAN ≤ IN_SITU_MOISTURE_OPT_MAX
- Ensure that IN_SITU_MOISTURE_OPT_STD_DEV ≤ 0.5 * (IN_SITU_MOISTURE_OPT_MAX - IN_SITU_MOISTURE_OPT_MIN)
- Ensure that RELATIVE_DENSITY_MIN ≤ RELATIVE_DENSITY_MEAN ≤ RELATIVE_DENSITY_MAX
- Ensure that RELATIVE_DENSITY_STD_DEV ≤ 0.5 * (RELATIVE_DENSITY_MAX - RELATIVE_DENSITY_MIN)
- Ensure that LAB_DENSITY_MIN ≤ LAB_DENSITY_MAX
- Ensure that 99 * (IN_SITU_DRY_DEN_PCF_MAX / MAXIMUM_LAB_DRY_DENSITY) ≤ IN_SITU_DRY_DEN_MAX ≤ 101 * (IN_SITU_DRY_DEN_PCF_MAX / MAXIMUM_LAB_DRY_DENSITY)
- Repeat for respective MEAN and MIN values
- Ensure that 99 * (IN_SITU_MOISTURE_DW_MAX / OPTIMUM_LAB_MOISTURE_CONTENT) ≤ IN_SITU_MOISTURE_OPT_MAX ≤ 101 * (IN_SITU_MOISTURE_DW_MAX / OPTIMUM_LAB_MOISTURE_CONTENT)
- Repeat for respective MEAN and MIN values
- A LAYER_NO should exist in **INV_LAYER** with DESCRIPTION = 7 with MATERIAL_TYPE = 51 - 65

Table: INV_UNBOUND

Extract RECORD_STATUS, NO_40_PASSING, and NO_200_PASSING from **INV_GRADATION** for matching STATE_CODE, SHRP_ID and LAYER_NO.

Extract PLASTICITY_INDEX, LIQUID_LIMIT, and PLASTIC_LIMIT from **INV_UNBOUND**.

Extract AASHTO_SOIL_CLASS from **INV_UNBOUND**.

- Generate a value of GI based on the following calculations

  F = NO_200_PASSING
  LL = Liquid Limit
  PI = Plasticity Index
  GI = (F - 35) [0.2 + 0.005 (LL - 40)] + 0.01 (F - 15) (PI - 10)

  If GI < 0, then GI = 0; if GI > 20, then GI = 20

If RECORD_STATUS $\geq$ 'D', then the value of AASHTO_SOIL_CLASS in **INV_UNBOUND** must match the criteria in the following table:

AASHTO SOIL CLASS	NO. 40 PASSING	NO. 200 PASSING	PLASTICITY INDEX	GI	LIQUID LIMIT	LIQ. LIM.-PLASTICITY INDEX
01	<30	<15	< 6	0		
02	<50	<25	< 6	0		
03	>50	<10	NP	0		
04		<35	<10	0	<40	
05		<35	<10	0	>40	
06		<35	>10	< 4	<40	
07		<35	>10	< 4	>40	
08		>35	<10	< 8	<40	
09		>35	<10	<12	>40	
10		>35	>10	<16	<40	
11		>35	>10	<20	>40	>30
12		>35	>10	<20	>40	<30

If the check indicates that the AASHTO_SOIL_CLASS does not meet the criteria above, a message statement indicating that "AASHTO_SOIL_CLASS does not match gradation and Atterberg data" is appropriate.

- Ensure that IN_SITU_DRY_DEN_MIN $\leq$ IN_SITU_DRY_DEN_MEAN $\leq$ IN_SITU_DRY_DEN_MAX

- Ensure that IN_SITU_DRY_DEN_STD_DEV $\leq$ 0.5 * (IN_SITU_DRY_DEN_MAX - IN_SITU_DRY_DEN_MIN)

- Ensure that IN_SITU_MOISTURE_MIN $\leq$ IN_SITU_MOISTURE_MEAN $\leq$ IN_SITU_MOISTURE_MAX

- Ensure that IN_SITU_MOISTURE_STD_DEV ≤ 0.5 * (IN_SITU_MOISTURE_MAX - IN_SITU_MOISTURE_MIN)

- Ensure that COMP_STRENGTH_MIN ≤ COMP_STRENGTH_MEAN ≤ COMP_STRENGTH_MAX

- Ensure that COMP_STRENGTH_STD_DEV ≤ 0.5 * (COMP_STRENGTH_MAX - COMP_STRENGTH_MIN)

- An equivalent LAYER_NO should exist in **INV_LAYER** with DESCRIPTION = 5, 6, 8, OR 11, with MATERIAL_TYPE = 22 - 27, 30, 33, 36 - 39, 44, 46, 49, 79, (in addition, DESCRIPTION = 11 can have MATERIAL_TYPE = 51 - 65)

- If all three Atterberg limits are present, ensure that LIQUID_LIMIT - PLASTIC_LIMIT = PLASTICITY_INDEXIf all three Atterberg limits are present, ensure that LIQUID_LIMIT - PLASTIC_LIMIT = PLASTICITY_INDEX

3.0 MATERIALS TESTING QC PROGRAMS

3.1 Level 1

A. Initial Level

Records in the IMS are at Level A when they first enter the system and are set back to A when changes are made to a given record or to selected related records.

B. Dependency Checks

Dependency checks (B) are performed on records at level A. For the Materials Testing data, the dependency checks are:

- For a given record in the **TST_UG07_SS07_*** tables, check to make sure that all existing records in **TST_SAMPLE_LOG** with matching STATE_CODE, SHRP_ID, CONSTRUCTION_NO, and SAMPLE_NO are at level E
- No B level checks on other **TST_*** tables

C. Minimum Data Elements

Tables and accompanying fields that must be included in a data record are identified below. Explanations are provided for those fields having certain conditions as to when they are required (i.e., X = always; * = conditionally).

Table	Field	Condition
TST_AC_MOIST_DAMAGE	CORE_DIAM	X
	CORE_THICK	X
	HEIGHT_STRIP_PEN	X
	SAMPLE_NO	X
	STRIP_RATING_C	X
	STRIP_RATING_F	X
	STRIP_RATING_P	X
	STRIP_RATING_PCF	X
TST_AC01	CORE_AVG_THICKNESS	
	not required if VISUAL_ EXAM = 07; must be null	
	SAMPLE_NO	X
TST_AC01_LAYER	LAYER_DESCRIPTION	X
TST_AC02	BSG	
	*N/A if COMMENT_* = 7 or 15	
	WATER_ABS	*
	SAMPLE_NO	X

TST_AC03	MAX_SPEC_GRAVITY	X
	SAMPLE_NO	X
TST_AC04	ASPHALT_CONTENT_MEAN	X
	SAMPLE_NO	X
TST_AC05	BSG_AFTER_MOLDING_1_U	X
	BSG_AFTER_MOLDING_2_U	X
	BSG_AFTER_MOLDING_3_U	X
	BSG_AFTER_MOLDING_4_C	X
	BSG_AFTER_MOLDING_5_C	X
	BSG_AFTER_VAC_SATURATION_4_C	X
	BSG_AFTER_VAC_SATURATION_5_C	X
	COARSE_AGG_STRIPPED_4_C	X
	COARSE_AGG_STRIPPED_5_C	X
	CONSTRUCTION_NO	X
	DIAMETER_1_U	X
	DIAMETER_2_U	X
	DIAMETER_3_U	X
	DIAMETER_4_C	X
	DIAMETER_5_C	X
	FINE_AGG_STRIPPED_4_C	X
	FINE_AGG_STRIPPED_5_C	X
	HEIGHT_1_U	X
	HEIGHT_2_U	X
	HEIGHT_3_U	X
	HEIGHT_4_C	X
	HEIGHT_5_C	X
	IN_TENSILE_STRENGTH_AVG_U	X
	IN_TENSILE_STRENGTH_AVG_C	X
	IN_TENSILE_STRENGTH_1_U	X
	IN_TENSILE_STRENGTH_2_U	X
	IN_TENSILE_STRENGTH_3_U	X
	IN_TENSILE_STRENGTH_4_C	X
	IN_TENSILE_STRENGTH_5_C	X
	LAB_CODE	X
	MAX_LOAD_1_U	X
	MAX_LOAD_2_U	X
	MAX_LOAD_3_U	X
	MAX_LOAD_4_C	X
	MAX_LOAD_5_C	X
	MAX_SPEC_GRAVITY	X
	METHOD_OF_COMPACTION	X
	PCT_AIR_VOIDS_1_U	X
	PCT_AIR_VOIDS_2_U	X
	PCT_AIR_VOIDS_3_U	X
	PCT_AIR_VOIDS_4_C	X
	PCT_AIR_VOIDS_5_C	X
	SAMPLE_NO_1_U	X
	SAMPLE_NO_2_U	X
	SAMPLE_NO_3_U	X
	SAMPLE_NO_4_C	X
	SAMPLE_NO_5_C	X
	TENSILE_STRENGTH_RATIO	X
	TEST_DATE_1	X
	TEST_DATE_2	X

	TEST_DATE_3	X
	TEST_DATE_4	X
	TEST_DATE_5	X
TST_AC07_V2_SPECIMEN_INFO	COMMENT_OTHER	
* Required if COMMENT_1, COMMENT_2, or COMMENT_3 = 99		
TST_AE01	MASS_OF_RECOVERED_BITUMEN	X
	SAMPLE_NO	X
TST_AE01S	ASPHALT_CONTENT	X
	SAMPLE_NO	X
TST_AE02	PENETRATION_77_F	X
	SAMPLE_NO	X
TST_AE02S	AVERAGE_PENETRATION	X
	SAMPLE_NO	X
	TEST_TEMPERATURE	X
TST_AE03	SAMPLE_NO	X
	SPECIFIC_GRAVITY	X
TST_AE04	LOAD_100_SHEAR_RATE	X
	LOAD_100_VISCOSITY	X
	SAMPLE_NO	X
	TEST_TEMPERATURE_F	X
TST_AE05	ABSOLUTE_VISC_140_F	X
	KINEMATIC_VISC_275_F	X
	SAMPLE_NO	X
TST_AE06S	SAMPLE_NO	X
	VACUUM_CAPILLARY_VISC	X
TST_AE07_DATA	No level C checks	
TST_AE07_MASTER	PG_HIGH_TEMP	X
	PG_LOW_TEMP	X
TST_AE08_DATA	No level C checks	
TST_AE08_MASTER	PG_HIGH_TEMP	X
	PG_LOW_TEMP	X
	REG_CO_A	X
	REG_CO_B	X
	REG_CO_C	X
	REG_R_SQUARE	X
TST_AE09_DATA	No level C checks	
TST_AE09_MASTER	FAIL_ELONG_AVG	X
	FAIL_ELONG_STD	X
	FAIL_STRAIN_AVG	X
	FAIL_STRAIN_STD	X
	FAIL_STRESS_AVG	X

	FAIL_STRESS_STD	X
	FRACTURE_TYPE	X
	PEAK_LOAD_AVG	X
	PEAK_LOAD_STD	X
	PG_HIGH_TEMP	X
	PG_LOW_TEMP	X
TST_AG01	ABSORPTION_OF_COARSE_AGG	X
	BSG_OF_COARSE_AGG	X
	SAMPLE_NO	X
TST_AG02	ABSORPTION_OF_FINE_AGG	X
	BSG_OF_FINE_AGG	X
	SAMPLE_NO	X
TST_AG04	NO_200_PASSING	X
	NO_40_PASSING	X
	NO_4_PASSING	X
	ONE_PASSING	X
	SAMPLE_NO	X
TST_AG05	ABSORPTION	*
	BSG	*
	UNCOMP_VOID_AVG	*
	* at least one must be non-null unless COMMENT_* = 61	
	SAMPLE_NO	X
TST_ASPHALT_CEMENT	DATE_SAMPLED	X
	SAMPLE_NO	X
	SAMPLE_VOLUME	X
TST_CS01	ASPHALT_COMPATIBILITY_INIT	X
	AVG_PENETRAT_INIT	X
	AVG_PENETRAT_INIT_TEMP	X
	BOND_INIT	X
	FLOW_INIT	X
	RESILIENCE_INIT	X
	SAMPLE_NO	X
TST_CS02	BONDING_STRENGTH	X
	DUROMETER_HARDNESS	X
	EXTRUSION_RATE	X
	NON_VOLATILE	X
	SAMPLE_NO	X
	SPECIFIC_GRAVITY	X
	TACK_FREE_TIME	X
	TENSILE_STRESS	X
TST_ESTAR_GSTAR_INPUT	No level C checks	
TST_ESTAR_GSTAR_CAM_COEFF	No level C checks	
TST_ESTAR_MASTER	No level C checks	
TST_ESTAR_MODULUS	No level C checks	

TST_ESTAR_MODULUS_COEFF	No level C checks		
TST_ESTAR_MR_INPUT	No level C checks		
TST_ESTAR_VISC_INPUT	No level C checks		
TST_ESTAR_VISC_MODEL_COEFF	No level C checks		
TST_ESTAR_VOLUM_INPUT	No level C checks		
TST_FRESH_PCC	AIR_CONTENT_MEAN	X	
	AMBIENT_TEMP	X	
	BEAM1	*	
	BEAM2	*	
	BEAM3	*	
	* required if CYLINDER1- CYLINDER6 do not begin with “L”, else they must be null		
	CYLINDER1	X	
	CYLINDER2	X	
	CYLINDER3	X	
	CYLINDER4	X	
	CYLINDER5	X	
	CYLINDER6	X	
	DATE_SAMPLED	X	
	LAB_CODE	X	
	PCC_MIX_TEMP	X	
	SAMPLE_LOC	X	
	SLUMP_MEAN	X	
TST_HOLE_LOG	HOLE_DATE	X	
	POINT_DISTANCE	X	
	TRANS_POS	X	
TST_ISD_MOIST	ISD_DRY_1	X	
	ISD_DRY_AVG	X	
	ISMC_1	*	
	ISMC_AVG	*	
	* required if MATERIAL_ TYPE = ‘G’		
	MATERIAL_TYPE	X	
TST_L05	MATL_CODE	X	
TST_L05A	DESCRIPTION	X	
	MEASURE_TYPE_1_STATION0	X	
	MEASURE_TYPE_1_STATION5	X	
	PROJECT_LAYER_CODE	*	(SPS ONLY)
TST_L05B	DESCRIPTION	X	
	MATL_CODE	X	
	PROJECT_LAYER_CODE	*	(SPS ONLY)
	REPR_THICKNESS	*	
	* only for LAYER _NO > 1		

TST_LINK_LAYER	No level C checks	
TST_LINK_SAMPLE	No level C checks	
TST_PC01	No level C checks	
TST_PC02	DIAMETER	X
	LENGTH	X
	MAX_LOAD	X
	TENSILE_STRENGTH	X
TST_PC03	No level C checks	
TST_PC04	DIAMETER	X
	ELASTIC_MOD	X
	LENGTH	X
	SAMPLE_NO	X
TST_PC05	APPARENT_SPECIFIC_GRAVITY	X
	BULK_SPECIFIC_GRAVITY_DRY	X
	DENSITY_OF_PCC	X
	PERCENT_ABSORPTION_AFTER _IMMER	X
	PERCENT_VOIDS_IN_PCC	X
	SAMPLE_NO	X
TST_PC06	CORE_AVG_THICKNESS ***** if VISUAL_ EXAM* = 57; must be null	*
	SAMPLE_NO	X
TST_PC07	DIAMETER	X
	SAMPLE_NO	X
	SHEAR_BOND_STRENGTH	X
TST_PC08	AIR_CONTENT	X
	SAMPLE_NO	X
	SPACING_FACTOR	X
	SPECIFIC_SURFACE	X
TST_PC09	MODULUS_OF_RUPTURE	X
	SPECIMEN_AGE	X
TST_SAMPLE_BULK_AC_AGG	DATE_SAMPLED	X
	PLANT_NAME	X
	PLANT_LOC	X
TST_SAMPLE_COMBINE	No level C checks	
TST_SAMPLE_LAB_AC_MIX	SAMPLE_SIZE	X
TST_SAMPLE_LOG	DEPTH_BOT_STRATA	*[1]
	DEPTH_TOP_STRATA	*[2]
	MATERIAL_CODE	X

[1] Required if DEPTH_TOP_STRATA is null.

[2] Required if DEPTH_BOT_STRATA is null.

TST_SAMPLE_LOG_LAB	No level C checks	
TST_SAMPLE_LOG_SPS_3_4	ACCEPT_CHECK	X
	DATE_SAMPLED	X
	SAMPLE_MATERIAL	X
TST_SC01	DUCTILITY	X
	OIL_DISTILLATE	X
	PARTICLE_CHARGE	X
	PCT_RESIDUE_BY_DIST	X
	PENETRATION	X
	SOLUBILITY	X
	SPECIFIC_GRAVITY	X
	VISCOSITY_AT_50	X
TST_SC02	SAMPLE_NO	X
	SAND_EQUIVALENT	X
TST_SC03	CLAY_LUMPS	X
	PCT_LIGHTWEIGHT_MATERIAL	X
	PCT_OF_WEAR	X
	SAMPLE_NO	X
	SOUNDNESS	X
	UNIT_WEIGHT	X
TST_SC04	FLAKINESS_INDEX	X
	SAMPLE_NO	X
TST_SC05	CONSISTENCY	X
	CURE_TIME	X
	SAMPLE_NO	X
	SET_TIME	X
	SYSTEM_CLASSIFICATION	X
	TRAFFIC_TIME	X
	WET_TRACK_ABRASION	X
TST_SC06	SAMPLE_NO	X
	SAND_ADHESION	X
	TACK_POINT	X
TST_SC07	AGG_SURFACE_RETAINING_COAT	X
	SAMPLE_NO	X
TST_SC08	CONSISTENCY	X
	SAMPLE_NO	X
TST_SC09	MIXING_TIME	X
	SAMPLE_NO	X
	WATER_DISCOLORATION	X
TST_SC10A	NO_10_PASSING	X
	NO_200_PASSING	X
	NO_4_PASSING	X
	NO_8_PASSING	X
	ONE_HALF_PASSING	X
	SAMPLE_NO	X

	THREE_EIGHTHS_PASSING	X
TST_SC10B	FIVE_SIXTEENTHS_PASSING	X
	NO_100_PASSING	X
	NO_16_PASSING	X
	NO_200_PASSING	X
	NO_30_PASSING	X
	NO_4_PASSING	X
	NO_50_PASSING	X
	NO_8_PASSING	X
	SAMPLE_NO	X
TST_SC11	AGG_SPREAD_RATE	X
	BSG_OF_AGGREGATE	X
	RESIDUAL_ASPH_SPREAD_RATE	X
	SAMPLE_NO	X
TST_SC12	ASPHALT_CONTENT	X
	SAMPLE_NO	X
TST_SC13	INIT_FRICTION_VALUE	X
	NO_10_PASSING	X
	NO_200_PASSING	X
	NO_4_PASSING	X
	NO_8_PASSING	X
	ONE_HALF_PASSING	X
	POLISH_VALUE	X
	SAMPLE_NO	X
	THREE_EIGHTHS_PASSING	X
TST_SP01_DATA	No level C checks	
TST_SP01_MASTER	GYRATE_N_DES	X
	AVG_REL_DENS_N_DES	X
	AIR_VOIDS_N_DES	X
	VMA_N_DES	X
	VFA_N_DES	X
TST_SP02	AGG_COARSE_SPEC_GRAV	X
	AGG_COARSE_PCT	X
	AGG_FINE_SPEC_GRAV	X
	AGG_FINE_PCT	X
	AGG_FILLER_SPEC_GRAV	X
	AGG_FILLER_PCT	X
TST_SS01_UG01_UG02	MOISTURE_CONTENT	X
	NO_200_PASSING	X
	NO_4_PASSING	X
	NO_40_PASSING	X
	ONE_PASSING	X
	SAMPLE_NO	X
	WASHING_PASSING	X
TST_SS02_UG03	COLLOIDS	*
	*required if COMMENT_* ! = 48	
	FINE_SAND	X

	HYDRO_001	*
	*required if COMMENT_* ! = 48	
	HYDRO_002	X
	HYDRO_02	X
	HYDRO_MOIST	X
	NO_200_PASSING	X
	NO_40_PASSING	X
	NO_4_PASSING	X
	ONE_PASSING	X
	SAMPLE_NO	X
TST_SS04_UG08	AASHTO_SOIL_CLASS	*
	***r**equired if LAYER_NO = 1 (subgrade)	
	MAX_PART_SIZE	X
	PART_SIZE_RANGE	X
TST_SS06	DEFLECTION_AVG	X
	SOIL_MOD_UNCORRECTED	X
	SOIL_MOD_CORRECTED	X
	TEST_DATE	X
	COMMENT_OTHER	*
	*required if COMMENT_* = 99	
TST_SS08	DRY_DENSITY	X
	MOISTURE_CONTENT	X
TST_SS10	DRY_DENSITY	X
	MOISTURE_CONTENT	X
	UNCONFINED_COMPRESSED _STRENGTH	X
TST_SS11	AVG_HYDRAULIC_CONDUCTIVITY	X
	INITIAL_WATER_CONTENT	X
TST_SS12	No level C checks	
TST_SS14_UG14_COMMENT	No level C checks	
TST_SS14_UG14_DATA	No level C checks	
TST_SS14_UG14_MASTER	No level C checks	
TST_TB01	DETAIL_TREAT_MATL	X
	DETAIL_TREAT_TYPE	X
	SAMPLE_NO	X
	THICKNESS	*
	not required if VISUAL_EXAM _ = 07 or 57 or If THICKNESS_ CODE = 92	
TST_TB02	COMP_STRENGTH	X
	CROSS_SECTION_AREA	X
	MAX_LOAD	X
	ORIGINAL_LENGTH	X
	P32_METHOD	X
	SAMPLE_NO	X

TST_UG04_SS03	LIQUID_LIMIT	*
	*not required if PLASTICITY_INDEX = “NP”	
	PLASTICITY_INDEX	X
	PLASTIC_LIMIT	*
	*not required if PLASTICITY_INDEX = “NP”	
TST_UG05_SS05	MAX_LAB_DRY_DENSITY	X
	MAX_LAB_DRY_DENSITY_TEST	X
	OPTIMUM_LAB_MOISTURE	X
TST_UG07_SS07_A	AFTER_MOIST_CONT*	*
	AVERAGE_DIAMETER	*
	BOTTOM_DIAMETER	*
	COMP_DRY_DENSITY	*
	COMP_MOIST_CONT	*
	*N/A if COMMENT_*= 7 or 15	
	CONSTRUCTION_NO	X
	IN_SITU_DENSITY	**
	**required if TEST_DATE ≥01-Aug-93;	
	IN_SITU_MOIST	*
	INITIAL_AREA	*
	INITIAL_LENGTH	*
	*N/A if COMMENT_*= 7 or 15	
	LAB_CODE	X
	LAYER_TYPE	X
	LOC_NO	X
	MR_MATL_TYPE	X
	MAX_DRY_DENSITY	**
	**required if TEST_DATE ≥01-Aug-93;	
	MAX_DRY_DENSITY_95	*
	*N/A if COMMENT_*= 7 or 15	
	MIDDLE_DIAMETER	*
	*N/A if COMMENT_*= 7 OR 15	
	NET_DIAMETER	*
	OPT_MOIST_CONT	**
	required if TEST_DATE ≥01-Aug-93;	
	N/A if COMMENT_*= 7 or 15	
	RECORD_STATUS	X
	TEST_DATE	X
	TOP_DIAMETER	*
	N/A if COMMENT_*= 7 or 15	
TST_UG07_SS07_B	AFTER_MOIST_CONT	X
	AVERAGE_DIAMETER	X
	BOTTOM_DIAMETER	X
	CONSTRUCTION_NO	X
	DRY_DENSITY	X
	INITIAL_AREA	X
	INITIAL_LENGTH	X
	INITIAL_VOLUME	X
	INITIAL_WEIGHT	X
	LAB_CODE	X
	LAYER_TYPE	X
	LOC_NO	X
	MR_MATL_TYPE	X
	MIDDLE_DIAMETER	X

	NET_DIAMETER	X
	RECORD_STATUS	X
	TEST_DATE	X
	TOP_DIAMETER	X
	WET_DENSITY	X
TST_UG07_SS07_WKSHT_CYCLES	APPLIED_CONTACT_LOAD	X
	APPLIED_CONTACT_STRESS	X
	APPLIED_CYCLIC_LOAD	X
	APPLIED_CYCLIC_STRESS	X
	APPLIED_MAX_AXIAL_LOAD	X
	APPLIED_MAX_AXIAL_STRESS	X
	CONSTRUCTION_NO	X
	DEF_LVDT_1	X
	DEF_LVDT_1_2	X
	DEF_LVDT_2	X
	LAB_CODE	X
	LAYER_TYPE	X
	LOC_NO	X
	MR_MATL_TYPE	X
	RECORD_STATUS	X
	RES_MOD	X
	RES_STRAIN	X
	TEST_DATE	X
TST_UG07_SS07_WKSHT_SUM	APPLIED_CONTACT_LOAD_AVG	*
	APPLIED_CONTACT_STRESS_AVG	*
	* required if TEST_DATE > 01-Aug-93	
	APPLIED_CYCLIC_LOAD_AVG	X
	APPLIED_CYCLIC_STRESS_AVG	**
	APPLIED_MAX_AXIAL_LOAD_AVG	**
	APPLIED_MAX_AXIAL_STRESS_AVG	**
	** required if TEST_DATE2 > 01-Aug-93	
	CONSTRUCTION_NO	X
	DEF_LVDT_1_AVG	X
	DEF_LVDT_2_AVG	X
	DEF_LVDT_1_2_AVG	X
	LAB_CODE	X
	LAYER_TYPE	X
	LOC_NO	X
	MR_MATL_TYPE	X
	RECORD_STATUS	X
	RES_MOD_AVG	X
	RES_STRAIN_AVG	X
	TEST_DATE	X
TST_UG09	AVG_HYDRAULIC_CONDUCTIVITY	X
	HYDRAULIC_GRADIENT	X
	INITIAL_DRY_DENSITY	X
	INITIAL_MOISTURE_CONTENT	X
	SAMPLE_NO	X
TST_UG10_SS09	MOIST_CONTENT	X
TST_UNBOUND_SPEC_GRAV	TEST_DATE	X
	LAB_CODE	X

TST_UNCOMP_BITUMINOUS	DATE_SAMPLED	X
	LAYER_TYPE	X
	MIX_TYPE	X
	SAMPLE_LOC	X
	SAMPLE_NO	X
	SAMPLE_SIZE	X

D. Expanded Range Checks

Expanded range checks are applied to certain fields to identify data element values that fall outside an expected range. Field names are listed below the bolded table name.

Table	Units	Range
TST_AC_MOIST_DAMAGE		
COARSE_AGG_STRIPPED		0 - 100
CORE_DIAM		3 - 13
CORE_THICK		1 - 24
FIELD_SET		1 - 10
FINE_AGG_STRIP		0 - 100
HEIGHT_STRIP_PEN		0 - 18
LAYER_DEPTH_A		0 - 18
LAYER_DEPTH_B		0 - 18
LAYER_DEPTH_C		0 - 18
LAYER_DEPTH_D		0 - 18
MOIST_IN_CORE		Y, N
STRIP_RATING_C		0 - 3
STRIP_RATING_F		0 - 2
STRIP_RATING_P		1 - 5
STRIP_RATING_PCF		1 - 10
TST_AC01		
CORE_AVG_THICKNESS[3]	in	0.0 - 50.0(GPS); 1.0 - 10.0(SPS6); 3.0 - 8.0(SPS8); 1.0 - 30.0(other SPS)
TEST_DATE		>= 01-Jan-87, <= Today's date
TEST_NO		1 - 4
TST_AC01_LAYER		
FIELD_SET		1 - 10
LAYER_DESCRIPTION		1, 2, 3, 4, 5, 8, 9, 10
LAYER_THICKNESS	in	0.1 - 18.0
TEST_NO		1 - 4
TST_AC02		
BSG		1.000 - 4.000
FIELD_SET		1 - 10
PARAFFIN_COATED		Y, N
TEST_NO		1 - 4, 6 - 9, 11 - 14, etc
WATER_ABS	%	0 - 6

[3] Not applicable if VISUAL_EXAM* = 7.

TST_AC03

FIELD_SET		1 - 10
MAX_SPEC_GRAVITY		1.000 - 4.000
TEST_NO		1 - 5

TST_AC04

ASPHALT_CONTENT_MEAN	%	0.0 - 30.0
FIELD_SET		1 - 10
TEST_NO		1 - 5

TST_AC05

BSG_AFTER_MOLDING_1_U		1.000 - 4.000
BSG_AFTER_MOLDING_2_U		1.000 - 4.000
BSG_AFTER_MOLDING_3_U		1.000 - 4.000
BSG_AFTER_MOLDING_4_C		1.000 - 4.000
BSG_AFTER_MOLDING_5_C		1.000 - 4.000
BSG_AFTER_MOLDING_6_ C		1.000 - 4.000
BSG_AFTER_VAC_SATURATION_4_C		1.000 - 4.000
BSG_AFTER_VAC_SATURATION_5_C		1.000 - 4.000
BSG_AFTER_VAC_SATURATION_6_C		1.000 - 4.000
COARSE_AGG_STRIPPED_4_C	%	0 - 100
COARSE_AGG_STRIPPED_5_C	%	0 - 100
COARSE_AGG_STRIPPED_6_C	%	0 - 100
DIAMETER_1_U	mm	99.0 - 104.0
DIAMETER_2_U	mm	99.0 - 104.0
DIAMETER_3_U	mm	99.0 - 104.0
DIAMETER_4_C	mm	99.0 - 104.0
DIAMETER_5_C	mm	99.0 - 104.0
DIAMETER_6_C	mm	99.0 - 104.0
FIELD_SET		1 - 10
FINE_AGG_STRIPPED_4_C	%	0 - 100
FINE_AGG_STRIPPED_5_C	%	0 - 100
FINE_AGG_STRIPPED_6_C	%	0 - 100
HEIGHT_1_U	mm	51.0 - 102.0
HEIGHT_2_U	mm	51.0 - 102.0
HEIGHT_3_U	mm	51.0 - 102.0
HEIGHT_4_C	mm	51.0 - 102.0
HEIGHT_5_C	mm	51.0 - 102.0
HEIGHT_6_C	mm	51.0 - 102.0
IN_TENSILE_STRENGTH_AVG_U	kPa	344 - 3103
IN_TENSILE_STRENGTH_AVG_C	kPa	344 - 3103
IN_TENSILE_STRENGTH_1_U	kPa	344 - 3103
IN_TENSILE_STRENGTH_2_U	kPa	344 - 3103
IN_TENSILE_STRENGTH_3_U	kPa	344 - 3103
IN_TENSILE_STRENGTH_4_C	kPa	344 - 3103
IN_TENSILE_STRENGTH_5_C	kPa	344 - 3103
IN_TENSILE_STRENGTH_6_C	kPa	344 - 3103
IN_TENSILE_STRENGTH_STD_U	kPa	68 - 620
IN_TENSILE_STRENGTH_STD_C	kPa	56 - 466
MAX_LOAD_1_U	N	4448 - 26689
MAX_LOAD_2_U	N	4448 - 26689
MAX_LOAD_3_U	N	4448 - 26689
MAX_LOAD_4_C	N	4448 - 26689
MAX_LOAD_5_C	N	4448 - 26689
MAX_LOAD_6_C	N	4448 - 26689
MAX_SPEC_GRAVITY		1.000 - 4.000

PCT_AIR_VOIDS_1_U	%	5.0 - 10.0
PCT_AIR_VOIDS_2_U	%	5.0 - 10.0
PCT_AIR_VOIDS_3_U	%	5.0 - 10.0
PCT_AIR_VOIDS_4_C	%	5.0 - 10.0
PCT_AIR_VOIDS_5_C	%	5.0 - 10.0
PCT_AIR_VOIDS_6_C	%	5.0 - 10.0
TENSILE_STRENGTH_RATIO		0.25 - 1.00
TEST_DATE_1		>= 01-Jan-92
TEST_DATE_2		>= 01-Jan-92
TEST_DATE_3		>= 01-Jan-92
TEST_DATE_4		>= 01-Jan-92
TEST_DATE_5		>= 01-Jan-92
TEST_DATE_6		>= 01-Jan-92
TEST_NO		1 - 4

TST_AC07_V2_CREEP_COMP_SUM

CONSTRUCTION_NO		1 - 20
CREEP_POISSON_CALC		0.05 - 0.75
CREEP_POISSON_USED		0.05 - 0.50
FIELD_SET		1 - 10
LAYER_NO		2 - 20
TEST_TEMPERATURE	deg C	(-8.0) - (-12.0), 4.0 - 6.0, 23.0 - 27.0
TEST_NO		1, 2, 3, 6, 7, 8, 11, 12, 13

TST_AC07_V2_IDT_SUM

CONSTRUCTION_NO		1 - 20
FIELD_SET		1 - 10
IDT_SPECIMEN_1	MPa	0.30 - 3.10
IDT_SPECIMEN_2	MPa	0.30 - 3.10
IDT_SPECIMEN_3	MPa	0.30 - 3.10
IDT_AVERAGE	MPa	0.30 - 3.10
IDT_POISSON_CALC		0.05 - 0.75
IDT_POISSON_USED		0.05 - 0.50
IDT_INITIAL_TANGENT_MODULUS	Gpa	null, 0.0 - 3.0
IDT_FAILURE_STRAIN	microstrain	null, 2000.00 - 6500.00
IDT_FRACTURE_ENERGY	kJ/m^3	null, 1300.0 - 4300.0
LAYER_NO		2 - 20
TEST_NO		1, 2, 3, 6, 7, 8, 11, 12, 13
TEST_TEMPERATURE	deg C	23.0 - 27.0

TST_AC07_V2_MR_SUM

CONSTRUCTION_NO		1 - 20
FIELD_SET		1 - 10
INSTANT_MR_POISSON_CALC_AVG		0.05 - 0.75
INSTANT_MR_POISSON_CALC_CYCLE_1		0.05 - 0.75
INSTANT_MR_POISSON_CALC_CYCLE_2		0.05 - 0.75
INSTANT_MR_POISSON_CALC_CYCLE_3		0.05 - 0.75
INSTANT_MR_POISSON_USED_AVG		0.05 - 0.50
INSTANT_MR_POISSON_USED_CYCLE_1		0.05 - 0.50
INSTANT_MR_POISSON_USED_CYCLE_2		0.05 - 0.50
INSTANT_MR_POISSON_USED_CYCLE_3		0.05 - 0.50
LAYER_NO		2 - 20
TEST_TEMPERATURE	deg C	4.0 - 6.0, 23.0 - 27.0, 38.0 - 42.0
TEST_NO		1, 2, 3, 6, 7, 8, 11, 12, 13
TOTAL_MR_POISSON_CALC_AVG		0.05 - 0.75

TOTAL_MR_POISSON_CALC_CYCLE_1		0.05 - 0.75
TOTAL_MR_POISSON_CALC_CYCLE_2		0.05 - 0.75
TOTAL_MR_POISSON_CALC_CYCLE_3		0.05 - 0.75
TOTAL_MR_POISSON_USED_AVG		0.05 - 0.50
TOTAL_MR_POISSON_USED_CYCLE_1		0.05 - 0.50
TOTAL_MR_POISSON_USED_CYCLE_2		0.05 - 0.50
TOTAL_MR_POISSON_USED_CYCLE_3		0.05 - 0.50

TST_AC07_V2_SPECIMEN_INFO

BSG_AC_SPECIMEN_1		1.000 - 4.000
BSG_AC_SPECIMEN_2		1.000 - 4.000
BSG_AC_SPECIMEN_3		1.000 - 4.000
COMMENT_1		null, 1 - 99
COMMENT_2		null, 1 - 99
COMMENT_3		null, 1 - 99
CONSTRUCTION_NO		1 - 20
DIAMETER_SPECIMEN_1		96.0 - 158.0
DIAMETER_SPECIMEN_2		96.0 - 158.0
DIAMETER_SPECIMEN_3		96.0 - 158.0
FIELD_SET		1 - 10
LAYER_NO		2 - 20
TEST_NO		1, 2, 3, 6, 7, 8, 11, 12, 13
THICKNESS_SPECIMEN_1		25.0 - 64.0
THICKNESS_SPECIMEN_2		25.0 - 64.0
THICKNESS_SPECIMEN_3		25.0 - 64.0

TST_AE01

ASH_CONTENT_OF_BITUMEN	%	0.0 - 2.0
FIELD_SET		1 - 10
MASS_OF_RECOVERED_BITUMEN		50 - 999
TEST_DATE		>= 01-Jan-90, <= Today's date
TEST_NO		1 - 5

TST_AE01S

ASH_CONTENT_OF_BITUMEN	%	0.0 - 2.0
ASPHALT_CONTENT	%	3 - 12
FIELD_SET		1 - 10
MOISTURE_IN_MIXTURE	%	0 - 3
TEST_DATE		>= 01-Jan-90, <= Today's date
TEST_NO		1 - 4

TST_AE02

FIELD_SET		1 - 10
PENETRATION_115_F		10 - 250
PENETRATION_77_F		5 - 120
PENETRATION_INDEX		-5 - 5
TEST_DATE		>= 01-Jan-90, <= Today's date
TEST_NO		1 - 5

TST_AE02S

AVERAGE_PENETRATION	.1 mm	10 - 250
FIELD_SET		1 - 10
TEST_DATE		>= 01-Jan-90, <= Today's date
TEST_NO		1 - 4
TEST_TEMPERATURE	deg C	20 - 30

TST_AE03

FIELD_SET		1 - 10
SPECIFIC_GRAVITY		0.9 - 1.1
TEST_DATE		>= 01-Jan-90, <= Today's date
TEST_NO		1 - 5

TST_AE04

FIELD_SET		1 - 10
FRACTURE_LOAD		100 - 10000
FRACTURE_SHEAR_STRESS		0.00001 - 99
LOAD_100_SHEAR_RATE		0.001 - 0.1
LOAD_100_VISCOSITY		0 - 9999
LOAD_1000_SHEAR_RATE		0.001 - 0.1
LOAD_1000_VISCOSITY		0 - 9999
LOAD_300_SHEAR_RATE		0.001 - 0.1
LOAD_300_VISCOSITY		0 - 9999
LOAD_3000_SHEAR_RATE		0.001 - 0.1
LOAD_3000_VISCOSITY		0 - 9999
TEST_DATE		>= 01-Jan-90, <= Today's date
TEST_NO		1 - 5
TEST_TEMPERATURE_F	deg F	70 - 80

TST_AE05

ABSOLUTE_VISC_140_F		500 - 5800000
ABSOLUTE_VISC_CALIB_FACTOR		0 - 12000
ABSOLUTE_VISC_FLOW_TIME		50 - 5400
ABSOLUTE_VISC_VACUUM_PRESSURE		11 - 12
FIELD_SET		1 - 10
KINEMATIC_VISC_275_F		100 - 100000
KINEMATIC_VISC_CALIB_CONST		0 - 100
KINEMATIC_VISC_EFFLUX_TIME		50 - 5400
TEST_DATE		>= 01-Jan-90, <= Today's date
TEST_NO		1 - 5

TST_AE06S

FIELD_SET		1 - 10
TEST_DATE		>= 01-Jan-90, <= Today's date
TEST_NO		1 - 4
TEST_TEMPERATURE	deg C	59 - 61
VACUUM	mm Hg	290 - 310
VACUUM_CAPILLARY_VISC	poise	500 - 999999

TST_AE07_DATA

COMPLEX_MOD	kPa	0.1 - 10000.0
PHASE_ANGLE	deg angle	0.0 - 90.0
TEST_TEMP	deg C	5.0 - 85.0

TST_AE07_MASTER

COND_CYCLE_NO		10 - 20
COND_CYCLE_FREQ	radian/s	1.0 - 99.9
FIELD_AGE_TIME	months	0 - 120
PG_HIGH_TEMP	deg C	46 - 84
PG_LOW_TEMP	deg C	-46 - (-10)
PLATE_DIAMETER	mm	7.90 - 8.10, 24.90 - 25.10
TEST_DATE		>= 01-Jan-90, <= Today's date
TEST_FREQ	radian/s	1.0 - 99.9

TEST_GAP	mm	0.95 - 1.05; 1.95 - 2.05
TEST_STRAIN_AMP	%	0.80 - 15.00
TEST_TORQUE_AMP	mN-m	> 0

TST_AE08_DATA

DEFL	mm	0.0800 - 4.0000
LOAD	N	0.9300 - 1.0300
SOAK_TIME	min	55.0 - 65.0, 1380.0 - 1500.0
STIFF_ESTIMATE	MPa	50 - 2000
STIFF_MEASURE	MPa	50 - 2000
STIFF_PCT_DIFF	%	-2 - 2
TEST_TEMP	deg C	-40.0 - 25.0
TEST_TIME	sec	8, 15, 30, 60, 120, 240

TST_AE08_MASTER

BEAM_THICK	mm	6.3 - 6.4
BEAM_WIDTH	mm	12.6 - 12.8
FIELD_AGE_TIME	months	0 - 120
PG_HIGH_TEMP	deg C	46 - 84
PG_LOW_TEMP	deg C	-46 - (-10)
REG_R_SQUARE		0.8 - 1.0
SOAK_TIME	min	55.0 - 65.0, 1380.0 - 1500.0
TEST_DATE		>= 01-Jan-90, <= Today's date
TEST_TEMP	deg C	-40.0 - 25.0

TST_AE09_MASTER

CONDITION_TIME	min	50 - 70
ELONG_RATE	mm/min	0.95 - 1.05
FIELD_AGE_TIME	months	0 - 120
FRACTURE_TYPE		1 - 3
GAUGE_LENGTH	mm	25.0 - 35.0
PG_HIGH_TEMP	deg C	46 - 84
PG_LOW_TEMP	deg C	-46 - (-10)
SPECIMEN_AREA	sq mm	30 - 40
TEST_DATE		>= 01-Jan-90, <= Today's date
TEST_TEMP	deg C	-40.0 - 25.0

TST_AG01

ABSORPTION_OF_COARSE_AGG		0 - 10
BSG_OF_COARS_AGG		2 - 4
FIELD_SET		1 - 10
TEST_DATE		>= 01-Jan-90, <= Today's date
TEST_NO		1 - 5

TST_AG02

ABSORPTION_OF_FINE_AGG		0 - 10
BSG_OF_FINE_AGG		2 - 4
FIELD_SET		1 - 10
TEST_DATE		>= 01-Jan-90, <= Today's date
TEST_NO		1 - 5

TST_AG04

FIELD_SET		1 - 10
NO_10_PASSING	%	5 - 90
NO_200_PASSING	%	0.0 - 15.0
NO_40_PASSING	%	4 - 65

NO_4_PASSING	%	10 - 100
NO_80_PASSING	%	2 - 30
ONE_HALF_PASSING	%	45 - 100
ONE_PASSING	%	75 - 100
TEST_DATE		>= 01-Jan-90, <= Today's date
TEST_NO		1 - 5
THREE_EIGHTHS_PASSING	%	40 - 100
THREE_FOURTHS_PASSING	%	55 - 100

TST_AG05

ABSORPTION	%	0.0 - 8.0
BSG		1.5 - 3.5
FIELD_SET		1 - 10
TEST_DATE		>= 01-Jan-90, <= Today's date
TEST_NO		1 - 4
UNCOMP_VOID_AVG	%	30 - 60

TST_ASPHALT_CEMENT

DATE_SAMPLED		>= 01-Jan-87, <= Today's date
DATE_SHIPPED		null, >=01-Jan-87, <= Today's date
FIELD_SET		1 - 10
PLANT_TYPE		null, 1 - 3
SAMPLE_VOLUME	gal	1 - 55

TST_CS01

ASPHALT_COMPATIBILITY_HEAT		P, F
ASPHALT_COMPATIBILITY_INIT		P, F
AVG_PENETRAT_HEAT	.1 mm	20 - 130
AVG_PENETRAT_HEAT_TEMP	deg C	24 - 26
AVG_PENETRAT_INIT	.1 mm	20 - 130
AVG_PENETRAT_INIT_TEMP	deg C	24 - 26
BOND_HEAT		P, F
BOND_INIT		P, F
FIELD_SET		1 - 10
FLOW_HEAT	mm	0 - 15
FLOW_INIT	mm	0 - 15
RESILIENCE_HEAT	%	40 - 99
RESILIENCE_INIT	%	50 - 99
TEST_DATE		>= 01-Jan-90, <= Today's date
TEST_NO		1 - 4

TST_CS02

BONDING_STRENGTH	psi	25 - 200
DUROMETER_HARDNESS		5 - 45
EXTRUSION_RATE	g/min	50 - 500
FIELD_SET		1 - 10
MOVEMENT_CAPABILITY		S, U
NON_VOLATILE	%	80 - 100
OZONE_AND_UV_RESISTANCE		S, U
SPECIFIC_GRAVITY		0.9 - 2.0
TACK_FREE_TIME	min	0 - 120
TENSILE_STRENGTH	psi	5 - 75
TEST_DATE		>= 01-Jan-90, <= Today's date
TEST_NO		1 – 4

TST_ESTAR_GSTAR_INPUT

GSTAR	psi	0.0293 – 676,000

TST_ESTAR_GSTAR_CAM_COEFF

No level D checks

TST_ESTAR_MASTER

No level D checks

TST_ESTAR_MODULUS

ESTAR	psi	3,311 - 6,607,000

TST_ESTAR_MODULUS_COEFF

MASTERCURVE_QUALITY		P

TST_ESTAR_MR_INPUT

MR_5C	MPa	4,800 - 34,053
MR_25C	MPa	1,081 - 15,411
MR_40C	MPa	379 - 6,864

TST_ESTAR_VISC_INPUT

VISCOSITY	Megapoise	0.00199 - 27,000

TST_ESTAR_VISC_MODEL_COEFF

No level D checks

TST_ESTAR_VOLUM_INPUT

VMA	%	9.5 – 34.7
VFA	%	32.8 – 95.1

TST_FRESH_PCC

AIR_CONTENT_MEAN	%	1 - 20
AMBIENT_TEMP	deg F	40 - 120
DATE_SAMPLED		>= 01-Jan-87, <= Today's date
FIELD_SET		1 - 10
PCC_MIX_TEMP	deg F	50 - 100
SAMPLE_LOC		1 - 5
SLUMP_MEAN		1 - 9.9
TIME_SAMPLED		null, 1 - 23:59

TST_HOLE_LOG

DIAMETER	in	null, 3 - 13
FIELD_SET		1 - 10
HOLE_DATE		>= 01-Jan-87, <= Today's date
LENGTH	ft	null, 1.0 - 12.0
POINT_DISTANCE	ft	-1200.0 - 1200.0
RECOVERED		null, Y, N
REFUSAL		null, Y, N
REFUSAL_DEPTH	ft	null, 0.0 - 25.0
TRANS_POS	ft	-20.0 - 12.0
WIDTH	ft	null, 1.0 - 12.0

TST_ISD_MOIST

FIELD_SET		1 - 10
ISD_DRY_1	pcf	50.00 - 200.00
ISD_DRY_2	pcf	50.00 - 200.00

ISD_DRY_3	pcf	50.00 - 200.00
ISD_DRY_4	pcf	50.00 - 200.00
ISD_DRY_AVG	pcf	50.00 - 200.00
ISD_WET_1	pcf	50.00 - 250.00
ISD_WET_2	pcf	50.00 - 250.00
ISD_WET_3	pcf	50.00 - 250.00
ISD_WET_4	pcf	50.00 - 250.00
ISD_WET_AVG	pcf	50.00 - 250.00
ISMC_1	%	1.5 - 70.0
ISMC_2	%	1.5 - 70.0
ISMC_3	%	1.5 - 70.0
ISMC_4	%	1.5 - 70.0
ISMC_AVG	%	1.5 - 70.0
MATERIAL_TYPE		G, AT, T

TST_L05

MATL_CODE	1 - 350
INV_LAYER_NO_1	null, 1 - 10
INV_LAYER_NO_2	null, 1 - 10

TST_L05A

GPS

All GPS

FIELD	RANGE(DESCRIPTION)
LAYER_THICK_STATION0 LAYER_THICK_WITHIN LAYER_THICK_STATION5	null, 0.0 - 18.0 (1); 0.0 - 1.5 (2); 0.0 - 18.0 (3); 0.0 - 10.0 (4); 0.0 - 24.0 (5); 0.0 - 48.0 (6); 0.0 - 240.0 (7); 0.0 - 6.0 (8); 0.0 - 2.5 (9); 0.0 - 1.5 (10)
MEASURE_TYPE_1_STATION0 MEASURE_TYPE_2_STATION0 MEASURE_TYPE_3_STATION0 MEASURE_TYPE_1_WITHIN MEASURE_TYPE_2_WITHIN MEASURE_TYPE_3_WITHIN MEASURE_TYPE_1_STATION5 MEASURE_TYPE_2_STATION5 MEASURE_TYPE_3_STATION5	null, 1 - 10

GPS Experiment Specific

GPS EXPERIMENT	Valid DESCRIPTION
1	2 - 7, 9, 10
2	2 - 7, 9, 10
3	2, 3, 5 - 7

GPS EXPERIMENT	Valid DESCRIPTION
4	2, 3, 5 - 7
5	2, 3, 5 - 7
6*	1 - 10
7*	1 - 10
9	1 - 3, 5 - 8

The following table illustrates valid MATL_CODE_* values for a given DESCRIPTION by GPS experiment. Null is also acceptable for each value.

DESC	GPS EXPERIMENT Valid MATL_CODE_STATION0 MATL_CODE_WITHIN MATL_CODE_STATION5							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**9**
1						See below*		4 - 6
2	71 - 73, 81 – 83							
3	1		4	5	6	1		4 - 6
4	1					See below**		
5	302 – 309	319 - 341	302 - 309, 319 - 341					
6	302 - 309, 319 - 341							
7	101 - 121, 131 - 137, 141 - 148, 151, 160 - 166, 171 - 173, 176 - 178, 200 - 217, 251 - 267, 280 – 294							
8						74, 75, 77		71, 74, 75, 77, 78, 79, 80, 85
9	2					2		
10	71 - 73, 81 - 83					71 - 73, 81 - 83		
11								

*DESC = 1:
For GPS6A, 6B, 6D, 7A, 7B, and 7D a MATL_CODE_* = 1 is allowed.
For GPS6C, 6S, 7C, 7F, 7R, and 7S a MATL_CODE_* = 1 or 13 is allowed.
**DESC = 4:

For GPS6C and 6S, a MATL_CODE_* = 1 or 13 is allowed.

SPS

For sections in the SPS1 Experiment:

DESCRIPTION 2, 3 - 9 and 11

For all sections like ?101 - ?124, the following ranges (if not null) are valid for the given DESCRIPTION:

DESCRIPTION	LAYER_THICK_STATION0 LAYER_THICK_WITHIN LAYER_THICK_STATION5
2	0.0 – 1.5
6	4.0 - 47.9
7	24.0 - 240.0
8	0.1 – 0.5
9	0.1 – 1.0
11	4.0 - 47.9

In addition, for each test section, the following ranges (if not null) apply for DESCRIPTION = 3, 4, and 5:

SHRP_ID	LAYER_THICK_STATION0 LAYER_THICK_WITHIN LAYER_THICK_STATION5		
	DESCRIPTION = 3	DESCRIPTION = 4	DESCRIPTION = 5
?101	1.0 - 8.0	1.0 - 8.0	7.0 - 9.0
?102	1.0 - 5.0	1.0 - 5.0	11.0 - 13.0
?103	1.0 - 5.0	1.0 - 5.0	7.0 - 9.0
?104	1.0 - 8.0	1.0 - 8.0	11.0 - 13.0
?105	1.0 - 5.0	1.0 - 5.0	1.0 - 9.5
?106	1.0 - 8.0	1.0 - 8.0	1.0 - 13.5
?107	1.0 - 5.0	1.0 - 5.0	1.0 - 9.5

SHRP_ID	LAYER_THICK_STATION0 LAYER_THICK_WITHIN LAYER_THICK_STATION5		
	DESCRIPTION = 3	DESCRIPTION = 4	DESCRIPTION = 5
?108	1.0 - 8.0	1.0 - 8.0	1.0 - 13.5
?109	1.0 - 8.0	1.0 - 8.0	1.0 - 17.5
?110	1.0 - 8.0	1.0 - 8.0	1.0 - 9.5
?111	1.0 - 5.0	1.0 - 5.0	1.0 - 13.5
?112	1.0 - 5.0	1.0 - 5.0	1.0 - 17.5
?113	1.0 - 5.0	1.0 - 5.0	7.0 - 9.0
?114	1.0 - 8.0	1.0 - 8.0	11.0 - 13.0
?115	1.0 - 8.0	1.0 - 8.0	7.0 - 9.0
?116	1.0 - 5.0	1.0 - 5.0	11.0 - 13.0
?117	1.0 - 8.0	1.0 - 8.0	1.0 - 9.5
?118	1.0 - 5.0	1.0 - 5.0	1.0 - 13.5
?119	1.0 - 8.0	1.0 - 8.0	1.0 - 9.5
?120	1.0 - 5.0	1.0 - 5.0	1.0 - 13.5
?121	1.0 - 5.0	1.0 - 5.0	1.0 - 17.5
?122	1.0 - 5.0	1.0 - 5.0	1.0 - 9.5
?123	1.0 - 8.0	1.0 - 8.0	1.0 - 13.5
?124	1.0 - 8.0	1.0 - 8.0	1.0 - 17.5

In addition, for each test section, the following ranges (if not null) apply for each DESCRIPTION (not supplementals):

DESCRIPTION	MATL_CODE_STATION0 MATL_CODE_WITHIN MATL_CODE_STATION5

DESCRIPTION	MATL_CODE_STATION0 MATL_CODE_WITHIN MATL_CODE_STATION5
2	71 - 73, 81 – 83
3	1
4	1
6	302 - 310, 333, 336 - 338, 350
7	100 - 178, 200 – 294
8	74, 75
9	2
11	100 - 178, 200 – 294

In addition, for each test section in the primary experiment, the following ranges (if not null) apply for a DESCRIPTION = 5:

SHRP_ID	MATL_CODE_STATION0 MATL_CODE_WITHIN MATL_CODE_STATION5
?101	303 – 305
?102	303 – 305
?103	319
?104	319
?105	303 - 305, 319
?106	303 - 305, 319
?107	303 - 305, 325
?108	303 - 305, 325
?109	303 - 305, 325
?110	319, 325
?111	319, 325

SHRP_ID	MATL_CODE_STATION0 MATL_CODE_WITHIN MATL_CODE_STATION5
?112	319, 325
?113	303 – 305
?114	303 – 305
?115	319
?116	319
?117	303 - 305, 319
?118	303 - 305, 319
?119	303 - 305, 325
?120	303 - 305, 325
?121	303 - 305, 325
?122	319, 325
?123	319, 325
?124	319, 325

For sections in the SPS2 Experiment:

DESCRIPTION 3, 5, 6, 7, 8 or 11

The following ranges (if not null) are valid for the given DESCRIPTION (not supplementals):

DESCRIPTION	LAYER_THICK_STATION0 LAYER_THICK_WITHIN LAYER_THICK_STATION5
6	4.0 - 47.9
7	24.0 - 240.0
8	0.1 - 0.5
11	4.0 - 47.9

The following ranges (if not null) apply for DESCRIPTION = 3 and 5:

SHRP_ID	LAYER_THICK_STATION0 LAYER_THICK_WITHIN LAYER_THICK_STATION5	
	DESCRIPTION = 3	DESCRIPTION = 5
?201, ?202, ?213, ?214, ?225, ?231,?237, ?238, ?245, ?246	7.0 - 9.0	5.0 - 7.0
?203, ?204, ?207, ?208, ?215, ?216, ?219, ?220, ?226, ?228, ?232, ?234, ?239, ?240, ?247, ?248	10.0 - 12.0	5.0 - 7.0
?205, ?206, ?217, ?218, ?227, ?233	7.0 - 9.0	5.0 - 7.0
?209, ?210, ?221, ?222, ?229, ?235, ?241, ?242, ?249, ?250	7.0 - 9.0	1.0 - 9.5
?211, ?212, ?223, ?224, ?230, ?236, ?243, ?244, ?251, ?252	10.0 - 12.0	1.0 - 9.5

The following ranges (if not null) apply for each DESCRIPTION (not supplementals):

DESCRIPTION	MATL_CODE_STATION0 MATL_CODE_WITHIN MATL_CODE_STATION5
6	302 - 310, 333, 336 - 338, 350
7	100 - 178, 200 – 294
8	74, 75
11	100 - 178, 200 – 294

The following ranges (if not null) apply for a DESCRIPTION = 3:

SHRP_ID	MATL_CODE_STATION0 MATL_CODE_WITHIN MATL_CODE_STATION5
?201 - ?236	4
?237 - ?252	5

The following ranges (if not null) apply for a DESCRIPTION = 5

SHRP_ID	MATL_CODE_STATION0 MATL_CODE_WITHIN MATL_CODE_STATION5
?201, ?202, ?203, ?204, ?213, ?214, ?215, ?216, ?225, ?226, ?231, ?232, ?237, ?238, ?239, ?240, ?245, ?246, ?247, ?248	303 - 305
?205, ?206, ?207, ?208, ?217, ?218, ?219, ?220, ?227, ?228, ?233, ?234	334
?209, ?210, ?221, ?222, ?229, ?235, ?241, ?242, ?249, ?250	303 - 305, 325
?211, ?212, ?223, ?224, ?230, ?236, ?243, ?244, ?251, ?252	303 - 305, 325

For sections in the SPS3 Experiment:

For all CONSTRUCTION_NOs and for all sections, the following ranges (if not null) are valid for the given DESCRIPTION (not supplementals):

DESCRIPTION	LAYER_THICK_STATION0 LAYER_THICK_WITHIN LAYER_THICK_STATION5	MATL_CODE_STATION0 MATL_CODE_WITHIN MATL_CODE_STATION5
2	0.0 - 1.5	71 - 73, 81 - 83
3	1.0 - 14.0	1
4	1.0 - 14.0	1
5	4.0 - 24.0	302 - 310, 319 - 341, 350
6	4.0 - 47.9	302 - 310, 319 - 341, 350
7	24.0 - 240.0	100 - 178, 200 - 294
8	0.1 - 6.0	70 - 85
9	0.0 - 2.5	2
10	0.0 - 1.5	11, 12, 71 - 73, 81 - 84

For all CONSTRUCTION_NOs, a DESCRIPTION = 11 is not valid.

For CONSTRUCTION_NO = 1, a DESCRIPTION = 1 is not valid.

For CONSTRUCTION_NO > = 2, a DESCRIPTION = 1 is not valid except for SHRP_ID like ?310.

For CONSTRUCTION_NO = 2 and SHRP_ID like ?310, the following ranges (if not null) are valid for a DESCRIPTION = 1:

LAYER_THICK_STATION0 LAYER_THICK_WITHIN LAYER_THICK_STATION5	MATL_CODE_STATION0 MATL_CODE_WITHIN MATL_CODE_STATION5
0.0 - 1.5	1

For sections in the SPS4 Experiment:

For all CONSTRUCTION_NOs and for all sections, the following ranges (if not null) are valid for the given DESCRIPTION (not supplementals):

DESCRIPTION	LAYER_THICK_STATION0 LAYER_THICK_WITHIN LAYER_THICK_STATION5	MATL_CODE_STATION0 MATL_CODE_WITHIN MATL_CODE_STATION5
2	0.0 - 1.5	71 - 73, 81 - 83
3	6.0 - 13.0	4, 5
5	4.0 - 24.0	302 - 310, 319 - 341, 350
6	4.0 - 47.9	302 - 310, 319 - 341, 350
7	24.0 - 240.0	100 - 178, 200 - 294

For all CONSTRUCTION_NOs, a DESCRIPTION = 1, 2, 4, 8, 9, 10, or 11 is not valid.

For sections in the SPS5 Experiment:

For all CONSTRUCTION_NOs and for all sections (SHRP_ID like ?501 - ?509), the following ranges (if not null) are valid for the given DESCRIPTION:

DESCRIPTION	LAYER_THICK_STATION0 LAYER_THICK_WITHIN LAYER_THICK_STATION5	MATL_CODE_STATION0 MATL_CODE_WITHIN MATL_CODE_STATION5
2	0.0 - 1.5	71 - 73, 81 - 83
3	0.0 - 14.0	1
4	0.0 - 14.0	1, 13
5	4.0 - 24.0	302 - 310, 319 - 341, 350
6	4.0 - 47.9	302 - 310, 319 - 341, 350

DESCRIPTION	LAYER_THICK_STATION0 LAYER_THICK_WITHIN LAYER_THICK_STATION5	MATL_CODE_STATION0 MATL_CODE_WITHIN MATL_CODE_STATION5
7	24.0 - 240.0	100 - 178, 200 - 294
8	0.1 - 6.0	74 - 84
9	0.0 - 2.5	2
10	0.0 - 1.5	11, 12, 71 - 73, 81 - 84

For all CONSTRUCTION_NOs, a DESCRIPTION = 11 is not valid.

For CONSTRUCTION_NO = 1, a DESCRIPTION = 1 is not valid.

The following checks specifically apply for CONSTRUCTION_NO >= 2:

A DESCRIPTION = 1 is not valid for SHRP_ID = ?501.

For test sections where SHRP_ID = ?502 - ?509, the following ranges are valid for DESCRIPTION = 1:

SECT. ID	MATL_CODE_STATION0 MATL_CODE_WITHIN MATL_CODE_STATION5	LAYER_THICK_STATION0 LAYER_THICK_WITHIN LAYER_THICK_STATION5
?502	13	1.0 - 3.0
?503	13	1.0 - 6.0
?504	1	1.0 - 6.0
?505	1	1.0 - 3.0
?506	1	1.0 - 5.0
?507	1	1.0 - 8.0
?508	13	1.0 - 8.0
?509	13	1.0 - 5.0

For sections in the SPS6 Experiment:

For all CONSTRUCTION_NOs and for all sections (SHRP_ID like ?601 - ?608), the following ranges (if not null) are valid for the given DESCRIPTION:

DESCRIPTION	LAYER_THICK_STATION0 LAYER_THICK_WITHIN LAYER_THICK_STATION5	MATL_CODE_STATION0 MATL_CODE_WITHIN MATL_CODE_STATION5
2	0.0 - 1.5	71 - 73, 81 - 83
3	7.0 - 13.0	4, 5
5	3.0 - 24.0	302 - 310, 319 - 341, 350
6	4.0 - 47.9	302 - 310, 319 - 341, 350
7	24.0 - 240.0	100 - 178, 200 - 294
8	0.1 - 6.0	74 - 84
9	0.0 - 2.5	2
10	0.0 - 1.5	11, 12, 71 - 73, 81 - 84

For all CONSTRUCTION_NOs, a DESCRIPTION = 11 is not valid (not supplementals).

The following check specifically applies for CONSTRUCTION_NO = 1:

DESCRIPTION = 1 is not valid.

For test sections where SHRP_ID = ?601 - ?608, the following ranges are valid for the given DESCRIPTION:

DESCRIPTION	LAYER_THICK_STATION0 LAYER_THICK_WITHIN LAYER_THICK_STATION5	MATL_CODE_STATION0 MATL_CODE_WITHIN MATL_CODE_STATION5
4	1.0 – 7.0	1

The following checks specifically apply for CONSTRUCTION_NO ≥ 2:

DESCRIPTION = 1 is not valid for SHRP_ID = ?601, ?602, ?605.

For test sections where SHRP_ID = ?603, ?604, ?606, ?607, ?608, the following ranges (if not null) are valid for a DESCRIPTION = 1:

SECT. ID	LAYER_THICK_STATION0 LAYER_THICK_WITHIN LAYER_THICK_STATION5	MATL_CODE_STATION0 MATL_CODE_WITHIN MATL_CODE_STATION5
?603	1 - 5	1
?604	1 - 5	1
?606	1 - 5	1

SECT. ID	LAYER_THICK_STATION0 LAYER_THICK_WITHIN LAYER_THICK_STATION5	MATL_CODE_STATION0 MATL_CODE_WITHIN MATL_CODE_STATION5
?607	1 - 5	1
?608	1 - 9	1

For sections in the SPS7 Experiment:

For all CONSTRUCTION_NOs and for all sections (SHRP_ID like ?701 - ?709), the following ranges (if not null) are valid for the given DESCRIPTION:

DESCRIPTION	LAYER_THICK_STATION0 LAYER_THICK_WITHIN LAYER_THICK_STATION5	MATL_CODE_STATION0 MATL_CODE_WITHIN MATL_CODE_STATION5
2	0.0 - 1.5	71 - 73, 81 - 83
3	7.0 - 13.0	4, 5, 6
5	3.0 - 24.0	302 - 310, 319 - 341, 350
6	4.0 - 47.9	302 - 310, 319 - 341, 350
7	24.0 - 240.0	100 - 178, 200 - 294
8	0.1 - 6.0	70 - 85
9	0.0 - 2.5	2
10	0.0 - 1.5	11, 12

For all CONSTRUCTION_NOs, a DESCRIPTION = 4 or 11 is not valid (not supplementals).

For CONSTRUCTION_NO = 1, DESCRIPTION = 1 is not valid.

The following checks specifically apply for CONSTRUCTION_NO >= 2:

DESCRIPTION = 1 is not valid for SHRP_ID = ?701.

DESCRIPTION = 2, 9 or 10 is not valid.

For test sections where SHRP_ID = ?702 - ?709, the following ranges (if not null) are valid for a DESCRIPTION = 1:

SHRP_ID	LAYER_THICK_STATION0 LAYER_THICK_WITHIN LAYER_THICK_STATION5
?702, ?703, ?704, ?705	2.0 – 4.0
?706, ?707, ?708, ?709	4.0 – 6.0

SHRP_ID	MATL_CODE_STATION0 MATL_CODE_WITHIN MATL_CODE_STATION5
?702 - ?709	4, 90 (CN = 2)

For sections in the SPS8 Experiment:

For SHRP_ID like ?801 - ?806:

DESCRIPTION 3 - 9, 11

For sections like ?801 - ?806, the following ranges (if not null) are valid for the given DESCRIPTION:

DESCRIPTION	LAYER_THICK_STATION0 LAYER_THICK_WITHIN LAYER_THICK_STATION5	MATL_CODE_STATION0 MATL_CODE_WITHIN MATL_CODE_STATION5
6	4.0 - 47.9	302 - 310, 333, 336 - 338, 350
7	24.0 - 240.0	100 - 178, For SHRP_ID ?801 -?804; 200 - 294, For SHRP_ID ?805 - ?806
8	0.1 - 0.5	74, 75
9	0.1 - 1.0	2
11	4.0 - 47.9	100 - 178, 200 - 294

In addition, for each test section, the following ranges (if not null) apply for DESCRIPTION = 3, 4[4], and 5:

[4] If DESCRIPTION = 4 exists.

SHRP_ID	LAYER_THICK_STATION0 LAYER_THICK_WITHIN LAYER_THICK_STATION5		MATL_CODE_STATION0 MATL_CODE_WITHIN MATL_CODE_STATION5	
	DESCRIPTION = 3 or 4	DESCRIPTION = 5	DESCRIPTION = 3 or 4	DESCRIPTION = 5
?801, ?803, ?805	1.0 - 4.5	7 - 9	1	303 - 305
?802, ?804, ?806	1.0- 7.5	11 - 13	1	303 - 305

For SHRP_ID like ?807 - ?812:

DESCRIPTION 3, 5, 6, 7 and 11

In addition, for each test section, the following ranges (if not null) apply for the given DESCRIPTION:

DESCRIPTION	LAYER_THICK_STATION0 LAYER_THICK_WITHIN LAYER_THICK_STATION5	MATL_CODE_STATION0 MATL_CODE_WITHIN MATL_CODE_STATION5
5	5.0 - 7.0	303 - 305
6	4.0 - 47.9	302 - 310, 333, 336 - 338, 350
7	24.0 - 240.0	100 - 178, For SHRP_ID ?807 - ?810 200 - 294, For SHRP_ID ?811 - ?812
11	4.0 - 47.9	100 - 178, 200 - 294

In addition, for each test section, the following ranges (if not null) apply for DESCRIPTION = 3:

SHRP_ID	LAYER_THICK_STATION0 LAYER_THICK_WITHIN LAYER_THICK_STATION5	MATL_CODE_STATION0 MATL_CODE_WITHIN MATL_CODE_STATION5
?807, ?809, ?811	7.5 - 8.5	4
?808, ?810, ?812	10.5 - 12.5	4

For sections in the SPS9 Experiment:

DESCRIPTION 1 - 11

For all sections, the following ranges (if not null) apply for the given DESCRIPTION (not supplementals):

DESCRIPTION	LAYER_THICK_STATION0 LAYER_THICK_WITHIN LAYER_THICK_STATION5
1	0.8 - 8.0
2	0.1 - 1.5
3	1.0 - 13.0
4	1.0 - 10.0
5	3.0 - 24.0
6	4.0 - 47.9
7	Must be null
8	0.1 - 6.0
9	0.3 - 2.5
10	0.1 - 1.5
11	4.0 - 47.9

DESCRIPTION	MATL_THICK_STATION0 MATL_THICK_WITHIN MATL_THICK_STATION5
1	1, 13
2	71 – 73, 81 - 83
3	1, 4, 5, 6
4	1
5	302 - 310, 319 - 341, 350
6	302 - 310, 319 - 341, 350
7	100 – 178, 200 - 294
8	74 - 84
9	2

DESCRIPTION	MATL_THICK_STATION0 MATL_THICK_WITHIN MATL_THICK_STATION5
10	11, 12, 71 - 73, 81 – 84
11	100 – 178, 200 – 294

TST_L05B

GPS

All GPS

FIELD	RANGE (DESCRIPTION)
REPR_THICKNESS	0.0 - 18.0(1); 0.0 - 1.5(2); 0.0 - 18.0(3);0.0 - 10.0(4); 0.0 - 24.0(5); 0.0 - 48.0(6);null or 0.0 - 240.0(7); 0.0 - 6.0(8); 0.0 - 2.5(9);0.0 - 1.5(10) 999.9 is also acceptable for all values
INV_LAYER_NO_1	null, 1 - 10
INV_LAYER_NO_2	null, 1 - 10

GPS Experiment Specific

GPS EXPERIMENT	Valid EXPERIMENT
1	2 - 7, 9, 10
2	2 - 7, 9, 10
3	2, 3, 5 - 7
4	2, 3, 5 - 7
5	2, 3, 5 - 7
6*	1 - 10
7*	1 - 10
9	1, 3, 5 - 8

The following table illustrates valid MATL_CODE values for a given DESCRIPTION by GPS experiment:

DESC	GPS EXPERIMENT Valid MATL_CODE (999 is also acceptable for each value)							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**9**
1						See below*		4 - 6
2	71 - 73, 81 - 83							
3	1		4	5	6	1		4 - 6
4	1					See below**		
5	302-309	319 - 341	302 - 309, 319 - 341					
6	302 - 309, 319 - 341							
7	101 - 121, 131 - 137, 141 - 148, 151, 160 - 166, 171 - 173, 176 - 178, 200 - 217, 251 - 267, 280 – 294							
8						74, 75, 77		71, 74, 75, 77, 78, 79, 80, 85
9	2					2		
10	71 - 73, 81 - 83					71 - 73, 81 - 83		
11								

*DESC = 1
For GPS6A, 6B, 6D, 7A, 7B, and 7D a MATL_CODE = 1 or 999 is allowed.
For GPS6C, 6S, 7C, 7F, 7R, and 7S a MATL_CODE = 1, 13 or 999 is allowed.
**DESC = 4
For GPS6C and 6S, a MATL_CODE = 1, 13 or 999 is allowed.

SPS

For sections in the SPS1 Experiment:

DESCRIPTION 2, 3 - 9; 11 (not supplementals)

If LAYER_NO > 1, then the REPR_THICKNESS and MATL_CODE must be non-null.

If REPR_THICKNESS is non-null, it must be ≥ 0.

For all sections, the following ranges are valid for the given DESCRIPTION (not supplementals):

DESCRIPTION	REPR_THICKNESS
2	0.0 - 1.5
6	4.0 - 47.9
7	24.0 - 240.0
8	0.1 - 0.5
9	0.1 - 1.0
11	4.0 - 47.9

In addition, for each test section in the primary experiment, the following ranges apply for DESCRIPTION = 3, 4[5], and 5[6]:

SHRP_ID	REPR_THICKNESS		
	DESCRIPTION = 3 + 4	DESCRIPTION = 5	DESCRIPTION = 5 + 5
?101	6.0 - 8.0	7.0 - 9.0	
?102	3.0 - 5.0	11.0 - 13.0	
?103	3.0 - 5.0	7.0 - 9.0	
?104	6.0 - 8.0	11.0 - 13.0	
?105	3.0 - 5.0		6.5 - 9.5
?106	6.0 - 8.0		10.5 - 13.5
?107	3.0 - 5.0		6.5 - 9.5
?108	6.0 - 8.0		10.5 - 13.5
?109	6.0 - 8.0		14.5 - 17.5
?110	6.0 - 8.0		6.5 - 9.5
?111	3.0 - 5.0		10.5 - 13.5

[5] If DESCRIPTION = 4 exists.

[6] Sections with a "5 + 5" DESCRIPTION must have two LAYER_NOs with a DESCRIPTION = 5. The thicknesses for these two layers should be summed.

SHRP_ID	REPR_THICKNESS		
	DESCRIPTION = 3 + 4	DESCRIPTION = 5	DESCRIPTION = 5 + 5
?112	3.0 - 5.0		14.5 - 17.5
?113	3.0 - 5.0	7.0 - 9.0	
?114	6.0 - 8.0	11.0 - 13.0	
?115	6.0 - 8.0	7.0 - 9.0	
?116	3.0 - 5.0	11.0 - 13.0	
?117	6.0 - 8.0		6.5 - 9.5
?118	3.0 - 5.0		10.5 - 13.5
?119	6.0 - 8.0		6.5 - 9.5
?120	3.0 - 5.0		10.5 - 13.5
?121	3.0 - 5.0		14.5 - 17.5
?122	3.0 - 5.0		6.5 - 9.5
?123	6.0 - 8.0		10.5 - 13.5
?124	6.0 - 8.0		14.5 - 17.5

In addition, for each test section, the following ranges apply for each DESCRIPTION (not supplementals):

DESCRIPTION	MATL_CODE
2	71- 73, 81 - 83
3	1
4	1
6	302 - 310, 333, 336 - 338, 350
7	100 - 178, 200 - 294
8	74, 75
9	2

DESCRIPTION	MATL_CODE
11	100 - 178, 200 - 294

In addition, for each test section in the primary experiment, the following range applies for DESCRIPTION = 5:

SHRP_ID	MATL_CODE
?101	303 - 305
?102	303 - 305
?103	319
?104	319
?105	303 - 305, 319
?106	303 - 305, 319
?107	303 - 305, 325
?108	303 - 305, 325
?109	303 - 305, 325
?110	319, 325
?111	319, 325
?112	319, 325
?113	303 - 305
?114	303 - 305
?115	319
?116	319
?117	303 - 305, 319
?118	303 - 305, 319
?119	303 - 305, 325
?120	303 - 305, 325

SHRP_ID	MATL_CODE
?121	303 - 305, 325
?122	319, 325
?123	319, 325
?124	319, 325

For sections in the SPS2 Experiment:

DESCRIPTION 3, 5, 6, 7, 8, or 11 (plus 4 for supplementals)

If LAYER_NO > 1, then the REPR_THICKNESS and MATL_CODE must be non-null.

If REPR_THICKNESS is non-null, it must be ≥ 0.

The following ranges are valid for the given DESCRIPTION (not supplementals):

SHRP_ID	REPR_THICKNESS
6	4.0 - 47.9
7	24.0 - 240.0
8	0.1 - 0.5
11	4.0 - 47.9

The following ranges apply for DESCRIPTION = 3 and 5[7]:

SHRP_ID	REPR_THICKNESS		
	DESCRIPTION = 3	DESCRIPTION = 5	DESCRIPTION[7] = 5 + 5
?201, ?202, ?213, ?214, ?225, ?231, ?237, ?238, ?245, ?246	7.0 - 9.0	5.0 – 7.0	
?203, ?204, ?207, ?208, ?215, ?216, ?219, ?220, ?226, ?228, ?232, ?234, ?239, ?240, ?247, ?248	10.0 - 12.0	5.0 – 7.0	

[7] Add REPR_THICKNESS for two or more layers with DESCRIPTION=5.

SHRP_ID	REPR_THICKNESS		
	DESCRIPTION = 3	DESCRIPTION = 5	DESCRIPTION[7] = 5 + 5
?205, ?206, ?217, ?218, ?227, ?233	7.0 - 9.0	5.0 – 7.0	
?209, ?210, ?221, ?222, ?229, ?235, ?241, ?242, ?249, ?250	7.0 - 9.0		6.5 - 9.5
?211, ?212, ?223, ?224, ?230, ?236, ?243, ?244, ?251, ?252	10.0 - 12.0		6.5 - 9.5

The following ranges apply for each DESCRIPTION (not supplementals):

DESCRIPTION	MATL_CODE
6	302 - 310, 333, 336 - 338, 350
7	100 - 178, 200 - 294
8	74, 75
11	100 - 178, 200 - 294

The following ranges apply for a DESCRIPTION = 3:

SHRP_ID	MATL_CODE
?201 - 236	4
?237 - ?252	5

The following ranges apply for a DESCRIPTION = 5:

SHRP_ID	MATL_CODE
?201, ?202, ?203, ?204, ?213, ?214, ?215, ?216, ?225, ?226, ?231, ?232, ?237, ?238, ?239, ?240, ?245, ?246, ?247, ?248	303 - 305
?205, ?206, ?207, ?208, ?217, ?218, ?219, ?220, ?227, ?228, ?233, ?234	334
?209, ?210, ?221, ?222, ?229, ?235, ?241, ?242, ?249, ?250	303 - 305, 325

SHRP_ID	MATL_CODE
?211, ?212, ?223, ?224, ?230, ?236, ?243, ?244, ?251, ?252	303 - 305, 325

For sections in the SPS3 Experiment:

If LAYER_NO > 1, then the REPR_THICKNESS and MATL_CODE must be non-null.

If REPR_THICKNESS is non-null, it must be ≥ 0.

For all CONSTRUCTION_NOs and for all sections, the following ranges are valid for the given DESCRIPTION (not supplementals):

DESCRIPTION	REPR_THICKNESS	MATL_CODE
2	0.0 - 1.5, 999.9	71 - 73, 81 - 83, 999
3	see following checks	1, 999
4	1.0 – 10.0, 999.9	1, 999
5	4.0 – 24.0, 999.9	302 - 310, 319 - 341, 350, 999
6	4.0 – 47.9, 999.9	302 - 310, 319 - 341, 350, 999
7	24.0 - 240. 0, 999.9	100 - 178, 200 - 294, 999
8	0.1 - 6.0	70 - 85
9	0.0 - 2.5, 999.9	2, 999
10	0.0 - 1.5, 999.9	11, 12, 71 - 73, 81 - 84, 999

For all CONSTRUCTION_NOs, the following range for REPR_THICKNESS is valid for the given combinations of DESCRIPTIONs. Please note that this applies to a DESCRIPTION = 3 and all LAYER_NOs below a DESCRIPTION = 3 that have a DESCRIPTION = 4 (not supplementals).

DESCRIPTION	REPR_THICKNESS
3 + 4	1.0 - 14.0, 999.9

For all CONSTRUCTION_NOs, a DESCRIPTION = 11 is not valid (not supplementals).

For CONSTRUCTION_NO = 1, a DESCRIPTION = 1 is not valid.

For CONSTRUCTION_NO ≥ 2, a DESCRIPTION = 1 is not valid except for SHRP_ID like ?310 (not supplementals).

For CONSTRUCTION_NO = 2 and SHRP_ID like ?310, the following ranges (if not null) are valid for a DESCRIPTION = 1:

REPR_THICKNESS	MATL_CODE
0.0 - 1.5	1

For sections in the SPS4 Experiment:

If LAYER_NO > 1, then the REPR_THICKNESS and MATL_CODE must be non-null.

If REPR_THICKNESS is non-null, it must be ≥ 0.

For all CONSTRUCTION_NOs and for all sections, the following ranges are valid for the given DESCRIPTION (not supplementals):

DESCRIPTION	REPR_THICKNESS	MATL_CODE
2	0.0 - 1.5	71 - 73, 81 - 83
3	6.0 - 13.0, 999.9	4, 5, 999
5	4.0 - 24.0, 999.9	302 - 310, 319 - 341, 350, 999
6	4.0 - 47.9, 999.9	302 - 310, 319 - 341, 350, 999
7	24.0 - 240.0, 999.9	100 - 178, 200 - 294, 999

For all CONSTRUCTION_NOs, a DESCRIPTION = 1, 2, 4, 8, 9, 10, or 11 is not valid (not supplementals).

For sections in the SPS5 Experiment:

If LAYER_NO > 1, then the REPR_THICKNESS and MATL_CODE must be non-null.

If REPR_THICKNESS is non-null, it must be > 0.

For all CONSTRUCTION_NOs and for all sections (SHRP_ID like ?501-?509), the following ranges (if not null) are valid for the given DESCRIPTION (not supplementals):

DESCRIPTION	REPR_THICKNESS	MATL_CODE
2	0.0 - 1.5, 999.9	71 - 73, 81 - 83, 999
5	4.0 - 24.0, 999.9	302 - 310, 319 - 341, 350, 999
6	4.0 - 47.9, 999.9	302 - 310, 319 - 341, 350, 999
7	24.0 - 240.0, 999.9	100 - 178, 200 - 294

DESCRIPTION	REPR_THICKNESS	MATL_CODE
8	0.1 - 6.0, 999.9	74 - 84, 999
9	0.0 - 2.5, 999.9	2, 999
10	0.0 - 1.5, 999.9	11, 12, 71 - 73, 81 - 84, 999

A DESCRIPTION = 11 is not valid.

The following checks specifically apply for CONSTRUCTION_NO = 1:

A DESCRIPTION = 1 is not valid.

For all sections (SHRP_ID_ LIKE ?501 - ?509), the following range for REPR_THICKNESS is valid for the given combinations of DESCRIPTIONs. Please note that this applies to a DESCRIPTION = 3 and all LAYER_NOs below a DESCRIPTION = 3 that have a DESCRIPTION = 4 (not supplementals).

DESCRIPTION	REPR_THICKNESS	MATL_CODE
3 + 4	3.0 – 14.0, 999.9	1, 999

The following checks specifically apply for CONSTRUCTION_NO ≥ 2:

For all sections (SHRP_ID_ LIKE ?501 - ?509), the following range for REPR_THICKNESS is valid for the given combinations of DESCRIPTIONs. Please note that this applies to a DESCRIPTION = 3 and all LAYER_NOs below a DESCRIPTION = 3 that have a DESCRIPTION = 4 (not supplementals).

DESCRIPTION	REPR_THICKNESS	MATL_CODE
3 + 4	0.0 – 14.0, 999.9	1, 999

DESCRIPTION = 1 not valid for SHRP_ID = ?501.

For test sections where SHRP_ID = ?502 - ?509, the following ranges are valid:

SECT. ID	DESCRIPTION[8]	MATL_CODE[9]	REPR_THICKNESS
?502	1 + 4	13	1.0 - 3.0
?503	1 + 4	13	4.0 - 6.0
?504	1 + 4	1	4.0 - 6.0
?505	1 + 4	1	1.0 - 3.0
?506	1 + 4	1	2.0 - 5.0[10]
?507	1 + 4	1	5.0 - 8.0[10]
?508	1 + 4	13	5.0 - 8.0[10]
?509	1 + 4	13	2.0 - 5.0[10]

For sections in the SPS6 Experiment:

If LAYER_NO > 1, then the REPR_THICKNESS and MATL_CODE must be non-null.

If REPR_THICKNESS is non-null, it must be $\geq$ 0.

For all CONSTRUCTION_NOs and for all sections (SHRP_ID like ?601 - ?608), the following ranges are valid for the given DESCRIPTION (not supplementals):

DESCRIPTION	REPR_THICKNESS	MATL_CODE
2	0.0 - 1.5, 999.9	71 - 73, 81 - 83, 999
3	7.0 - 13.0, 999.9	4, 5, 999
5	3.0 - 24.0, 999.9	302 - 310, 319 - 341, 350, 999
6	4.0 - 47.9, 999.9	302 - 310, 319 - 341, 350, 999

[8] These thicknesses include the experimental design overlay thickness and an additional allowance (over and above the experimental design overlay thickness) of 2 inches for the mill-replacement layer. If milling in excess of 2 inches occurs, the data may fail the QC checks. Therefore, this data is to be flagged and commented upon by the RCOC prior to manual upgrading of RECORD_STATUS.

[9] Similar to note 8 above, the MATL_CODE should be checked for all LAYER_NOs with a DESCRIPTION=1 and all LAYER_NOs above the LAYER_NO with a DESCRIPTION=3 that have a DESCRIPTION=4 (if a LAYER_NO with a DESCRIPTION=4 exists). It is not mandatory that a LAYER_NO with a DESCRIPTION=4 exist above a LAYER_NO with a DESCRIPTION=3.

[10] These thicknesses include the experimental design overlay thickness and an additional allowance (over and above the experimental design overlay thickness) of 2 inches for the mill-replacement layer. If milling in excess of 2 inches occurs, the data may fail the QC checks. Therefore, this data is to be flagged and commented upon by the RCOC prior to manual upgrading of RECORD_STATUS.

DESCRIPTION	REPR_THICKNESS	MATL_CODE
7	24.0 - 240.0, 999.9	100 - 178, 200 - 294, 999
8	0.1 - 6.0, 999.9	74 - 84, 999
9	0.0 - 2.5, 999.9	2, 999
10	0.0 - 1.5, 999.9	11, 12, 71 - 73, 81 - 84, 999

For all CONSTRUCTION_NOs, a DESCRIPTION = 11 is not valid.

The following check specifically applies for CONSTRUCTION_NO = 1:

For test sections where SHRP_ID - ?601 - ?608, the following ranges are valid for the given DESCRIPTION:

DESCRIPTION	REPR_THICKNESS	MATL_CODE
1	0.8 - 8.0, 999.9	1, 999
4	1.0 - 10.0, 999.9	1, 999

The following checks specifically apply for CONSTRUCTION_NO $\geq$ 2:

For CONSTRUCTION_NO = 2, a DESCRIPTION = 1 or 4 with a REPR_THICKNESS > 0 is not valid for SHRP_ID = ?601, ?602, or ?605.

For test sections where SHRP_ID = ?603, ?604, ?606, ?607, ?608 the following ranges are valid:

SECTION	DESCRIPTION[11]	REPR_THICKNESS	MATL_CODE
?603	1 + 4	3.0 - 5.0, 999.9	1
?604	1 + 4	3.0 - 5.0, 999.9	1
?606	1 + 4	3.0 - 5.0, 999.9	1
?607	1 + 4	3.0 - 5.0, 999.9	1
?608	1 + 4	7.0 - 9.0, 999.9	1

[11] DESCRIPTION above includes the LAYER_NO with a DESCRIPTION = 1 and all LAYER_NOs above the LAYER_NO with a DESCRIPTION = 3 that have a DESCRIPTION = 4 (if a LAYER_NO with a DESCRIPTION = 4 exists). It is not mandatory that a LAYER_NO with a DESCRIPTION = 4 exist above a LAYER_NO with a DESCRIPTION = 3. The REPR_THICKNESS values should be summed for all LAYER_NOs corresponding to the above criteria and compared with the values listed for REPR_THICKNESS above.

For sections in the SPS7 Experiment:

If LAYER_NO > 1, then the REPR_THICKNESS and MATL_CODE must be non-null.

If REPR_THICKNESS is non-null, it must be ≥ 0.

For all sections (SHRP_ID like ?701 - ?709), the following ranges are valid for the given DESCRIPTION (not supplementals):

DESCRIPTION	REPR_THICKNESS	MATL_CODE
2	0.0 - 1.5, 999.9	71 - 73, 81 - 83, 999
3	7.0 - 13.0, 999.9	4, 5, 6, 999
5	3.0 - 24.0, 999.9	302 - 310, 319 - 341, 350, 999
6	4.0 - 47.9, 999.9	302 - 310, 319 - 341, 350, 999
7	24.0 - 240.0, 999.9	100 - 178, 200 - 294, 999
8	0.1 - 6.0, 999.9	74 - 84, 999
9	0.0 - 2.5, 999	2, 999
10	0.0 - 1.5, 999.9	11, 12, 71 - 73, 81 - 84, 999

For all CONSTRUCTION_NOs, a DESCRIPTION = 4 or 11 is not valid (not supplementals).

For CONSTRUCTION_NO = 1, a DESCRIPTION = 1 is not valid.

The following checks specifically apply for CONSTRUCTION_NO > = 2:

DESCRIPTION = 1 is not valid for SHRP_ID = ?701.

DESCRIPTION = 2, 9 or 10 is not valid (not supplementals).

For test sections where SHRP_ID = ?702-?709 the following ranges are valid for a DESCRIPTION =1:

SHRP_ID	REPR_THICKNESS
?702 - ?705	2.0 - 4.0
?706 - ?709	4.0 - 6.0

SHRP_ID	MATL_CODE
?702 - ?709	4, 90, 999

For sections in the SPS8 Experiment:

If LAYER_NO > 1, then the REPR_THICKNESS and MATL_CODE must be non-null.

If REPR_THICKNESS is non-null, it must be ≥ 0.

For SHRP_ID like ?801 - ?806:

DESCRIPTION 3 - 9, 11

For sections like ?801 - ?806, the following ranges are valid for the given DESCRIPTION:

DESCRIPTION	REPR_THICKNESS	MATL_CODE
6	4.0 - 47.9	302 - 310, 333, 336 - 338, 350
7	24.0 - 240.0	100 - 178, For SHRP_ID ?801 -?804 200 - 294, For SHRP_ID ?805 - ?806
8	0.1 - 0.5	74, 75
9	0.1 - 1.0	2
11	4.0 - 47.9	100 - 178, 200 - 294

In addition, for each test section, the following ranges apply for DESCRIPTION = 3, 4[12], and 5:

SHRP_ID	REPR_THICKNESS		MATL_CODE	
	DESCRIPTION = 3 + 4	DESCRIPTION = 5	DESCRIPTION = 3 + 4	DESCRIPTION = 5
?801, ?803, ?805	3.5 - 4.5	7.0 - 9.0	1	303 - 305
?802, ?804, ?806	6.5 - 7.5	11.0 - 13.0	1	303 - 305

For SHRP_ID like ?807 - ?812:

DESCRIPTION 3, 5, 6, 7 and 11

In addition, for each test section, the following ranges apply for the given DESCRIPTION:

DESCRIPTION	REPR_THICKNESS	MATL_CODE
5	5.0 - 7.0	303 - 305
6	4.0 - 47.9	302 - 310, 333, 336 - 338, 350

[12] If DESCRIPTION = 4 exists.

DESCRIPTION	REPR_THICKNESS	MATL_CODE
7	24.0 - 240.0	100 - 178, For SHRP_ID ?807 - ?810 200 - 294, For SHRP_ID ?811 - ?812
11	4.0 - 47.9	100 - 178, 200 - 294

In addition, for each test section, the following ranges (if not null) apply for DESCRIPTION = 3:

SHRP_ID	REPR_THICKNESS	MATL_CODE
?807, ?809, ?811	7.5 - 8.5	4
?808, ?810, ?812	10.5 - 12.5	4

For sections in the SPS9 Experiment:

DESCRIPTION 1 - 11

For all sections, the following ranges (if not null) apply for the given DESCRIPTION (not supplementals):

DESCRIPTION	REPR_THICKNESS
1	0.8 - 8.0
2	0.1 - 1.5
3	1.0 - 13.0
4	1.0 - 10.0
5	3.0 - 24.0
6	4.0 - 47.9
7	24.0 - 240.0
8	0.1 - 6.0
9	0.3 - 2.5
10	0.1 - 1.5
11	4.0 - 47.9

DESCRIPTION	MATL_CODE
1	1, 13
2	71 – 73, 81 - 83
3	1, 4, 5, 6
4	1
5	302 - 310, 319 - 341, 350
6	302 - 310, 319 - 341, 350
7	100 – 178, 200 - 294
8	74 - 84
9	2
10	11, 12, 71 – 73, 81 - 84
11	100 – 178, 200 - 294

TST_PC01

CAPPED_LENGTH	in	3.2 - 13.2
COMP_STRENGTH	psi	300 - 10000
CROSS_SECTION_AREA	sq in	9.50 - 33.50
DIAMETER	in	3.50 - 6.50
FIELD_SET		1 - 10
LD_RATIO		0.80 - 2.20
MAX_LOAD	lb	2900 - 300000
ORIGINAL_LENGTH	in	3.6 - 12.25
TEST_DATE		>= 01-Jan-87, <= Today's date
TEST_NO		1 - 4

TST_PC02

DIAMETER	in	3.50 - 6.50
FIELD_SET		1 - 10
LD_RATIO		0.80 - 2.20
LENGTH	in	3.2 - 13.2
MAX_LOAD	lb	3000 - 80000
TENSILE_STRENGTH	psi	100 - 1500
TEST_DATE		>= 01-Jan-87, <= Today's date
TEST_NO		1 - 4

TST_PC03

COEF_THERMAL_EXPANSION	mm/mm/deg C	0.0000060 - 0.0000140
DIAMETER	mm	90.0 - 160.0
LAB_CODE		5111

THICKNESS	mm	170.0 - 190.0
TEST_DATE		>= 01-Jan-96, <= Today's date

TST_PC04

ELASTIC_MOD	psi	500000 - 9999999
FIELD_SET		1 - 10
POISON_RATIO		0.05 - 0.35
TEST_DATE		>= 01-Jan-87, <= Today's date
TEST_NO		1 - 4
UNIT_WT	pcf	100 - 200

TST_PC05

APPARENT_SPECIFIC_GRAVITY		2 - 4
BULK_SPECIFIC_GRAVITY_DRY		2 - 4
DENSITY_OF_PCC	lb/cu	100 - 180
FIELD_SET		1 - 10
PERCENT_ABSORPTION_AFTER_IMMER	%	0 - 20
PERCENT_VOIDS_IN_PCC	%	4 - 20
TEST_DATE		>= 01-Jan-87, <= Today's date
TEST_NO		1 - 4

TST_PC06

CORE_AVG_THICKNESS	in	2.0 - 15.0[13]
FIELD_SET		1 - 10
TEST_DATE		>= 01-Jan-87, <= Today's date
TEST_NO		1 - 4

TST_PC07

CROSS_SECTIONAL_AREA	sq	11 - 14
DIAMETER	in	3.8 - 4.2
FIELD_SET		1 - 10
LENGTH_OF_SPECIMAN	in	5 - 18
MAXIMUM_LOAD	lb	2000 - 14000
THICKNESS_OF_ORIG_SURFACE_LAYER	in	7 - 12
SHEAR_BOND_STRENGTH	psi	200 - 1000
TEST_DATE		>= 01-Jan-87, <= Today's date
TEST_NO		1 - 4
THICKNESS_OF_OVERLAY_LAYER	in	2 - 6

TST_PC08

AIR_CONTENT		1.0 - 20.0
AVG_CHORD_LENGTH		0.0020 - 0.0400
FIELD_SET		1 - 10
NO_AIR_VOIDS		10 - 20000
PASTE_AIR_RATIO		2.000 - 30.000
SPACING_FACTOR		0.001 - 0.022
SPECIFIC_SURFACE		100 - 1800

[13] Not applicable if VISUAL_EXAM_* = 57.

TEST_DATE		>= 01-Jan-87, <= Today's date
TEST_NO		1 - 4
TRAVERSE_LENGTH_AIR		0.100 - 20.000
TRAVERSE_LENGTH_PASTE		0.100 - 40.000
TRAVERSE_LENGTH_TOTAL		55 - 100

TST_PC09

AVERAGE_DEPTH	in	5.5 - 6.5
AVERAGE_WIDTH	in	5.5 - 6.5
FIELD_SET		1 - 10
MAXIMUM_APPLIED_LOAD	lbf	2000 - 15000
MODULUS_OF_RUPTURE	psi	150 - 1000
SPAN_LENGTH	in	16.5 - 19.5
SPECIMEN_AGE	days	1 - 999
TEST_DATE		>= 01-Jan-87, <= Today's date
TEST_NO		1 - 4

TST_SAMPLE_BULK_AC_AGG

DATE_SAMPLED		01-JAN-1987 - Today's date
DATE_SHIPPED		01-JAN-1987 - Today's date
SAMPLE_LOC		1, 2, 3, 4, 6, 7

TST_SAMPLE_COMBINE

No level D checks

TST_SAMPLE_LAB_AC_MIX

MIX_DATE		01-JAN-1987 - Today's date
MIX_TEMP	deg C	130 - 180

TST_SAMPLE_LOG

DEPTH_BOT_STRATA	in	null, 0.0 - 96.0; 0.0 - 240.0 (shoulder auger)
DEPTH_TOP_STRATA	in	null, 0.0 - 96.0; 0.0 - 240.0 (shoulder auger)
DIAMETER	in	null, 3 - 13
DLR	in	null, 0.0 - 99.9
FIELD_SET		1 - 10
IOP	in	null, 0.0 - 99.9
NO_BLOWS_1		null, 0 - 99
NO_BLOWS_2		null, 0 - 99
NO_BLOWS_3		null, 0 - 99
REFUSAL		null, Y, N

TST_SAMPLE_LOG_LAB

FIELD_SET		1 - 10

TST_SAMPLE_LOG_SPS_3_4

DATE_SAMPLED		>= 01-Jan-87, <= Today's date
FIELD_SET		1 - 10

TST_SCO1

CEMENT_MIXING	%	0 - 99
COAGULATION_OF_AC		Y, N
COATED_LESS_THAN_UNCOATED		Y, N
COATING_OF_STONE		G, F, P
DEMULSIBILITY	%	30 - 99
DUCTILITY		30 - 150
FIELD_SET		1 - 10
FREE_WATER_PRESENT		Y, N
OIL_DISTILLATE	%	0 - 5
PARTICLE_CHARGE		P
PCT_RESIDUE_BY_DIST	%	50 - 80
PENETRATION		10 - 250
SIEVE_TEST		0 - 5
SOLUBILITY	%	95 - 100
SPECIFIC_GRAVITY		0.9 - 1.1
STORAGE_STABILITY		0 - 5
TEST_DATE		>= 01-Jan-87, <= Today's date
TEST_NO		1 - 4
TEST_TEMPERATURE	deg C	24 - 26
UNIT_WEIGHT_OF_EMULSION	lb/gal	7.5 - 9.0
VISCOSITY_AT_50		90 - 450

TST_SC02

FIELD_SET		1 - 10
SAND_EQUIVALENT	%	30 - 99
TEST_DATE		>= 01-Jan-87, <= Today's date
TEST_NO		1 - 4

TST_SC03

CLAY_LUMPS	%	0 - 5
FIELD_SET		1 - 10
PCT_LIGHTWEIGHT_MATERIAL	%	0 - 3
PCT_OF_WEAR	%	5 - 60
SOUNDNESS	%	0 - 15
TEST_DATE		>= 01-Jan-87, <= Today's date
TEST_NO		1 - 4
UNIT_WEIGHT	lb/cu ft	75 - 150

TST_SC04

FIELD_SET		1 - 10
FLAKINESS_INDEX	%	0 - 40
TEST_DATE		>= 01-Jan-87, <= Today's date
TEST_NO		1 - 4

TST_SC05

CONSISTENCY	cm	0 - 6
CURE_TIME	hrs	1 - 8
FIELD_SET		1 - 10
SET_TIME	hrs	0.25 - 3.00
TEST_DATE		>= 01-Jan-87, <= Today's date

TEST_NO		1 - 4
TRAFFIC_TIME	hrs	1 - 24
WET_TRACK_ABRASION	gal/sq ft	0 - 100

TST_SC06

FIELD_SET		1 - 10
SPECIMEN_THICKNESS	in	0 - 1
TACK_POINT	cycles	50 - 1000
TEMPERATURE_OF_TEST	deg F	74 - 80
TEST_DATE		>= 01-Jan-87, <= Today's date
TEST_NO		1 - 4
WEIGHT_ON_TEST_WHEEL	lb	120 - 130

TST_SC07

AGG_SURFACE_RETAINING_COAT	%	75 - 100
FIELD_SET		1 - 10
TEST_DATE		>= 01-Jan-87, <= Today's date
TEST_NO		1 - 4

TST_SC08

ASPHALT_AGG_DISTRIBUTION		U, N
CONSISTENCY		T, S
FIELD_SET		1 - 10
SURFACE_OF_SPECIMEN		T, S
TEST_DATE		>= 01-Jan-87, <= Today's date
TEST_NO		1 - 4

TST_SC09

FIELD_SET		1 - 10
MIXING_TIME	s	60 - 300
PAPER_TOWEL_STAINED		Y, N
TEST_DATE		>= 01-Jan-87, <= Today's date
TEST_NO		1 - 4
WATER_DISCOLORATION		N, S, M

TST_SC10A

FIELD_SET		1 - 10
NO_10_PASSING	%	0 - 5
NO_200_PASSING	%	0 - 2
NO_4_PASSING	%	0 - 40
NO_8_PASSING	%	0 - 10
ONE_HALF_PASSING	%	80 - 100
TEST_DATE		>= 01-Jan-87, <= Today's date
TEST_NO		1 - 4
THREE_EIGHTHS_PASSING	%	60 - 100

TST_SC10B

FIELD_SET		1 - 10
FIVE_SIXTEENTHS_PASSING	%	90 - 100
NO_100_PASSING	%	5 - 25
NO_16_PASSING	%	25 - 75

NO_200_PASSING	%	5 - 20
NO_30_PASSING	%	20 - 50
NO_4_PASSING	%	70 - 100
NO_50_PASSING	%	15 - 30
NO_8_PASSING	%	45 - 100
TEST_DATE		>= 01-Jan-87, <= Today's date
TEST_NO		1 - 4

TST_SC11

AGG_SPREAD_RATE	lb/sq yd	8 - 40
AGG_WASTAGE_FACTOR		0 - 30
AVG_LEAST_DIMENSION	in	0 - 1
BSG_OF_AGGREGATE		2 - 4
FIELD_SET		1 - 10
RESIDUAL_ASPH_SPREAD_RATE	gal/sq yd	0.1 - 0.5
SURFACE_CONDITION_VAR	gal/sq yd	0.0 - 0.3
TEST_DATE		>= 01-Jan-87, <= Today's date
TEST_NO		1 - 4

TST_SC12

ASPHALT_CONTENT	%	6 - 12
FIELD_SET		1 - 10
TEST_DATE		>= 01-Jan-87, <= Today's date
TEST_NO		1 - 4

TST_SC13

FIELD_SET		1 - 10
INIT_FRICTION_VALUE		0 - 150
NO_10_PASSING	%	0 - 100
NO_200_PASSING	%	0 - 50
NO_4_PASSING	%	0 - 100
NO_8_PASSING	%	0 - 100
ONE_HALF_PASSING	%	0 - 100
POLISH_VALUE		0 - 150
TEST_DATE		>= 01-Jan-87, <= Today's date
TEST_NO		1 - 4
THREE_EIGHTHS_PASSING	%	0 - 100

TST_SP01_DATA

BULK_SPEC_GRAV_COR		1.000 - 4.000
BULK_SPEC_GRAV_RAW		1.000 - 4.000
GYRATE_NO		7 - 288
REL_DENS_COR		0 - 99.9
SPECIMEN_NO		1 - 2

TST_SP01_MASTER

AGG_BULK_SPEC_GRAV		1.0000 - 4.0000
AGG_EFF_SPEC_GRAV		1.0000 - 4.0000
AGGR_NOM_SIZE	mm	9 - 38
AIR_VOIDS_N_DES	%	1.0 - 10.0
ASPHALT_CONTENT	%	2.00 - 15.00
ASPHALT_SPEC_GRAV		0.900 - 1.100

AVG_REL_DENS_N_DES		0.0 - 99.9
AVG_REL_DENS_N_INI		0.0 - 99.9
AVG_REL_DENS_N_MAX		0.0 - 99.9
BULK_SPEC_GRAV_1		1.000 - 4.000
BULK_SPEC_GRAV_2		1.000 - 4.000
COMPACT_TEMP	deg C	100 - 300
DESIGN_H_AIR_TEMP	deg C	20 - 50
GYRATE_ANGLE	deg angle	1.23 - 1.27
GYRATE_N_DES		0.0 - 99.9
GYRATE_N_INI		0.0 - 99.9
GYRATE_N_MAX		0.0 - 99.9
GYRATE_ROT_SPEED	rpm	29 - 31
GYRATE_VT_PRESS	kPa	580 - 620
MIX_MAX_SPEC_GRAV		1.000 - 4.000
MIX_TEMP	deg C	100 - 300
PG_HIGH_TEMP	deg C	46 - 84
PG_LOW_TEMP	deg C	-46 - (-10)
SPECIMEN_DIAMETER	mm	140 - 160
TEST_DATE		>= 01-Jan-90, <= Today's date
TRAFFIC_LEVEL	MESAL	0.1 - 500.0
VFA_N_DES	%	25.0 - 99.9
VMA_N_DES	%	10.0 - 20.0

TST_SP02

AGG_COARSE_PCT	%	25 - 75
AGG_COARSE_SPEC_GRAV		2.000 - 3.000
AGG_COMB_SPEC_GRAV		2.000 - 3.000
AGG_EFF_SPEC_GRAV		2.000 - 3.000
AGG_FILLER_PCT	%	0 - 25
AGG_FILLER_SPEC_GRAV		2.000 - 3.000
AGG_FINE_PCT	%	25 - 75
AGG_FINE_SPEC_GRAV		2.000 - 3.000
BINDER_ABS_PCT	%	0.00 - 9.99
BINDER_EFF_PCT	%	2.00 - 9.99
BINDER_PCT	%	2.0 - 15.0
BINDER_SPEC_GRAV		0.900 - 1.100
MIX_BULK_SPEC_GRAV		1.000 - 4.000
MIX_MAX_SPEC_GRAV		1.500 - 3.000
TEST_DATE		>= 01-Jan-90, <= Today's date
VFA		25.0 - 99.9
VMA		10 - 20

TST_SS01_UG01_UG02

FIELD_SET		1 - 10
NO_10_PASSING	%	5 - 100
NO_200_PASSING	%	0.0 - 99.9
NO_40_PASSING	%	0 - 99
NO_4_PASSING	%	10 - 100
NO_80_PASSING	%	0 - 99
ONE_AND_HALF_PASSING	%	40 - 100
ONE_HALF_PASSING	%	20 - 100
ONE_PASSING	%	35 - 100
SAMPLE_WT	lb	0 - 150

TEST_DATE		>= 01-Jan-87, <= Today's date
TEST_NO		1 - 4
THREE_EIGHTHS_PASSING	%	10 - 100
THREE_FOURTHS_PASSING	%	35 - 100
THREE_PASSING	%	90.0 - 100.0
TWO_PASSING	%	0 - 100

TST_SS02_UG03

COLLOIDS	%	0.0 - 35.0
FIELD_SET		1 - 10
HYGRO_MOIST	%	0 - 10
NO_10_PASSING	%	5 - 100
NO_200_PASSING	%	0.0 - 99.9
NO_40_PASSING	%	0 - 99
NO_4_PASSING	%	10 - 100
NO_80_PASSING	%	0 - 99
ONE_AND_HALF_PASSING	%	40 - 100
ONE_HALF_PASSING	%	20 - 100
ONE_PASSING	%	35 - 100
TEST_DATE		>= 01-Jan-87, <= Today's date
TEST_NO		1 - 4
THREE_EIGHTHS_PASSING	%	10 - 100
THREE_FOURTHS_PASSING	%	35 - 100
THREE_PASSING	%	90.0 - 100.0
TWO_PASSING	%	0 - 100

TST_SS04_UG08

AASHTO_SOIL_CLASS		501 - 515
FIELD_SET		1 - 10
TEST_DATE		>= 01-Jan-87, <= Today's date
TEST_NO		1 - 4

TST_SS06

DEFLECTION_AVG	in	0.01 - 0.4
FIELD_SET		1 - 10
SOIL_MOD_UNCORRECTED	pci	25 - 675
SOIL_MOD_CORRECTED	pci	25 - 675
TEST_DATE		>= 01-Jan-87, <= Today's date

TST_SS08

DRY_DENSITY	pcf	60 - 140
FIELD_SET		1 - 10
MOISTURE_CONTENT	%	4 - 70
SPECIMEN_DIAMETER	in	2.6 - 3.0
SPECIMEN_HEIGHT	in	5.0 - 7.5
SPECIMEN_MASS_DRY	g	null, 500 - 2000
SPECIMEN_MASS_MOIST	g	null, 500 - 2000
TEST_DATE		>= 01-Jan-87, <= Today's date
TEST_NO		1 - 4

TST_SS10

AVERAGE_CROSS_SECTIONAL_AREA	sq in	5 - 7
AVERAGE_RATE_OF_STRAIN_TO_FAIL	%/min	0.5 - 3.0
AVERAGE_STRAIN_AT_FAILURE	%	0 - 30
DRY_DENSITY	pcf	60 - 140
FIELD_SET		1 - 10
LENGTH_TO_DIAMETER_RATIO		1.9 - 2.6
MOISTURE_CONTENT	%	4 - 70
SPECIMEN_DIAMETER	in	2.6 - 3.0
SPECIMEN_HEIGHT	in	5.0 - 7.5
TEST_DATE		>= 01-Jan-87, <= Today's date
TEST_NO		1 - 4
UNCONFINED_COMPRESSED_STRENGTH	psi	0 - 999

TST_SS11

AVG_HYDRAULIC_CONDUCTIVITY	cm/sec	1E(-9) - 1E(0)
FIELD_SET		1 - 10
FINAL_DEGREE_OF_SATURATION	%	70 - 100
FINAL_DRY_DENSITY	pcf	80 - 140
FINAL_SPECIMEN_DIAMETER	in	2.6 - 3.0
FINAL_SPECIMEN_HEIGHT	in	2.60 - 7.00
FINAL_SPECIMEN_MASS	g	500 - 2000
FINAL_WATER_CONTENT	%	4 - 80
INITIAL_DRY_DENSITY	pcf	60 - 140
INITIAL_SPECIMEN_DIAMETER	in	2.6 - 3.0
INITIAL_SPECIMEN_HEIGHT	in	2.60 - 7.00
INITIAL_SPECIMEN_MASS	g	500 - 2000
INITIAL_WATER_CONTENT	%	4 - 70
MAX_HYDRAULIC_GRADIENT		0 - 50
MIN_HYDRAULIC_GRADIENT		0 - 40
TEST_DATE		>= 01-Jan-87, <= Today's date
TEST_NO		1 - 4
TOTAL_BACK_PRESSURE	psi	0 - 300

TST SS11

FIELD_SET		1 - 10
TEST_DATE		>= 01-Jan-87, <= Today's date

TST_SS12

FIELD_SET		1 - 10
TEST_DATE		>= 01-Jan-87, <= Today's date

TST_SS14_UG14_COMMENT

No level D checks

TST_SS14_UG14_DATA

NO_BLOWS		1 - 20
PEN_BTWN_RDGS	mm	1 - 100
PEN_PER_BLOW	mm	1 - 100
DCP_INDEX	mm/blow	1 - 200
CBR	%	0 - 100
MOISTURE	%	0 - 100

TST_SS14_UG14_MASTER

TEST_DATE		1/1/2005 - Today's Date
ZERO_POINT_DEPTH	mm	>= 0

TST_TB01

FIELD_SET		1 - 10
TEST_DATE		>= 01-Jan-87, <= Today's date
TEST_NO		1 - 4
THICKNESS	in VISUAL	1.0 - 16.5 (N/A if EXAM_* = 7 or 57)

TST_TB02

CAPPED_LENGTH	in	3.0 - 10.0
COMP_STRENGTH	psi	200 - 15000
CROSS_SECTION_AREA	sq in	8.0 - 18.0
DIAMETER	in	3.5 - 6.5
FIELD_SET		1 - 10
LD_RATIO		0.70 - 2.10
MAX_LOAD	psi	5000 - 200000
ORIGINAL_LENGTH	in	2.9 - 8.0
TEST_DATE		>= 01-Jan-87, <= Today's date
TEST_NO		1 - 4

TST_UG04_SS03

FIELD_SET		1 - 10
LIQUID_LIMIT		0, 10 - 150
TEST_DATE		>= 01-Jan-87, <= Today's date
TEST_NO		1 - 4

TST_UG05_SS05

FIELD_SET		1 - 10
OPTIMUM_LAB_MOISTURE	%	4 - 30
TEST_DATE		>= 01-Jan-87 <= Today's date
TEST_NO		1 - 4

TST_UG07_SS07_A

AFTER_MOIST_CONT	%	0.0 - 50.0[14]
COMP_DRY_DENSITY	kg/cu m	800.0 - 3200.0[14]
COMP_MOIST_CONT	%	0.0 - 50.0[14]
FIELD_SET		1 - 10
IN_SITU_DENSITY	kg/cu m	800.0 - 3200.0[14]
IN_SITU_MOIST	%	0.0 - 50.0[14]
LAYER_TYPE		1, 2
MR_MATL_TYPE		1, 2
MAX_DRY_DENSITY	kg/cu m	800.0 - 3200.0[14]
MAX_DRY_DENSITY_95	kg/cu m	800.0 - 3200.0[14]
MAX_STRENGTH	kPa	40 - 950

[14] If all these fields, including BOTTOM_DIAMETER, MIDDLE_DIAMETER, and TOP_DIAMETER are null, then the record shall pass every check on these fields.

OPT_MOIST_CONT	%	0.0 - 50.0[14]
TEST_DATE		>= 01-Jan-87, <= Today's date

For MATL_TYPE = 1

AVERAGE_DIAMETER	mm	146.0 - 158.0[14]
INITIAL_AREA	sq mm	16742 - 19600[14]
INITIAL_LENGTH	mm	295.0 - 315.0[14]
INITIAL_VOLUME	cu mm	4940000 - 6200000
NET_DIAMETER	mm	146.0 - 158.0[14]

For MATL_TYPE = 2

AVERAGE_DIAMETER	mm	66.0 - 80.0[14]
INITIAL_AREA	sq mm	3420 - 5030[14]
INITIAL_LENGTH	mm	137.0 - 158.0[14]
INITIAL_VOLUME	cu mm	468000 - 794740
NET_DIAMETER	mm	66.0 - 80.0[14]

TST_UG07_SS07_B

AFTER_MOIST_CONT	%	0.0 - 50.0
AVERAGE_DIAMETER	mm	66.0 - 80.0
DRY_DENSITY	kg/cu m	800.0 - 3200.0
FIELD_SET		1 - 10
IN_SITU_MOIST	%	0.0 - 50.0
INITIAL_AREA	sq mm	3420 - 5030
INITIAL_LENGTH	mm	137.0 - 165.0
INITIAL_VOLUME	cu mm	468000 - 794740
INITIAL_WEIGHT	g	370.0 - 2150.0
LAYER_TYPE		1
MR_MATL_TYPE		2
MAX_STRENGTH	kPa	69 - 690
NET_DIAMETER	mm	66.0 - 80.0
WET_DENSITY	kg/cu m	800.0 - 3200.0
TEST_DATE		>= 01-Jan-87, <= Today's date

TST_UG07_SS07_WKSHT_CYCLES

FIELD_SET		1 - 10
LAYER_TYPE		1, 2
MR_MATL_TYPE		1, 2
TEST_DATE		>= 01-Jan-87, <= Today's date

For LAYER_TYPE = 1 and MATL_TYPE = 1 and TEST_DATE >= 01-Aug-93

APPLIED_CONTACT_LOAD	N	10.0 - 143.0
APPLIED_CONTACT_STRESS	kPa	0.5 - 8.0
APPLIED_CYCLIC_LOAD	N	182.0 - 1287.0
APPLIED_CYCLIC_STRESS	kPa	9.0 - 72.0
APPLIED_MAX_AXIAL_LOAD	N	202.0 - 1430.0
APPLIED_MAX_AXIAL_STRESS	kPa	10.0 - 80.0
DEF_LVDT_1	mm	0.01270 - 0.635
DEF_LVDT_1_2	mm	0.01270 - 0.635
DEF_LVDT_2	mm	0.01270 - 0.635

RES_MOD	MPa	7 - 415
RES_STRAIN		0.00004 - 0.0021

For LAYER_TYPE = 1 and MR_MATL_TYPE = 1 and TEST_DATE < 01-Aug-93

APPLIED_CONTACT_LOAD	N	32.5 - 510.0
APPLIED_CONTACT_STRESS	kPa	2.0 - 30.0
APPLIED_CYCLIC_LOAD	N	261.0 - 5049.0
APPLIED_CYCLIC_STRESS	kPa	16.0 - 270.0
APPLIED_MAX_AXIAL_LOAD	N	325.0 - 5100.0
APPLIED_MAX_AXIAL_STRESS	kPa	18.0 - 300.0
DEF_LVDT_1	mm	0.01270 - 0.635
DEF_LVDT_1_2	mm	0.01270 - 0.635
DEF_LVDT_2	mm	0.01270 - 0.635
RES_MOD	MPa	7 - 415
RES_STRAIN		0.00004 - 0.0021

For LAYER_TYPE = 1 and MR_MATL_TYPE = 2

APPLIED_CONTACT_LOAD	N	0.1 - 33.0
APPLIED_CONTACT_STRESS	kPa	0.1 - 8.0
APPLIED_CYCLIC_LOAD	N	32.4 - 297.0
APPLIED_CYCLIC_STRESS	kPa	9.0 - 72.0
APPLIED_MAX_AXIAL_LOAD	N	36.0 - 330.0
APPLIED_MAX_AXIAL_STRESS	kPa	10.0 - 80.0
DEF_LVDT_1	mm	0.008 - 0.635
DEF_LVDT_1_2	mm	0.008 - 0.635
DEF_LVDT_2	mm	0.008 - 0.635
RES_MOD	MPa	7 - 415
RES_STRAIN		0.00005 - 0.0044

For LAYER_TYPE = 2 and MR_MATL_TYPE = 1

APPLIED_CONTACT_LOAD	N	10 - 568
APPLIED_CONTACT_STRESS	kPa	0.1 - 32
APPLIED_CYCLIC_LOAD	N	263.0 - 5049.0
APPLIED_CYCLIC_STRESS	kPa	16.0 - 270.0
APPLIED_MAX_AXIAL_LOAD	N	292.0 - 5610.0
APPLIED_MAX_AXIAL_STRESS	kPa	18.0 - 300.0
DEF_LVDT_1	mm	0.01270 - 0.635
DEF_LVDT_1_2	mm	0.01270 - 0.635
DEF_LVDT_2	mm	0.01270 - 0.635
RES_MOD	MPa	7 - 415
RES_STRAIN		0.00004 - 0.0021

For LAYER_TYPE = 2 and MR_MATL_TYPE = 2

APPLIED_CONTACT_LOAD	N	0.1 - 122.0
APPLIED_CONTACT_STRESS	kPa	0.1 - 32.0
APPLIED_CYCLIC_LOAD	N	60.7 - 1099.0
APPLIED_CYCLIC_STRESS	kPa	16.0 - 270.0
APPLIED_MAX_AXIAL_LOAD	N	67.5 - 1221.0
APPLIED_MAX_AXIAL_STRESS	kPa	18.0 - 300.0
DEF_LVDT_1	mm	0.008 - 0.635
DEF_LVDT_1_2	mm	0.008 - 0.635
DEF_LVDT_2	mm	0.008 - 0.635

RES_MOD	MPa	7 - 415
RES_STRAIN		0.00005 - 0.0044

TST_UG07_SS07_WKSHT_SUM

FIELD_SET		1 - 10
LAYER_TYPE		1, 2
MR_MATL_TYPE		1, 2
TEST_DATE		>= 01-Jan-87, <= Today's date

For LAYER_TYPE = 1 and MR_MATL_TYPE = 1 and TEST_DATE >= 01-Aug-93

APPLIED_CONTACT_LOAD_AVG	N	10.0 - 143.0
APPLIED_CONTACT_STRESS_AVG	kPa	0.5 - 8.0
APPLIED_CYCLIC_LOAD_AVG	N	182.0 - 1287.0
APPLIED_CYCLIC_STRESS_AVG	kPa	9.0 - 72.0
APPLIED_MAX_AXIAL_LOAD_AVG	N	202.0 - 1430.0
APPLIED_MAX_AXIAL_STRESS_AVG	kPa	10.0 - 80.0
DEF_LVDT_1_AVG	mm	0.01270 - 0.635
DEF_LVDT_1_2_AVG	mm	0.01270 - 0.635
DEF_LVDT_2_AVG	mm	0.01270 - 0.635
RES_MOD_AVG	MPa	7 - 415
RES_STRAIN_AVG		0.00004 - 0.0021

For LAYER_TYPE = 1 and MR_MATL_TYPE = 1 and TEST_DATE < 01-Aug-93

APPLIED_CONTACT_LOAD_AVG	N	32.5 - 510.0
APPLIED_CONTACT_STRESS_AVG	kPa	2.0 - 30.0
APPLIED_CYCLIC_LOAD_AVG	N	261.0 - 5049.0
APPLIED_CYCLIC_STRESS_AVG	kPa	16.0 - 270.0
APPLIED_MAX_AXIAL_LOAD_AVG	N	325 - 5100
APPLIED_MAX_AXIAL_STRESS_AVG	kPa	18 - 300
DEF_LVDT_1_AVG	mm	0.01270 - 0.635
DEF_LVDT_1_2_AVG	mm	0.01270 - 0.635
DEF_LVDT_2_AVG	mm	0.01270 - 0.635
RES_MOD_AVG	MPa	7 - 415
RES_STRAIN_AVG		0.00004 - 0.0021

For LAYER_TYPE = 1 and MR_MATL_TYPE = 2

APPLIED_CONTACT_LOAD_AVG	N	0.1 - 33.0
APPLIED_CONTACT_STRESS_AVG	kPa	0.1 - 8.0
APPLIED_CYCLIC_LOAD_AVG	N	32.4 - 297.0
APPLIED_CYCLIC_STRESS_AVG	kPa	9.0 - 72.0
APPLIED_MAX_AXIAL_LOAD_AVG	N	36.0 - 330.0
APPLIED_MAX_AXIAL_STRESS_AVG	kPa	10.0 - 80.0
DEF_LVDT_1_AVG	mm	0.008 - 0.635
DEF_LVDT_1_2_AVG	mm	0.008 - 0.635
DEF_LVDT_2_AVG	mm	0.008 - 0.635
RES_MOD_AVG	MPa	7 - 415
RES_STRAIN_AVG		0.00005 - 0.0044

For LAYER_TYPE = 2 and MR_MATL_TYPE = 1

APPLIED_CONTACT_LOAD_AVG	N	10 - 568
APPLIED_CONTACT_STRESS_AVG	kPa	0.1 - 32

APPLIED_CYCLIC_LOAD_AVG	N	263.0 - 5049.0
APPLIED_CYCLIC_STRESS_AVG	kPa	16.0 - 270.0
APPLIED_MAX_AXIAL_LOAD_AVG	N	292.0 - 5610.0
APPLIED_MAX_AXIAL_STRESS_AVG	kPa	18.0 - 300.0
DEF_LVDT_1_AVG	mm	0.01270 - 0.635
DEF_LVDT_1_2_AVG	mm	0.01270 - 0.635
DEF_LVDT_2_AVG	mm	0.01270 - 0.635
RES_MOD_AVG	MPa	7 - 415
RES_STRAIN_AVG		0.00004 - 0.0021

For LAYER_TYPE = 2 and MR_MATL_TYPE = 2

APPLIED_CONTACT_LOAD_AVG	N	0.1 - 122.0
APPLIED_CONTACT_STRESS_AVG	kPa	0.1 - 32
APPLIED_CYCLIC_LOAD_AVG	N	60.7 - 1099.0
APPLIED_CYCLIC_STRESS_AVG	kPa	16.0 - 270.0
APPLIED_MAX_AXIAL_LOAD_AVG	N	67.5 - 1221.0
APPLIED_MAX_AXIAL_STRESS_AVG	kPa	18.0 - 300.0
DEF_LVDT_1_AVG	mm	0.008 - 0.635
DEF_LVDT_1_2_AVG	mm	0.008 - 0.635
DEF_LVDT_2_AVG	mm	0.008 - 0.635
RES_MOD_AVG	MPa	7 - 415
RES_STRAIN_AVG		0.00005 - 0.0044

TST_UG09

AVG_HYDRAULIC_CONDUCTIVITY	cm/sec	1E(-9) - 1E(0)
FIELD_SET		1 - 10
FINAL_DRY_DENSITY	pcf	70 - 140
FINAL_MOISTURE_CONTENT	%	4 - 40
HYDRAULIC_GRADIENT		0.1 - 2
INITIAL_DRY_DENSITY	pcf	70 - 140
INITIAL_MOISTURE_CONTENT	%	4 - 40
TEST_DATE		>= 01-Jan-87, <= Today's date
TEST_NO		1 - 4

TST_UG10_SS09

FIELD_SET		1 - 10
MOIST_CONTENT	%	0.0 - 50.0
TEST_DATE		>= 01-Jan-87, <= Today's date
TEST_NO		1 - 4

TST_UNBOUND_SPEC_GRAV

SPEC_GRAV		2.2 - 2.9

TST_UNCOMP_BITUMINOUS

DATE_SAMPLED		>= 01-Jan-87, <= Today's date
DATE_SHIPPED		null, >= 01-Jan-87, <= Today's date
FIELD_SET		1 - 10
LAYER_TYPE		1 - 6
MIX_TYPE		1 - 4
OFFSET	ft	null, 0 - 24
PLANT_TYPE		null, 1 - 3

SAMPLE_LOC		1 - 6
SAMPLE_SIZE	lb	10 - 500
STATION		null, -100 - 1100

E. Intramodular Checks

Each E-type check is separated by a single line. In general, each bullet represents a procedure, action, etc., of the check.

Table: TST_AC_MOIST_DAMAGE

- LAYER_DEPTH_A <= LAYER_DEPTH_B <= LAYER_DEPTH_C <= LAYER_DEPTH_D

  Error Message: **TST_AC_MOIST_DAMAGE**-E-1, LAYER_DEPTH_A <= LAYER_DEPTH_B <= LAYER_DEPTH_C <= LAYER_DEPTH_D

- HEIGHT_STRIP_PEN <= CORE_THICK

  Error Message: **TST_AC_MOIST_DAMAGE**-E-2, HEIGHT_STRIP_PEN <= CORE_THICK

- STRIP_RATING_PCF = STRIP_RATING_P + STRIP_RATING_C + STRIP_RATING_F

  Error Message: **TST_AC_MOIST_DAMAGE**-E-3, STRIP_RATING_PCF = (STRIP_RATING_P + STRIP_RATING_C + STRIP_RATING_F)

Tables: TST_AC_MOIST_DAMAGE, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_AC_MOIST_DAMAGE**-E-4, There is no matching sample in **TST_SAMPLE_BASIC_INFO**

Tables: TST_AC01, TST_AC01_LAYER

- All corresponding records in **TST_AC01_LAYER** must be at level E

  Error Message: **TST_AC01**-E-1, All corresponding records in **TST_AC01_LAYER** are not at level E

Tables: TST_AC01, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_AC01**-E-2, There is no matching sample in **TST_SAMPLE_BASIC_INFO**

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or

equal to DATE_SAMPLED

Error message: **TST_AC01**-E-3, Sample was tested before it was taken.

Tables: TST_AC01_LAYER, TST_AC01

For records with matching SHRP_ID, STATE_CODE, FIELD_LAYER_NO, FIELD_SET, TEST_NO, LOC_NO in **TST_AC01** and for which VISUAL_EXAM_1, VISUAL_EXAM_2, VISUAL_EXAM_3, VISUAL_EXAM_4, VISUAL_EXAM_5, and VISUAL_EXAM_6 in **TST_AC01** does not equal 7:

- Extract CORE_AVG_THICKNESS from **TST_AC01** and extract LAYER_THICKNESS from **TST_AC01_LAYER**: CORE_AVG_THICKNESS + 0.2 ≥ LAYER_THICKNESS

  Error Message: **TST_AC01_LAYER-E**-1, **TST_AC01**.CORE_AVG_THICKNESS + .2 >= **TST_AC01_LAYER**.LAYER_THICKNESS failed.

- For records with matching SHRP_ID, STATE_CODE, FIELD_LAYER_NO, FIELD_SET, TEST_NO, LOC_NO and CONSTRUCTION_NO in **TST_AC01_LAYER**, the LAYER_THICKNESS should be non-null for at least for one layer if a record exists in **TST_HOLE_LOG** with RECOVERED="Y" and if SHRP_ID, STATE_CODE, FIELD_SET, LOC_NO and CONSTRUCTION_NO match **TST_AC01_LAYER**

  Error Message: **TST_AC01_LAYER**-E-2, At least one layer in **TST_AC01_LAYER** must have non-null LAYER_THICKNESS when a matching record in **TST_HOLE_LOG** has RECOVERED = Y.

Tables: TST_AC02, TST_AC03

For matching SHRP_ID, STATE_CODE, LAYER_NUMBER, FIELD_SET, TEST_NO, LOC_NO in **TST_AC03:**

- check that **TST_AC02**.BSG <= **TST_AC03**.MAX_SPEC_GRAVITY

  Error Message: **TST_AC02**-E-1, **TST_AC02**.BSG <= **TST_AC03**.MAX_SPEC_GRAVITY: {BSG} <= {MAX_SPEC_GRAVITY} failed.

Tables: TST_AC02, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_AC02**-E-2, There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_AC02**-E-3, Sample was tested before it was taken.

Tables: TST_AC03, TST_AC02

For matching SHRP_ID, STATE_CODE, LAYER_NUMBER, FIELD_SET, TEST_NO, LOC_NO in **TST_AC02:**

- check that **TST_AC03**.MAX_SPEC_GRAVITY >= **TST_AC02**.BSG

  Error Message: **TST_AC03**-E-1, **TST_AC03**.MAX_SPEC_GRAVITY >= **TST_AC02**.BSG: {MAX_SPEC_GRAVITY} >= {BSG} failed.

Tables: TST_AC03, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_AC03**-E-2, There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_AC03**-E-3, Sample was tested before it was taken.

Tables: TST_AC04, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_AC04**-E-1, There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_AC04**-E-2, Sample was tested before it was taken.

Table: TST_AC05

- MAX_SPEC_GRAVITY > BSG_AFTER_MOLDING_1_U >= BSG_AFTER_MOLDING_2_U >= BSG_AFTER_MOLDING_3_U >= BSG_AFTER_MOLDING_4_C >= BSG_AFTER_MOLDING_5_C

  Error Messages: **TST_AC05**-E-1a, MAX_SPEC_GRAVITY >= BSG_AFTER_MOLDING_1_U failed.
  TST_AC05-E-1b, MAX_SPEC_GRAVITY >= BSG_AFTER_MOLDING_2_U failed.
  TST_AC05-E-1c MAX_SPEC_GRAVITY >= BSG_AFTER_MOLDING_3_U failed.
  TST_AC05-E-1d MAX_SPEC_GRAVITY >= BSG_AFTER_MOLDING_4_C failed.

TST_**AC05**-E-1e MAX_SPEC_GRAVITY >= BSG_AFTER_MOLDING_5_C failed.

- MAX_SPEC_GRAVITY>BSG_AFTER_VAC_SATURATION_4_C >= BSG_AFTER_VAC_SATURATION_5_C

  Error Messages: **TST**_**AC05**-E-2a, MAX_SPEC_GRAVITY >= BSG_AFTER_VAC_SATURATION_4_C failed.
  TST_**AC05**-E-2b, MAX_SPEC_GRAVITY >= BSG_AFTER_VAC_SATURATION_5_C failed.

If BSG_AFTER_MOLDING_6_C and BSG_AFTER_VAC_SATURATION_6_C are not null, then:

- MAX_SPEC_GRAVITY >= BSG_AFTER_MOLDING_6_C
  and
- MAX_SPEC_GRAVITY >= BSG_AFTER_VAC_SATURATION_6_C

  Error Messages: **TST**_**AC05**-E-3, MAX_SPEC_GRAVITY >= BSG_AFTER_MOLDING_6_C failed.
  TST_**AC05**-E-4, MAX_SPEC_GRAVITY >= BSG_AFTER_VAC_SATURATION_6_C failed.

- 98 * [1-(BSG_AFTER_MOLDING_1_U/MAX_SPECIFIC_GRAVITY)] <= PCT_AIR_VOIDS_1_U <= 102 * [1-(BSG_AFTER_MOLDING_1_U/MAX_SPECIFIC_GRAVITY)]

  Error Message: **TST**_**AC05**-E-5,
  98*(1-(BSG_AFTER_MOLDING_1_U/MAX_SPEC_GRAVITY)) <= PCT_AIR_VOIDS_1_U <= 102*(1-(BSG_AFTER_MOLDING_1_U/MAX_SPEC_GRAVITY)) failed.

- 98 * [1-(BSG_AFTER_MOLDING_2_U/MAX_SPECIFIC_GRAVITY)] <= PCT_AIR_VOIDS_2_U <= 102 * [1-(BSG_AFTER_MOLDING_2_U/MAX_SPECIFIC_GRAVITY)]

  Error Message: **TST**_**AC05**-E-6,
  98*(1-(BSG_AFTER_MOLDING_2_U/MAX_SPEC_GRAVITY)) <= PCT_AIR_VOIDS_2_U <= 102*(1-(BSG_AFTER_MOLDING_2_U/MAX_SPEC_GRAVITY)) failed.

- 98 * [1-(BSG_AFTER_MOLDING_3_U/MAX_SPECIFIC_GRAVITY)] <= PCT_AIR_VOIDS_3_U <= 102 * [1-(BSG_AFTER_MOLDING_3_U/MAX_SPECIFIC_GRAVITY)]

  Error Message: **TST**_**AC05**-E-7,
  98*(1-(BSG_AFTER_MOLDING_3_U/MAX_SPEC_GRAVITY)) <= PCT_AIR_VOIDS_3_U <= 102*(1-(BSG_AFTER_MOLDING_3_U/MAX_SPEC_GRAVITY)) failed.

- 98 * [1-(BSG_AFTER_MOLDING_4_C/MAX_SPECIFIC_GRAVITY)] <= PCT_AIR_VOIDS_4_C <= 102 * [1-(BSG_AFTER_MOLDING_4_C/MAX_SPECIFIC_GRAVITY)]

  Error Message: **TST**_**AC05**-E-8,
  98*(1-(BSG_AFTER_MOLDING_4_C/MAX_SPEC_GRAVITY)) <= PCT_AIR_VOIDS_4_C <= 102*(1-(BSG_AFTER_MOLDING_4_C/MAX_SPEC_GRAVITY)) failed.

- 98 * [1-(BSG_AFTER_MOLDING_5_C/MAX_SPECIFIC_GRAVITY)] <= PCT_AIR_VOIDS_5_C <= 102 * [1-

(BSG_AFTER_MOLDING_5_C/MAX_SPECIFIC_GRAVITY)]

Error Message: **TST**_**AC05**-E-9,
98*(1-(BSG_AFTER_MOLDING_5_C/MAX_SPEC_GRAVITY)) <= PCT_AIR_VOIDS_5_C <= 102*(1-(BSG_AFTER_MOLDING_5_C/MAX_SPEC_GRAVITY)) failed.

- If BSG_AFTER_MOLDING_6_C and PCT_AIR_VOIDS_6_C are not null, then
  98 * [1-(BSG_AFTER_MOLDING_6_C/MAX_SPECIFIC_GRAVITY)] <= PCT_AIR_VOIDS_6_C <= 102 * [1-(BSG_AFTER_MOLDING_6_C/MAX_SPECIFIC_GRAVITY)]

  Error Message: **TST**_**AC05**-E-10,
  98*(1-(BSG_AFTER_MOLDING_6_C/MAX_SPEC_GRAVITY)) <= PCT_AIR_VOIDS_6_C <= 102*(1-(BSG_AFTER_MOLDING_6_C/MAX_SPEC_GRAVITY)), failed.

- If MAX_LOAD_6_C is not null, then
  AVG(MAX_LOAD_1_U, MAX_LOAD_2_U, MAX_LOAD_3_U) >= AVG(MAX_LOAD_4_C, MAX_LOAD_5_C, MAX_LOAD_6_C)
  else,
  AVG(MAX_LOAD_1_U, MAX_LOAD_2_U, MAX_LOAD_3_U) >= AVG(MAX_LOAD_4_C, MAX_LOAD_5_C)

  Error Messages: **TST**_**AC05**-E-11, AVG(MAX_LOAD_1_U, MAX_LOAD_2_U, MAX_LOAD_3_U) >= AVG(MAX_LOAD_4_C, MAX_LOAD_5_C, MAX_LOAD_6_C) failed
  OR
  TST_**AC05**-E-12, AVG(MAX_LOAD_1_U, MAX_LOAD_2_U, MAX_LOAD_3_U) >= AVG(MAX_LOAD_4_C, MAX_LOAD_5_C) failed.

- If IN_TENSILE_STRENGTH_6_C is not null, then
  AVG(IN_TENSILE_STRENGTH_1_U, IN_TENSILE_STRENGTH_2_U, IN_TENSILE_STRENGTH_3U) >= AVG(IN_TENSILE_STRENGTH_4_C, IN_TENSILE_STRENGTH_5_C, IN_TENSILE_STRENGTH_6_C)
  else,
  AVG(IN_TENSILE_STRENGTH_1_U, IN_TENSILE_STRENGTH_2_U, IN_TENSILE_STRENGTH_3U) >= AVG(IN_TENSILE_STRENGTH_4_C, IN_TENSILE_STRENGTH_5_C)

  Error Messages: **TST**_**AC05**-E-13, AVG(IN_TENSILE_STRENGTH_1_U, IN_TENSILE_STRENGTH_2_U, IN_TENSILE_STRENGTH_3_U) >= AVG(IN_TENSILE_STRENGTH_4_C, IN_TENSILE_STRENGTH_5_C, IN_TENSILE_STRENGTH_6_C) failed
  OR
  TST_**AC05**-E-14, AVG(IN_TENSILE_STRENGTH_1_U, IN_TENSILE_STRENGTH_2_U, IN_TENSILE_STRENGTH_3_U) >= AVG(IN_TENSILE_STRENGTH_4_C, IN_TENSILE_STRENGTH_5_C) failed.

- 6.0 * (MAX_LOAD_1_U/HEIGHT_1_U) <= IN_TENSILE_STRENGTH_1_U <= 6.28 * (MAX_LOAD_1_U/HEIGHT_1_U)

  Error Message: **TST**_**AC05**-E-15, 6.0 * MAX_LOAD_1_U/HEIGHT_1_U <= IN_TENSILE_STRENGTH_1_U <= 6.28 * MAX_LOAD_1_U/HEIGHT_1_U failed.

- 6.0 * (MAX_LOAD_2_U/HEIGHT_2_U) <= IN_TENSILE_STRENGTH_2_U <= 6.28 * (MAX_LOAD_2_U/HEIGHT_2_U)

Error Message: **TST**_**AC05**-E-16, 6.0 * MAX_LOAD_2_U/HEIGHT_2_U <= IN_TENSILE_STRENGTH_2_U <= 6.28 * MAX_LOAD_2_U/HEIGHT_2_U failed.

- 6.0 * (MAX_LOAD_3_U/HEIGHT_3_U) <= IN_TENSILE_STRENGTH_3_U <= 6.28 * (MAX_LOAD_3_U/HEIGHT_3_U)

  Error Message: **TST**_**AC05**-E-17, 6.0 * MAX_LOAD_3_U/HEIGHT_3_U <= IN_TENSILE_STRENGTH_3_U <= 6.28 * MAX_LOAD_3_U/HEIGHT_3_U failed.

- 6.0 * (MAX_LOAD_4_U/HEIGHT_4_C) <= IN_TENSILE_STRENGTH_4_C <= 6.28 * (MAX_LOAD_4_C/HEIGHT_4_C)

  Error Message: **TST**_**AC05**-E-18, 6.0 * MAX_LOAD_4_C/HEIGHT_4_C <= IN_TENSILE_STRENGTH_4_C <= 6.28 * MAX_LOAD_4_C/HEIGHT_4_C failed.

- 6.0 * (MAX_LOAD_5_C/HEIGHT_5_C) <= IN_TENSILE_STRENGTH_5_C <= 6.28 * (MAX_LOAD_5_C/HEIGHT_5_C)

  Error Message: **TST**_**AC05**-E-19, 6.0 * MAX_LOAD_5_C/HEIGHT_5_C <= IN_TENSILE_STRENGTH_5_C <= 6.28 * MAX_LOAD_5_C/HEIGHT_5_C failed.

- If MAX_LOAD_6_C, HEIGHT_6_C and IN_TENSILE_STRENGTH_6_C are not null, then 6.0 * (MAX_LOAD_6_C/HEIGHT_6_C) <= IN_TENSILE_STRENGTH_6_C <= 6.28 * (MAX_LOAD_6_C/HEIGHT_6_C)

  Error Message: **TST**_**AC05**-E-20, 6.0 * MAX_LOAD_6_C/HEIGHT_6_C <= IN_TENSILE_STRENGTH_6_C <= 6.28 * MAX_LOAD_6_C/HEIGHT_6_C failed.

- 0.98 * AVG(IN_TENSILE_STRENGTH_1_U, IN_TENSILE_STRENGTH_2_U, IN_TENSILE_STRENGTH_3_U) <= IN_TENSILE_STRENGTH_AVG_U <= 1.02 * AVG (IN_TENSILE_STRENGTH_1_U, IN_TENSILE_STRENGTH_2_U, IN_TENSILE_STRENGTH_3_U)

  Error Message: **TST**_**AC05**-E-21, 0.98 * AVG(IN_TENSILE_STRENGTH_1_U, IN_TENSILE_STRENGTH_2_U, IN_TENSILE_STRENGTH_3_U) <= IN_TENSILE_STRENGTH_AVG_U <= 1.02 * AVG(IN_TENSILE_STRENGTH_1_U, IN_TENSILE_STRENGTH_2_U, IN_TENSILE_STRENGTH_3_U) failed.

- If IN_TENSILE_STRENGTH_6_C is not null, then
  0.98 * AVG(IN_TENSILE_STRENGTH_4_C, IN_TENSILE_STRENGTH_5_C, IN_TENSILE_STRENGTH_6_C) <= IN_TENSILE_STRENGTH_AVG_C <= 1.02 * AVG (IN_TENSILE_STRENGTH_4_C, IN_TENSILE_STRENGTH_5_C, IN_TENSILE_STRENGTH_6_C)
  else
  0.98 * AVG(IN_TENSILE_STRENGTH_4_C, IN_TENSILE_STRENGTH_5_C) <= IN_TENSILE_STRENGTH_AVG_C <= 1.02 * AVG(IN_TENSILE_STRENGTH_4_C,IN_TENSILE_STRENGTH_5_C)

  Error Messages: **TST**_**AC05**-E-22, 0.98 * AVG(IN_TENSILE_STRENGTH_4_C, IN_TENSILE_STRENGTH_5_C, IN_TENSILE_STRENGTH_6_C) <= IN_TENSILE_STRENGTH_AVG_C <= 1.02 * AVG(IN_TENSILE_STRENGTH_4_C, IN_TENSILE_STRENGTH_5_C, IN_TENSILE_STRENGTH_6_C failed
  OR
  TST_**AC05**-E-23, 0.98 * AVG(IN_TENSILE_STRENGTH_4_C, IN_TENSILE_STRENGTH_5_C) <= IN_TENSILE_STRENGTH_AVG_C <= 1.02 * AVG(IN_TENSILE_STRENGTH_4_C, IN_TENSILE_STRENGTH_5_C) failed.

- 0.98 * (IN_TENSILE_STRENGTH_AVG_C/IN_TENSILE_STRENGTH_AVG_U) <= TENSILE_STRENGTH_RATIO <= 1.02 * (IN_TENSILE_STRENGTH_AVG_C/ IN_TENSILE_STRENGTH_AVG_U)

  Error Message: **TST_AC05**-E-24, 0.98 * (IN_TENSILE_STRENGTH_AVG_C/ IN_TENSILE_STRENGTH_AVG_U) <= TENSILE_STRENGTH_RATIO <= 1.02 * (IN_TENSILE_STRENGTH_AVG_C/IN_TENSILE_STRENGTH_AVG_U) failed

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Tables: TST_AC05, TST_SAMPLE_BASIC_INFO

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO_1_U, TEST_DATE_1 must be greater than or equal to DATE_SAMPLED

  Error message: **TST_AC05**-E-26 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO} Sample was tested before it was taken (sample_no_1_u: {SAMPLE_NO_1_U}).

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO_2_U, TEST_DATE_2 must be greater than or equal to DATE_SAMPLED

  Error message: **TST_AC05**-E-28 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO} Sample was tested before it was taken (sample_no_2_u: {SAMPLE_NO_2_U}).

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO_3_U, TEST_DATE_3 must be greater than or equal to DATE_SAMPLED

  Error message: **TST_AC05**-E-30 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO} Sample was tested before it was taken (sample_no_3_u: {SAMPLE_NO_3_U}).

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO_4_C, TEST_DATE_4 must be greater than or equal to DATE_SAMPLED

  Error message: **TST_AC05**-E-32 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO} Sample was tested before it was taken (sample_no_4_c: {SAMPLE_NO_4_C}).

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO_5_C, TEST_DATE_5 must be greater than or equal to DATE_SAMPLED

  Error message: **TST_AC05**-E-34 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO} Sample was tested before it was taken (sample_no_5_c: {SAMPLE_NO_5_C}).

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO_6_C, TEST_DATE_6 must be greater than or equal to DATE_SAMPLED

  Error message: **TST_AC05**-E-36 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO} Sample was tested before it was taken (sample_no_6_c: {SAMPLE_NO_6_C}).

Note: Before beginning the Level E QC on the **TST_AC07_V2_*** tables, all the tables should be sorted by key fields in ascending order.

Nominally, a fixed number of test temperatures exist (3 for Mr, 3 for Creep and 1 for IDT) with 1 record for each temperature. However the code should be flexible enough to handle any number of test temperatures for temperature comparisons.

Table: TST_AC07_V2_SPECIMEN_INFO

- Matching STATE_CODE, SHRP_ID, CONSTRUCTION_NO exists in **EXPERIMENT_SECTION**

  Error message: **TST_AC07_V2_SPECIMEN_INFO**-E-101, No matching record in **EXPERIMENT_SECTION**

- Matching STATE_CODE, SHRP_ID, CONSTRUCTION_NO, LAYER_NO in **TST_L05B** has LAYER_TYPE = 'AC' or 'TB'

  Error message: **TST_AC07_V2_SPECIMEN_INFO**-E-102, No matching layer in **TST_L05B** or matching record is not layer type of 'AC' or 'TB'

- Matching STATE_CODE, SHRP_ID, FIELD_SET, SAMPLE_NO_1 record must be in **TST_SAMPLE_LOG** or **TST_SAMPLE_LOG_LAB**

  Error message: **TST_AC07_V2_SPECIMEN_INFO**-E-103, Could not find matching SAMPLE_NO {SAMPLE_NO_1} in **TST_SAMPLE_LOG** or **TST_SAMPLE_LOG_LAB** for this section.

- Matching STATE_CODE, SHRP_ID, FIELD_SET, SAMPLE_NO_2 record must exist in **TST_SAMPLE_LOG** or **TST_SAMPLE_LOG_LAB**

  Error message: **TST_AC07_V2_SPECIMEN_INFO**-E-104, Could not find matching SAMPLE_NO '{SAMPLE_NO_1}' in **TST_SAMPLE_LOG** or **TST_SAMPLE_LOG_LAB** for this section.

- Matching STATE_CODE, SHRP_ID, FIELD_SET, SAMPLE_NO_3 record must exist in **TST_SAMPLE_LOG** or **TST_SAMPLE_LOG_LAB**

  Error message: **TST_AC07_V2_SPECIMEN_INFO**-E-105, Could not find matching SAMPLE_NO {SAMPLE_NO_1} in **TST_SAMPLE_LOG** or **TST_SAMPLE_LOG_LAB** for this section.

- CREEP_DATA_ANAL_FILE <> MR_DATA_ANAL_FILE <> IDT_DATA_ANAL_FILE_1<> IDT_DATA_ANAL_FILE_2 <> IDT_DATA_ANAL_FILE_3

  Error message: **TST_AC07_V2_SPECIMEN_INFO**-E-106, One or more analysis file names are identical.

  Creep analysis file = {CREEP_DATA_ANAL_FILE}
  Resilient modulus analysis file = {MR_DATA_ANAL_FILE}
  Indirect tensile analysis file 1 = {IDT_DATA_ANAL_FILE_1}
  Indirect tensile analysis file 2 = {IDT_DATA_ANAL_FILE_2}
  Indirect tensile analysis file 3 = {IDT_DATA_ANAL_FILE_3}

- SAMPLE_NO_1 <> SAMPLE_NO_2 <> SAMPLE_NO_3

  Error message: **TST_AC07_V2_SPECIMEN_INFO**-E-107, One or more sample numbers are identical.

  SAMPLE_NO for Specimen 1 = {SAMPLE_NO_1}
  SAMPLE_NO for Specimen 2 = {SAMPLE_NO_2}
  SAMPLE_NO for Specimen 3 = {SAMPLE_NO_3}

Tables: TST_AC07_V2_SPECIMEN_INFO, TST_AC07_V2_MR_SUM, TST_AC07_V2_CREEP_COMP_SUM, TST_AC07_V2_IDT_SUM

- For each STATE_CODE, SHRP_ID, LAYER_NO, TEST_NO, CONSTRUCTION_NO, FIELD_SET in **TST_AC07_V2_SPECIMEN_INFO**, one of the following conditions must exist:
- at least three records must exist in **TST_AC07_V2_MR_SUM**,
- at least three records must exist in **TST_AC07_V2_CREEP_COMP_SUM**, or
- at least one record must exist in **TST_AC07_V2_IDT_SUM**

  Error message: **TST_AC07_V2_SPECIMEN_INFO**-E-111, Insufficient test records for {STATE_CODE, SHRP_ID, LAYER_NO, TEST_NO, FIELD_SET, CONSTRUCTION_NO}. One of the following must exist: at least 3 matching records in **TST_AC07_V2_MR_SUM** or **TST_AC07_V2_CREEP_COMP_SUM** or at least 1 matching records in **TST_AC07_V2_IDT_SUM.**

Tables: TST_AC07_V2_SPECIMEN_INFO, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, and SAMPLE_NO_1 = SAMPLE_NO

  Error message: **TST_AC07_V2_SPECIMEN_INFO**-E-108 {STATE_CODE, SHRP_ID, FIELD_SET}, There is no matching sample {SAMPLE_NO_1} in **TST_SAMPLE_BASIC_INFO**.

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, and SAMPLE_NO_2 = SAMPLE_NO

  Error message: **TST_AC07_V2_SPECIMEN_INFO**-E-109 {STATE_CODE, SHRP_ID, FIELD_SET}, There is no matching sample {SAMPLE_NO_2} in **TST_SAMPLE_BASIC_INFO**.

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO_3 = SAMPLE_NO

  Error message: **TST_AC07_V2_SPECIMEN_INFO**-E-110 {STATE_CODE, SHRP_ID, FIELD_SET}, There is no matching sample {SAMPLE_NO_3} in **TST_SAMPLE_BASIC_INFO**.

Table: TST_AC07_V2_MR_SUM

TEST_TEMPERATURE	INST_MR_CYCLE_*, INST_MR_AVG, TOTAL_MR_CYCLE_*, TOTAL_MR_AVG
4.0 - 6.0	1.10 - 20.00
23.0 - 27.0	0.55 - 13.80
38.0 - 42.0	0.20 - 6.00
ELSE	0.20 - 20.00

Error message: **TST_AC07_V2_MR_SUM**-E-101a-ff, as applicable:
For TEST_TEMPERATURE=X, {INST_MR_CYCLE_*, INST_MR_AVG, TOTAL_MR_CYCLE_*, TOTAL_MR_AVG} (insert appropriate field) (field value) not in (insert test range)

For example, **TST_AC07_V2_MR_SUM**-E-101i, For TEMPERATURE= 23.0 - 27.0, INST_MR_CYCLE_1 (15.00) not in 0.55 - 13.80

- 0.95 * AVERAGE(INST_MR_CYCLE_*) <= INST_MR_AVG <= 1.05 * AVERAGE(INST_MR_CYCLE_*)

  Error message: **TST_AC07_V2_MR_SUM**-E-102, INST_MR_AVG should be within 5 percent of average of INST_MR_CYCLE values {0.95 * AVERAGE(INST_MR_CYCLE_*)} <= INST_MR_AVG = {INST_MR_AVG} <= {1.05 * AVERAGE(INST_MR_CYCLE_*)}

- 0.95 * AVERAGE(TOTAL_MR_CYCLE_*) <= TOTAL_MR_AVG <= 1.05 * AVERAGE(TOTAL_MR_CYCLE_*)

  Error message: **TST_AC07_V2_MR_SUM**-E-103, TOTAL_MR_AVG should be within 5 percent of average of TOTAL_MR_CYCLE values {0.95 * AVERAGE(TOTAL_MR_CYCLE_*)} <= TOTAL_MR_AVG = {TOTAL_MR_AVG} <= {1.05 * AVERAGE(TOTAL_MR_CYCLE_*)}

- 0.90 * AVERAGE(INST_MR_POISSON_CALC_CYCLE_*) <= INST_MR_POISSON_CALC_AVG <= 1.10 * AVERAGE(INST_MR_POISSON_CALC_CYCLE_*)

  Error message: **TST_AC07_V2_MR_SUM**-E-104, INST_MR_POISSON_CALC_AVG should be within 10 percent of average of INST_MR_POISSON_CALC_CYCLE values {0.90 * AVERAGE(INST_MR_POISSON_CALC_CYCLE_*)} <= INST_MR_POISSON_CALC_AVG = {INST_MR_POISSON_CALC_AVG} <= {1.10 * AVERAGE(INST_MR_POISSON_CALC_CYCLE_*)}

- 0.90 * AVERAGE(INST_MR_POISSON_USED_CYCLE_*) <= INST_MR_POISSON_USED_AVG <= 1.10 * AVERAGE(INST_MR_POISSON_USED_CYCLE_*)

  Error message: **TST_AC07_V2_MR_SUM**-E-105, INST_MR_POISSON_USED_AVG should be within 10 percent of average of INST_MR_POISSON_USED_CYCLE values {0.90 * AVERAGE(INST_MR_POISSON_USED_CYCLE_*)} <= INST_MR_POISSON_USED_AVG

= {INST_MR_POISSON_USED_AVG} <= {1.10 * AVERAGE(INST_MR_POISSON_USED_CYCLE_*)}

- 0.90 * AVERAGE(TOTAL_MR_POISSON_CALC_CYCLE_*) <= TOTAL_MR_POISSON_CALC_AVG <= 1.10 * AVERAGE(TOTAL_MR_POISSON_CALC_CYCLE_*)

  Error message: **TST_AC07_V2_MR_SUM**-E-106, TOTAL_MR_POISSON_CALC_AVG should be within 10 percent of average of TOTAL_MR_POISSON_CALC_CYCLE values {0.90 * AVERAGE(TOTAL_MR_POISSON_CALC_CYCLE_*)} <= TOTAL_MR_POISSON_CALC_AVG = {TOTAL_MR_POISSON_CALC_AVG} <= {1.10 * AVERAGE(TOTAL_MR_POISSON_CALC_CYCLE_*)}

- 0.90 * AVERAGE(TOTAL_MR_POISSON_USED_CYCLE_*) <= TOTAL_MR_POISSON_USED_AVG <= 1.10 * AVERAGE(TOTAL_MR_POISSON_USED_CYCLE_*)

  Error message: **TST_AC07_V2_MR_SUM**-E-107, TOTAL_MR_POISSON_USED_AVG should be within 10 percent of average of TOTAL_MR_POISSON_USED_CYCLE values {0.90 * AVERAGE(TOTAL_MR_POISSON_USED_CYCLE_*)} <= TOTAL_MR_POISSON_USED_AVG = {TOTAL_MR_POISSON_USED_AVG} <= {1.10 * AVERAGE(TOTAL_MR_POISSON_USED_CYCLE_*)}

- For matching STATE_CODE, SHRP_ID, LAYER_NO, TEST_NO, CONSTRUCTION_NO and FIELD_SET, extract TEST_TEMPERATURE and INST_MR_AVG. Order the results from lowest to highest temperature. The following relationship must exist:

  INST_MR_AVG (Temp 1) >=
  INST_MR_AVG (Temp 2) >=
  INST_MR_AVG (Temp 3) >=
  .....
  INST_MR_AVG (Temp N);
  where Temp 1 is lowest temp and Temp N is highest temp

  Error message: **TST_AC07_V2_MR_SUM**-E-108, INST_MR_AVG cannot increase with increasing temperature.
  Temperature 1 {TEST_TEMPERATURE} - INST_MR_AVG = {INST_MR_AVG}
  Temperature 2 {TEST_TEMPERATURE} - INST_MR_AVG = {INST_MR_AVG}
  Temperature 3 {TEST_TEMPERATURE} - INST_MR_AVG = {INST_MR_AVG}
  ......

- For matching STATE_CODE, SHRP_ID, LAYER_NO, TEST_NO, CONSTRUCTION_NO and FIELD_SET, extract TEST_TEMPERATURE and TOTAL_MR_AVG. Order the results from lowest to highest temperature. The following relationship must exist:

  TOTAL_MR_AVG (Temp 1) >=
  TOTAL_MR_AVG (Temp 2) >=
  TOTAL_MR_AVG (Temp 3) >=
  .....
  TOTAL_MR_AVG (Temp N);
  where Temp 1 is lowest temp and Temp N is highest temp

  Error message: **TST_AC07_V2_MR_SUM**-E-109, TOTAL_MR_AVG cannot increase with increasing temperature.
  Temperature 1 {TEST_TEMPERATURE} - TOTAL_MR_AVG = {TOTAL_MR_AVG}
  Temperature 2 {TEST_TEMPERATURE} - TOTAL_MR_AVG = {TOTAL_MR_AVG}

Temperature 3 {TEST_TEMPERATURE} - TOTAL_MR_AVG = {TOTAL_MR_AVG}
.....

- MR_DATA_FILE_SPECIMEN_1 <> MR_DATA_FILE_SPECIMEN_2 <> MR_DATA_FILE_SPECIMEN_3

Error message: **TST_AC07_V2_MR_SUM**-E-110, One or more analysis file names are identical.

MR_DATA_FILE_SPECIMEN_1 = {MR_DATA_FILE_SPECIMEN_1}
MR_DATA_FILE_SPECIMEN_2 = {MR_DATA_FILE_SPECIMEN_2}
MR_DATA_FILE_SPECIMEN_3 = {MR_DATA_FILE_SPECIMEN_3}

- Matching STATE_CODE, SHRP_ID, CONSTRUCTION_NO, LAYER_NO, TEST_NO, FIELD_SET, record must exist in **TST_AC07_V2_SPECIMEN_INFO** with RECORD_STATUS = 'E'

Error message: **TST_AC07_V2_MR_SUM**-E-120, No matching record exists in **TST_AC07_V2_SPECIMEN_INFO**, or matching record not at E.

Table: TST_AC07_V2_CREEP_COMP_SUM

TEMPERATURE	CREEP_COMP_*_SEC
-8.0 - 12.0	0.010 - 0.500
4.0 - 6.0	0.010 - 2.000
23.0 - 27.0	0.010 - 50.000
ELSE	0.010 - 50.000

Error message: **TST_AC07_V2_CREEP_COMP_SUM**-E-101a-bb,If TEST_TEMPERATURE = X, {CREEP_COMP_*_SEC) (insert appropriate field) must be between (insert appropriate range).

For example, **TST_AC07_V2_CREEP_COMP_SUM**-E-101h, If TEST_TEMPERATURE = 4.0 - 6.0, CREEP_COMP_1_SEC (0.008) must be between 0.010 - 50.000.

- CREEP_COMP_1_SEC <= CREEP_COMP_2_SEC <= CREEP_COMP_5_SEC <= CREEP_COMP_10_SEC <= CREEP_COMP_20_SEC <= CREEP_COMP_50_SEC <= CREEP_COMP_100_SEC

Error message: **TST_AC07_V2_CREEP_COMP_SUM**-E-102: Creep compliance values cannot decrease over time CREEP_COMP_1_SEC = {CREEP_COMP_1_SEC} <= {CREEP_COMP_2_SEC} <= {CREEP_COMP_5_SEC} <= {CREEP_COMP_10_SEC} <={CREEP_COMP_20_SEC} <= {CREEP_COMP_50_SEC} <= {CREEP_COMP_100_SEC} = CREEP_COMP_100_SEC

- For matching STATE_CODE, SHRP_ID, LAYER_NO, TEST_NO, CONSTRUCTION_NO and FIELD_SET, extract TEST_TEMPERATURE and CREEP_COMP_x_SEC. Order the results from lowest to highest temperature for STATE_CODE, SHRP_ID, LAYER_NO, TEST_NO,

CONSTRUCTION_NO and FIELD_SET. The following relationship must exist for each value of x (1, 2, 5, 10, 20, 50, 100).

CREEP_COMP_X_SEC (Temp 1) <=
CREEP_COMP_X_SEC (Temp 2) <=
CREEP_COMP_X_SEC (Temp 3) <=
.....
CREEP_COMP_X_SEC (Temp N);
where Temp 1 is lowest temp and Temp N is highest.

Error message: **TST_AC07_V2_CREEP_COMP_SUM**-E-103: Creep compliance value at {x} second must increase with increasing temperature. TEST_TEMPERATURE1 = {TEST_TEMPERATURE}, CREEP_COMP_{x}_SEC = {CREEP_COMP_x_SEC} <= TEST_TEMPERATURE2 = {TEST_TEMPERATURE}, CREEP_COMP_{x}_SEC = {CREEP_COMP_x_SEC} <= TEST_TEMPERATURE3 = {TEST_TEMPERATURE}, CREEP_COMP_{x}_SEC = {CREEP_COMP_x_SEC}...

- CREEP_DATA_FILE_SPECIMEN_1 <> CREEP_DATA_FILE_SPECIMEN_2 <> CREEP_DATA_FILE_SPECIMEN_3

  Error message: **TST_AC07_V2_CREEP_COMP_SUM**-E-104: One or more analysis file names are identical.

  CREEP_DATA_FILE_SPECIMEN_1 = {CREEP_DATA_FILE_SPECIMEN_1}
  CREEP_DATA_FILE_SPECIMEN_2 = {CREEP_DATA_FILE_SPECIMEN_2}
  CREEP_DATA_FILE_SPECIMEN_3 = {CREEP_DATA_FILE_SPECIMEN_3}

- Matching STATE_CODE, SHRP_ID, CONSTRUCTION_NO, LAYER_NO, TEST_NO, FIELD_SET, record must exist in **TST_AC07_V2_SPECIMEN_INFO** with RECORD_STATUS = 'E'

  Error message: **TST_AC07_V2_CREEP_COMP_SUM**-E-120, No matching record exists in **TST_AC07_V2_SPECIMEN_INFO**, or matching record not at E.

Table: TST_AC07_V2_IDT_SUM

- 0.95 * AVERAGE(IDT_SPECIMEN_*) <= IDT_AVERAGE <= 1.05 * AVERAGE(IDT_SPECIMEN_*)

  Error message: **TST_AC07_V2_IDT_SUM**-E-101: IDT_AVERAGE should be within 5 percent of average of INST_MR_CYCLE values {0.95 * AVERAGE(IDT_SPECIMEN_*)} <= IDT_AVERAGE = {IDT_AVERAGE} <= {1.05 * AVERAGE(IDT_SPECIMEN_*)}

- IDT_DATA_FILE_SPECIMEN_1 <> IDT_DATA_FILE_SPECIMEN_2 <> IDT_DATA_FILE_SPECIMEN_3

Error message: **TST_AC07_V2_IDT_SUM**-E-102: One or more analysis file names are identical.

IDT_DATA_FILE_SPECIMEN_1 = {IDT_DATA_FILE_SPECIMEN_1}
IDT_DATA_FILE_SPECIMEN_2 = {IDT_DATA_FILE_SPECIMEN_2}
IDT_DATA_FILE_SPECIMEN_3 = {IDT_DATA_FILE_SPECIMEN_3}

- Matching STATE_CODE, SHRP_ID, CONSTRUCTION_NO, LAYER_NO, TEST_NO,

FIELD_SET, record must exist in **TST_AC07_V2_SPECIMEN_INFO** with RECORD_STATUS = 'E'

Error message: **TST_AC07_V2_IDT_SUM**-E-103, No matching record exists in **TST_AC07_V2_SPECIMEN_INFO**, or matching record not at E.

Tables: TST_AE01, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_AE01**-E-1, There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_AE01**-E-2, Sample was tested before it was taken.

Tables: TST_AE01S, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_AE01S**-E-1, There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_AE01S**-E-2, Sample was tested before it was taken.

Table: TST_AE02

- ·(20 - 500A)/(1 + 50A) - 0.1≤ PENETRATION_INDEX ≤ (20 - 500A)/ (1 + 50A) + 0.1, where A = [log10 (PENETRATION_115_F) - log10 (PENETRATION_77_F)]/21.1

  Error Message: **TST_AE02**-E-1, (20 - 500A)/(1 + 50A) - 0.1≤ PENETRATION_INDEX ≤ (20 - 500A)/ (1 + 50A) + 0.1, where A = [log10 (PENETRATION_115_F) - log10 (PENETRATION_77_F)]/21.1 failed.

Tables: TST_AE02, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_AE02**-E-2, There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_AE02**-E-3, Sample was tested before it was taken.

Tables: TST_AE02S, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_AE02S**-E-1, There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_AE02S**-E-2, Sample was tested before it was taken.

Tables: TST_AE03, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_AE03**-E-1, There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_AE03**-E-2, Sample was tested before it was taken.

Tables: TST_AE04, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_AE04**-E-1, There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_AE04**-E-2, Sample was tested before it was taken.

Table: TST_AE05

- 0.98 * KINEMATIC_VISC_CALIB_CONST * KINEMATIC_VISC_EFFLUX_TIME <

KINEMATIC_VISC_
275_F < 1.02 * KINEMATIC_VISC_CALIB_CONST * KINEMATIC_VISC_EFFLUX_TIME

Error Message: **TST_AE05**-E-1, 0.98 * KINEMATIC_VISC_CALIB_CONST * KINEMATIC_VISC_EFFLUX_TIME < KINEMATIC_VISC_275_F < 1.02 * KINEMATIC_VISC_CALIB_CONST * KINEMATIC_VISC_EFFLUX_TIME failed.

- 0.98 * ABSOLUTE_VISC_CALIB_FACTOR * ABSOLUTE_VISC_FLOW_TIME <ABSOLUTE_VISC_ 140_F < 1.02 * ABSOLUTE_VISC_CALIB_FACTOR * ABSOLUTE_VISC_FLOW_TIME

  Error Message: **TST_AE05**-E-2, 0.98 * ABSOLUTE_VISC_CALIB_FACTOR * ABSOLUTE_VISC_FLOW_TIME < ABSOLUTE_VISC_140_f < 1.02 * ABSOLUTE_VISC_CALIB_FACTOR * ABSOLUTE_VISC_FLOW_TIME failed.

Tables: TST_AE05, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_AE05**-E-3, There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_AE05**-E-4, Sample was tested before it was taken.

Tables: TST_AE06S, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_AE06S**-E-1, There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_AE06S**-E-2, Sample was tested before it was taken.

Table: TST_AE07_MASTER

- For matching TST_ID, **TST_LINK_SAMPLE**.LAYER_TYPE = 'AC'

  Error Message: **TST_AE07_MASTER**-E-101, {TST_ID, AGING_TYPE} For matching TST_ID, LAYER_TYPE in **TST_LINK_SAMPLE** must be 'AC'

- If AGING_TYPE = 1, 2, or 3, FIELD_AGE_TIME is null

Error Message: **TST_AE07_MASTER**-E-102, {TST_ID, AGING_TYPE} FIELD_AGE_TIME must be null if AGING_TYPE = 1, 2, 3

- If AGING_TYPE = 4, FIELD_AGE_TIME is not null

  Error Message: **TST_AE07_MASTER**-E-103, {TST_ID, AGING_TYPE} FIELD_AGE_TIME must be non-null if AGING_TYPE = 4

- PG_HIGH_TEMP > PG_LOW_TEMP

  Error Message: **TST_AE07_MASTER**-E-104, {TST_ID, AGING_TYPE} PG_HIGH_TEMP must be greater than than PG_LOW_TEMP

- If PLATE_DIAMETER is between 7.9 and 8.1, then TEST_GAP is between 1.95 and 2.05 OR If PLATE_DIAMETER is between 24.9 and 25.1, then TEST_GAP is between .95 and 1.05

  Error Message: **TST_AE07_MASTER**-E-105, {TST_ID, AGING_TYPE} TST_GAP is not appropriate for given PLATE_DIAMETER

- If TEST_CONTROL = 1, then TEST_TORQUE_AMP is not null and TEST_STRAIN_AMP is null

  Error Message: **TST_AE07_MASTER**-E-106, {TST_ID, AGING_TYPE} If TEST_CONTROL = 1 (stress control mode), TEST_TORQUE_AMP must be non-null and TEST_STRAIN_AMP must be null

- If TEST_CONTROL = 2, then TEST_STRAIN_AMP is not null and TEST_TORQUE_AMP is null

  Error Message: **TST_AE07_MASTER**-E-107, {TST_ID, AGING_TYPE} If TEST_CONTROL = 2 (stress control mode), TEST_STRAIN_AMP must be non-null and TEST_TORQUE_AMP must be null

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Tables: TST_AE07_MASTER, TST_LINK_SAMPLE, TST_SAMPLE_BASIC_INFO

Retrieve SAMPLE_NO from **TST_LINK_SAMPLE**, where **TST_AE07_MASTER**.TST_ID = **TST_LINK_SAMPLE**.TST_ID. Use this SAMPLE_NO for the following checks:

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, and SAMPLE_NO

  Error message: **TST_AE07_MASTER**-E-108, There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_AE07_MASTER**-E-109, Sample was tested before it was taken.

Tables: TST_AE08_DATA

- For a given record, ((STIFF_ESTIMATE – STIFF_MEASURE) / STIFF_ESTIMATE)* 100 * 0.95 < STIFF_PCT_DIFF < ((STIFF_ESTIMATE – STIFF_MEASURE) / STIFF_ESTIMATE)* 100 * 1.05

  Error Message TST_AE08_DATA-E-101 {TST_ID, AGING_TYPE, TEST_TEMP, TEST_TIME, TEST_RUN} STIFF_PCT_DIFF is not consistent with STIFF_ESTIMATE and STIFF_MEASURE

Table: TST_AE08_MASTER

- For matching TST_ID, **TST_LINK_SAMPLE**.LAYER_TYPE = 'AC'

  Error Message: **TST_AE08_MASTER**-E-101: {TST_ID, AGING_TYPE, TEST_TEMP, SOAK_TIME, TEST_RUN,} For matching TST_ID, LAYER_TYPE in **TST_LINK_SAMPLE** must be 'AC'

- If AGING_TYPE = 1, 2, or 3, FIELD_AGE_TIME is null

  Error Message: **TST_AE08_MASTER**-E-102: {TST_ID, AGING_TYPE, TEST_TEMP, SOAK_TIME, TEST_RUN} FIELD_AGE_TIME must be null if AGING_TYPE = 1, 2, 3

- If AGING_TYPE = 4, FIELD_AGE_TIME is not null

  Error Message: **TST_AE08_MASTER**-E-103: {TST_ID, AGING_TYPE, TEST_TEMP, SOAK_TIME, TEST_RUN} FIELD_AGE_TIME must be non-null if AGING_TYPE = 4

- PG_HIGH_TEMP > PG_LOW_TEMP

  Error Message: **TST_AE08_MASTER**-E-104: {TST_ID, AGING_TYPE, TEST_TEMP, SOAK_TIME, TEST_RUN} PG_HIGH_TEMP must be greater than PG_LOW_TEMP

Tables: TST_AE08_MASTER, TST_LINK_SAMPLE, TST_SAMPLE_BASIC_INFO

Retrieve SAMPLE_NO from **TST_LINK_SAMPLE**, where **TST_AE08_MASTER**.TST_ID = **TST_LINK_SAMPLE**.TST_ID. Use this SAMPLE_NO for the following checks:

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, and SAMPLE_NO

  Error message: **TST_AE08_MASTER**-E-105, There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_AE08_MASTER**-E-106, Sample was tested before it was taken.

Table: TST_AE09_DATA

- (PEAK_LOAD/**TST_AE09_MASTER.**SPECIMEN_AREA)*1000 between 0.95 * FAIL_STRESS and 1.05 * FAIL_STRESS for matching TST_ID, AGING_TYPE, and

TEST_TEMP

Error Message: **TST_AE09_DATA**-E-101:{TST_ID, AGING_TYPE, REPEAT_NO} Failure stress (FAIL_STRESS) is not equal to peak load (PEAK_LOAD) divided by specimen area (times 1000) in **TST_AE09_MASTER** for matching TST_ID, AGING_TYPE, and TEST_TEMP.

- (FAIL_ELONG/**TST_AE09_MASTER.**GAUGE_LENGTH)*100 between 0.95 * FAIL_STRAIN and 1.05 * FAIL_STRAIN for matching TST_ID, AGING_TYPE**,** and TEST_TEMP

  Error Message: **TST_AE09_DATA**-E-102: {TST_ID, AGING_TYPE, REPEAT_NO} Failure strain (FAIL_STRAIN) is not equal to elongation at failure (FAIL_ELONG) divided by effective gauge length (times 100) in **TST_AE09_MASTER** for matching TST_ID, AGING_TYPE, and TEST_TEMP.

Table: TST_AE09_MASTER

- For matching TST_ID, **TST_LINK_SAMPLE**.LAYER_TYPE = 'AC'

  Error Message: **TST_AE09_MASTER**-E-101: {TST_ID, AGING_TYPE, TEST_TEMP} For matching TST_ID, LAYER_TYPE in **TST_LINK_SAMPLE** must be 'AC'
- If AGING_TYPE = 1, 2, or 3, FIELD_AGE_TIME is null

  Error Message: **TST_AE09_MASTER**-E-102: {TST_ID, AGING_TYPE} FIELD_AGE_TIME must be null if AGING_TYPE = 1, 2, 3

- If AGING_TYPE = 4, FIELD_AGE_TIME is not null

  Error Message: **TST_AE09_MASTER**-E-103: {TST_ID, AGING_TYPE} FIELD_AGE_TIME must be non-null if AGING_TYPE = 4

- PG_HIGH_TEMP > PG_LOW_TEMP

  Error Message: **TST_AE09_MASTER**-E-104: {TST_ID, AGING_TYPE} PG_HIGH_TEMP must be greater than than PG_LOW_TEMP

- Average (**TST_AE09_DATA**.PEAK_LOAD) is between 0.95 * PEAK_LOAD_AVG and 1.05 * PEAK_LOAD_AVG for matching TST_ID and AGING_TYPE

  Error Message: **TST_AE09_MASTER**-E-105: {TST_ID, AGING_TYPE} Reported average peak load (PEAK_LOAD_AVG) is not equal to average of peak loads (PEAK_LOAD) in the **TST_AE09_DATA** table for matching TST_ID and AGING_TYPE

- Standard Deviation (**TST_AE09_DATA**.PEAK_LOAD) is between 0.95 * PEAK_LOAD_STD and 1.05 * PEAK_LOAD_STD for matching TST_ID and AGING_TYPE

  Error Message: **TST_AE09_MASTER**-E-106: {TST_ID, AGING_TYPE} Reported standard deviation of peak load (PEAK_LOAD_STD) is not equal to standard deviation of peak loads (PEAK_LOAD) in the **TST_AE09_DATA** table for matching TST_ID and AGING_TYPE

- Average (**TST_AE09_DATA**.FAIL_STRESS) is between 0.95 * FAIL_STRESS_AVG and 1.05 * FAIL_STRESS_AVG for matching TST_ID and AGING_TYPE

Error Message: **TST_AE09_MASTER**-E-107: {TST_ID, AGING_TYPE} Reported average failure stress (FAIL_STRESS_AVG) is not equal to average of failure stresses (FAIL_STRESS) in the **TST_AE09_DATA** table for matching TST_ID and AGING_TYPE

- Standard Deviation (**TST_AE09_DATA**.FAIL_STRESS) is between 0.95 * FAIL_STRESS_STD and 1.05 * FAIL_STRESS_STD for matching TST_ID and AGING_TYPE

  Error Message: **TST_AE09_MASTER**-E-108: {TST_ID, AGING_TYPE} Reported standard deviation of failure stress (FAIL_STRESS_STD) is not equal to average of failure stresses (FAIL_STRESS) in the **TST_AE09_DATA** table for matching TST_ID and AGING_TYPE

- Average (**TST_AE09_DATA**.FAIL_ELONG) is between 0.95 * FAIL_ELONG_AVG and 1.05 * FAIL_ELONG_AVG for matching TST_ID and AGING_TYPE

  Error Message: **TST_AE09_MASTER**-E-109: {TST_ID, AGING_TYPE} Reported average failure elongation (FAIL_ELONG_AVG) is not equal to average of failure elongations (FAIL_ELONG) in the **TST_AE09_DATA** table for matching TST_ID and AGING_TYPE

- Standard Deviation (**TST_AE09_DATA**.FAIL_ELONG) is between 0.95 * FAIL_ELONG_STD and 1.05 * FAIL_ELONG_STD for matching TST_ID and AGING_TYPE

  Error Message: **TST_AE09_MASTER**-E-110: {TST_ID, AGING_TYPE} Reported standard deviation of failure elongation (FAIL_ELONG_STD) is not equal to average of failure elongations (FAIL_ELONG) in the **TST_AE09_DATA** table for matching TST_ID and AGING_TYPE

- Average (**TST_AE09_DATA**.FAIL_STRAIN) is between 0.95 * FAIL_STRAIN_AVG and 1.05 * FAIL_STRAIN_AVG for matching TST_ID and AGING_TYPE

  Error Message: **TST_AE09_MASTER**-E-111: {TST_ID, AGING_TYPE} Reported average failure strain (FAIL_STRAIN_AVG) is not equal to average of failure strains (FAIL_STRAIN) in the **TST_AE09_DATA** table for matching TST_ID and AGING_TYPE

- Standard Deviation (**TST_AE09_DATA**.FAIL_STRAIN) is between 0.95 * FAIL_STRAIN_STD and 1.05 * FAIL_STRAIN_STD for matching TST_ID and AGING_TYPE

  Error Message: **TST_AE09_MASTER**-E-112: {TST_ID, AGING_TYPE} Reported standard deviation of failure strain (FAIL_STRAIN_STD) is not equal to average of failure strain s (FAIL_STRAIN) in the **TST_AE09_DATA** table for matching TST_ID and AGING_TYPE

Tables: TST_AE09_MASTER, TST_LINK_SAMPLE, TST_SAMPLE_BASIC_INFO

Retrieve SAMPLE_NO from **TST_LINK_SAMPLE**, where **TST_AE09_MASTER**.TST_ID = **TST_LINK_SAMPLE**.TST_ID. Use this SAMPLE_NO for the following checks:

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, and SAMPLE_NO

  Error message: **TST_AE09_MASTER**-E-113, There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, and SAMPLE_NO, TEST_DATE must be greater than or equal to

DATE_SAMPLED

Error message: **TST_AE09_MASTER**-E-114, Sample was tested before it was taken.

Table: TST_AG01

- 0.98 * SAMPLE_WEIGHT_OVEN_DRY_AIR / [SSD_SAMPLE_WEIGHT_IN_AIR - SSD_SAMPLE_
  WEIGHT_IN WATER] < BSG_OF_COARSE_AGG < 1.02 * SAMPLE_WEIGHT_OVEN_DRY_AIR/
  [SSD_SAMPLE_WEIGHT_IN_AIR - SSD_SAMPLE_WEIGHT_IN WATER]

  Error Message: **TST_AG01**-E-1, 0.98 * SAMPLE_WEIGHT_OVEN_DRY_AIR/ (SSD_SAMPLE_WEIGHT_IN_AIR - SSD_SAMPLE_WEIGHT_IN_WATER) < BSG_OF_COARSE_AGG < 1.02 * SAMPLE_WEIGHT_OVEN_DRY_AIR/ (SSD_SAMPLE_WEIGHT_IN_AIR - SSD_SAMPLE_WEIGHT_IN_WATER) failed.

- 100 * (0.95 * [SSD_SAMPLE_WEIGHT_IN_AIR - SAMPLE_WEIGHT_OVEN_DRY_AIR] / SAMPLE_WEIGHT_OVEN_DRY_AIR) <= ABSORPTION_OF_COARSE_AGG <= (1.05 * [SSD_SAMPLE_WEIGHT_IN_AIR - SAMPLE_WEIGHT_OVEN_DRY_AIR] / SAMPLE_WEIGHT_OVEN_DRY_AIR) * 100[15]

  Error Message: **TST_AG01**-E-2, 100 * (0.95 * (SSD_SAMPLE_WEIGHT_IN_AIR - SAMPLE_WEIGHT_OVEN_DRY_AIR) / SAMPLE_WEIGHT_OVEN_DRY_AIR <= ABSORPTION_OF_COARSE_AGG <= 100 * (1.05 * (SSD_SAMPLE_WEIGHT_IN_AIR - SAMPLE_WEIGHT_OVEN_DRY_AIR) / SAMPLE_WEIGHT_OVEN_DRY_AIR) failed.

Tables: TST_AG01, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_AG01**-E-3, There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_AG01**-E-4, Sample was tested before it was taken.

Table: TST_AG02

- 0.98 * ((SAMPLE_WEIGHT_OVEN_DRY_AIR / (PYCNOMETER_SAMPLE_WEIGHT_WATER + SSD_SAMPLE_WEIGHT-PYCNOMETER_SAMPLE_WEIGHT_CALIB)) < BSG_OF_FINE_AGG < 1.02 * ((SAMPLE_WEIGHT_OVEN_DRY_AIR / (PYCNOMETER_SAMPLE_WEIGHT_WATER + SSD_SAMPLE_WEIGHT-PYCNOMETER_SAMPLE_WEIGHT_CALIB))

[15] All values rounded to 1 decimal place before calculation.

Error Message: **TST_AG02**-E-1,
0.98 * (SAMPLE_WEIGHT_OVEN_DRY_AIR/ (PYCNOMETER_SAMPLE_WEIGHT_WATER + SSD_SAMPLE_WEIGHT - PYCNOMETER_SAMPLE_WEIGHT_CALIB)) < BSG_OF_FINE_AGG < 1.02 * (SAMPLE_WEIGHT_OVEN_DRY_AIR/(PYCNOMETER_SAMPLE_WEIGHT_WATER + SSD_SAMPLE_WEIGHT - PYCNOMETER_SAMPLE_WEIGHT_CALIB)) failed

- 100 * (0.95 * ((SSD_SAMPLE_WEIGHT-SAMPLE_WEIGHT_OVEN_DRY_AIR)/SAMPLE_WEIGHT_ OVEN_DRY_AIR)) < ABSORPTION_OF_FINE_AGG < (1.05 * ((SSD_SAMPLE_WEIGHT-SAMPLE_WEIGHT_OVEN_DRY_AIR)/SAMPLE_WEIGHT_ OVEN_DRY_AIR)) * 100[15]

  Error Message: **TST_AG02**-E-2,
  100 * (0.95 * ((SSD_SAMPLE_WEIGHT - SAMPLE_WEIGHT_OVEN_DRY_AIR)/ SAMPLE_WEIGHT_OVEN_DRY_AIR)) <= ABSORPTION_OF_FINE_AGG < 100 * (1.05 * ((SSD_SAMPLE_WEIGHT - SAMPLE_WEIGHT_OVEN_DRY_AIR)/ SAMPLE_WEIGHT_OVEN_DRY_AIR)) failed.

Tables: TST_AG02, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_AG02**-E-3 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_AG02**-E-4 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} Sample was tested before it was taken.

Tables: TST_AG04, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_AG04**-E-1 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_AG04**-E-2 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} Sample was tested before it was taken.

Tables: TST_AG05, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE,

SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

Error message: **TST_AG05**-E-1 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_AG05**-E-2 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} Sample was tested before it was taken.

Table: TST_ASPHALT_CEMENT

- If PLANT_TYPE = 3, PLANT_TYPE_OTHER must be non null

  Error Message: **TST_ASPHALT_CEMENT**-E-1, If PLANT_TYPE = 3 then PLANT_TYPE_OTHER must be non-null.

- DATE_SAMPLED <= DATE_SHIPPED (check is not conducted if either or both of the entries are null)

  Error Message: **TST_ASPHALT_CEMENT**-E-2, DATE_SAMPLED <= DATE_SHIPPED.

Tables: TST_CS01, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_CS01**-E-1 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_CS01**-E-2 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} Sample was tested before it was taken.

Tables: TST_CS02, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_CS02**-E-1 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

Error message: **TST_CS02**-E-2 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} Sample was tested before it was taken.

Tables: TST_ESTAR_GSTAR_INPUT, TST_ESTAR_GSTAR_CAM_COEFF

- There must be a record in **TST_ESTAR_GSTAR_CAM_COEFF** with matching ESTAR_LINK at level E

  Error message: TST_ESTAR_GSTAR_INPUT -E-101{ESTAR_LINK} There is no matching record in **TST_ESTAR_GSTAR_CAM_COEFF** at level E

Table: TST_ESTAR_MASTER

- SAMPLE_DATE must be later than CONSTRUCTION_DATE where SAMPLE_TYPE_ESTAR = 4

  Error message: TST_ESTAR_MASTER -E-101{ESTAR_LINK}The sampling date for field aged materials must be after the construction date.

Table: TST_ESTAR_MASTER

- Either SHRP_ID and LAYER_NO or PROJECT_ID and PROJECT_LAYER_CODE must be non-null

  Error message: TST_ESTAR_MASTER -E-102{ESTAR_LINK}This data set is missing defining project and layer identification.

Tables: TST_ESTAR_MASTER, TST_ESTAR_GSTAR_INPUT

- Where PREDICTIVE_MODEL = 3 or 4, there must be a record in **TST_ESTAR_GSTAR_INPUT** with matching ESTAR_LINK at level E

  Error message: TST_ESTAR_MASTER -E-103{ESTAR_LINK} There is no matching record in **TST_ESTAR_GSTAR_INPUT** at level E

Tables: TST_ESTAR_MASTER, TST_ESTAR_MR_INPUT

- Where PREDICTIVE_MODEL = 1, there must be a record in **TST_ESTAR_MR_INPUT** with matching ESTAR_LINK at level E

  Error message: TST_ESTAR_MASTER -E-104{ESTAR_LINK} There is no matching record in **TST_ESTAR_MR_INPUT** at level E

Tables: TST_ESTAR_MASTER, TST_ESTAR_VISC_INPUT

- Where PREDICTIVE_MODEL = 2 or 5, there must be a record in **TST_ESTAR_VISC_INPUT** with matching ESTAR_LINK at level E

  Error message: TST_ESTAR_MASTER -E-105{ESTAR_LINK} There is no matching record in **TST_ESTAR_VISC_INPUT** at level E

Tables: TST_ESTAR_MASTER, TST_ESTAR_VOLUM_INPUT

- Where PREDICTIVE_MODEL = 2,3,4 or 5, there must be a record in **TST_ESTAR_VOLUM_INPUT** with matching ESTAR_LINK at level E

  Error message: TST_ESTAR_MASTER -E-106{ESTAR_LINK} There is no matching record in **TST_ESTAR_VOLUM_INPUT** at level E

Table: TST_ESTAR_MODULUS

- For a given FREQUENCY, as TEMPERATURE increases, ESTAR must decrease

  Error message: **TST_ESTAR_MODULUS**-E-101{ESTAR_LINK, FREQUENCY} ESTAR does not decrease with an increase in TEMPERATURE

- For a given TEMPERATURE, as FREQUENCY decreases, ESTAR must also decrease

  Error message: **TST_ESTAR_MODULUS**-E-102{ESTAR_LINK, TEMPERATURE} ESTAR does not decrease with a decrease in FREQUENCY

- The following relationship between ESTAR at FREQUENCY = 0.1 HZ and a given temperature and the ESTAR at 25Hz and the next highest temperature must be as follows:

(ESTAR1 - ESTAR2)/ESTAR2 must be between A1 and A2

TEMPERATURE 1	TEMPERATURE 2	A1	A2
14	40	0.25	-0.25
40	70	0.50	-0.75
70	100	0.50	-0.75
100	130	0.50	-0.75

WHERE ESTAR1 is the ESTAR value at TEMPERATURE 1 and FREQUENCY =0.1 and ESTAR2 is the ESTAR value at TEMPERATURE 2 and FREQUENCY = 25

Error message: **TST_ESTAR_MODULUS**-E-103{ESTAR_LINK, TEMPERATURE1} The relationship between the ESTAR values at this temperature and the next is outside the expected range.

*All ESTAR values at TEMPERATURE = TEMPRATURE 1 should be kept at level D.

- For FREQUENCY = 0.1, the ESTAR value at one TEMPERATURE must be greater than the ESTAR value at the next highest temperature.

  Error message: **TST_ESTAR_MODULUS**-E-104{ESTAR_LINK, TEMPERATURE} The ESTAR value at 0.1Hz and this temperature should be greater than the value for the next highest temperature.

  *All ESTAR values at this TEMPERATURE should be kept at level D

Tables: TST_ESTAR_MODULUS, TST_ESTAR_MASTER

- There must be a record in **TST_ESTAR_MASTER** with matching ESTAR_LINK at level E

  Error message: TST_ESTAR_MODULUS-E-105{ESTAR_LINK} There is no matching record in **TST_ESTAR_MASTER** at level E

Tables: TST_ESTAR_MODULUS, TST_ESTAR_MODULUS_COEFF

- There must be a record in **TST_ESTAR_MODULUS_COEFF** with matching ESTAR_LINK at level E

  Error message: TST_ESTAR_MODULUS-E-106{ESTAR_LINK} There is no matching record in **TST_ESTAR_MODULUS_COEFF** at level E

Table: TST_ESTAR_MODULUS_COEFF

- SHIFT_FACTOR_COEFF_1*100 - SHIFT_FACTOR_COEFF_2*10+SHIFT_FACTOR_COEFF_3 must be between 3 and 7

  Error message: TST_ESTAR_MODULUS_COEFF-E-101{ESTAR_LINK} The shift factor coefficients are outside the expected range.

Tables: TST_ESTAR_MODULUS_COEFF, TST_ESTAR_MASTER

- There must be a record in **TST_ESTAR_MASTER** with matching ESTAR_LINK at level E

  Error message: TST_ESTAR_MODULUS_COEFF-E-102{ESTAR_LINK} There is no matching record in **TST_ESTAR_MASTER** at level E

Table: TST_FRESH_PCC

- If SAMPLE_LOC = 5, SAMPLE_LOC_OTHER must be non-null

  Error Message: SPS2MATL_**TST_FRESH_PCC**-E-1, SAMPLE_LOC_OTHER must be non-null for SAMPLE_LOC = 5.

- DATE_SAMPLED <= DATE_SHIPPED (check is not conducted if either or both of the entries are null)

Error Message: SPS2MATL_**TST**_**FRESH**_**PCC**-E-2, DATE-SAMPLED is later than DATE_SHIPPED.

Table: TST_HOLE_LOG

- For each STATE_CODE, SHRP_ID, FIELD_SET, there can only be one value of CONSTRUCTION_NO

  Error Message: **TST**_**HOLE**_**LOG**-E-101, For each STATE_CODE, SHRP_ID, FIELD_SET there can only be one value of CONSTRUCTION_NO.

- For each STATE_CODE, SHRP_ID, HOLE_DATE, there can only be one value of FIELD_SET.

  Error Message: **TST**_**HOLE**_**LOG**-E-102, For each STATE_CODE, SHRP_ID, HOLE_DATE there can only be one value of FIELD_SET.

- For a given STATE_CODE and SHRP_ID, min(HOLE_DATE) for FIELD_SET must be greater than max(HOLE_DATE) for FIELD_SET – 1

  Error Message: **TST**_**HOLE**_**LOG**-E-103, For a given STATE_CODE and SHRP_ID, min(HOLE_DATE) for FIELD_SET must be greater than max(HOLE_DATE) for FIELD_SET - 1.

Table: TST_ISD_MOIST

- No checks are performed. If record is at Level D, set to Level E.

Table: TST_L05A

- If MEASURE_TYPE_1_STATION0 = 8, then LAYER_THICK_STATION0 must be null

  Error Message: **TST**_**L05A**-E-1, If MEASURE_TYPE_1_STATION0=8, LAYER_THICK_STATION0 must be null.

- If MEASURE_TYPE_1_WITHIN = 8, then LAYER_THICK_WITHIN must be null

  Error Message: **TST**_**L05A**-E-2, If MEASURE_TYPE_1_WITHIN=8, LAYER_THICK_WITHIN must be null.

- If MEASURE_TYPE_1_STATION5 = 8, then LAYER_THICK_STATION5 must be null

  Error Message: **TST**_**L05A**-E-3, If MEASURE_TYPE_1_STATION5=8, LAYER_THICK_STATION5 must be null.

- If MEASURE_TYPE_1_STATION0 <> 5, 8, then LAYER_THICK_STATION0 must be non-null

  Error Message: **TST**_**L05A**-E-4, If MEASURE_TYPE_1_STATION0 != 5 or 8, LAYER_THICK_STATION0 must be non-null.

- If MEASURE_TYPE_1_WITHIN <> 5, 8, then LAYER_THICK_WITHIN must be non-null

Error Message: **TST_L05A**-E-5, If MEASURE_TYPE_1_WITHIN != 5 or 8, LAYER_THICK_WITHIN must be non-null.

- If MEASURE_TYPE_1_STATION5 <> 5, 8, then LAYER_THICK_STATION5 must be non null

  Error Message: **TST_L05A**-E-6, If MEASURE_TYPE_1_STATION5 != 5 or 8, LAYER_THICK_STATION5 must be non-null.

Tables: TST_L05A, TST_L05B

SPS sections, except SPS9

- For matching SHRP_ID, STATE_CODE, and PROJECT_LAYER_CODE in **TST_L05B** the DESCRIPTION must match

  Error Message: **TST_L05A**-E-79, For matching STATE_CODE,SHRP_ID,PROJECT_LAYER_CODE in TST_L05B the DESCRIPTION must match

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Tables: TST_L05A and L05B (each table checked separately)

All Experiments

- A layer with a DESCRIPTION = 7 must be the first layer (LAYER_NO = 1)

  Error Message: **TST_L05A/B**-E-7, For LAYER_NO = 1, DESCRIPTION must always = 7.

- There must be a layer with a DESCRIPTION of 3 **(not supplementals)**

  Error Message: **TST_L05A**-E-90, There must be a layer with a DESCRIPTION of 3.

- There cannot be two layers with a DESCRIPTION = 1 **(This check exempt for GPS6C, 6D, 6S, 7C, 7D, 7F, 7R, 7S, and supplementals)**

  Error Message: **TST_L05A/B**-E-27, There cannot be 2 or more layers with a DESCRIPTION of 1. Exempt for GPS-6C, 6D, 6S, 7C, 7D, 7S, and supplementals.

- There cannot be two or more layers with a DESCRIPTION = 3

  Error Message: **TST_L05A/B**-E-28, There cannot be >= 2 layers with a DESCRIPTION of 3.

- There cannot be two layers with a DESCRIPTION = 5 **(This check exempt for SPS1, SPS2, and supplementals)**

  Error Message: **TST_L05A/B**-E-29, There cannot be 2 or more layers with a DESCRIPTION of 5. Exempt for SPS-1, 2, and supplementals.

- There cannot be two layers with a DESCRIPTION = 7 **(TST_L05B only)**

  Error Message: **TST_L05B**-E-78, There cannot be >= 2 layers with a DESCRIPTION of 7.

- A DESCRIPTION = 1 must not be designated for a layer below a layer with a DESCRIPTION = 3

  Error Message: **TST**_**L05A/B**-E-15, A layer for DESCRIPTION = 1 cannot be below a layer for DESCRIPTION 3.

- A DESCRIPTION = 2 must not be designated for a layer below a layer with a DESCRIPTION = 5, 6, or 11

  Error Message: **TST**_**L05A/B**-E-16, A layer for DESCRIPTION = 2 cannot be below a layer for DESCRIPTION 5, 6 or 11.

- A DESCRIPTION = 4 must not be designated for a layer below a layer with a DESCRIPTION = 5, 6, or 11

  Error Message: **TST**_**L05A/B**-E-18, A layer for DESCRIPTION = 4 cannot be below a layer for DESCRIPTION 5, 6 or 11.

- A DESCRIPTION = 4 must be placed directly below a layer(s) with DESCRIPTION = 1, 3, or 4

  Error Message: **TST**_**L05A/B**-E-19, There must be a layer with a DESCRIPTION of 4 directly below a layer with a DESCRIPTION of 1, 3 or 4.

- A DESCRIPTION = 5 must not be designated for a layer below a layer with a DESCRIPTION = 6 or 11

  Error Message: **TST**_**L05A/B**-E-20, A layer for DESCRIPTION = 5 cannot be below a layer for DESCRIPTION 6 or 11.

- A DESCRIPTION = 6 must not be designated for a layer below a layer with a DESCRIPTION = 11

  Error Message: **TST**_**L05A/B**-E-21, A layer for DESCRIPTION = 6 cannot be below a layer for DESCRIPTION 11.

- A DESCRIPTION = 2 cannot be placed directly below a layer with DESCRIPTION = 9

  Error Message: **TST**_**L05A/B**-E-23, A layer with a DESCRIPTION of 2 cannot be placed directly below a layer with a DESCRIPTION of 9.

- A DESCRIPTION = 9 must not be designated for a layer below a layer with a DESCRIPTION = 3, 5, 6, 8, or 11

  Error Message: **TST**_**L05A/B**-E-24, A layer for DESCRIPTION = 9 cannot be below a layer for DESCRIPTION 3, 5, 6, 8 or 11.

- A DESCRIPTION = 10 must not be designated for a layer below a layer with a DESCRIPTION = 3, 5, 6, or 8

  Error Message: **TST**_**L05A/B**-E-25, A layer for DESCRIPTION = 10 cannot be below a layer for DESCRIPTION 3, 5, 6 or 8.

- If PROJECT_LAYER_CODE and is non-null, then MATL_CODE must be non-null

Error message **TST_L05A/B**-E-91 (STATE_CODE, SHRP_ID, CONSTRUCTION_NO, LAYER_NO) Where PROJECT_LAYER_CODE is non-null, MATL_CODE must be non-null

- For each combination of STATE_CODE, SHRP_ID, and LAYER_NO, there can be only one value for DESCRIPTION

  Error message **TST_L05A/B**-E-92 (STATE_CODE, SHRP_ID, LAYER_NO) There must be only one DESCRIPTION for a given layer.

- For each combination of STATE_CODE, SHRP_ID, and LAYER_NO, there can be only one value for LAYER_TYPE

  Error message **TST_L05A/B**-E-93 (STATE_CODE, SHRP_ID, LAYER_NO) There must be only one LAYER_TYPE for a given layer.

Level E checks 91 - 93 for **TST_L05A/B** should be run for all records in **TST_L05A/B** prior to running the following check:

- If all records for the test section are not at RECORD_STATUS = E then print an error message

  Error Message: "For this test section, all records in **TST_L05A/B** are not at RECORD_STATUS = E."

For sections in the GPS1 and GPS2 Experiments:

- There must be a layer with a DESCRIPTION = 5

  Error Message: **TST_L05A/B**-E-30, For GPS-1, 2: There must be a layer with a DESCRIPTION of 5.

For sections in the GPS3, GPS4, and GPS5 Experiments:

- The uppermost or top layer of a pavement structure must have a DESCRIPTION = 3

  Error Message: **TST_L05A/B**-E-31, For GPS 3,4,5: The top layer must have DESCRIPTION of 3.

- If a section has DESCRIPTION = 2, then a layer with DESCRIPTION = 5 must exist directly below the layer with DESCRIPTION = 2

  Error Message: **TST_L05A/B**-E-26, If GPS3, 4, 5: There must be a layer with a DESCRIPTION of 5 directly below a layer with a DESCRIPTION of 2.

For sections in the GPS6*, GPS7*, and GPS9 Experiments:

- There must be a layer with a DESCRIPTION = 1

  Error Message: **TST_L05A/B**-E-32, For GPS 6*, 7*, 9: There must be a layer with a DESCRIPTION of 1.

- The uppermost or top layer of a pavement structure must have a DESCRIPTION = 1, 2, 9, or 10 for GPS6* and GPS7* and must have a DESCRIPTION = 1 for GPS9

Error Message: **TST_L05A/B**-E-33, For GPS 6, 7, the top layer must have DESCRIPTION of 1, 2, 9 or 10.

- The uppermost or top layer of a pavement structure must have a DESCRIPTION = 1 for GPS9

  Error Message: **TST_L05A/B**-E-34, For GPS 9 The top layer must have DESCRIPTION of 1.

For sections in the SPS1 Experiment:

- The top layer can only have a DESCRIPTION of 3 or 9 (not supplementals)

  Error Message: **TST_L05A/B**-E-35, For SPS 1 The top layer must have DESCRIPTION of 3 or 9.

- There must be a layer with a DESCRIPTION of 5 (not supplementals)

  Error Message: **TST_L05A/B**-E-36, For SPS 1: There must be a layer with a DESCRIPTION of 5.

- There cannot be two layers with a DESCRIPTION of 9 (not supplementals)

  Error Message: **TST_L05A/B**-E-37, There cannot be >= 2 layers with a DESCRIPTION of 9.

- There must be a layer with a DESCRIPTION of 4 or 5 directly below a layer with a DESCRIPTION of 3 (not supplementals)

  Error Message: **TST_L05A/B**-E-38, If SPS1: There must be a layer with a DESCRIPTION of 4 or 5 directly below a layer with a DESCRIPTION of 3.

- SHRP_ID's like ?105 through ?112 and ?117 through ?124 must have two layers with a DESCRIPTION = 5

  Error Message: **TST_L05A/B**-E-40, If SPS1: If SHRP_ID like ?105-?112 and ?117-?124 must have 2 layers with a DESCRIPTION=5.

For sections in the SPS2 Experiment:

- The top layer can only have a DESCRIPTION of 3 (not supplementals)

  Error Message: **TST_L05A/B**-E-41, For SPS 2 The top layer must have DESCRIPTION of 3.

- There must be a layer with a DESCRIPTION of 5

  Error Message: **TST_L05A/B**-E-42, For SPS 2: There must be a layer with a DESCRIPTION of 5.

- SHRP_ID's like ?209 - ?212, ?221 - ?224, ?229 - ?230, ?235 - ?236, ?241 - ?244, and ?249 - ?252 must have two layers with a DESCRIPTION = 5

  Error Message: **TST_L05A/B**-E-43, For SPS2,SHRP_ID like ?209-?212, ?221-?224, ?229,?230, ?235, ?236, ?241-?244 and ?249-?252: must have 2 layers with a DESCRIPTION=5.

For sections in the SPS3 Experiment:

For CONSTRUCTION_NO = 1, the following check applies

- The top layer can only have a DESCRIPTION of 2, 3, 9, or 10 (not supplementals)

  Error Message: **TST_L05A/B**-E-44, For SPS 3,construction_no=1: The top layer must have DESCRIPTION of 2,3,9 or 10.

For CONSTRUCTION_NO >=2, the following checks apply

- There must be a layer with a DESCRIPTION = 1 for SHRP_ID like ?310

  Error Message: **TST_L05A/B**-E-45, For SPS 3,SHRP_ID like ?310: There must be a layer with a DESCRIPTION of 1.

- For SHRP_ID = ?330, the top layer can only have a DESCRIPTION = 2, 3, 9, or 10

  Error Message: **TST_L05A/B**-E-48, For SPS 3,construction_no>=2,SHRP_ID like ?330: The top layer must have DESCRIPTION of 2,3,9 or 10.

For all CONSTRUCTION_NOs, the following check applies:

- There cannot be two layers with a DESCRIPTION of 9 (not supplementals)

  Error Message: **TST_L05A/B**-E-49, For SPS3: There cannot be >= 2 layers with a DESCRIPTION of 9.

For sections in the SPS4 Experiment:

- For all CONSTRUCTION_NOs the top layer can only have a DESCRIPTION of 3 (not supplementals)

  Error Message: **TST_L05A/B**-E-51, For SPS 4: The top layer must have DESCRIPTION of 3.

For sections in the SPS5 Experiment:

For CONSTRUCTION_NO = 1, the following check applies:

- The top layer can only have a DESCRIPTION of 2, 3, 9, or 10 (not supplementals)

  Error Message: **TST_L05A/B**-E-52, For SPS 5,construction_no=1: The top layer must have DESCRIPTION of 2,3,9 or 10.

For CONSTRUCTION_NO >=2, the following checks apply:

- The top layer can only have a DESCRIPTION = 1, 2, 9, or 10 for SHRP_ID like ?502 - ?509

  Error Message: **TST_L05A/B**-E-53, For SPS 5, construction_no >= 2, SHRP_ID like ?502 - ?509: The top layer must have DESCRIPTION of 1,2,9,10.

- For SHRP_ID = ?501, the top layer can only have a DESCRIPTION = 2, 3, 9, or 10

  Error Message: **TST_L05A/B**-E-54, For SPS 5, construction_no >= 2, SHRP_ID like ?501: The top layer must have DESCRIPTION of 2, 3, 9 or 10.

- There must be a layer with a DESCRIPTION = 1 for SHRP-ID ?502 - ?509

  Error Message: **TST_L05A/B**-E-55, For SPS 5, SHRP_ID like ?502 - ?509: There must be a layer with a DESCRIPTION of 1.

For all CONSTRUCTION_NOs, the following checks apply:

- There cannot be two or more layers with a DESCRIPTION = 9 that have a LAYER_THICK_STATION0, LAYER_THICK_WITHIN, or LAYER_THICK_STATION5 > 0 for SHRP_IDs like ?506 - ?509 **(L05A only)**

  Error Message: **TST_L05A**-E-57, For SPS5, SHRP_ID like ?506 - ?509, DESCRIPTION=9, and LAYER_THICK_* > 0: There cannot be >= 2 layers with a DESCRIPTION of 9.

- There must not be a layer with a DESCRIPTION = 9 that has a REPR_THICKNESS > 0 for SHRP_IDs like ?506 - ?509 below a layer with a DESCRIPTION of 1 or 4 **(L05B only)**

  Error Message: **TST_L05B**-E-56, For SPS5, SHRP_ID like ?506 - ?509, DESCRIPTION=9, REPR_THICKNESS > 0: it must not be designated for a layer below a layer with a DESCRIPTION of 1 or 4.

- There cannot be two or more layers with a DESCRIPTION = 9 that have a REPR_THICKNESS > 0 for SHRP_IDs like ?506 - ?509 **(L05B only)**

  Error Message: **TST_L05B**-E-57, For SPS5,SHRP_ID like ?506 - ?509, DESCRIPTION=9, REPR_THICKNESS > 0: There cannot be >= 2 layers with a DESCRIPTION of 9.

For sections in the SPS6 Experiment:

For CONSTRUCTION_NO = 1, the following check applies:

- The top layer can only have a DESCRIPTION of 2, 3, 9, or 10 (not supplementals)

  Error Message: **TST_L05A/B**-E-58, For SPS 6, construction_no=1: The top layer must have DESCRIPTION of 2, 3, 9 or 10.

For CONSTRUCTION_NO >= 2, the following checks apply:

- The top layer can only have a DESCRIPTION = 1, 2, 9, or 10 for SHRP_ID = ?603, ?604, ?606, ?607, ?608

  Error Message: **TST_L05A/B**-E-59, For SPS 6,construction_no>=2,SHRP_ID like ?603 ,?604 , ?606 - ?608: The top layer must have DESCRIPTION of 1, 2, 9, 10.

- There must be a layer with a LAYER_THICK_STATION0, LAYER_THICK_WITHIN, or LAYER_THICK_STATION5 > 0 with a DESCRIPTION = 1 for SHRP_ID = ?603, ?604, ?606, ?607, ?608 **(L05A only)**

  Error Messages: **TST_L05A**-E-60a, For SPS-6, SHPR_ID like ?603, ?604, ?606 -?608, there must be a layer with a DESCRIPTION of 1.
  TST_L05A-E-60b, For SPS-6, SHPR_ID like ?603, ?604, ?606 - ?608, there must be a layer with LAYER_THICK* > 0 with a DESCRIPTION of 1.

- There must be a layer with a REPR_THICKNESS > 0 with a DESCRIPTION = 1 for SHRP_ID = ?603, ?604, ?606, ?607, ?608 **(L05B only)**

Error Messages: TST_L05B-E-60a, For SPS-6, SHPR_ID like ?603, ?604, ?606 - ?608, there must be a layer with a DESCRIPTION of 1.
TST_L05B-E-60b, For SPS-6, SHPR_ID like ?603, ?604, ?606 - ?608, there must be a layer with REPR_THICKNESS > 0 with a DESCRIPTION of 1.

- For SHRP_ID = ?601, ?602, ?605, the top layer can only have a DESCRIPTION = 2, 3, 10 or a DESCRIPTION = 1 or 9 with a LAYER_THICK_STATION0, LAYER_THICK_WITHIN, or LAYER_THICK_STATION5 = 0 **(L05A only)**

  Error Message: **TST_L05A**-E-61a, For SPS 6, SHRP_ID like ?601, ?602, ?605, the top layer can only have a DESCRIPTION of 2, 3, 10 or DESCRIPTION = 1 or 9 with either LAYER_THICK* = 0. [If DESCRIPTION != 2, 3, 10 and LAYER_THICK* != 0]
  TST_L05A-E-61b, For SPS 6, SHRP_ID like ?601, ?602, ?605, the top layer can only have a DESCRIPTION of 2, 3, 10 or DESCRIPTION = 1 or 9 with either LAYER_THICK* = 0. [If DESCRIPTION != 2, 3, 10 nor 1, 9]

- For SHRP_ID = ?601, ?602, ?605, the top layer can only have a DESCRIPTION = 2, 3, 10 or a DESCRIPTION = 1 or 9 with a REPR_THICKNESS = 0 **(L05B only)**

  Error Messages: **TST_L05B**-E-61a, For SPS 6, SHRP_ID like ?601, ?602, ?605, the top layer can only have a DESCRIPTION of 2, 3, 10 or DESCRIPTION = 1 or 9 with REPR_THICKNESS = 0. [If DESCRIPTION != 2, 3, 10 and REPR_THICKNESS > 0]
  TST_L05B-E-61b, For SPS 6, SHRP_ID like ?601, ?602, ?605, the top layer can only have a DESCRIPTION of 2, 3, 10 or DESCRIPTION = 1 or 9 with REPR_THICKNESS = 0. [If DESCRIPTION != 2, 3, 10 nor 1, 9]

For all CONSTRUCTION_NOs, the following checks apply:

- If a DESCRIPTION = 9 with a LAYER_THICK_STATION0, LAYER_THICK_WITHIN, or LAYER_THICK_STATION5 > 0 exists, it must not be designated for a layer below a layer with a DESCRIPTION = 1 **(L05A only)** (not supplementals)

  Error Message: **TST_L05A**-E-62, For SPS6, and LAYER_THICK_* > 0: it must not be designated for a layer below a layer with a DESCRIPTION of 1.

- If a DESCRIPTION = 9 with a REPR_THICKNESS > 0 exists, it must not be designated for a layer below a layer with a DESCRIPTION = 1 **(L05B only)** (not supplementals)

  Error Message: **TST_L05B**-E-62, For SPS6, and REPR_THICKNESS > 0: it must not be designated for a layer below a layer with a DESCRIPTION of 1.

For sections in the SPS7 Experiment:

For CONSTRUCTION_NO = 1, the following checks apply:

- The top layer can only have a DESCRIPTION of 2, 3, 9, or 10 (not supplementals)

  Error Message: **TST_L05A/B**-E-63, For SPS 7, construction_no=1: The top layer must have DESCRIPTION of 2, 3, 9 or 10.

- There cannot be a layer with a DESCRIPTION of 1 (not supplementals)

  Error Message: **TST_L05A/B**-E-64, For SPS7, construction_no=1: There cannot be a layer with a DESCRIPTION of 1.

For CONSTRUCTION_NO = 2, the following checks apply:

- The top layer can only have a DESCRIPTION =1 for SHRP_ID = ?702 - ?709

  Error Message: **TST_L05A/B**-E-65, For SPS 7, construction_no=2,SHRP_ID like ?701-?709: The top layer can only have a DESCRIPTION of 1.

- For SHRP_ID = ?701, the top layer can only have a DESCRIPTION = 2, 3, 9, or 10

  Error Message: **TST_L05A/B**-E-66, For SPS 7, SHRP_ID = ?701, construction_no=2: The top layer must be DESCRIPTION of 2, 3, 9 or 10.

For all CONSTRUCTION_NOs, the following check applies:

- There cannot be two layers with a DESCRIPTION of 9 (not supplementals)

  Error Message: **TST_L05A/B**-E-67, For SPS7: There cannot be two layers with a DESCRIPTION of 9.

For sections in the SPS8 Experiment:

The following checks are only to be applied to sections where SHRP_ID is like ?801 - ?806:

- The top layer can only have a DESCRIPTION of 3 or 9

  Error Message: **TST_L05A/B**-E-68, For SPS 8, SHRP_ID like ?801-?806: The top layer must have DESCRIPTION of 3 or 9.

- There cannot be two layers with a DESCRIPTION of 9

  Error Message: **TST_L05A/B**-E-69, For SPS8, SHRP_ID like ?801-?806: There cannot be two layers with a DESCRIPTION of 9.

- There must be a layer with a DESCRIPTION of 4 or 5 directly below a layer with a DESCRIPTION = 3

  Error Message: **TST_L05A/B**-E-70, If SPS8, SHRP_ID like ?801-?806: There must be a layer with a DESCRIPTION of 4 or 5 directly below a layer with a DESCRIPTION of 3.

The following check is only to be applied to sections where SHRP_ID is like ?807 - ?812:

- The top layer can only have a DESCRIPTION of 3

  Error Message: **TST_L05A/B**-E-72, For SPS 8, SHRP_ID like ?807-?812: The top layer must have DESCRIPTION of 3.

For sections in the SPS9 Experiment:

- A DESCRIPTION = 8 must not be designated for a layer below a layer with DESCRIPTION = 11

  Error Message: **TST_L05A/B**-E-SPS9_02, A layer for DESCRIPTION = 2 cannot be below a layer for DESCRIPTION 11.

- The upper most or top layer of a pavement structure must have DESCRIPTION = 1, 3, or 9

Error Message: **TST_L05A/B**-E-SPS9_03, The top layer must have DESCRIPTION of 1, 3 or 9.

- There must be a layer with DESCRIPTION = 4 or 5 directly below a layer with DESCRIPTION = 3

  Error Message: **TST_L05A/B**-E-SPS9_01, There must be a layer with a DESCRIPTION of 4 or 5 directly below a layer with a DESCRIPTION of 3.

- There must be a layer with DESCRIPTION = 5

  Error Message: **TST_L05A/B**-E-SPS9_04, For SPS 9: There must be a layer with a DESCRIPTION of 5.

- There cannot be two layers with DESCRIPTION = 5 (**L05B only**)

  Error Message: **TST_L05B**-E-SPS9_05, There cannot be two layers with a DESCRIPTION of 5.

- There cannot be two layers with DESCRIPTION = 7

  Error Message: **TST_L05A/B**-E-SPS9_06, There cannot be two layers with a DESCRIPTION of 7.

- There cannot be two layers with DESCRIPTION = 9 (not supplementals)

  Error Message: **TST_L05A/B**-E-SPS9_07, There cannot be two layers with a DESCRIPTION of 9.

Tables: TST_L05A, TST_AC01_LAYER

For matching SHRP_ID, STATE_CODE, CONSTRUCTION_NO, and LAYER_NO (check is null if **TST_AC01_LAYER** has no matching records--this should be a single record [**TST_L05A**] to multiple record [**TST_AC01_LAYER**] check):

- **TST_L05A.**DESCRIPTION should be equal to **TST_AC01_LAYER**.LAYER_DESCRIPTION for each matching record

  Error Message: **TST_L05A**-E-8, For all matching records in TST_AC01_LAYER, TST_L05A.DESCRIPTION must match TST_AC01_LAYER.LAYER_DESCRIPTION.

- For all matching records with a TEST_NO = “1" in **TST_AC01_LAYER**, the following criteria should apply: MIN(LAYER_THICKNESS) <= LAYER_THICK_STATION0 <= MAX(LAYER_THICKNESS)

  Error Message: **TST_L05A**-E-9, For all matching records in TST_AC01_LAYER with a TEST_NO=1, MIN(LAYER_THICKNESS) <= LAYER_THICK_STATION0<=MAX(LAYER_THICKNESS). {MIN(LAYER_THICKNESS)} <= {LAYER_THICK_STATION0} <= {MAX(LAYER_THICKNESS)} failed.

- For TEST_NO = “2" in **TST_AC01_LAYER**, the following criteria should apply: MIN(LAYER_THICKNESS) <= LAYER_THICK_STATION5 <= MAX(LAYER_THICKNESS)

Error Message: **TST_L05A**-E-10, For all matching records in TST_AC01_LAYER with a TEST_NO=2, MIN(LAYER_THICKNESS)<= LAYER_THICK_STATION5<=MAX(LAYER_THICKNESS). {MIN(LAYER_THICKNESS)}<= {LAYER_THICK_STATION5} <={MAX(LAYER_THICKNESS)] failed.

- For all matching records with a TEST_NO = "3" in **TST_AC01_LAYER**, the following criteria should apply:
  MIN(LAYER_THICKNESS) <= LAYER_THICK_WITHIN <= MAX(LAYER_THICKNESS)

  Error Message: **TST_L05A**-E-11, For all matching records in TST_AC01_LAYER with a TEST_NO=3, MIN(LAYER_THICKNESS)<= LAYER_THICK_WITHIN<=MAX(LAYER_THICKNESS). {MIN(LAYER_THICKNESS)}<= {LAYER_THICK_WITHIN} <={MAX(LAYER_THICKNESS)} failed.

Tables: TST_L05A, TST_PC06

For matching SHRP_ID, STATE_CODE, CONSTRUCTION_NO, and LAYER_NO (check is null if **TST_PC06** has no matching records--this should be a single record [**TST_L05A**] to multiple record [**TST_PC06**] check):

- For TEST_NO = 1 in **TST_PC06**, the following criteria should apply:
  0.85 * MIN(CORE_AVG_THICKNESS) <= LAYER_THICK_STATION0 <= 1.15 * MAX(CORE_AVG__THICKNESS)

  Error Message: **TST_L05A**-E-12, For all matching records in TST_PC06 with a TEST_NO=1,

  0.85*MIN(CORE_AVG_THICKNESS)<=LAYER_THICK_STATION0<=1.15*MAX(CORE_AVG_THICKNESS). 0.85*{MIN(CORE_AVG_THICKNESS)} <= {LAYER_THICK_STATION0} <= 1.15*{MAX(CORE_AVG_THICKNESS)} failed.

- For TEST_NO = 2 in **TST_PC06**, the following criteria should apply:
  0.85 * MIN(CORE_AVG_THICKNESS) <= LAYER_THICK_STATION5 <= 1.15 * MAX(CORE_AVG__THICKNESS)

  Error Message: **TST_L05A**-E-13, For all matching records in TST_PC06 with a TEST_NO=2, 0.85 * MIN(CORE_AVG_THICKNESS)<=LAYER_THICK_STATION5<= 1.15* MAX(CORE_AVG_THICKNESS).
  0.85 * {MIN(CORE_AVG_THICKNESS)}<={LAYER_THICK_STATION5}<= 1.15* {MAX(CORE_AVG_THICKNESS)} failed.

- For TEST_NO = 3 in **TST_PC06**, the following criteria should apply:
  0.85 * MIN(CORE_AVG_THICKNESS) <= LAYER_THICK_WITHIN <= 1.15 * MAX(CORE_AVG__THICKNESS)

  Error Message: **TST_L05A**-E-14, For all matching records in **TST_PC06** with a TEST_NO=3, 0.85 * MIN(CORE_AVG_THICKNESS)<=LAYER_THICK_WITHIN<= 1.15 * MAX(CORE_AVG_THICKNESS).
  0.85 * {MIN(CORE_AVG_THICKNESS)}<={LAYER_THICK_WITHIN}<= 1.15 * {MAX(CORE_AVG_THICKNESS)} failed.

Tables: TST_L05, TST_L05B (SPS ONLY)

For SHRP_ID, STATE_CODE, AND PROJECT_LAYER_CODE in **TST_L05B** extract a matching STATE_CODE**,** PROJECT_LAYER_CODE, AND SHRP_ID with a matching first two digits from **TST_L05.**

- MATL_CODE in **TST_L05** must match MATL_CODE in **TST_L05B**

  Error Message: **TST_L05**-E-2, **TST_L05**.MATL_CODE must match **TST_L05B**.MATL_CODE.

Tables: TST_L05B, TST_L05A

For SHRP_ID, STATE_CODE, CONSTRUCTION_NO, and LAYER_NO in **TST_L05B** extract REPR_THICKNESS (if not null or if REPR_THICKNESS = 999.9) and for a matching SHRP_ID, STATE_CODE, CONSTRUCTION_NO, and LAYER_NO in **TST_L05A** extract LAYER_THICK_STATION0 if not null (check is void if null) and make the following check:

- 0.8 * LAYER_THICK_STATION0 **<=** REPR_THICKNESS <= 1.2 * LAYER_THICK_STATION0

  Error Message: **TST_L05B**-E-73, 0.8 * TST_L05A.LAYER_THICK_STATION0 <= REPR_THICKNESS <= 1.2 * TST_L05A.LAYER_THICK_STATION0 failed.

Likewise, for **TST_L05A** extract LAYER_THICK_WITHIN if not null (check is void if null) and make the following check:

- 0.8 * LAYER_THICK_WITHIN **<=** REPR_THICKNESS <= 1.2 * LAYER_THICK_WITHIN

  Error Message: **TST_L05B**-E-74, 0.8 * TST_L05A.LAYER_THICK_WITHIN <= REPR_THICKNESS <= 1.2 * TST_L05A.LAYER_THICK_WITHIN failed.

Also, for **TST_L05A** extract LAYER_THICK_STATION5 if not null (check is void if null) and make the following check**:**

- 0.8 * LAYER_THICK_STATION5 **<=** REPR_THICKNESS <= 1.2 * LAYER_THICK_STATION5

  Error Message: **TST_L05B**-E-75, 0.8 * TST_L05A.LAYER_THICK_STATION5 <= REPR_THICKNESS <= 1.2 * TST_L05A.LAYER_THICK_STATION5 failed.

Tables TST_L05B, TST_L05

- The value in **TST_L05B**.INV_LAYER_NO must equal **TST_L05**.INV_LAYER_NO_1 for matching records identified by STATE_CODE, first two characters of SHRP_ID and PROJECT_LAYER_CODE.

  Error Message: **TST_L05B**-E-76. The values of INV_LAYER_NO_1 must be equal for matching records in TST_L05B and TST_L05

- The value in **TST_L05B**.INV_LAYER_NO_2 must equal **TST_L05**.INV_LAYER_NO_2 for matching records identified by STATE_CODE, first two characters of SHRP_ID and PROJECT_LAYER_CODE.

Error Message: **TST_L05B**-E-77. The values of INV_LAYER_NO_2 must be equal for matching records in TST_L05B and TST_L05

Table: TST_L05 (SPS ONLY)

- In order for a record identified by SHRP_ID, STATE_CODE, and PROJECT_LAYER_CODE in **TST_L05** to be set to a RECORD_STATUS = E, all corresponding matching records identified by STATE_CODE, PROJECT_LAYER_CODE, and a matching first two digits of SHRP_ID from **TST_L05A** and **TST_L05B** must have a RECORD_STATUS = E

  Error Messages: **TST_L05**-E-1, WARNING: All matching records in **TST_L05A** and **TST_L05B** must be at RECORD_STATUS = E before the corresponding record in **TST_L05** is set to RECORD_STATUS = E.
  TST_L05-E-1, WARNING: All matching records in **TST_L05A** must be at RECORD_STATUS = E before the corresponding record in **TST_L05** is set to RECORD_STATUS = E.
  TST_L05-E-1, WARNING: All matching records in **TST_L05B** must be at RECORD_STATUS = E before the corresponding record in **TST_L05** is set to RECORD_STATUS = E.

Table: TST_LINK_LAYER

- For matching TST_ID, **TST_LINK_SAMPLE**.LAYER_TYPE = **TST_LINK_LAYER**.LAYER_TYPE

  Error Message: **TST_LINK_LAYER**-E-101: {STATE_CODE, SHRP_ID, LAYER_NO, CONSTRUCTION_NO, TST_ID}, LAYER_TYPE not consistent with **TST_LINK_SAMPLE** for matching TST_ID

Table: TST_LINK_SAMPLE

- For matching (STATE_CODE, SHRP_ID, LAYER_NO, CONSTRUCTION_NO), **TST_LO5B**.LAYER_TYPE = **TST_LINK_SAMPLE**.LAYER_TYPE

  Error Message: **TST_LINK_SAMPLE**-E-102: {TST_ID} For matching STATE_CODE, SHRP_ID, LAYER_NO, CONSTRUCTION_NO, LAYER_TYPE not consistent with **TST_LO5B**

- (TST_ID, STATE_CODE, SHRP_ID, LAYER_NO, CONSTRUCTION_NO) in **TST_LINK_LAYER**

  Error Message: **TST_LINK_SAMPLE**-E-103: {TST_ID} Corresponding TST_ID, STATE_CODE, SHRP_ID, LAYER_NO, CONSTRUCTION_NO must exist in **TST_LINK_LAYER**

Tables: TST_LINK_SAMPLE, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, and SAMPLE_NO

  Error message: **TST_LINK-SAMPLE**-E-104 There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

Tables: TST_PC01, TST_PC06

For SHRP_ID, STATE_CODE, LAYER_NO, FIELD_SET, TEST_NO, and SAMPLE_NO:

- Extract **TST_PC01**.ORIGINAL_LENGTH
  Extract **TST_PC06**.CORE_AVG_THICKNESS
  CORE_AVG_THICKNESS + 0.1001 must be >= ORIGINAL_LENGTH

  Error message: **TST_PC01**-E-6, CORE_AVG_THICKNESS + 0.1 (value) must be >= ORIGINAL_LENGTH (value).

Tables: TST_PC01, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_PC01**-E-4 There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_PC01**-E-5 Sample was tested before it was taken.

Tables: TST_PC01, TST_TB02

For SHRP_ID and STATE_CODE and valid, non-null data exists: check in the order below that:

- $0.77 * (DIAMETER)^2 < CROSS_SECTION_AREA < 0.80 * (DIAMETER)^2$

  Error Message: **TST_PC01**-E-1, 0.77 * (DIAMETER^2) < CROSS_SECTION_AREA < 0.8 * (DIAMETER^2) failed.

- 0.98 * (CAPPED_LENGTH/DIAMETER) < LD_RATIO < 1.02 * (CAPPED_LENGTH/DIAMETER)

  Error Message: **TST_PC01**-E-2, 0.98 * (CAPPED_LENGTH/DIAMETER) < LD_RATIO < 1.02 * (CAPPED_LENGTH/DIAMETER) failed.

- 0.95 * ((0.737 + 0.144 * LD_RATIO) * (MAX_LOAD/CROSS_SECTION_AREA)) < COMP_STRENGTH < 1.05 * (0.737 + 0 .144 * LD_RATIO) *(MAX_LOAD/CROSS_SECTION_AREA))

  Error Message: **TST_PC01**-E-3, 0.95 * ((0.737 + (0.144 * LD_RATIO)) * (LD_MAX_LOAD/CROSS_SECTION_AREA)) < COMP_STRENGTH < 1.05 * ((0.737 + (0.144 * LD_RATIO)) * (LD_MAX_LOAD/CROSS_SECTION_AREA)) failed.

Table: TST_PC02

For SHRP_ID, STATE_CODE, LAYER_NO, FIELD_SET, CONSTRUCTION_NO and valid, non-null data exists:

- ((0.62 * MAX_LOAD)/(DIAMETER * LENGTH)) < TENSILE_STRENGTH < ((0.65 * MAX_LOAD)/(DIAMETER * LENGTH))

  Error Message: **TST_PC02**-E-1, ((0.62 * MAX_LOAD)/(DIAMETER * LENGTH)) < TENSILE_STRENGTH < ((0.65 * MAX_LOAD)/(DIAMETER * LENGTH)) failed.

- 0.98 * (LENGTH/DIAMETER) < LD_RATIO < 1.02 * (LENGTH/DIAMETER)

  Error Message: **TST_PC02**-E-2, 0.98 * (LENGTH/DIAMETER) < LD_RATIO < 1.02 * (LENGTH/DIAMETER) failed.

Tables: TST_PC02, TST_PC06

For SHRP_ID, STATE_CODE, LAYER_NO, FIELD_SET, TEST_NO, and SAMPLE_NO:

- Extract **TST_PC02**.LENGTH
  Extract **TST_PC06**.CORE_AVG_THICKNESS
  CORE_AVG_THICKNESS + 0.1001 must be >= LENGTH

  Error message: **TST_PC02**-E-5, CORE_AVG_THICKNESS + 0.1 (value) must be >= LENGTH (value).

Tables: TST_PC02, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_PC02**-E-3 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_PC02**-E-4 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} Sample was tested before it was taken.

Tables: TST_PC03, TST_L05B

- For a matching SHRP_ID, STATE_CODE, and LAYER_NO, between **TST_PC03** and **TST_L05B**, the record in **TST_L05B** must have a DESCRIPTION of 1 or 3 and a LAYER_TYPE = “PC”

  Error Message: **TST_PC03**-E-1, For matching STATE_CODE, SHRP_ID, LAYER_NO, between TST_PC03 and TST_L05B, the record in TST_L05B must have a DESCRIPTION of 1 or 3 and a LAYER_TYPE=PC.

Tables: TST_PC03, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_PC03**-E-2 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_PC03**-E-3 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} Sample was tested before it was taken.

Table: TST_PC04

For SHRP_ID, STATE_CODE, LAYER_NO, FIELD_SET, and CONSTRUCTION_NO and valid, non-null data exists:

- 0.98 * (LENGTH/DIAMETER) < LD_ RATIO < 1.02 * (LENGTH/DIAMETER)

  Error Message: **TST_PC04**-E-1, 0.98 * (LENGTH/DIAMETER) < LD_RATIO < 1.02 * (LENGTH/DIAMETER) failed.

Tables: TST_PC04, TST_PC06

For SHRP_ID, STATE_CODE, LAYER_NO, FIELD_SET, TEST_NO, and SAMPLE_NO:

- Extract **TST_PC04**.LENGTH
  Extract **TST_PC06**.CORE_AVG_THICKNESS
  CORE_AVG_THICKNESS + 0.5001 must be >= LENGTH

  Error message: **TST_PC04**-E-4, CORE_AVG_THICKNESS + 0.5 (value) must be >= LENGTH (value).

Tables: TST_PC04, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_PC04**-E-2 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_PC04**-E-3 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} Sample was tested before it was taken.

Table: TST_PC05

- 100.0 * (0.95 * (WEIGHT_SDS_AIR_IMMERSION - WEIGHT_OF_OVEN_DRIED_IN_AIR) / WEIGHT_OF_OVEN_DRIED_IN_AIR) < PERCENT_ABSORPTION_AFTER_IMMER < (1.05 * (WEIGHT_SDS_AIR_AIR_IMMERSION - WEIGHT_OF_OVEN_DRIED_IN_AIR) / WEIGHT_OF_OVEN_DRIED_IN_AIR) * 100.0

  Error Message: **TST_PC05**-E-1, 100 * (0.95 * (WEIGHT_SDS_AIR_IMMERSION - WEIGHT_OF_OVEN_DRIED_IN_AIR)/WEIGHT_OF_OVEN_DRIED_IN_AIR) < PERCENT_ABSORPTION_AFTER_IMMER < 100 *(1.05 * (WEIGHT_SDS_AIR_IMMERSION - WEIGHT_OF_OVEN_DRIED_IN_AIR)/WEIGHT_OF_OVEN_DRIED_IN_AIR) failed.

- 0.98 * WEIGHT_OF_OVEN_DRIED_IN_AIR / (WEIGHT_SDS_AIR_IMMERSION_BOIL - WEIGHT_ WATER_IMMERSION_BOIL) < BULK_SPECIFIC_GRAVITY_DRY < 1.02 * WEIGHT_OF_OVEN_ DRIED_IN_AIR / (WEIGHT_SDS_AIR_IMERSION_BOIL - WEIGHT_WATER_IMMERSION_BOIL)

  Error Message: **TST_PC05**-E-2, 0.98 * WEIGHT_OV_OVEN_DRIED_IN_AIR/ (WEIGHT_SDS_AIR_IMMERSION_BOIL - WEIGH_WATER_IMMERSION_BOIL) < BULK_SPECIFIC_GRAVITY_DRY 1.02 * WEIGHT_OV_OVEN_DRIED_IN_AIR/ (WEIGHT_SDS_AIR_IMMERSION_BOIL-WEIGH_WATER_IMMERSION_BOIL) failed.

- 0.98 * WEIGHT_OF_OVEN_DRIED_IN_AIR / (WEIGHT_OF_OVEN_DRIED_IN_AIR - WEIGHT_ WATER_IMMERSION_BOIL) < APPARENT_SPECIFIC_GRAVITY < 1.02 * WEIGHT_OF_OVEN_ DRIED_IN_AIR / (WEIGHT_OF_OVEN_DRIED_IN_AIR - WEIGHT_WATER_IMMERSION_BOIL)

  Error Message: **TST_PC05**-E-3, 0.98 * WEIGHT_OF_OVEN_DRIED_IN_AIR/ (WEIGHT_OF_OVEN_DRIED_IN_AIR - WEIGHT_WATER_IMMERSION_BOIL) < APPARENT_SPECIFIC_GRAVITY < 1.02 * WEIGHT_OF_OVEN_DRIED_IN_AIR/ (WEIGHT_OF_OVEN_DRIED_IN_AIR - WEIGHT_WATER_IMMERSION_BOIL) failed.

- 100.0 * (0.95 * (APPARENT_SPECIFIC_GRAVITY - BULK_SPECIFIC_GRAVITY_DRY) / APPARENT_ SPECIFIC_GRAVITY) < PERCENT_VOIDS_IN_PCC < (1.05 * (APPARENT_SPECIFIC_GRAVITY - BULK_SPECIFIC_GRAVITY_DRY) / APPARENT_SPECIFIC_GRAVITY) * 100.0

  Error Message: **TST_PC05**-E-4, 100 * (0.95 * (APPARENT_SPECIFIC_GRAVITY - BULK_SPECIFIC_GRAVITY_DRY)/APPARENT_SPECIFIC_GRAVITY) < PERCENT_VOIDS_IN_PCC < 100 * (1.05 * (APPARENT_SPECIFIC_GRAVITY - BULK_SPECIFIC_GRAVITY_DRY)/ APPARENT_SPECIFIC_GRAVITY) failed.

- 0.98 * 62.36 * BULK_SPECIFIC_GRAVITY_DRY < DENSITY_OF_PCC < 1.02 * 62.36 * BULK_
  SPECIFIC_GRAVITY_DRY

  Error Message: **TST_PC05**-E-5, 0.98 * 62.36 * BULK_SPECIFIC_GRAVITY < DENSITY_OF_PCC < 1.02 * 62.36 * BULK_SPECIFIC_GRAVITY_DRY failed.

Tables: TST_PC05, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE,

SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

Error message: **TST_PC05**-E-6 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_PC05**-E-7 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} Sample was tested before it was taken.

Tables: TST_PC06, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_PC06**-E-1 There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_PC06**-E-2 Sample was tested before it was taken.

Table: TST_PC07

- 0.98 * (3.1416 * DIAMETER ^ 2) / 4. < CROSS_SECTIONAL_AREA < 1.02 * (3.1416 * DIAMETER ^ 2) / 4

  Error Message: **TST_PC07**-E-1, (0.98 * (3.1416 * DIAMETER^2)/4) < CROSS_SECTIONAL_AREA < (1.02 * (3.1416 * DIAMETER^2)/4) failed.

- 0.98 * MAXIMUM_LOAD / CROSS_SECTION_AREA < SHEAR_BOND_STRENGTH < 1.02 * MAXIMUM_LOAD / CROSS_SECTION_AREA

  Error Message: **TST_PC07**-E-2, 0.98 * MAXIMUM_LOAD/CROSS_SECTIONAL_AREA < SHEAR_BOND_STRENGTH < 1.02 * MAXIMUM_LOAD/CROSS_SECTIONAL_AREA failed.

Tables: TST_PC07, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_PC07**-E-3 There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

Error message: **TST_PC07**-E-4 Sample was tested before it was taken.

Table: TST_PC08

For SHRP_ID, STATE_CODE, LAYER_NO, TEST_NO, FIELD_SET, and LOC_NO, and if valid, non-null data exists:

- 0.95 * [(TRAVERSE_LENGTH_AIR * 100)/TRAVERSE_LENGTH_TOTAL] ≤ AIR_CONTENT ≤ 1.05 * [(TRAVERSE_LENGTH_AIR * 100)/TRAVERSE_LENGTH_TOTAL]

  Error Message: **TST_PC08**-E-1, 0.95 * ((TRAVERSE_LENGTH_AIR * 100)/TRAVERSE_LENGTH_TOTAL) < AIR_CONTENT < 1.05 * ((TRAVERSE_LENGTH_AIR * 100)/TRAVERSE_LENGTH_TOTAL) failed.

- 0.95 * (TRAVERSE_LENGTH_AIR/NO_AIR_VOIDS) ≤ AVG_CHORD_LENGTH ≤ 1.05 * TRAVERS_LENGTH_AIR/NO_AIR_VOIDS)

  Error Message: **TST_PC08**-E-2, 0.95 * (TRAVERSE_LENGTH_AIR/NO_AIR_VOIDS) <= AVG_CHORD_LENGTH <= 1.05 * (TRAVERSE_LENGTH_AIR/NO_AIR_VOIDS) failed.

- 0.95 * (4/AVG_CHORD_LENGTH) ≤ SPECIFIC_SURFACE ≤ 1.05 * (4/AVG_CHORD_LENGTH)

  Error Message: **TST_PC08**-E-3, 0.95 * (4/AVG_CHORD_LENGTH) <= SPECIFIC_SURFACE <= 1.05 * (4/AVG_CHORD_LENGTH) failed.

- 0.95 * (TRAVERSE_LENGTH_PASTE/TRAVERSE_LENGTH_AIR) ≤ PASTE_AIR_RATIO ≤ 1.05 * (TRAVERSE_LENGTH_PASTE/TRAVERSE_LENGTH_AIR)

  Error Message: **TST_PC08**-E-4, 0.95 * (TRAVERSE_LENGTH_PASTE/TRAVERSE_LENGTH_AIR) <= PASTE_AIR_RATIO <= 1.05 * (TRAVERSE_LENGTH_PASTE/TRAVERSE_LENGTH_AIR) failed.

- 0.95 * [TRAVERSE_LENGTH_PASTE/(4 * NO_AIR_VOIDS)] ≤ SPACING_FACTOR ≤ 1.05 * [TRAVERSE_LENGTH_PASTE/ (4 * NO_AIR_VOIDS)]

  Error Message: **TST_PC08**-E-5, 0.95 * (TRAVERSE_LENGTH_PASTE/(4*NO_AIR_VOIDS)) <= SPACING_FACTOR <= 1.05 * (TRAVERSE_LENGTH_PASTE/(4*NO_AIR_VOIDS)) failed.

If PASTE_AIR_RATIO > 4.3432:

- 0.95 * 3/α [1.4 (1 + P/A) ^ _ - 1] ≤ SPACING_FACTOR ≤ 1.05 * 3/α [1.4 (1 + P/A) ^ _ - 1]

  Where α = SPECIFIC_SURFACE
  P = (TRAVERSE_LENGTH_PASTE * 100/TRAVERSE_LENGTH_TOTAL)
  A = AIR_CONTENT

  Error Message: **TST_PC08**-E-6, 0.95 * 3/α[1.4(1+P/A)^.33 -1] <= SPACING_FACTOR <= 1.05 * 3/α[1.4(1+P/A)^.33 -1], Where α=SPECIFIC_SURFACE,

P=(TRAVERSE_LENGTH_PASTE*100/TRAVERSE_LENGTH_TOTAL), A=AIR_CONTENT failed.

Tables: TST_PC08, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_PC08**-E-7 There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_PC08**-E-8 Sample was tested before it was taken.

Tables: TST_PC09, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_PC09**-E-1 There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_PC09**-E-2 Sample was tested before it was taken.

Table: TST_SAMPLE_BULK_AC_AGG

- DATE_SHIPPED must be greater than or equal to DATE_SAMPLED

  Error message: **TST_SAMPLE_BULK_AC_AGG**-E-101 DATE_SHIPPPED must be greater than or equal to DATE_SAMPLED

View*: TST_SAMPLE_BASIC_INFO

- For each STATE_CODE, SHRP_ID, and FIELD_SET in **TST_SAMPLE_BASIC_INFO**, there must only be one value for CONSTRUCTION_NO

  Error message: **TST_SAMPLE_BASIC_INFO**-E-101 There can only be one CONSTRUCTION_NO for a given FIELD_SET

- For each STATE_CODE, SHRP_ID, and DATE_SAMPLED in **TST_SAMPLE_BASIC_INFO**, there must only be one value for FIELD_SET

  Error message: **TST_SAMPLE_BASIC_INFO**-E-102 There can only be one FIELD_SET for a given DATE_SAMPLED.

- For each STATE_CODE, SHRP_ID, and FIELD_SET in **TST_SAMPLE_BASIC_INFO**, the minimum date for FIELD_SET must not be less than the maximum date for FIELD_SET - 1

  Error message: **TST_SAMPLE_BASIC_INFO**-E-103 FIELD_SET {FIELD_SET} overlaps {FIELD_SET – 1}.

***Note: This is a view, not a table. There is no record_status field to update, but errors will be listed in the QC output.**

Tables: TST_SAMPLE_COMBINE, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, and SAMPLE_NO

  Error message: **TST_SAMPLE_COMBINE**-E-101{STATE_CODE, SHRP_ID, FIELD_SET, SAMPLE_NO_NEW} There is no matching sample in **TST_SAMPLE_BASIC_INFO**

Tables: TST_SAMPLE_LAB_AC_MIX, TST_ASPHALT_CEMENT

- For each record in **TST_SAMPLE_LAB_AC_MIX**, a record must exist in **TST_ASPHALT_CEMENT** with matching STATE_CODE, SHRP_ID, FIELD_SET, and where **TST_SAMPLE_LAB_AC_MIX**. SAMPLE_NO_BINDER = **TST_ASPHALT_CEMENT**.SAMPLE_NO

  Error message: **TST_SAMPLE_LAB_AC_MIX**-E-101 There must be a matching record in **TST_ASPHALT_CEMENT** with matching STATE_CODE, SHRP_ID, FIELD_SET and **TST_SAMPLE_LAB_AC_MIX**.SAMPLE_NO_BINDER = **TST_ASPHALT_CEMENT**.SAMPLE_NO

Tables: TST_SAMPLE_LAB_AC_MIX, TST_SAMPLE_BULK_AC_AGG

- For each record in **TST_SAMPLE_LAB_AC_MIX**, a record must exist in **TST_SAMPLE_BULK_AC_AGG** with matching STATE_CODE, SHRP_ID, FIELD_SET, and where **TST_SAMPLE_LAB_AC_MIX**.SAMPLE_NO_AGG [TC7]= **TST_SAMPLE_BULK_AC_AGG**. SAMPLE_NO

  Error message: **TST_SAMPLE_LAB_AC_MIX**-E-102 There must be a matching record in **TST_SAMPLE_BULK_AC_AGG** with matching STATE_CODE, SHRP_ID, FIELD_SET and **TST_SAMPLE_LAB_AC_MIX**.SAMPLE_NO_AGG[TC8] = **TST_SAMPLE_BULK_AC_AGG**.SAMPLE_NO

Tables: TST_SAMPLE_LOG, TST_HOLE_LOG

- For each record in **TST_SAMPLE_LOG**, a record must exist in **TST_HOLE_LOG** with matching STATE_CODE, SHRP_ID, FIELD_SET, and LOC_NO

  Error Message: **TST_SAMPLE_LOG**-E-1: No matching record exists in **TST_HOLE_LOG**.

Tables: TST_SAMPLE_LOG_LAB, TST_UNCOMP_BITUMINOUS, TST_SAMPLE_LAB_AC_MIX

- For matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, a record must exist at level 'E' in **TST_UNCOMP_BITUMINOUS** or **TST_SAMPLE_LAB_AC_MIX**

  Error message: **TST_SAMPLE_LOG_LAB**-E-101 There must be a matching record with RECORD_STATUS = 'E' in **TST_UNCOMP_BITUMINOUS** or **TST_SAMPLE_LAB_AC_MIX**

Table: TST_SAMPLE_LOG_SPS_3_4

- No checks are performed. If record is at Level D, set to Level E.

Tables: TST_SC01, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_SC01**-E-1 There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_SC01**-E-2 Sample was tested before it was taken.

Tables: TST_SC02, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_SC02**-E-1 There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_SC02**-E-2 Sample was tested before it was taken.

Tables: TST_SC03, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_SC03**-E-1 There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE,

SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

Error message: **TST_SC03**-E-2 Sample was tested before it was taken.

Tables: TST_SC04, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_SC04**-E-1 There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_SC04**-E-2 Sample was tested before it was taken.

Table: TST_SC05

- TRAFFIC_TIME >= CURE_TIME >= SET_TIME

  Error Message: **TST_SC05**-E-1, TRAFFIC_TIME >= CURE_TIME >= SET_TIME.

Tables: TST_SC05, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_SC05**-E-2 There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_SC05**-E-3 Sample was tested before it was taken.

Table: TST_SC06

- WEIGHT_AFTER_TESTING <= WEIGHT_BEFORE_TESTING

  Error message: **TST_SC06**-E-1, WEIGHT_AFTER_TESTING <= WEIGHT_BEFORE_TESTING.

Tables: TST_SC06, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

Error message: **TST_SC06**-E-2 There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_SC06**-E-3 Sample was tested before it was taken.

Tables: TST_SC07, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_SC07**-E-1 There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_SC07**-E-2 Sample was tested before it was taken.

Tables: TST_SC08, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_SC08**-E-1 There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_SC08**-E-2 Sample was tested before it was taken.

Tables: TST_SC09, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_SC09**-E-1 There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_SC09**-E-2 Sample was tested before it was taken.

Table: TST_SC10A

- ONE_HALF_PASSING >= THREE_EIGHTHS_PASSING >= NO_4_PASSING >= NO_8_PASSING >= NO_10_PASSING >= NO_200_PASSING

  Error Message: **TST_SC10A**-E-1, ONE_HALF_PASSING >= THREE_EIGHTHS_PASSING >= NO_4_PASSING >= NO_8_PASSING >= NO_10_PASSING >= NO_200_PASSING failed.

Tables: TST_SC10A, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_SC10A**-E-2 There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_SC10A**-E-3 Sample was tested before it was taken.

Table: TST_SC10B

- FIVE_SIXTEENTHS_PASSING >= NO_4_PASSING >= NO_8_PASSING >= NO_16_PASSING >= NO_30_PASSING >= NO_50_PASSING >= NO_100_PASSING >= NO_200_PASSING

  Error Message: **TST_SC10B**-E-1, FIVE_SIXTEENTHS_PASSING >= NO_4_PASSING >= NO_8_PASSING >= NO_16_PASSING >= NO_30_PASSING >= NO_50_PASSING > NO_100_PASSING >= NO_200_PASSING failed.

Tables: TST_SC10B, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_SC10B**-E-2 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_SC010B**-E-3 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} Sample was tested before it was taken.

Table: TST_SC11

- RESIDUAL_ASPH_SPREAD_RATE >= SURFACE_CONDITION_VAR

  Error Message: **TST_SC11**-E-1, RESIDUAL_ASPH_SPREAD_RATE >= SURFACE_CONDITION_VAR failed.

Tables: TST_SC11, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_SC11**-E-2 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_SC11**-E-3 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} Sample was tested before it was taken.

Tables: TST_SC12, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_SC12**-E-1 There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_SC12**-E-2 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} Sample was tested before it was taken.

Tables: TST_SC13, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_SC13**-E-1 There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_SC13**-E-2 Sample was tested before it was taken.

Table: TST_SP01_MASTER

- For matching TST_ID, **TST_LINK_SAMPLE**.LAYER_TYPE = 'AC'

  Error Message: **TST_SP01_MASTER**-E-101: For matching TST_ID, LAYER_TYPE in **TST_LINK_SAMPLE** must be 'AC'

- PG_HIGH_TEMP > PG_LOW_TEMP

  Error Message: **TST_SP01_MASTER**-E-102: PG_HIGH_TEMP must be greater than PG_LOW_TEMP

- MIX_TEMP > COMPACT_TEMP

  Error Message: **TST_SP01_MASTER**-E-103: MIX_TEMP must be greater than COMPACT_TEMP

- GYRATE_N_INI < GYRATE_N_DES < GYRATE_N_MAX

  Error Message: **TST_SP01_MASTER**-E-104: Number of initial gyrations **(**GYRATE_N_INI**)** must be less than design number of gyrations (GYRATE_N_DES), which must be less than maximum number of gyrations (GYRATE_N_MAX)

- AVG_REL_N_INI < AVG_REL_N_DES < AVG_REL_N_MAX

  Error Message: **TST_SP01_MASTER**-E-105: Average relative density at initial number of gyrations (AVG_REL_N_INI) must be less than average relative density at design number of gyrations (AVG_REL_N_DES), which must be less than relative density at maximum number of gyrations (AVG_REL_N_MAX)

- Average (**TST_SP01_DATA**.REL_DENSITY_COR where **TST_SP01_DATA**.GYRATE_NO = GYRATE_N_INI) is between 0.95 * AVG_REL_DENS_N_INI and 1.05 * AVG_REL_DENS_N_INI

  Error Message: **TST_SP01_MASTER**-E-106: Reported average relative density at initial number of gyrations (AVG_REL_DENS_N_INI) is not equal to average corrected relative density (REL_DENS_CORR) from **TST_SP01_DATA** for matching TST_ID at initial number of gyrations

- Average (**TST_SP01_DATA**.REL_DENSITY_COR where **TST_SP01_DATA**.GYRATE_NO = GYRATE_N_DES) is between 0.95 * AVG_REL_DENS_N_DES and 1.05 * AVG_REL_DENS_N_DES

  Error Message: **TST_SP01_MASTER**-E-107: Reported average relative density at design number of gyrations (AVG_REL_DENS_N_DES) is not equal to average corrected relative density (REL_DENS_CORR) from **TST_SP01_DATA** for matching TST_ID at design number of gyrations

- Average (**TST_SP01_DATA**.REL_DENSITY_COR where **TST_SP01_DATA**.GYRATE_NO = GYRATE_N_MAX) is between 0.95 * AVG_REL_DENS_N_MAX and 1.05 * AVG_REL_DENS_N_MAX

  Error Message: **TST_SP01_MASTER**-E-108: Reported average relative density at maximum number of gyrations (AVG_REL_DENS_N_MAX) is not equal to average corrected relative

density (REL_DENS_CORR) from **TST_SP01_DATA** for matching TST_ID at maximum number of gyrations

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Tables: TST_SP01_MASTER, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, and SAMPLE_NO

  Error message: **TST_SP01_MASTER**-E-109 There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_SP01_MASTER**-E-110 Sample was tested before it was taken.

Table: TST_SP02

- For matching TST_ID, **TST_LINK_SAMPLE**.LAYER_TYPE = 'AC'

  Error Message: **TST_SP02**-E-101: {TST_ID} For matching TST_ID, LAYER_TYPE in **TST_LINK_SAMPLE** must be 'AC'

- If all three AGG_%_PCT fields are non-null, AGG_COARSE_PCT + AGG_FINE_PCT + AGG_FILLER_PCT must be between 99.5 and 100.5

  Error Message: **TST_SP02**-E-103: {TST_ID} Sum of coarse aggregate (AGG_COARSE_PCT), fine aggregate (AGG_FINE_PCT) and mineral filler (AGG_FILLER_PCT) content is not equal to 100%

- AGG_EFF_SPEC_GRAV > AGG_COMB_SPEC_GRAV

  Error Message: **TST_SP02**-E-104: {TST_ID} Effective specific gravity of combined aggregate (AGG_EFF_SPEC_GRAV) must be greater than specific gravity of combined aggregates (AGG_COMB_SPEC_GRAV)

- MIX_MAX_SPEC_GRAV > MIX_BULK_SPEC_GRAV

  Error Message: **TST_SP02**-E-105: {TST_ID} Theoretical maximum specific gravity of mix (MIX_MAX_SPEC_GRAV) must be greater than the bulk specific gravity of the mix (MIX_BULK_SPEC_GRAV)

- BINDER_PCT > BINDER_EFF_PCT

  Error Message: **TST_SP02**-E-106: {TST_ID} Binder content (BINDER_PCT) must be greater than effective binder content (BINDER_EFF_PCT)

- VMA > AIR_VOIDS

  Error Message: **TST_SP02**-E-107: {TST_ID} Percent voids in the mineral aggregate (VMA) must be greater than percent air voids (AIR_VOIDS)

Tables: TST_SS01_UG01_UG02, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_SS01_UG01_UG02**-E-1 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_SS01_UG01_UG02**-E-2 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} Sample was tested before it was taken.

Table: TST_SS02_UG03

For SHRP_ID and STATE_CODE and valid, non-null, data exists:

- check that

  97.5 < (GT_2MM + COARSE_SAND + FINE_SAND + SILT + CLAY) < 102.5

  Error Message: **TST_SS02_UG03**-E-1, 97.5 < (GT_2MM + COARSE_SAND + FINE_SAND + SILT + CLAY) < 102.5 failed.

- check that

  HYDRO_02 >= HYDRO_002 >= HYDRO_001

  Error Message: **TST_SS02_UG03**-E-2, HYDRO_02 >= HYDRO_002 >= HYDRO_001 failed.

Tables: TST_SS02_UG03, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_SS02_UG03**-E-3 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_SS02_UG03**-E-4 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} Sample was tested before it was taken.

Tables: TST_SS04_UG08, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE,

SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

Error message: **TST_SS04_UG08**-E-2 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_SS04_UG08**-E-3 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} Sample was tested before it was taken.

Tables: TST_SS04_UG08, TST_SS02_UG03, TST_UG04_SS03

For SHRP_ID, STATE_CODE, LAYER_NO, FIELD_SET, TEST_NO, LOC_ NO: (check only applies to the subgrade, LAYER_NO=1)

- Extract NO_40_PASSING and NO_200_ PASSING from **TST_SS02_UG03**
- Extract PLASTICITY_INDEX and LIQUID_LIMIT from **TST_UG04_SS03**
- Extract AASHTO_SOIL_CLASS from **TST_SS04_UG08**
- Generate a value of GI based on the following calculations:

  F = NO_200_PASSING
  LL = LIQUID_LIMIT
  PI = PLASTICITY_INDEX
  GI = (F - 35) [0.2 + 0.005 (LL - 40)] + 0.01 (F - 15) (PI - 10)
  if GI < 0, then GI = 0; if GI > 20, then GI = 20

The value of AASHTO_SOIL_CLASS in **TST_SS04_UG08** must match with the criteria in the following table:

AASHTO SOIL CLASS	NO. 40 PASSING	NO. 200 PASSING	PLASTICITY INDEX	GI	LIQUID LIMIT	PLASTICITY INDEX
502	<=30	<=15	<= 6	0		
503	<=50	<=25	<= 6	0		
504	>50	<=10	NP	0		
506		<=35	<=10	0	<=40	
507		<=35	<=10	0	>40	
508		<=35	>10	<= 4	<=40	
509		<=35	>10	<= 4	>40	
510		>35	<=10	<= 8	<=40	
511		>35	<=10	<= 12	>40	
512		>35	>10	<=16	<=40	
514		>35	>10	<= 20	>40	>=30
515		>35	>10	<= 20	>40	<=30

Error Message: **TST_SS04_UG08**-E-1, AASHTO_SOIL_CLASS does not match gradation and Atterberg data. (Based on Atterberg and gradation results, the AASHTO classification should be X)

Table: TST_SS06

- 0.98 * (10/DEFLECTION_AVG)≤ SOIL_MOD_UNCORRECTED ≤ 1.02 * (10/DEFLECTION_AVG)

  Error Message: **TST_SS06**-E-1, 0.98 * (10/DEFLECTION_AVG)≤ SOIL_MOD_UNCORRECTED ≤ 1.02 * (10/DEFLECTION_AVG) failed.

- SOIL_MOD_CORRECTED ≤ SOIL_MOD_UNCORRECTED

  Error Message: **TST_SS06**-E-2, SOIL_MOD_CORRECTED ≤ SOIL_MOD_UNCORRECTED failed

- There must be a record in TST_HOLE_LOG with matching STATE_CODE, SHRP_ID, LOC_NO, and FIELD_SET

  Error Message: **TST_SS06**-E-3, There is no matching location in TST_HOLE_LOG

Table: TST_SS08

- SPECIMEN_MASS_MOIST > SPECIMEN_MASS_DRY

  Error Message: **TST_SS08-E-1,** SPECIMEN_MASS_MOIST > SPECIMEN_MASS_DRY failed.

- [362 * SPECIMEN_MASS_MOIST / (100 + MOISTURE_CONTENT)] / [SPECIMEN_HEIGHT * 3.1416 * (SPECIMEN_DIAMETER/2)^2] < DRY_DENSITY < [400 * SPECIMEN_MASS_MOIST / (100 + MOISTURE_CONTENT)] / (SPECIMEN_HEIGHT * [3.1416 * (SPECIMEN_DIAMETER/2)^2])

  Error Message: **TST_SS08**-E-2, [362 * SPECIMEN_MASS_MOIST / (100 + MOISTURE_CONTENT)] / [SPECIMEN_HEIGHT * 3.1416 * (SPECIMEN_DIAMETER/2)^2] < DRY_DENSITY < [400 * SPECIMEN_MASS_MOIST / (100 + MOISTURE_CONTENT)] / (SPECIMEN_HEIGHT * [3.1416 * (SPECIMEN_DIAMETER/2)^2]) failed.

Tables: TST_SS08, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_SS08**-E-3 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

Error message: **TST_SS08**-E-4 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} Sample was tested before it was taken.

Table: TST_SS10

- 0.98 * SPECIMEN_HEIGHT / SPECIMEN_DIAMETER < LENGTH_TO_DIAMETER_RATIO < 1.02 * SPECIMEN_HEIGHT / SPECIMEN_DIAMETER

  Error Message: **TST_SS10**-E-1, 0.98 * SPECIMEN_HEIGHT / SPECIMEN_DIAMETER < LENGTH_TO_DIAMETER_RATIO < 1.02 * SPECIMEN_HEIGHT / SPECIMEN_DIAMETER

Tables: TST_SS10, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_SS10**-E-2 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_SS10**-E-3 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} Sample was tested before it was taken.

Table: TST_SS11

- INITIAL_WATER_CONTENT <= FINAL_WATER_CONTENT

  Error Message: **TST_SS11**-E-1, INITIAL_WATER_CONTENT <= FINAL_WATER_CONTENT failed.

- MIN_EFFECTIVE_STRESS <= MAX_EFFECTIVE_STRESS

  Error Message: **TST_SS11**-E-2, MIN_EFFECTIVE_STRESS <= MAX_EFFECTIVE_STRESS failed.

- MIN_HYDRAULIC_GRADIENT <= MAX_HYDRAULIC_GRADIENT

  Error Message: **TST_SS11**-E-3, MIN_HYDRAULIC_GRADIENT <= MAX_HYDRAULIC_GRADIENT failed.

Tables: TST_SS11, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_SS11**-E-4 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_SS11**-E-5 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} Sample was tested before it was taken.

Table: TST_SS12

- No checks are performed. If record is at Level D, set to Level E.

Table: TST_SS14_UG14_COMMENT

- No checks are performed. If record is at Level D, set to Level E.

Table: TST_SS14_UG14_DATA

Note: Before performing the following checks, records with record_status = 'D' will be selected, and all records with the same STATE_CODE, SHRP_ID, LOC_NO, and TEST_DATE as these level D records will be set to 'D', where record_status='E'. This will allow all related readings to be QC'd properly.

- PEN_BTWN_RDGS: READING_NO(n) must = PEN_CUMULATIVE: READING_NO(n) – PEN_CUMULATIVE: READING_NO (n-1)

  Error message: **TST_SS14_UG14_DATA**-E-101{STATE_CODE, SHRP_ID, LOC_NO, TEST_DATE, READING_NO} PEN_BTWN_RDGS is inconsistent with PEN_CUMULATIVE values.

- PEN_PER_BLOW must = PEN_BTWN_RDGS / NO_BLOWS +/- 1mm

  Error message: **TST_SS14_UG14_DATA**-E-102{STATE_CODE, SHRP_ID, LOC_NO, TEST_DATE, READING_NO} PEN_PER_BLOW must equal PEN_BTWN_RDGS / NO_BLOWS +/- 1mm.

Tables: TST_SS14_UG14_DATA, TST_SS14_UG14_MASTER

- DCP_INDEX must = PEN_PER_BLOW * **TST_SS14_UG14_MASTER**.DCP_HAMMER

  Error message: **TST_SS14_UG14_DATA**-E-103{STATE_CODE, SHRP_ID, LOC_NO, TEST_DATE, READING_NO} DCP_INDEX must equal PEN_PER_BLOW * **TST_SS14_UG14_MASTER**.DCP_HAMMER

Tables: TST_SS14_UG14_MASTER, TST_HOLE_LOG

- There must be a record in **TST_HOLE_LOG** with matching STATE_CODE, SHRP_ID, FIELD_SET, and LOC_NO

  Error message: **TST_SS14_UG14_MASTER**-E-101{STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO} There is no matching location in **TST_HOLE_LOG**

Tables: TST_TB01, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_TB01**-E-1 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_TB01**-E-2 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} Sample was tested before it was taken.

Table: TST_TB02

For non-null values, perform the following checks:

- CROSS_SECTION_AREA > 0.77 * DIAMETER^2 and CROSS_SECTION_AREA < 0.8 * DIAMETER^2

  Error Message: **TST_TB02**-E-1, CROSS_SECTION_AREA > 0.77 * DIAMETER^2 and CROSS_SECTION_AREA < 0.8 * DIAMETER^2 failed.

- 0.98 * CAPPED_LENGTH/DIAMETER < LD_RATIO < 1.02 * CAPPED_LENGTH/DIAMETER

  Error Message: **TST_TB02**-E-2, 0.98 * CAPPED_LENGTH/DIAMETER < LD_RATIO < 1.02 * CAPPED_LENGTH/DIAMETER failed.

- 0.95 * ((0.737 + (0.144 * LD_RATIO)) * (LONG_MAX_LOAD/CROSS_SECTIONAL_AREA)) < COMP_STRENGTH < 1.05 * ((0.737 + (0.144 * LD_RATIO)) * (LONG_MAX_LOAD/CROSS_SECTIONAL_AREA))

  Error Message: **TST_TB02**-E-3, 0.95 * ((0.737 + (0.144 * LD_RATIO)) * (LONG_MAX_LOAD/CROSS_SECTIONAL_AREA)) < COMP_STRENGTH < 1.05 * ((0.737 + (0.144 * LD_RATIO)) * (LONG_MAX_LOAD/CROSS_SECTIONAL_AREA)) failed.

Tables: TST_TB02, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_TB02**-E-3 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

Error message: **TST_TB02**-E-4 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} Sample was tested before it was taken.

Table: TST_UG04_SS03

For SHRP_ID and STATE_CODE and valid, non null, data exists then check that

- LIQUID_LIMIT >= PLASTIC_LIMIT

  Error Message: **TST_UG04_SS03**-E-1, LIQUID_LIMIT >= PLASTIC_LIMIT failed.

- [0.95 * (LIQUID_LIMIT - PLASTIC_LIMIT)] < PLASTICITY_INDEX < [1.05 * (LIQUID_LIMIT - PLASTIC_LIMIT)]

  Error Message: **TST_UG04_SS03**-E-2, 0.95 * (LIQUID_LIMIT - PLASTIC_LIMIT) < PLASTICITY_INDEX < 1.05 * (LIQUID_LIMIT - PLASTIC_LIMIT) failed.

Tables: TST_UG04_SS03, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_UG04_SS03**-E-3 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_UG04_SS03**-E-4 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} Sample was tested before it was taken.

Tables: TST_UG05_SS05, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_UG05_SS05**-E-1 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_UG05_SS05**-E-2 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} Sample was tested before it was taken.

Table: TST_UG07_SS07_A[16]

- 0.98 * AVERAGE_DIAMETER <= [(TOP_DIAMETER + MIDDLE_DIAMETER + BOTTOM_DIAMETER)/3] <= 1.02 * AVERAGE_DIAMETER

  Error Message: **UG07_A**-E-1, the AVERAGE_DIAMETER must be approx. equal to the average of the top, middle and bottom diameter measurements. Check the input of all appropriate values.

- 0.98 * INITIAL_VOLUME <= (INITIAL_LENGTH * INITIAL_AREA) <= 1.02 * INITIAL_VOLUME

  Error Message: **UG07_A**-E-2, the INITIAL_VOLUME must be approx. equal to the calculation of volume using the INITIAL_LENGTH multiplied by INITIAL_AREA. Check the input of all appropriate values.

- 0.98 * (INITIAL_WT_CONT_SOIL - FINAL_WT_CONT_SOIL) <= WT_WET_SOIL_USED <= (INITIAL_WT_CONT_SOIL - FINAL_CONT_SOIL) * 1.02

  Error Message: **UG07_A**-E-3, the WT_WET_SOIL_USED must be approximately equal to the calculation of INITIAL_WT_CONT_SOIL subtracted by FINAL_WT_CONT_SOIL. Check the input of all appropriate values.

- AFTER_MOIST_CONT <= COMP_MOIST_CONT * 1.20

  Error Message: **UG07_A**-E-4, the AFTER_MOIST_CONT (water content after testing) must be <= 1.2 * COMP_MOIST_CONT (compaction water content). Check both values.

- 0.98 * (TOTAL_HT - CAP_BASE_HT) <= INITIAL_LENGTH <= (TOTAL_HT - CAP_BASE_HT) * 1.02

  Error Message: **UG07_A**-E-5, the INITIAL_LENGTH must be approximately equal to the TOTAL_HT (total height of cap, sample, and base) subtracted by CAP_BASE_HT (height of cap and base).

Tables: TST_UG07_SS07_A, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **UG07_A**-E-8 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **UG07_A**-E-9 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} Sample was tested before it was taken.

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[16] If a field in TST_UG07_SS07_A used in a Level E calculation is null, the record shall pass every check on that field.

Tables: TST_UG07_SS07_A[16] and TST_UG07_SS07_WKSHT_CYCLES

For matching SHRP_ID, STATE_CODE, LAYER_NO, TEST_NO, FIELD_SET, and SAMPLE_NO:

- LAB_CODE, CONSTRUCTION_NO, LOC_NO, LAYER_TYPE, and MR_MATL_TYPE must exactly match between the two tables for all combinations of CON_PRESSURE, NOM_MAX_AXIAL_STRESS, and CYCLE_NO

  Error Message: **UG07_A**-E-7, For the same sample in **TST_UG07_SS07_WKSHT_CYCLES** and **TST_UG07_SS07_A**, the LAB_CODE, CONSTRUCTION_NO, LOC_NO, LAYER_TYPE, and MR_MATL_TYPE must match. Check the input of all appropriate values.

Tables: TST_UG07_SS07_A[16] and TST_UG07_SS07_WKSHT_SUM

For matching SHRP_ID, STATE_CODE, LAYER_NO, TEST_NO, FIELD_SET, and SAMPLE_NO:

- LAB_CODE, CONSTRUCTION_NO, LOC_NO, LAYER_TYPE, and MR_MATL_TYPE must exactly match between the two tables for all combinations of CON_PRESSURE and NOM_MAX_AXIAL_STRESS

  Error Message: **UG07_A**-E-6 For the same sample in **TST_UG07_SS07_WKSHT_SUM** and **TST_UG07_SS07_A**, the LAB_CODE, CONSTRUCTION_NO, LOC_NO, LAYER_TYPE, and MR_MATL_TYPE must match. Check the input of all appropriate values.

Table: TST_UG07_SS07_B

For matching SHRP_ID, STATE_CODE, LAYER_NO, TEST_NO, FIELD_SET, and SAMPLE_NO:

- 0.98 * AVERAGE_DIAMETER <= [(TOP_DIAMETER + MIDDLE_DIAMETER + BOTTOM_DIAMETER)/3] <= 1.02 * AVERAGE_DIAMETER

  Error Message: **UG07_B**-E-1, the AVERAGE_DIAMETER must be approx. equal to the average of the top, middle and bottom diameter measurements. Check the input of all appropriate values.

- 0.98 * INITIAL_VOLUME <= (INITIAL_LENGTH * INITIAL_AREA) <= 1.02 * INITIAL_VOLUME

  Error Message: **UG07_B**-E-2, the INITIAL_VOLUME must be approx. equal to the calculation of volume using the INITIAL_LENGTH multiplied by INITIAL_AREA. Check the input of all appropriate values.

- DRY_DENSITY < WET_DENSITY

  Error Message: **UG07_B**-E-3, the DRY_DENSITY must be less than the WET_DENSITY. Check all appropriate values.

Tables: TST_UG07_SS07_B, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **UG07_B**-E-6 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **UG07_B**-E-7 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} Sample was tested before it was taken.

Tables: TST_UG07_SS07_B and TST_UG07_SS07_WKSHT_CYCLES

For matching SHRP_ID, STATE_CODE, LAYER_NO, TEST_NO, FIELD_SET, and SAMPLE_NO:

- LAB_CODE, CONSTRUCTION_NO, LOC_NO, LAYER_TYPE, and MR_MATL_TYPE must exactly match between the two tables for all combinations of CON_PRESSURE, NOM_MAX_AXIAL_STRESS, and CYCLE_NO

  Error Message: **UG07_B**-E-5 For the same sample in TST_UG07_SS07_WKSHT_CYCLES and TST_UG07_SS07_A, the LAB_CODE, CONSTRUCTION_NO, LOC_NO, LAYER_TYPE, and MR_MATL_TYPE must match. Check the input of all appropriate values.

Tables: TST_UG07_SS07_B and TST_UG07_SS07_WKSHT_SUM

For matching SHRP_ID, STATE_CODE, LAYER_NO, TEST_NO, FIELD_SET, and SAMPLE_NO:

- LAB_CODE, CONSTRUCTION_NO, LOC_NO, LAYER_TYPE, and MR_MATL_TYPE must exactly match between the two tables for all combinations of CON_PRESSURE and NOM_MAX_AXIAL_STRESS

  Error Message: **UG07_B**-E-4, For the same sample in **TST_UG07_SS07_WKSHT_SUM** and **TST_UG07_SS07_A**, the LAB_CODE, CONSTRUCTION_NO, LOC_NO, LAYER_TYPE, and MR_MATL_TYPE must match. Check the input of all appropriate values.

Table: TST_UG07_SS07_WKSHT_CYCLES

- APPLIED_CONTACT_LOAD < APPLIED_CYCLIC_LOAD < APPLIED_MAX_AXIAL_LOAD

  Error Message: **UG07_WK**-E-1, In **TST_UG07_SS07_WKSHT_CYCLES**, the APPLIED_CONTACT_LOAD must be less than the APPLIED_CYCLIC_LOAD which must be less than the APPLIED_MAX_AXIAL_LOAD. Check input of all appropriate values.

- APPLIED_CONTACT_STRESS < APPLIED_CYCLIC_STRESS < APPLIED_MAX_AXIAL_STRESS

Error Message: **UG07_WK**-E-2, In **TST_UG07_SS07_WKSHT_CYCLES** the APPLIED_CONTACT_STRESS must be less than the APPLIED_CYCLIC_STRESS which must be less than APPLIED_MAX_AXIAL_STRESS.

- 0.85 * NOM_MAX_AXIAL_STRESS <= APPLIED_MAX_AXIAL_STRESS < 1.15 * NOM_MAX_
  AXIAL_STRESS

  Error Message: **UG07_WK**-E-3, In **TST_UG07_SS07_WKSHT_CYCLES** the APPLIED_MAX_AXIAL_STRESS must be within +- 15 percent of the NOM_MAX_AXIAL_STRESS. Check the input of APPLIED_MAX_AXIAL_STRESS value.

- [MAX(DEF_LVDT_1, DEF_LVDT_2)/MIN(DEF_LVDT_1, DEF_LVDT_2)] <= 1.30

  Error Message: **UG07_WK**-E-4, In **TST_UG07_SS07_WKSHT_CYCLES** the max. vertical deformation divided by the min. vertical deformation must be less than or equal to 1.3. Check the input of both values.

- 0.95 * DEF_LVDT_1_2 <= [(DEF_LVDT_1 + DEF_LVDT_2)/2] <= 1.05 * DEF_LVDT_1_2

  Error Message: **UG07_WK**-E-5, In **TST_UG07_SS07_WKSHT_CYCLES** the value of DEF_LVDT_1_2 should be approx. equal to the calculation of the average deformation using DEF_LVDT_1 and DEF_LVDT_2.

- 0.95 * RES_MOD <= [(APPLIED_CYCLIC_STRESS/RES_STRAIN)/1000] <= 1.05 * RES_MOD

  Error Message: **UG07_WK**-E-6, In **TST_UG07_SS07_WKSHT_CYCLES** the value of RES_MOD should be approx. equal to the calculation of Mr using APPLIED_CYCLIC_STRESS divided by RES_STRAIN which in turn is divided by 1000.

Tables: TST_UG07_SS07_WKSHT_CYCLES, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **UG07_WK**-E-12 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **UG07_WK**-E-13 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} Sample was tested before it was taken.

Tables: TST_UG07_SS07_WKSHT_CYCLES and TST_UG07_SS07_A or TST_UG07_SS07_B

For matching SHRP_ID, STATE_CODE, LAYER_NO, TEST_NO, FIELD_SET, and SAMPLE_NO, extract INITIAL_LENGTH and INITIAL_AREA from TST_UG07_SS07_A or TST_UG07_SS07_B, whichever is non-null.

- 0.95 * RES_STRAIN <= (DEF_LVDT_1_2/INITIAL_LENGTH) <= 1.05 * RES_STRAIN

  Error Message: **UG07_WK**-E-7, Using the INITIAL_LENGTH value from **TST_UG07_SS07_A**, the value for RES_STRAIN in **TST_UG07_SS07_WKSHT_CYCLES** should be approximately equal to DEF_LVDT_1_2 divided by INITIAL_LENGTH.

- 0.95 * APPLIED_MAX_AXIAL_LOAD <= (APPLIED_MAX_AXIAL_STRESS * (INITIAL_AREA/1000)) <= 1.05 * APPLIED_MAX_AXIAL_LOAD

  Error Message: **UG07_WK**-E-8, In **TST_UG07_SS07_WKSHT_CYCLES** the value of APPLIED_MAX_LOAD must be approx. equal to the APPLIED_MAX_AXIAL_STRESS multiplied by (initial_area/1000). Check input of all appropriate values.

- 0.95 * APPLIED_CYCLIC_LOAD <= (APPLIED_CYCLIC_STRESS * (INITIAL_AREA/1000)) <= 1.05 * APPLIED_CYCLIC_LOAD

  Error Message: **UG07_WK**-E-9, In TST_UG07_SS07_WKSHT_CYCLES the value of APPLIED_CYCLIC_LOAD must be approx. equal to the APPLIED_CYCLIC_STRESS multiplied by (initial_area/1000). Check input of all appropriate values.

- 0.90 * APPLIED_CONTACT_LOAD <= (APPLIED_CONTACT_STRESS * (INITIAL_AREA/1000)) <= 1.10 * APPLIED_CONTACT_LOAD

  Error Message: **UG07_WK**-E-10, In TST_UG07_SS07_WKSHT_CYCLES the value of APPLIED_CONTACT_LOAD must be approx. equal to the APPLIED_CONTACT_STRESS multiplied by (initial_area / 1000).

- For matching SHRP_ID, STATE_CODE, LAYER_NO, TEST_NO, FIELD_SET, and SAMPLE_NO, INITIAL_AREA must be non-null in either **TST_UG07_SS07_A** or **TST_UG07_SS07_B**

  Error Message: **UG07_WK**-E-11, In **TST_UG07_SS07_WKSHT_CYCLES**, INITIAL_AREA is NULL in both **TST_UG07_SS07_A** and **TST_UG07_SS07_B**.

Table: TST_UG07_SS07_WKSHT_SUM

- APPLIED_CONTACT_LOAD_AVG < APPLIED_CYCLIC_LOAD_AVG < APPLIED_MAX_AXIAL_LOAD_AVG

  Error Message: **UG07_SUM**-E-1, In **TST_UG07_SS07_WKSHT_SUM** the APPLIED_CONTACT_LOAD_AVG must be less than the APPLIED_CONTACT_LOAD_AVG which must be less than the APPLIED_MAX_AXIAL_LOAD_AVG.Check input of all appropriate values.

- APPLIED_CONTACT_STRESS_AVG < APPLIED_CYCLIC_STRESS_AVG < APPLIED_MAX_AXIAL_ STRESS_AVG

  Error Message: **UG07_SUM**-E-2, In **TST_UG07_SS07_WKSHT_SUM** the APPLIED_CONTACT_STRESS_AVG must be less than the APPLIED_CYCLIC_STRESS_AVG which must be less than APPLIED_MAX_AXIAL_STRESS_AVG. Check input of all appropriate values.

- 0.85 * NOM_MAX_AXIAL_STRESS <= APPLIED_MAX_AXIAL_STRESS_AVG <= 1.15 * NOM_MAX_ AXIAL_STRESS

Error Message: **UG07_SUM**-E-3, In **TST_UG07_SS07_WKSHT_SUM** the APPLIED_MAX_AXIAL_STRESS_AVG must be within +- 15 percent of the NOM_MAX_AXIAL_STRESS. Check the input of NOM_MAX_AXIAL_STRESS and APPLIED_MAX_AXIAL_STRESS_AVG values.

- MAX(DEF_LVDT_1_AVG or DEF_LVDT_2_AVG)/MIN(DEF_LVDT_1_AVG or DEF_LVDT_2_AVG) <= 1.30

  Error Message: **UG07_SUM**-E-4, In **TST_UG07_SS07_WKSHT_SUM** the max. vertical deformation divided by the min. vertical deformation must be less than or equal to 1.3. Check the input of both values.

- 0.95 * DEF_LVDT_1_2_AVG <= [(DEF_LVDT_1_AVG+DEF_LVDT_2_AVG)/2] <= 1.05 * DEF_LVDT_1_ 2_AVG

  Error Message: **UG07_SUM**-E-5, In **TST_UG07_SS07_WKSHT_SUM** the value of DEF_LVDT_1_2_AVG should be approx. equal to the calculation of the average deformation using DEF_LVDT_1_AVG and DEF_LVDT_2_AVG.

- 0.95 * RES_MOD_AVG <= [(APPLIED_CYCLIC_STRESS_AVG/RES_STRAIN_AVG)/1000] <= 1.05 * RES_MOD_AVG

  Error Message: **UG07_SUM**-E-6, In **TST_UG07_SS07_WKSHT_SUM** the value of RES_MOD_AVG should be approx. equal to the calculation of Mr using APPLIED_CYCLIC_STRESS_AVG divided by RES_STRAIN_AVG which in turn is divided by 1000.

Tables: TST_UG07_SS07_WKSHT_SUM, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **UG07_SUM**-E-23 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **UG07_SUM**-E-24 {STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, SAMPLE_NO} Sample was tested before it was taken.

Tables: TST_UG07_SS07_WKSHT_SUM and TST_UG07_SS07_A or TST_UG07_SS07_B

For matching SHRP_ID, STATE_CODE, LAYER_NO, TEST_NO, FIELD_SET, and SAMPLE_NO, extract INITIAL_LENGTH from **TST_UG07_SS07_A** or **TST_UG07_SS07_B**, whichever is non-null.

- 0.95 * RES_STRAIN_AVG <= (DEF_LVDT_1_2_AVG/INITIAL_LENGTH) <= 1.05* RES_STRAIN_AVG

Error Message: **UG07_SUM**-E-7, Using the INITIAL_LENGTH value from **TST_UG07_SS07_A** or **TST_UG07_SS07_B** the value for RES_STRAIN_AVG in **TST_UG07_SS07_WKSHT_SUM** should be approx equal to DEF_LVDT_1_2_AVG / INITIAL_LENGTH.

For matching SHRP_ID, STATE_CODE, LAYER_NO, TEST_NO, FIELD_SET, SAMPLE_NO, CON_PRESSURE, and NOM_MAX_AXIAL_STRESS, extract INITIAL_AREA from **TST_UG07_SS07_A** or **TST_UG07_SS07_B**, whichever is non-null. (If INITIAL_AREA is null in both tables, fail check.)

- 0.95 * APPLIED_MAX_AXIAL_LOAD_AVG <= (APPLIED_MAX_AXIAL_STRESS_AVG * (INITIAL_AREA/1000)) <= 1.05 * APPLIED_MAX_AXIAL_LOAD_AVG

  Error Message: **UG07_SUM**-E-8, In **TST_UG07_SS07_WKSHT_SUM** the value of APPLIED_MAX_LOAD_AVG must be approx. equal to the APPLIED_MAX_AXIAL_STRESS_AVG multiplied by (initial_area / 1000). Check input of all appropriate values.

- 0.95 * APPLIED_CYCLIC_LOAD_AVG <= (APPLIED_CYCLIC_STRESS_AVG * (INITIAL_AREA/1000)) <= 1.05 * APPLIED_CYCLIC_LOAD_AVG

  Error Message: **UG07_SUM**-E-9, In **TST_UG07_SS07_WKSHT_SUM** the value of APPLIED_CYCLIC_LOAD_AVG must be approx. equal to the APPLIED_CYCLIC_STRESS_AVG multiplied by (initial_area / 1000).

- 0.90 * APPLIED_CONTACT_LOAD_AVG <= (APPLIED_CONTACT_STRESS_AVG * (INITIAL_AREA/1000)) <= 1.10 * APPLIED_CONTACT_LOAD_AVG

  Error Message: **UG07_SUM**-E-10, In **TST_UG07_SS07_WKSHT_SUM** the value of APPLIED_CONTACT_LOAD_AVG must be approx. equal to the APPLIED_CONTACT_STRESS_AVG multiplied by (initial_area / 1000).

- For matching SHRP_ID, STATE_CODE, LAYER_NO, TEST_NO, FIELD_SET, and SAMPLE_NO, INITIAL_AREA must be non-null in either TST_UG07_SS07_A or TST_UG07_SS07_B

  Error Message: **UG07_SUM**-E-11, In TST_UG07_SS07_WKSHT_SUM, INITIAL_AREA is NULL in both **TST_UG07_SS07_A** and **TST_UG07_SS07_B**.

Tables: TST_UG07_SS07_WKSHT_SUM and TST_UG07_SS07_WKSHT_CYCLES

For matching SHRP_ID, STATE_CODE, LAYER_NO, TEST_NO, FIELD_SET, SAMPLE_NO, CON_PRESSURE, and NOM_MAX_AXIAL_STRESS:

- 0.95 * APPLIED_MAX_AXIAL_LOAD_AVG <= AVG (APPLIED_MAX_AXIAL_LOAD(1 - 5)) <= 1.05 * APPLIED_MAX_AXIAL_LOAD_AVG

  Error Message: **UG07_SUM**-E-19, The value APPLIED_MAX_AXIAL_LOAD_AVG reported in **TST_UG07_SS07_WKSHT_SUM** must equal the calculated average for APPLIED_MAX_AXIAL_LOAD (load_cycle = 1 to 5) from **TST_UG07_SS07_WKSHT_CYCLES**. Check the input of all appropriate values.

- 0.95 * APPLIED_CYCLIC_LOAD_AVG <= AVG (APPLIED_CYCLIC_LOAD (1 - 5)) <= 1.05 * APPLIED_CYCLIC_LOAD_AVG

Error Message: **UG07_SUM**-E-20, The value APPLIED_CYCLIC_LOAD_AVG reported in **TST_UG07_SS07_WKSHT_SUM** must equal the calculated average for APPLIED_CYCLIC_LOAD (load_cycle = 1 to 5) from **TST_UG07_SS07_WKSHT_CYCLES**. Check the input of all appropriate values.

- 0.90 * APPLIED_CONTACT_LOAD_AVG <= AVG (APPLIED_CONTACT_LOAD (1 - 5)) <= 1.10 * APPLIED_CONTACT_LOAD_AVG

  Error Message: **UG07_SUM**-E-21, The value APPLIED_CONTACT_LOAD_AVG reported in **TST_UG07_SS07_WKSHT_SUM** must equal the calculated average for APPLIED_CONTACT_LOAD (load_cycle = 1 to 5) from **TST_UG07_SS07_WKSHT_CYCLES**. Check the input of all appropriate values.

- 0.95 * APPLIED_MAX_AXIAL_STRESS_AVG <= AVG (APPLIED_MAX_AXIAL_STRESS (1 - 5)) <= 1.05 * APPLIED_MAX_AXIAL_STRESS_AVG

  Error Message: **UG07_SUM**-E-22, The value APPLIED_MAX_AXIAL_STRESS_AVG reported in **TST_UG07_SS07_WKSHT_SUM** must equal the calculated average for APPLIED_MAX_AXIAL_STRESS (load_cycle = 1 to 5) from **TST_UG07_SS07_WKSHT_CYCLES**. Check the input of all appropriate values.

- 0.95 * APPLIED_CYCLIC_STRESS_AVG <= AVG (APPLIED_CYCLIC_STRESS (1 - 5)) <= 1.05 * APPLIED_CYCLIC_STRESS_AVG

  Error Message: **UG07_SUM**-E-12, The value APPLIED_CYCLIC_STRESS_AVG reported in **TST_UG07_SS07_WKSHT_SUM** must equal the calculated average for APPLIED_CYCLIC_STRESS (load_cycle = 1 to 5) from **TST_UG07_SS07_WKSHT_CYCLES**. Check the input of all appropriate values.

- 0.90 * APPLIED_CONTACT_STRESS_AVG <= AVG (APPLIED_CONTACT_STRESS (1 - 5)) <= 1.10 * APPLIED_CONTACT_STRESS_AVG

  Error Message: **UG07_SUM**-E-13, The value APPLIED_CONTACT_STRESS_AVG reported in **TST_UG07_SS07_WKSHT_SUM** must the calculated average for APPLIED_CONTACT_STRESS (load_cycle = 1 to 5) from **TST_UG07_SS07_WKSHT_CYCLES**. Check the input of all appropriate values.

- 0.95 * DEF_LVDT_1_AVG <= AVG (DEF_LVDT_1 (1 - 5)) <= 1.05 * DEF_LVDT_1_AVG

  Error Message: **UG07_SUM**-E-14, The value DEF_LVDT_1_AVG reported in **TST_UG07_SS07_WKSHT_SUM** must equal the calculated average for DEF_LVDT_1 (load_cycle = 1 to 5) from **TST_UG07_SS07_WKSHT_CYCLES**. Check the input of all appropriate values.

- 0.95 * DEF_LVDT_2_AVG <= AVG (DEF_LVDT_2 (1 - 5)) <= 1.05 * DEF_LVDT_2_AVG

  Error Message: **UG07_SUM**-E-15, The value DEF_LVDT_2_AVG reported in **TST_UG07_SS07_WKSHT_SUM** must equal the calculated average for DEF_LVDT_2 (load_cycle = 1 to 5) from **TST_UG07_SS07_WKSHT_CYCLES**. Check the input of all appropriate values.

- 0.95 * DEF_LVDT_1_2_AVG <= AVG (DEF_LVDT_1_2 (1 - 5)) <= 1.05 * DEF_LVDT_1_2_AVG

Error Message: **UG07_SUM**-E-16, The value DEF_LVDT_1_2_AVG reported in **TST_UG07_SS07_WKSHT_SUM** must equal the calculated average for DEF_LVDT_1_2 (load_cycle = 1 to 5) from **TST_UG07_SS07_WKSHT_CYCLES**. Check the input of all appropriate values.

- 0.95 * RES_STRAIN_AVG <= AVG (RES_STRAIN (1 - 5)) <= 1.05 * RES_STRAIN_AVG

  Error Message: **UG07_SUM**-E-17, The value RES_STRAIN_AVG reported in **TST_UG07_SS07_WKSHT_SUM** must equal the calculated average for RES_STRAIN (load_cycle = 1 to 5) from **TST_UG07_SS07_WKSHT_CYCLES**. Check the input of all appropriate values.

- 0.95 * RES_MOD_AVG <= AVG (RES_MOD (1 - 5)) <= 1.05 * RES_MOD_AVG

  Error Message: **UG07_SUM**-E-18, The value RES_MOD_AVG reported in **TST_UG07_SS07_WKSHT_SUM** must equal the calculated average for RES_MOD (load_cycle = 1 to 5) from **TST_UG07_SS07_WKSHT_CYCLES**. Check the input of all appropriate values.

Tables: TST_UG09, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_UG09**-E-1 There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_UG09**-E-2 Sample was tested before it was taken.

Tables: TST_UG10_SS09, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_UG10_SS09**-E-1 There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_UG10_SS09**-E-2 Sample was tested before it was taken.

Table: TST_UNBOUND_SPEC_GRAV

- If COMMENT_1, COMMENT_2, COMMENT_3, COMMENT_4, COMMENT_5, or COMMENT_6 = 99, then COMMENTS_OTHER must be non-null

Error message: **TST_UNBOUND_SPEC_GRAV**-E-101 If comment code of 99 exists, then COMMENTS_OTHER must be non-null.

Tables: TST_UNBOUND_SPEC_GRAV, TST_L05B

- For each record in **TST_UNBOUND_SPEC_GRAV**, a record with matching SHRP_ID, STATE_CODE, and LAYER_NO must exist in **TST_L05B**

  Error message: **TST_UNBOUND_SPEC_GRAV**-E-102 A Matching record must exist in **TST_L05B**.

- For each record with matching STATE_CODE, SHRP_ID, and LAYER_NO, a record must exist in **TST_L05B** with DESCRIPTION in (5, 6, 7, 11)

  Error message: **TST_UNBOUND_SPEC_GRAV**-E-103 Layer is not unbound according to **TST_L05B**.DESCRIPTION.

Tables: TST_UNBOUND_SPEC_GRAV, TST_SAMPLE_BASIC_INFO

- There must be a record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO

  Error message: **TST_UNBOUND_SPEC_GRAV**-E-105 There is no matching sample in **TST_SAMPLE_BASIC_INFO**.

- For the matching record in **TST_SAMPLE_BASIC_INFO** with matching STATE_CODE, SHRP_ID, FIELD_SET, LOC_NO, and SAMPLE_NO, TEST_DATE must be greater than or equal to DATE_SAMPLED

  Error message: **TST_UNBOUND_SPEC_GRAV**-E-106 Sample was tested before it was taken.

Tables: TST_UNCOMP_BITUMINOUS

- If SAMPLE_LOC = 5, then STATION and OFFSET must be non-null

  Error Message: **TST_UNCOMP_BITUMINOUS**-E-1, If SAMPLE_LOC = 5, then STATION and OFFSET must be non-null

- If SAMPLE_LOC = 5, then STATION and OFFSET must be non-null

  Error Message: **TST_UNCOMP_BITUMINOUS**-E-2, If SAMPLE_LOC = 6, then SAMPLE_LOC_OTHER must be non-null

- For a LAYER_TYPE = 1 - 5, MIX_TYPE can only equal 1 or 2

  Error Message: **TST_UNCOMP_BITUMINOUS**-E-3, For a LAYER_TYPE = 1 - 5, MIX_TYPE can only equal 1 or 2

- For a LAYER_TYPE = 6, MIX_TYPE can only equal 3 or 4

Error Message: **TST**_**UNCOMP**_**BITUMINOUS**-E-4, For a LAYER_TYPE = 6, MIX_TYPE can only equal 3 or 4

- For PLANT_TYPE = 3, PLANT_TYPE_OTHER must be non-null

  Error Message: **TST**_**UNCOMP**_**BITUMINOUS**-E-5, For PLANT_TYPE = 3, PLANT_TYPE_OTHER must be non-null

- DATE_SAMPLED <= DATE_SHIPPED

  Error Message: **TST**_**UNCOMP**_**BITUMINOUS**-E-6, DATE_SAMPLED must be <= DATE_SHIPPED

4.0 PROFILE QC PROGRAMS

4.1 Level 1

A. Initial Level

Records in the IMS are at Level A when they first enter the system and are set back to A when changes are made to a given record or to selected related records.

B. Dependency Checks

No Dependency Checks are performed for Profile because Profile data are not dependent on Layer or Experiment data.

C. Minimum Data Elements

Tables and accompanying fields that must be included in a data record are identified below. Explanations are provided for those fields having certain conditions as to when they are required (i.e., X = always; * = conditionally).

Table	Field	Condition
MON_PROFILE_DATA	LEFT_ELEVATION	X
	RIGHT_ELEVATION	X
MON_PROFILE_MASTER	AVERAGE_SPEED	* - if DEVICE_CODE = P
	DISPLACEMENT	X
	FILTER_WAVELENGTH	* - if DEVICE_CODE = P
	IRI_AVERAGE	X
	IRI_LEFT_WHEEL_PATH	X
	IRI_RIGHT_WHEEL_PATH	X
	RMSVA_16	X
	RMSVA_4	X
	SENSOR_TYPE	* - if DEVICE_CODE = P
	SLOPE_VARIANCE	X
	SOFTWARE_VERSION	X
	START_METHOD	* - if DEVICE_CODE = P

D. Expanded Range Checks

Expanded range checks are applied to certain fields to identify data element values that fall outside an expected range. Field names are listed below the bolded table name. SPS supplemental sections are not checked.

Table	Units	Range
MON_PROFILE_DATA		
LEFT_ELEVATION	mm	-150 - 150
RIGHT_ELEVATION	mm	-150 - 150
MON_PROFILE_MASTER		
DEVICE_CODE		D or P
IRI_AVERAGE	m/km	0.4 - 4.8
IRI_LEFT_WHEEL_PATH	m/km	0.4 - 4.8
IRI_RIGHT_WHEEL_PATH	m/km	0.4 - 4.8
RCO_CODE		1, 2, or 3

The following expanded range checks are applicable only if the DEVICE_CODE = P:

AVERAGE_SPEED	kph	45 - 90
FILTER_WAVELENGTH	m	91.4 or 100
SENSOR_TYPE		1, 2, or 3
START_METHOD		1 or 2
STOP_METHOD		1, 2, or 3
WAVE_LENGTH_INIT		null, 0 or 1

The following expanded reange checks are applicable on if the DEVICE_CODE = D:

AVERAGE_SPEED	kph	null
FILTER_WAVELENGTH	m	null
SENSOR_TYPE		null
START_METHOD		null
STOP_METHOD		null
WAVE_LENGTH_INIT		null

E. Intramodular Checks

Each E-type check is separated by a single line. In general, each bullet represents a procedure, action, etc., of the check.

The **MON_PROFILE_MASTER** table contains a record for each profilometer run at a given SHRP site. The other table related to the profile module is the **MON_PROFILE_DATA** table which contains actual profilometer-generated elevations at a fixed interval along the current run. The additional piece of information included in this table is a status field, EVENT_MARK. Each record in the **MON_PROFILE_MASTER** should be analyzed independently along with all associated records within **the MON_PROFILE_DATA** table. After applying all checks within a particular level (e.g., expanded range checks) to this family of records, and if all of the QC/QA checks have been successfully passed, the entire group of records can be promoted to the next appropriate level by modifying the RECORD_STATUS field in each of the records.

Tables: MON_PROFILE_DATA and MON_PROFILE MASTER

- For each **MON_PROFILE_MASTER** test, ensure that the number of matching records in the MON_PROFILE_DATA table is in the following range: [(SECTION_END - SECTION_START)/ELEVATION_SAMPLE_LENGTH/1000] - 10 <= MatchingRecords <=

[(SECTION_END - SECTION_START)/ELEVATION_SAMPLE_LENGTH/1000] + 25

Error Message: MON_PROFILE_MASTER-E-1, Number of records {MatchingRecords} not between {SECTION_START)/ELEVATION_SAMPLE_LENGTH/1000] - 10} and {[(SECTION_END - SECTION_START)/ELEVATION_SAMPLE_LENGTH/1000] + 25}

- If SENSOR_TYPE = 3 and DEVICE_CODE = P, then WAVE_LENGTH_INIT must be null

  Error Message: MON_PROFILE_MASTER-E-2, SENSOR_TYPE = 3 requires WAVE_LENGTH_INIT to be null when DEVICE_CODE='P'

- If SENSOR_TYPE = 1, 2 and DEVICE_CODE = P, then WAVE_LENGTH_INIT must be non-null

  Error Message: MON_PROFILE_MASTER-E-3, SENSOR_TYPE = {SENSOR_TYPE} requires WAVE_LENGTH_INIT to be non-null when DEVICE_CODE='P'

5.0 DEFLECTION QC PROGRAMS

5.1 Level 1

A. Initial Level

Records in the IMS are at Level A when they first enter the system and are set back to A when changes are made to a given record or to selected related records.

B. Dependency Checks

No dependency checks are required.

C. Minimum Data Elements

Tables and accompanying fields that must be included in a data record are identified below. Explanations are provided for those fields having certain conditions as to when they are required (i.e., X = always; * = conditionally).

Table	Field	Condition
MON_DEFL_BUFFER_SHAPE	BUFFER_SHAPE	X
MON_DEFL_DEV_CONFIG	LOAD_CELL_SERIAL_NO	X
	PLATE_RADIUS	X
MON_DEFL_DROP_DATA	DROP_LOAD	X
	PEAK_DEFL_1	*
	PEAK_DEFL_2	*
	PEAK_DEFL_3	*
	PEAK_DEFL_4	*
	PEAK_DEFL_5	*
	PEAK_DEFL_6	*
	PEAK_DEFL_7	*
	PEAK_DEFL_#	
	*At least 5 values where # is from 1 to 7 must be non-null	
MON_DEFL_EST_SENSOR_OFFSET	ESTIMATED_CENTER_OFFSET	X
MON_DEFL_FLX_BAKCAL_BASIN	AVG_DROP_LOAD	X
	DATA_PROCESS_EXTRACT_DATE	X
	MEAN_DEFL_1	X
	MEAN_DEFL_2	X
	MEAN_DEFL_3	X
	MEAN_DEFL_4	X
	MEAN_DEFL_5	X
	MEAN_DEFL_6	X
	MEAN_DEFL_7	X

	NO_DROPS	X
	PLATE_RADIUS	X
MON_DEFL_FLX_BAKCAL_LAYER	BAKCAL_LAYER_THICKNESS	X
	BAKCAL_POISSONS_RATIO	*
	*required if LAYER_TYPE other than RB	
	DATA_PROCESS_EXTRACT_DATE	X
	LAYER_TYPE	X
	L05B_LAYER_NO_1	*
	*required if LAYER_TYPE other than RB or SS	
	REF_CONSTRUCTION_NO	X
MON_DEFL_FLX_BAKCAL_POINT	DATA_PROCESS_EXTRACT_DATE	X
	ERROR_RMSE	X
	ELASTIC_MODULUS	X
	MODULUS_ASSUMED	X
	REF_CONSTRUCTION_NO	X
	SECTION_STAT_INCLUDE_FLAG	X
MON_DEFL_FLX_BAKCAL_SECT	DATA_PROCESS_EXTRACT_DATE	X
	ELASTIC_MODULUS_MEAN	X
	ELASTIC_MODULUS_STD	*
	*required if TOTAL_NO_BASINS > 1	
	ELASTIC_MODULUS_MIN	X
	ELASTIC_MODULUS_MAX	X
	REF_CONSTRUCTION_NO	X
	RMSE_MAX	X
	TOTAL_NO_BASINS	X
MON_DEFL_FLX_NMODEL_POINT	DATA_PROCESS_EXTRACT_DATE	X
	ERROR_RMSE	X
	MODEL_NO	X
	MODULUS_HIGHEST_LOAD	X
	MODULUS_ASSUMED	X
	REF_CONSTRUCTION_NO	X
MON_DEFL_FLX_NMODEL_SECT	DATA_PROCESS_EXTRACT_DATE	X
	MODEL_NO	X
	MODULUS_HIGHEST_LOAD_MEAN	X
	MODULUS_HIGHEST_LOAD_STD	*
	*required if TOTAL_NO_BASINS > 1	
	MODULUS_HIGHEST_LOAD_MIN	X
	MODULUS_HIGHEST_LOAD_MAX	X
	REF_CONSTRUCTION_NO	X
	RMSE_MAX	X
	TOTAL_NO_BASINS	X
MON_DEFL_LOC_INFO	CONFIGURATION_NO	X
MON_DEFL_MASTER	ROADWAY_ID	X
	SOFTWARE_VERSION	X
MON_DEFL_RGD_BAKCAL_BASIN	AVG_DROP_LOAD	X
	DATA_PROCESS_EXTRACT_DATE	X
	MEAN_DEFL_1	X
	MEAN_DEFL_3	X

	MEAN_DEFL_5	X
	MEAN_DEFL_6	X
	NO_DROPS	X
	PLATE_RADIUS	X
MON_DEFL_RGD_BAKCAL_POINT	DATA_PROCESS_EXTRACT_DATE	X
	EPCC_DL_FULL_BOND	X
	EPCC_DL_FULL_BOND_FLAG	X
	EPCC_DL_FULL_SLIP	X
	EPCC_DL_FULL_SLIP_FLAG	X
	EPCC_ES_FULL_BOND	X
	EPCC_ES_FULL_BOND_FLAG	X
	EPCC_ES_FULL_SLIP	X
	EPCC_ES_FULL_SLIP_FLAG	X
	ESUBGR	X
	ESUBGR_FLAG	X
	K_VAL	X
	K_VAL_FLAG	X
	MEAN_ERROR_DL	X
	MEAN_ERROR_ES	X
	MODULUS_RATIO	X
	RAD_REL_STIFF_DL	X
	RAD_REL_STIFF_DL_FLAG	X
	RAD_REL_STIFF_ES	X
	RAD_REL_STIFF_ES_FLAG	X
MON_DEFL_RGD_BAKCAL_SECT	BOND	X
	DATA_PROCESS_EXTRACT_DATE	X
	DL_STAT_FLAG	X
	EPCC_DL_MAX	X
	EPCC_DL_MEAN	X
	EPCC_DL_MIN	X
	EPCC_DL_STD	X
	EPCC_ES_MAX	X
	EPCC_ES_MEAN	X
	EPCC_ES_MIN	X
	EPCC_ES_STD	X
	ES_STAT_FLAG	X
	ESUBGR_MAX	X
	ESUBGR_MEAN	X
	ESUBGR_MIN	X
	ESUBGR_STD	X
	K_VAL_MAX	X
	K_VAL_MEAN	X
	K_VAL_MIN	X
	K_VAL_STD	X
	NO_DL_ACCEPT	X
	NO_ES_ACCEPT	X
	NO_PCC_DL_ACCEPT	X
	NO_PCC_ES_ACCEPT	X
	RAD_REL_STIFF_DL_MAX	X
	RAD_REL_STIFF_DL_MEAN	X
	RAD_REL_STIFF_DL_MIN	X
	RAD_REL_STIFF_DL_STD	X
	RAD_REL_STIFF_ES_MAX	X
	RAD_REL_STIFF_ES_MEAN	X

	RAD_REL_STIFF_ES_MIN	X
	RAD_REL_STIFF_ES_STD	X
	REF_CONSTRUCTION_NO	X
	TOT_NO_BASINS	X
MON_DEFL_RGD_BAKCAL_LAYER	BAKCAL_PCC_THICKNESS	X
	BAKCAL_POISSON_RATIO	X
	DATA_PROCESS_EXTRACT_DATE	X
	L05B_PCC_LAYER_NO_1	X
	MODULUS_RATIO	X
	REF_CONSTRUCTION_NO	X
MON_DEFL_TEMP_DEPTHS	LAYER_TEMP_DEPTH_1	X
	LAYER_TEMP_DEPTH_2	X
MON_DEFL_TEMP_VALUES	LAYER_TEMPERATURE_1	X
	LAYER_TEMPERATURE_2	X

D. Expanded Range Checks

Expanded range checks are applied to certain fields to identify data element values that fall outside an expected range. Field names are listed below the bolded table name.

Table	Units	Range
MON_DEFL_BUFFER_SHAPE		
BUFFER_ASSIGN_DATE		>= 1-Jan-1987 and <= Today's Date
BUFFER_DEASSIGN_DATE		>= 2-Jan-1987 and <= Today's Date
BUFFER_SHAPE		1, 2, 3, 4, 9
MON_DEFL_DEV_CONFIG		
NO_ACTIVE_DEFLECTORS		7 - 9
PLATE_RADIUS	mm	150 or 225
MON_DEFL_DEV_SENSORS		
RELATIVE_GAIN	mm	0.979 - 1.0214
MON_DEFL_DROP_DATA		
DROP_HEIGHT		1, 2, 3, 4
DROP_LOAD	kPa	35 - 1400
PEAK_DEFL_1	microns	null, 5 - 2032
PEAK_DEFL_2	microns	null, 5 - 2032
PEAK_DEFL_3	microns	5 - 2032
PEAK_DEFL_4	microns	5 - 2032
PEAK_DEFL_5	microns	3 - 2032
PEAK_DEFL_6	microns	1 - 2032
PEAK_DEFL_7	microns	1 - 2032
PEAK_DEFL_8	microns	null, 1 - 2032
PEAK_DEFL_9	microns	null, 5 - 2032
POINT_LOC	m	-31.0 - 335.0
TEST_TIME	hr/min	0 - 23 / 0 - 59

MON_DEFL_FLX_BAKCAL_BASIN[1]

CALC_PVMT_TEMP	^{o}C	-12.0 – 50.0
MEAN_DEFL_1	microns	0 - 2032
MEAN_DEFL_2	microns	0 - 2032
MEAN_DEFL_3	microns	0 - 2032
MEAN_DEFL_4	microns	0 - 2032
MEAN_DEFL_5	microns	0 - 2032
MEAN_DEFL_6	microns	0 - 2032
MEAN_DEFL_7	microns	0 - 2032
PLATE_RADIUS	mm	149 - 151

MON_DEFL_FLX_BAKCAL_LAYER[1]

AT_REST_PRESSURE_COEFFICIENT		0.00 - 3.00
BAKCAL_LAYER_NO		1 - 10
BAKCAL_POISSON_RATIO		0.00 - 0.50
LAYER_DENSITY	kg/m^3	>0, if LAYER_TYPE <> 'RB'

MON_DEFL_FLX_BAKCAL_POINT[1]

BAKCAL_LAYER_NO		1 - 10
ELASTIC_MODULUS	MPa	5.0 - 75000.0
ERROR_RMSE	%	0.00 - 4.00
MODULUS_ASSUMED		Y, N

MON_DEFL_FLX_BAKCAL_SECT[1]

BAKCAL_LAYER_NO		1 - 10
ELASTIC_MODULUS_MEAN	MPa	5.0 - 75000.0
RMSE_MAX	%	0.00 - 2.00
TOTAL_NO_BASINS		5 - 999

MON_DEFL_FLX_NMODEL_POINT[1]

BAKCAL_LAYER_NO		1 - 10
ERROR_RMSE	%	0.00 - 4.00
MODULUS_ASSUMED		Y, N
MODULUS_HIGHEST_LOAD	MPa	5.0 - 75000.0

MON_DEFL_FLX_NMODEL_SECT

BAKCAL_LAYER_NO		1 - 10
MODULUS_HIGHEST_LOAD_MEAN	MPa	5.0 - 75000.0
MODULUS_HIGHEST_LOAD_MIN	MPa	5.0 - 75000.0
MODULUS_HIGHEST_LOAD_MAX	MPa	5.0 - 75000.0
RMSE_MAX		0.00 - 2.00

MON_DEFL_LOC_INFO

AIR_TEMP_TEST	deg C	null, -30.0 - 50.0
CRACK_JOINT_OPEN_WIDTH	mm	null, 1 - 25
LANE_NO		C0, C1, C2, C3, C4, C5, F0, F1, F3, F4, F5, F9, G1, G3, J0, J1, J2, J3, J4, J5, J6, J7, J8, J9, L1, L3, P1, P3, S1, S3
POINT_LOC	m	-31.0 - 335.0
PVMT_SURF_TEMP	deg C	null, -30.0 - 75.0

[1] These tables may not be manually upgraded.

TEST_TIME	hr, min	0 - 23 / 0 - 59
MON_DEFL_MASTER		
SOFTWARE_VERSION (FWDWin)		10, 20, 25, 1.?.?
MON_DEFL_RGD_BAKCAL_BASIN		
AVG_DROP_LOAD	kN	20.000 - 100.000
MEAN_DEFL_1	microns	0 - 2032
MEAN_DEFL_2	microns	0 - 2032
MEAN_DEFL_3	microns	0 - 2032
MEAN_DEFL_4	microns	0 - 2032
MEAN_DEFL_5	microns	0 - 2032
MEAN_DEFL_6	microns	0 - 2032
MEAN_DEFL_7	microns	0 - 2032
PLATE_RADIUS	mm	149 - 151
MON_DEFL_RGD_BAKCAL_POINT		
EBASE_DL_FULL_BOND	MPa	10.0 - 75000.0
EBASE_DL_FULL_SLIP	MPa	10.0 - 75000.0
EBASE_ES_FULL_BOND	MPa	10.0 - 75000.0
EBASE_ES_FULL_SLIP	MPa	10.0 - 75000.0
EPCC_DL_FULL_BOND	MPa	12000.0 - 75000.0
EPCC_DL_FULL_SLIP	MPa	12000.0 - 75000.0
EPCC_ES_FULL_BOND	MPa	12,000.0 - 75000.0
EPCC_ES_FULL_SLIP	MPa	12,000.0 - 75000.0
ESUBGR	MPa	5.0 - 700.0
K_VAL	MPa/m	5.0 - 300.0
LANE_NO		J1, J4, J6, C1
MEAN_ERROR_DL	%	0 - 99.9
MEAN_ERROR_ES	%	0 - 99.9
RAD_REL_STIFF_DL	mm	500.0 - 2250.0
RAD_REL_STIFF_ES	mm	500.0 - 2000.0
MON_DEFL_RGD_BAKCAL_SECT		
DL_ACCEPT		0 - 999
EBASE_DL_MAX	MPa	10.0 - 75000.0
EBASE_DL_MEAN	MPa	10.0 - 75000.0
EBASE_DL_MIN	MPa	10.0 - 75000.0
EBASE_DL_STD	MPa	0.0 - 75000.0
EBASE_ES_MAX	MPa	10.0 - 75000.0
EBASE_ES_MEAN	MPa	10.0 - 75000.0
EBASE_ES_MIN	MPa	10.0 - 75000.0
EBASE_ES_STD	MPa	0.0 - 75000.0
EPCC_DL_MAX	MPa	12000.0 - 75000.0
EPCC_DL_MEAN	MPa	12000.0 - 75000.0
EPCC_DL_MIN	MPa	12000.0 - 75000.0
EPCC_DL_STD	MPa	0.0 - 75000.0
EPCC_ES_MAX	MPa	12000.0 - 75000.0
EPCC_ES_MEAN	MPa	12000.0 - 75000.0
EPCC_ES_MIN	MPa	12000.0 - 75000.0
EPCC_ES_STD	MPa	0.0 - 75000.0
ES_ACCEPT		0 - 999
ESUBGR_MAX	MPa	5.0 - 700.0
ESUBGR_MEAN	MPa	5.0 - 700.0
ESUBGR_MIN	MPa	5.0 - 700.0

ESUBGR_STD	MPa	0.0 - 700.0
K_VAL_MAX	MPa/m	5.0 - 300.0
K_VAL_MEAN	MPa/m	5.0 - 300.0
K_VAL_MIN	MPa/m	5.0 - 300.0
K_VAL_STD	MPa/m	0.0 - 300.0
RAD_REL_STIFF_DL_MAX	mm	500.0 - 2250.0
RAD_REL_STIFF_DL_MEAN	mm	500.0 - 2250.0
RAD_REL_STIFF_DL_MIN	mm	500.0 - 2250.0
RAD_REL_STIFF_DL_STD	mm	0.0 - 2250.0
RAD_REL_STIFF_ES_MAX	mm	500.0 - 2000.0
RAD_REL_STIFF_ES_MEAN	mm	500.0 - 2000.0
RAD_REL_STIFF_ES_MIN	mm	500.0 - 2000.0
RAD_REL_STIFF_ES_STD	mm	0.0 - 2000.0
TOT_NO_BASINS		1 - 999
MON_DEFL_RGD_BAKCAL_LAYER		
BAKCAL_POISSON_RATIO		0.14 - 0.16
BASE_THICKNESS	mm	3.0 - 8000.0
MODULUS_RATIO		1 - 400 or 999
PCC_THICKNESS	mm	3.0 - 500.0
MON_DEFL_TEMP_DEPTHS		
LAYER_TEMP_DEPTH_1	mm	10 - 49
LAYER_TEMP_DEPTH_2	mm	24 - 350
LAYER_TEMP_DEPTH_3	mm	null, 37 - 635
LAYER_TEMP_DEPTH_4	mm	null, 88 - 635
LAYER_TEMP_DEPTH_5	mm	null, 200 - 635
POINT_LOC	m	-31.0 - 335.0
TEST_DATE		<= Today's date
MON_DEFL_TEMP_VALUES		
LAYER_TEMPERATURE_1	deg C	-30.0 - 60.0
LAYER_TEMPERATURE_2	deg C	-30.0 - 60.0
LAYER_TEMPERATURE_3	deg C	null, -30.0 - 60.0
LAYER_TEMPERATURE_4	deg C	null, -30.0 - 60.0
LAYER_TEMPERATURE_5	deg C	null, -30.0 - 60.0
SURFACE_TEMPERATURE	deg C	-30 - 60
TIME_LAYER_TEMP	hrs, min	0 - 23 / 0 – 59

E. Intramodular Checks

Each E-type check is separated by a single line. In general, each bullet represents a procedure, action, etc., of the check.

Table: MON_DEFL_BUFFER_SHAPE

- If BUFFER_ASSIGN_DATE > 1-JUN-1999 and DEFL_UNIT_ID is in (8002-58, 8002-59, 8002-60, 8002-61, 8002-129, 8002-130, 8002-131, 8002-132) BUFFER_SHAPE cannot be 9

  Error Message: Unknown buffer shape not allowed for LTPP equipment.

- If BUFFER_ORDER_NO > 1, then BUFFER_ORDER_NO - 1 must exist for matching DEFL_UNIT_ID

Error Message: For DEFL_UNIT_ID = ?, BUFFER_ORDER_NO = ? Cannot exist without BUFFER_ORDER_NO = ? - 1.

- For the same DEFL_UNIT_ID and BUFFER_ORDER_NO, BUFFER_ASSIGN_DATE < BUFFER_DEASSIGN_DATE

  Error Message: For DEFL_UNIT_ID = ? And BUFFER_ORDER_NO = ?, BUFFER_ASSIGN_DATE >= BUFFER_DEASSIGN_DATE.

For the same DEFL_UNIT_ID, on any pair of BUFFER_ORDER_NO [BN] and BUFFER_ORDER_NO + 1 [BN + 1] (i.e. 1, 2 or 2, 3, etc.), perform the following checks:

- BUFFER_ASSIGN_DATE(BN + 1) > BUFFER_ASSIGN_DATE(BN)

  Error Message: For DEFL_UNIT_ID = ?, BUFFER_ASSIGN_DATE(BN + 1) <= BUFFER_ASSIGN_DATE(BN)

- BUFFER_ASSIGN_DATE(BN + 1) > BUFFER_DEASSIGN_DATE(BN)

  Error Message: For DEFL_UNIT_ID = ?, BUFFER_ASSIGN_DATE(BN + 1) <= BUFFER_DEASSIGN_DATE(BN)

Tables: MON_DEFL_DEV_CONFIG, MON_DEFL_DEV_SENSORS

- For each record in **MON_DEFL_DEV_CONFIG** the number of records in **MON_DEFL_DEV_SENSORS** with matching CONFIGURATION_NO should be equal to **MON_DEFL_DEV_CONFIG**.NO_ACTIVE_DEFLECTORS

  Error message: **MON_DEFL_DEV_CONFIG**-E-101 The number of records in **MON_DEFL_DEV_SENSORS** is not equal to **MON_DEFL_DEV_CONFIG**.NO_ ACTIVE_DEFLECTORS for CONFIGURATION_NO = {CONFIGURATION_NO }.

- For each record in **MON_DEFL_DEV_SENSORS** a record in **MON_DEFL_DEV_CONFIG** with matching CONFIGURATION_NO must exist

  Error message: **MON_DEFL_DEV_CONFIG**-E-102 A matching record does not exist in **MON_DEFL_DEV_CONFIG** for **MON_DEFL_DEV_SENSORS** {CONFIGURATION_NO, SENSOR_NO}.

Note to Programmer: At this point, set RECORD_STATUS = E for all MON_DEFL_DEV_CONFIG records passing the previous Level E checks.

Tables: MON_DEFL_DEV_SENSORS, MON_DEFL_LOC_INFO, MON_DEFL_MASTER

- For each record in **MON_DEFL_DEV_SENSORS,** the value of CENTER_OFFSET must be equal to the value in the table below depending on value of **MON_DEFL_LOC_INFO**.LANE_NO for matching CONFIGURATION_NO and **MON_DEFL_MASTER**.SOFTWARE_VERSION = 10 or 20 for matching STATE_CODE, SHRP_ID, and TEST_DATE

MON_DEFL_LOC_INFO LANE_NO	Required Values for MON_DEFL_DEV_SENSORS.CENTER_OFFSET								
	MON_DEFL_DEV_SENSORS.SENSOR_NO								
	1	2	3	4	5	6	7	8	9
C0	0	203	305	457	610	914	1524	-	-
C1	0	203	305	457	610	914	1524	-	-
C2	0	203	305	457	610	914	1524	-	-
C3	0	203	305	457	610	914	1524	-	-
C4	0	**-305**	305	457	610	914	1524	-	-
C5	0	**-305**	305	457	610	914	1524	-	-
F0	0	203	305	457	610	914	1524	-	-
F1	0	203	305	457	610	914	1524	-	-
F3	0	203	305	457	610	914	1524	-	-
F4	0	**-305**	305	457	610	914	1524	-	-
F5	0	**-305**	305	457	610	914	1524	-	-
F9	0	203	305	457	610	914	1524	-	-
G1	0	203	305	457	610	914	1524	-	-
G3	0	203	305	457	610	914	1524	-	-
J0	0	203	305	457	610	914	1524	-	-
J1	0	203	305	457	610	914	1524	-	-
J2	0	203	305	457	610	914	1524	-	-
J3	0	203	305	457	610	914	1524	-	-
J4	0	**-305**	305	457	610	914	1524	-	-
J5	0	**-305**	305	457	610	914	1524	-	-
J6	0	**-305**	305	457	610	914	1524	-	-

MON_DEFL_LOC_INFO LANE_NO	Required Values for MON_DEFL_DEV_SENSORS.CENTER_OFFSET								
	MON_DEFL_DEV_SENSORS.SENSOR_NO								
	1	2	3	4	5	6	7	8	9
J7	0	203	305	457	610	914	1524	-	-
J8	0	203	305	457	610	914	1524	-	-
J9	0	203	305	457	610	914	1524	-	-
L1	0	203	305	457	610	914	1524	-	-
L3	0	203	305	457	610	914	1524	-	-
P1	0	203	305	457	610	914	1524	-	-
P3	0	203	305	457	610	914	1524	-	-
S1	0	203	305	457	610	914	1524	-	-
S3	0	203	305	457	610	914	1524	-	-

Or

If **MON_DEFL_MASTER**.SOFTWARE_VERSION = 25 or 1.?.? (FWDWin) for matching STATE_CODE, SHRP_ID, and TEST_DATE, the required value for CENTER_OFFSET is the same for all values of **MON_DEFL_LOC_INFO**.LANE_NO

Then in **MON_DEFL_DEV_SENSORS**
If SENSOR_NO = 1 Then CENTER_OFFSET = 0
If SENSOR_NO = 2 Then CENTER_OFFSET = 203
If SENSOR_NO = 3 Then CENTER_OFFSET = 305
If SENSOR_NO = 4 Then CENTER_OFFSET = 457
If SENSOR_NO = 5 Then CENTER_OFFSET = 610
If SENSOR_NO = 6 Then CENTER_OFFSET = 914
If SENSOR_NO = 7 Then CENTER_OFFSET = 1219
If SENSOR_NO = 8 Then CENTER_OFFSET = 1524
If SENSOR_NO = 9 Then CENTER_OFFSET = -305

Error message: **MON_DEFL_DEV_SENSORS**-E-101 Center offset {CENTER_OFFSET} does not match LTPP Edition 25 specifications for matching LANE_NO {LANE_NO} and SOFTWARE_VERSION {SOFTWARE_VERSION}. See MON_DEFL_LOC_INFO section-{STATE_CODE, SHRP_ID} test_date - {TEST_DATE}, lane_no - {LANE_NO}.

*Note to Programmer: Note that the relationship between records in **MON_DEFL_DEV_SENSORS** and **MON_DEFL_LOC_INFO** is a one to many relationship. All unique combinations of CONFIGURATION_NO and LANE_NO in **MON_DEFL_LOC_INFO** must be checked to make sure the sensor spacing is correct. This check does not have to be performed for SENSOR_NO = 1 since the CENTER_OFFSET should always be zero. At this*

point, set RECORD_STATUS = E for all MON_DEFL_DEV_SENSORS records passing the previous Level E checks.

Table: MON_DEFL_DROP_DATA

- For each record with non-null values of PEAK_DEFL_(n) and PEAK_DEFL_(n + 1) where n is in (1 - 8)

  If LANE_NO is in (F0, F1, F3, J0, J1, J2, J3, J6, J7, J8, C0, C1, C3, S1, S3, G1, G3, P1, P3, L1, L3)

  And

  If PEAK_DEFL_(n) < PEAK_DEFL_(n + 1)

  Then

  Set **MON_DEFL_DROP_DATA**.NON_DECREASING_DEFL = 1

  Warning message: **MON_DEFL_DROP_DATA**-W-101 Deflection Basin test with non-decreasing deflection: record has been flagged.

Note to Programmer: This check is only to populate the NON_DECREASING_DEFL field for records not satisfying this check, and to generate a warning message in the QC log. DO NOT reset RECORD_STATUS for records not satisfying this check. Note that the relationship between sensor 8 and 9 is not being tested.

Tables: MON_DEFL_DROP_DATA, **MON_DEFL_LOC_INFO**

- For each record in **MON_DEFL_DROP_DATA** at least one record must exist in **MON_DEFL_LOC_INFO** with matching SHRP_ID, STATE_CODE, TEST_DATE, TEST_TIME, POINT_LOC, LANE_NO

  Error message: **MON_DEFL_DROP_DATA**-E-101 Missing record in **MON_DEFL_LOC_INFO** for **MON_DEFL_DROP_DATA** {SHRP_ID, STATE_CODE, TEST_DATE, TEST_TIME, POINT_LOC, LANE_NO, DROP_NO}.

- For each record in **MON_DEFL_LOC_INFO** at least one record must exist in **MON_DEFL_DROP_DATA** with matching SHRP_ID, STATE_CODE, TEST_DATE, TEST_TIME, POINT_LOC, LANE_NO

  Error message: **MON_DEFL_DROP_DATA**-E-102 No matching records in **MON_DEFL_DROP_DATA** for **MON_DEFL_LOC_INFO** {SHRP_ID, STATE_CODE, TEST_DATE, TEST_TIME, POINT_LOC, LANE_NO}.

  *Note to Progammer: At this point, set RECORD_STATUS = E for all **MON_DEFL_DROP_DATA** records passing the previous level E check.*

Tables: MON_DEFL_EST_SENSOR_OFFSET, **MON_DEFL_DEV_SENSORS**

- For each record in **MON_DEFL_EST_SENSOR_OFFSET**, a record must exist in

MON_DEFL_DEV_SENSORS with matching CONFIGURATION_NO, SENSOR_NO and **MON_DEFL_DEV_SENSORS**.CENTER_OFFSET_FLAG = 3

Error message: **MON_DEFL_EST_SENSOR_OFFSET**-E-101 For record in **MON_DEFL_EST_SENSOR_OFFSET** matching record with CENTER_OFFSET_FLAG = 3 does not exist in **MON_DEFL_DEV_SENSORS** for {CONFIGURATION_NO, SENSOR_NO}.

Note to Programmer: At this point, set RECORD_STATUS = E for all MON_DEFL_EST_SENSOR_OFFSET records passing the previous Level E check.

Tables: MON_DEFL_FLX_BAKCAL_BASIN, MON_DEFL_LOC_INFO

- For records in **MON_DEFL_LOC_INFO** with matching STATE_CODE, SHRP_ID, TEST_DATE, LANE_NO, POINT_LOC, the **MON_DEFL_LOC_INFO**.RECORD_STATUS = 'E'

  Error Message: **MON_DEFL_FLX_BAKCAL_BASIN**-E-1, There must be a matching record in **MON_DEFL_LOC_INFO** at level E.

Tables: MON_DEFL_FLX_BAKCAL_BASIN, MON_DEFL_TEMP_VALUES

- For records in **MON_DEFL_TEMP_VALUES** with matching STATE_CODE, SHRP_ID, TEST_DATE, LANE_NO, POINT_LOC, **MON_DEFL_LOC_INFO**.RECORD_STATUS = 'E'

  Error Message: **MON_DEFL_FLX_BAKCAL_BASIN**-E-2, Matching records in **MON_DEFL_TEMP_VALUES** are not at Level E.

Tables: MON_DEFL_FLX_BAKCAL_BASIN, MON_DEFL_LOC_INFO, MON_DEFL_DEV_SENSOR

- For matching STATE_CODE, SHRP_ID, CONSTRUCTION_NO, TEST_DATE, LANE_NO, POINT_LOC in **MON_DEFL_LOC_INFO**, all records in **MON_DEFL_DEV_SENSORS** where CONFIGURATION_NO = **MON_DEFL_LOC_INFO**.CONFIGURATION_NO must have RECORD_STATUS = 'E'

  Error Message: **MON_DEFL_FLX_BAKCAL_BASIN**-E-3, Unit configuration records in **MON_DEFL_DEV_SENSORS** are not at Level E.

Tables: MON_DEFL_FLX_BAKCAL_BASIN, MON_DEFL_DROP_DATA

- For records in **MON_DEFL_DROP_DATA** with matching STATE_CODE, SHRP_ID, TEST_DATE, LANE_NO, POINT_LOC, DROP_HEIGHT, the **MON_DEFL_DROP_DATA**.RECORD_STATUS = 'E'

  Error Message: **MON_DEFL_FLX_BAKCAL_BASIN**-E-4, Matching records in **MON_DEFL_DROP_DATA** must be at Level E.

Tables: MON_DEFL_FLX_BAKCAL_LAYER

- CONSTRUCTION_NO = REF_CONSTRUCTION_NO

Error Message: The CONSTRUCTION_NO and REF_CONSTRUCTION_NO must be equal.

Table: MON_DEFL_FLX_BAKCAL_LAYER, EXPERIMENT_SECTION

- If no **EXPERIMENT_SECTION** record with matching STATE_CODE, SHRP_ID, and CN_ASSIGN_DATE <= **MON_DEFL_FLX_BAKCAL_LAYER**.CN_REF_DATE exists, then **MON_DEFL_FLX_BAKCAL_LAYER**.CONSTRUCTION_NO cannot be computed

  Error Message: **MON_DEFL_FLX_BAKCAL_LAYER**-E-1, Cannot compute CONSTRUCTION_NO from **EXPERIMENT_SECTION**.

- If the **EXPERIMENT_SECTION** record with matching STATE_CODE, SHRP_ID, and CN_ASSIGN_DATE <= **MON_DEFL_FLX_BAKCAL_LAYER**.CN_REF_DATE exists, then **MON_DEFL_FLX_BAKCAL_LAYER**.CONSTRUCTION_NO must be equal to **EXPERIMENT_SECTION**.CONSTRUCTION_NO

  Error Message: **MON_DEFL_FLX_BAKCAL_LAYER**-E-2, Cannot compute CONSTRUCTION_NO from **EXPERIMENT_SECTION**.

- If the **EXPERIMENT_SECTION** record with matching STATE_CODE, SHRP_ID, and CONSTRUCTION_NO has **EXPERIMENT_SECTION**.CN_CHANGE_REASON in (7, 12, 13, 18, 19, 20, 43, 44, 45, 46, 47, 48, 51, 52, 55, 56), then CONSTRUCTION_NO = REF_CONSTRUCTION_NO

  Error Message: **MON_DEFL_FLX_BAKCAL_LAYER**-E-9, The CONSTRUCTION_NO and REF_CONSTRUCTION_NO do not match and the structural capacity of this section has changed.

Tables: MON_DEFL_FLX_BAKCAL_LAYER, TST_L05B

- For matching STATE_CODE, SHRP_ID, CONSTRUCTION_NO, L05B_LAYER_NO_*, **TST_L05B**.RECORD_STATUS = 'E' (one to many check)

  Error Message: **MON_DEFL_FLX_BAKCAL_LAYER**-E-3x, Matching layers in **TST_L05B** must be at Level E, where x = a-g

- Records with matching STATE_CODE, SHRP_ID, CONSTRUCTION_NO, and LAYER_TYPE not in ('SS', 'RB'), must exist in **TST_L05B**.

  Error Message: **MON_DEFL_FLX_BAKCAL_LAYER**-E-6, Record(s) NOT found in **TST_L05B**.

- For matching STATE_CODE, SHRP_ID, CONSTRUCTION_NO, LAYER_TYPE not in ('SS', 'RB'), 0.8 * SUM(**TST_L05B**.REPR_THICKNESS)<=LAYER_THICKNESS <= 1.2 * SUM(**TST_L05B**.REPR_ THICKNESS)

  Error Message: **MON_DEFL_FLX_BAKCAL_LAYER**-E-7, 0.8 * SUM (**TST_L05B**. REPR_THICKNESS) = {value} <= LAYER_THICKNESS = {value} <= 1.2 * SUM (**TST_L05B**.REPR_THICKNESS) = {value}

- Records with matching STATE_CODE, SHRP_ID, and CONSTRUCTION_NO must not have **TST_L05B**.REPR_THICKNESS = 999.9

Error Message: **MON_DEFL_FLX_BAKCAL_LAYER**-E-8, Values of 999.9 were present in the sum REPR_THICKNESS from **TST_L05B**.

Table: MON_DEFL_FLX_BAKCAL_POINT

- If the **EXPERIMENT_SECTION** record with matching STATE_CODE, SHRP_ID, and CONSTRUCTION_NO has **EXPERIMENT_SECTION**.CN_CHANGE_REASON in (7, 12, 13, 18, 19, 20, 43, 44, 45, 46, 47, 48, 51, 52, 55, 56), then CONSTRUCTION_NO = REF_CONSTRUCTION_NO

  Error Message: **MON_DEFL_FLX_BAKCAL_POINT**-E-3, The CONSTRUCTION_NO and REF_CONSTRUCTION_NO do not match and the structural capacity of this section has changed.

Tables: MON_DEFL_FLX_BAKCAL_POINT, MON_DEFL_FLX_BAKCAL_BASIN

- For matching STATE_CODE, SHRP_ID, TEST_DATE, LANE_NO, POINT_LOC, DROP_HEIGHT, FWD_PASS, DROP_HOUR_MINUTE, **MON_DEFL_FLX_BAKCAL_BASIN**.RECORD_STATUS = 'E' (many to one check)

  Error Message: **MON_DEFL_FLX_BAKCAL_POINT**-E-2, Matching records in **MON_DEFL_FLX_BAKCAL_BASIN** are not at Level E.

Tables: MON_DEFL_FLX_BAKCAL_POINT, MON_DEFL_FLX_BAKCAL_LAYER

- For matching STATE_CODE, SHRP_ID, CONSTRUCTION_NO, BAKCAL_LAYER_NO, **MON_DEFL_FLX_BAKCAL_LAYER**.RECORD_STATUS = 'E' (many to one check)

  Error Message: **MON_DEFL_FLX_BAKCAL_POINT**-E-1, Matching records in **MON_DEFL_FLX_BAKCAL_LAYER** are not at Level E.

Table: MON_DEFL_FLX_BAKCAL_SECT

- If the **EXPERIMENT_SECTION** record with matching STATE_CODE, SHRP_ID, and CONSTRUCTION_NO has **EXPERIMENT_SECTION**.CN_CHANGE_REASON in (7, 12, 13, 18, 19, 20, 43, 44, 45, 46, 47, 48, 51, 52, 55, 56), then CONSTRUCTION_NO = REF_CONSTRUCTION_NO

  Error Message: **MON_DEFL_FLX_BAKCAL_SECT**-E-4, The CONSTRUCTION_NO and REF_CONSTRUCTION_NO do not match and the structural capacity of this section has changed.

- CALC_PVMT_TEMP_MIN <= CALC_PVMT_TEMP_MEAN <= CALC_PVMT_TEMP_MAX

  Error Message: **MON_DEFL_FLX_BAKCAL_SECT**-E-2, CALC_PVMT_TEMP fields fail MIN <= MEAN <= MAX test.

- ELASTIC_MODULUS_MIN<=ELASTIC_MODULUS_MEAN <= ELASTIC_MODULUS_MAX

Error Message: **MON_DEFL_FLX_BAKCAL_SECT**-E-3, ELASTIC_MODULUS fields fail MIN <= MEAN <= MAX test.

Tables: MON_DEFL_FLX_BAKCAL_SECT, MON_DEFL_FLX_BAKCAL_POINT

- For matching STATE_CODE, SHRP_ID, TEST_DATE, BAKCAL_LAYER_NO, DROP_HEIGHT, if **MON_DEFL_FLX_BAKCAL_POINT**.SECTION.STAT_INCLUDE_FLAG = '1', then **MON_DEFL_FLX_BAKCAL_POINT**.RECORD_STATUS = 'E' (one to many check)

  Error Message: **MON_DEFL_FLX_BAKCAL_SECT**-E-1, Matching records in **MON_DEFL_FLX_BAKCAL_POINT** must be at Level E.

Table: MON_DEFL_FLX_NMODEL_POINT, EXPERIMENT_SECTION

- If the **EXPERIMENT_SECTION** record with matching STATE_CODE, SHRP_ID, and CONSTRUCTION_NO has **EXPERIMENT_SECTION**.CN_CHANGE_REASON in (7, 12, 13, 18, 19, 20, 43, 44, 45, 46, 47, 48, 51, 52, 55, 56), then CONSTRUCTION_NO = REF_CONSTRUCTION_NO

  Error Message: **MON_DEFL_FLX_NMODEL_POINT**-E-3, The CONSTRUCTION_NO and REF_CONSTRUCTION_NO do not match and the structural capacity of this section has changed.

Tables: MON_DEFL_FLX_NMODEL_POINT, MON_DEFL_FLX_BAKCAL_BASIN

- For matching STATE_CODE, SHRP_ID, TEST_DATE, LANE_NO, FWD_PASS, POINT_LOC, **MON_DEFL_FLX_BAKCAL_BASIN**.RECORD_STATUS = 'E' (many to one check)

  Error Message: **MON_DEFL_FLX_NMODEL_POINT**-E-2, Matching records in **MON_DEFL_FLX_BAKCAL_BASIN** must be at Level E.

Tables: MON_DEFL_FLX_NMODEL_POINT, MON_DEFL_FLX_BAKCAL_LAYER

- For matching STATE_CODE, SHRP_ID, CONSTRUCTION_NO, BAKCAL_LAYER, **MON_DEFL_FLX_BAKCAL_LAYER**.RECORD_STATUS = 'E' (many to one check)

  Error Message: **MON_DEFL_FLX_NMODEL_POINT**-E-1, Matching records in **MON_DEFL_FLX_BAKCAL_LAYER** must be at Level E.

Table: MON_DEFL_FLX_NMODEL_SECT

- CALC_PVMT_TEMP_MIN <= CALC_PVMT_TEMP_MEAN <= CALC_PVMT_TEMP_MAX

  Error Message: **MON_DEFL_FLX_NMODEL_SECT**-E-2, CALC_PVMT_TEMP fields fail MIN <= MEAN <= MAX test.

- MODULUS_HIGHEST_LOAD_MIN <= MODULUS_HIGHEST_LOAD_MEAN <= MODULUS_HIGHEST_LOAD_MAX

Error Message: **MON_DEFL_FLX_NMODEL_SECT**-E-3, MODULUS_HIGHEST_LOAD fields fail MIN <= MEAN <= MAX test.

Tables: MON_DEFL_FLX_NMODEL_SECT, MON_DEFL_FLX_NMODEL_POINT

- For matching STATE_CODE, SHRP_ID, TEST_DATE, BAKCAL_LAYER_NO, if **MON_DEFL_FLX_NMODEL_POINT**.SECTION_STAT_INCLUDE_FLAG = '1', then **MON_DEFL_FLX_NMODEL_POINT**.RECORD_STATUS = 'E' (one to many check)

  Error Message: **MON_DEFL_FLX_NMODEL_SECT**-E-1, Matching records in **MON_DEFL_FLX_NMODEL_POINT** must be at Level E.

- For each record in **MON_DEFL_FLX_NMODEL_SECT**, at least five records must exist in **MON_DEFL_FLX_NMODEL_POINT** with matching STATE_CODE, SHRP_ID, TEST_DATE, BAKCAL_LAYER_NO

  Error Message: **MON_DEFL_FLX_NMODEL_SECT**-E-4, There must be at least 5 records in **MON_DEFL_FLX_NMODEL_POINT** with matching STATE_CODE, SHRP_ID, TEST_DATE, BAKCAL_LAYER_NO.

Table: MON_DEFL_LOC_INFO

- If LANE_NO not in {C4, C5, F4, F5, J4, J5}, then CRACK_JOINT_OPEN_WIDTH must be null

  Error message: **MON_DEFL_LOC_INFO**-E-101 Crack/joint width measurement should not exist for {STATE_CODE, SHRP_ID, TEST_DATE, TEST_TIME, LANE_NO}.

Tables: MON_DEFL_LOC_INFO, EXPERIMENT_SECTION

- For all records in **MON_DEFL_LOC_INFO**, if the record in **EXPERIMENT_SECTION** with matching STATE_CODE and SHRP_ID where CONSTRUCTION_NO = 1[2] and GPS_SPS = "G", and the right most character of **MON_DEFL_LOC_INFO**.LANE_NO = 0, then **MON_DEFL_LOC_INFO**.POINT_LOC must be between -31 - 0 or 152 - 183

  Error message: **MON_DEFL_LOC_INFO**-E-102 POINT_LOC for FWD test pit measurement not between -31 to 0 or 152 to 183 meters for {STATE_CODE, SHRP_ID, TEST_DATE, POINT_LOC}

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[2] This check does NOT match CONSTRUCTION_NO values between tables. Locations for deflection testing are based on original experimental assignment. Thus all values of CONSTRUCTION_NO in MON_DEFL_LOC_INFO should have the same test locations.

- For all records in **MON_DEFL_LOC_INFO**, if the record in **EXPERIMENT_SECTION** with matching STATE_CODE and SHRP_ID where CONSTRUCTION_NO = 1^2 and GPS_SPS = "G", and the right most character of **MON_DEFL_LOC_INFO**.LANE_NO <> 0, then **MON_DEFL_LOC_INFO**.POINT_LOC must be between -19 - 171

  Error message: **MON_DEFL_LOC_INFO**-E-103 POINT_LOC for FWD non-test pit measurement not between -19 to 171 meters for {STATE_CODE, SHRP_ID, TEST_DATE, POINT_LOC}

- For all records in **MON_DEFL_LOC_INFO**, if the record in **EXPERIMENT_SECTION** with matching STATE_CODE and SHRP_ID where CONSTRUCTION_NO = 1^2 and GPS_SPS = "S" and EXPERIMENT_NO =1, 2, 3, 4, or 8, then the rightmost character of **MON_DEFL_LOC_INFO**.LANE_NO <> 0

  Error Message: **MON_DEFL_LOC_INFO**-E-104 Test pit LANE_NO = {**MON_DEFL_LOC_INFO**.LANE_NO} not valid for SPS section {STATE_CODE, SHRP_ID, TEST_DATE, POINT_LOC}

Tables: MON_DEFL_LOC_INFO, EXPERIMENT_SECTION, SPS_PROJECT_STATIONS

Note to Programmer: To implement these checks at this time, perform a check to see if matching records exists in SPS_PROJECT_STATIONS. If it does not, then print the following error message MON_DEFL_LOC_INFO-E-111. Location of Test relative to section cannot be determined. No record for {TEST_SECTION} in SPS_PROJECT_STATIONS; manual review of location required {STATE_CODE, SHRP_ID, TEST_DATE, POINT_LOC}

- For each record in **MON_DEFL_LOC_INFO**, if the record in **EXPERIMENT_SECTION** with matching STATE_CODE and SHRP_ID where CONSTRUCTION_NO = 1^2, GPS_SPS = "S", and EXPERIMENT_NO is in {1, 2, 3, 4, 8, 9, 9C, 9J, 9N, 9O}, and SEAS_ID is null, for **SPS_PROJECT_STATIONS**.TEST_SECTION equal the combination of **MON_DEFL_LOC_INFO**.STATE_CODE and **MON_DEFL_LOC_INFO**.SHRP_ID, then -1.6 < **MON_DEFL_LOC_INFO**.POINT_LOC < **SPS_PROJECT_STATIONS**.END_STATION - **SPS_PROJECT_STATIONS.**START_STATION + 1.6

  Error message: **MON_DEFL_LOC_INFO**-E-105 FWD measurement on non-SMP SPS project not inside or within 1.6 meters of the monitoring section limits as determined by section length computed from **SPS_PROJECT_STATIONS** for **MON_DEFL_LOC_INFO** {STATE_CODE, SHRP_ID, TEST_DATE, POINT_LOC}.

- For each record in **MON_DEFL_LOC_INFO**, if the record in **EXPERIMENT_SECTION** with matching STATE_CODE and SHRP_ID where CONSTRUCTION_NO = 1^2, GPS_SPS = "S", and EXPERIMENT_NO is in {5, 6, 7} for **SPS_PROJECT_STATIONS**.TEST_SECTION equal the combination of **MON_DEFL_LOC_INFO**.STATE_CODE and **MON_DEFL_LOC_INFO**.SHRP_ID and the right most character of **MON_DEFL_LOC_INFO**.LANE_NO <> 0, then -1.6 < **MON_DEFL_LOC_INFO**.POINT_LOC < **SPS_PROJECT_STATIONS**.END_STATION - **SPS_PROJECT_STATIONS.**START_STATION + 1.6

  Error message: **MON_DEFL_LOC_INFO**-E-106 FWD measurement on SPS 5, 6, or 7 project with LANE_NO not ending in 0, not inside or within 1.6 meters of the monitoring section limits as determined by section length computed from **SPS_PROJECT_STATIONS** for **MON_DEFL_LOC_INFO** {STATE_CODE, SHRP_ID, TEST_DATE, POINT_LOC}.

- For each record in **MON_DEFL_LOC_INFO**, if the record in **EXPERIMENT_SECTION** with

matching STATE_CODE and SHRP_ID where CONSTRUCTION_NO = 1^2, GPS_SPS = "S", and EXPERIMENT_NO is in {5, 6, 7} for **SPS_PROJECT_STATIONS**.TEST_SECTION equal the combination of **MON_DEFL_LOC_INFO**.STATE_CODE and **MON_DEFL_LOC_INFO**.SHRP_ID and the right most character of **MON_DEFL_LOC_INFO**.LANE_NO = 0, then -31 **< MON_DEFL_LOC_INFO**.POINT_LOC and <= 0 or **SPS_PROJECT_STATIONS**.END_STATION - **SPS_PROJECT_STATIONS.**START_STATION **<= MON_DEFL_LOC_INFO**.POINT_LOC **<= SPS_PROJECT_STATIONS**.END_STATION - **SPS_PROJECT_STATIONS.**START_STATION + 31

Error message: **MON_DEFL_LOC_INFO**-E-107 FWD measurement on SPS 5, 6, or 7 project with LANE_NO ending in 0, not within 31 meters before or after monitoring section limits as determined by section length computed from **SPS_PROJECT_STATIONS** for **MON_DEFL_LOC_INFO** {STATE_CODE, SHRP_ID, TEST_DATE, POINT_LOC}.

Tables: MON_DEFL_LOC_INFO, **MON_DEFL_DEV_CONFIG**

- For each record in **MON_DEFL_LOC_INFO** a record must exist in **MON_DEFL_DEV_CONFIG** with matching CONFIGURATION_NO

  Error message: **MON_DEFL_LOC_INFO**-E-108 A matching record does not exist in **MON_DEFL_DEV_CONFIG** for **MON_DEFL_LOC_INFO** {SHRP_ID, STATE_CODE, TEST_DATE, TEST_TIME, CONFIGURATION_NO, POINT_LOC, LANE_NO}.

- For each record in **MON_DEFL_DEV_CONFIG** a record must exist in **MON_DEFL_LOC_INFO** with matching CONFIGURATION_NO

  Error message: **MON_DEFL_LOC_INFO**-E-109 A matching record does not exist in **MON_DEFL_LOC_INFO** for **MON_DEFL_DEV_CONFIG** {CONFIGURATION_NO}.

Tables: MON_DEFL_LOC_INFO, **MON_DEFL_TEMP_DEPTHS**, **EXPERIMENT_SECTION**

- For each record in **MON_DEFL_LOC_INFO** where LANE_NO is not in {S*, G*, L*, P*} and record in **EXPERIMENT_SECTION** with matching STATE_CODE and SHRP_ID with CONSTRUCTION_NO = 1^2, GPS_SPS="S" and EXPERIMENT_NO is not 3 or 4, then at least one record must exist in **MON_DEFL_TEMP_DEPTHS** with matching SHRP_ID, STATE_CODE, TEST_DATE

  Error message: **MON_DEFL_LOC_INFO**-E-110 Pavement layer temperature data set missing for {STATE_CODE, SHRP_ID, TEST_DATE, DEFL_UNIT_ID}.

*Note to Programmer: At this point, set RECORD_STATUS = E for all **MON_DEFL_LOC_INFO** records passing the previous level E checks.*

Tables: MON_DEFL_MASTER, MON_DEFL_LOC_INFO

*Note to Programmer: Perform this check after completing the level E checks on **MON_DEFL_LOC_INFO**.*

- For each record in **MON_DEFL_MASTER** at least 10 matching records in **MON_DEFL_LOC_INFO** must have RECORD_STATUS = 'E'

Error message: **MON_DEFL_MASTER**-E-101 less than 10 matching records exist in **MON_DEFL_LOC_INFO** for {STATE_CODE, SHRP_ID, TEST_DATE, DEFL_UNIT_ID}.

*Note to Programmer: At this point set RECORD_STATUS = E for all **MON_DEFL_MASTER** records passing the previous Level E check.*

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*Note to Programmer: The QC checks on **MON_DEFL_RGD_BAKCAL_LAYER** and **MON_DEFL_RGD_BAKCAL_BASIN** should be run before running checks on other tables***.**

Table: MON_DEFL_RGD_BAKCAL_LAYER, EXPERIMENT_SECTION

- If the **EXPERIMENT_SECTION** record with matching STATE_CODE, SHRP_ID, and CONSTRUCTION_NO has **EXPERIMENT_SECTION**.CN_CHANGE_REASON in (7, 12, 13, 18, 19, 20, 43, 44, 45, 46, 47, 48, 51, 52, 55, 56), then CONSTRUCTION_NO = REF_CONSTRUCTION_NO

  Error Message: **MON_DEFL_RGD_BAKCAL_LAYER**-E-2, CONSTRUCTION_NO and REF_CONSTRUCTION_NO are not equal. Compare layer structures in **TST_L05B** for CONSTRUCTION_NO and REF_CONSTRUCTION_NO. If no significant structural difference, manually upgrade RECORD_STATUS to E.

Tables: MON_DEFL_RGD_BAKCAL_LAYER, TST_L05B

- For each non-null **MON_DEFL_RGD_BAKCAL_LAYER**.L05B_BASE_NO_* field, the record in **TST_L05B** with matching STATE_CODE, SHRP_ID, REF_CONSTRUCTION_NO = CONSTRUCTION_NO, and L05B_BASE_NO_* = LAYER_NO must have RECORD_STATUS = E

  Error Message: **MON_DEFL_RGD_BAKCAL_LAYER**-E-1x, where x = a - g, Matching layers in **TST_L05B** must be at level E for {STATE_CODE, SHRP_ID, REF_CONSTRUCTION_NO, L05B_BASE_NO_*}.

- For each non-null **MON_DEFL_RGD_BAKCAL_LAYER**.L05B_PCC_LAYER_NO_* field, the record in **TST_L05B** with matching STATE_CODE, SHRP_ID, REF_CONSTRUCTION_NO = CONSTRUCTION_NO, and L05B_PCC_LAYER_NO_* = LAYER_NO must have RECORD_STATUS = E

  Error Message: **MON_DEFL_RGD_BAKCAL_LAYER**-E-1x, where x = h - j, Matching layers in **TST_L05B** must be at level E for {STATE_CODE, SHRP_ID, REF_CONSTRUCTION_NO, L05B_PCC_LAYER_NO_*}.

Tables: MON_DEFL_RGD_BAKCAL_BASIN, MON_DEFL_LOC_INFO

- One record in **MON_DEFL_LOC_INFO** with matching STATE_CODE, SHRP_ID, CONSTRUCTION_NO, TEST_DATE, LANE_NO, and POINT_LOC must have RECORD_STATUS equal E

  Error Message: **MON_DEFL_RGD_BAKCAL_BASIN**-E-1, There must be a matching record in **MON_DEFL_LOC_INFO** at Level E.

Tables: MON_DEFL_RGD_BAKCAL_BASIN, MON_DEFL_LOC_INFO, MON_DEFL_DEV_SENSORS

- For records in **MON_DEFL_DEV_SENSORS** with matching CONFIGURATION_NO determined from record in **MON_DEFL_LOC_INFO** with matching STATE_CODE, SHRP_ID, TEST_DATE, and LANE_NO, the CENTER_OFFSET must be equal to the following:

SENSOR_NO	CENTER_OFFSET
1	0
3	305
5	610
6	914

  And, **MON_DEFL_DEV_SENSORS**.CENTER_OFFSET_FLAG must be null

  Error Message: **MON_DEFL_RGD_BAKCAL_BASIN**-E-2, Sensor offsets do not match values used in the backcalculation or CENTER_OFFSET_FLAG is not null. {SENSOR_NO, CENTER_OFFSET}.

*Note to Programmer: This check only needs to be performed once for each set of records in **MON_DEFL_RGD_BAKCAL_BASIN** with matching STATE_CODE, SHRP_ID, TEST_DATE and LANE_NO. If one record fails this check, all matching records fail the check. For computational efficiency, it may be necessary to first sort **MON_DEFL_RGD_BAKCAL_BASIN** by STATE_CODE, SHRP_ID, and TEST_DATE so that blocks of matching records can be treated as a group. Also, if the set of records in **MON_DEFL_DEV_SENSORS** with the same CONFIGURATION_NO fail this check, then all other checks on **MON_DEFL_RGD_BAKCAL_BASIN** with the same CONFIGURATION_NO will/should also fail. Consideration should also be given to tailoring the error message to reduce the amount printout; i.e., it might be more prudent to list all of the records in **MON_DEFL_RGD_BAKCAL_BASIN** that fail, rather than to list all of the records as indicated above.*

Table: MON_DEFL_RGD_BAKCAL_POINT

- For the same record, if (2 <= KVAL_FLAG <= 5) or (2 <= RAD_REL_STIFF_DL_FLAG <= 5) or (2 <= EPCC_DL_FULL_BOND_FLAG <= 5), then KVAL_FLAG = RAD_REL_STIFF_DL_FLAG and KVAL_FLAG = EPCC_DL_FULL_BOND_FLAG

  Error Message: **MON_DEFL_RGD_BAKCAL_POINT**-E-4, Invalid combination of KVAL_FLAG = {value}, RAD_REL_STIFF_DL_FLAG = {value}, and EPCC_DL_FULL_BOND_FLAG = {value}.

- For the same record, if (2 <= KVAL_FLAG <= 5) or (2 <= RAD_REL_STIFF_DL_FLAG <= 5) or (2 <= EPCC_DL_FULL_SLIP_FLAG <= 5), then KVAL_FLAG = RAD_REL_STIFF_DL_FLAG and KVAL_FLAG = EPCC_DL_FULL_SLIP_FLAG

  Error Message: **MON_DEFL_RGD_BAKCAL_POINT**-E-5, Invalid combination of KVAL_FLAG = {value}, RAD_REL_STIFF_DL_FLAG = {value}, and EPCC_DL_FULL_SLIP_FLAG = {value}.

- For the same record, if 2 <= KVAL_FLAG <= 6, then SECT_STAT_INCLUDE_FLAG_DL = 2

  Error Message: **MON_DEFL_RGD_BAKCAL_POINT**-E-6, Invalid combination of KVAL_FLAG = {value} and SECT_STAT_INCLUDE_FLAG_DL = {value}.

- For the same record, if (2 <= ESUBGR_FLAG <= 5) or (2 <= RAD_REL_STIFF_ES_FLAG <= 5) or (2 <= EPCC_ES_FLAG <= 5), then ESUBGR_FLAG = RAD_REL_STIFF_ES_FULL_BOND_FLAG and KVAL_FLAG = EPCC_ES_FLAG

  Error Message: **MON_DEFL_RGD_BAKCAL_POINT**-E-7, Invalid combination of ESUBGR_FLAG = {value}, RAD_REL_STIFF_ES_FULL_BOND_FLAG = {value}, and EPCC_ES_FLAG = {value}.

- For the same record, if (2 <= ESUBGR_FLAG <= 5) or (2 <= RAD_REL_STIFF_ES_FLAG <= 5) or (2 <= EPCC_ES_FLAG <= 5), then ESUBGR_FLAG = RAD_REL_STIFF_ES_FULL_SLIP_FLAG and KVAL_FLAG = EPCC_ES_FLAG

  Error Message: **MON_DEFL_RGD_BAKCAL_POINT**-E-8, Invalid combination of ESUBGR_FLAG = {value}, RAD_REL_STIFF_ES_FULL_SLIP_FLAG = {value}, and EPCC_ES_FLAG = {value}.

- For the same record, if 2 <= ESUBGR_FLAG <= 6, then SECT_STAT_INCLUDE_FLAG_ES = 2

  Error Message: **MON_DEFL_RGD_BAKCAL_POINT**-E-9, Invalid combination of ESUBGR_FLAG = {value} and SECT_STAT_INCLUDE_FLAG_ES = {value}.

- For the same record, if SECT_STAT_INCLUDE_FLAG_DL = 2, then SECT_STAT_INCLUDE_FLAG_ES <> 2, and vice versa.

  Error Message: **MON_DEFL_RGD_BAKCAL_POINT**-E-14, Invalid combination of SECT_STAT_INCLUDE_FLAG_DL = {value} and SECT_STAT_INCLUDE_FLAG_ES = {value}.

- For the same record, if EBASE_DL_FULL_BOND is not NULL, then EPCC_DL_FULL_BOND >= EBASE_DL_FULL_BOND

  Error Message: **MON_DEFL_RGD_BAKCAL_POINT**-E-16, Invalid combination of EPCC_DL_FULL_BOND = {value} and EBASE_DL_FULL_BOND = {value}.

- For the same record, if EBASE_DL_FULL_SLIP is not NULL, then EPCC_DL_FULL_SLIP >= EBASE_DL_FULL_SLIP

  Error Message: **MON_DEFL_RGD_BAKCAL_POINT**-E-17, Invalid combination of EPCC_DL_FULL_SLIP = {value} and EBASE_DL_FULL_SLIP = {value}.

- For the same record, if EBASE_ES_FULL_BOND is not NULL, then EPCC_ES_FULL_BOND >= EBASE_ES_FULL_BOND

  Error Message: **MON_DEFL_RGD_BAKCAL_POINT**-E-19, Invalid combination of EPCC_ES_FULL_BOND = {value} and EBASE_ES_FULL_BOND = {value}.

- For the same record, if EBASE_ES_FULL_SLIP is not NULL, then EPCC_ES_FULL_SLIP >= EBASE_ES_FULL_SLIP

Error Message: **MON_DEFL_RGD_BAKCAL_POINT**-E-20, Invalid combination of EPCC_ES_FULL_SLIP = {value} and EBASE_ES_FULL_SLIP = {value}.

Tables: MON_DEFL_RGD_BAKCAL_POINT, MON_DEFL_RGD_BAKCAL_BASIN

- For records in **MON_DEFL_RGD_BAKCAL_BASIN** with matching STATE_CODE, SHRP_ID, TEST_DATE, LANE_NO, FWD_PASS, POINT_LOC, TEST_TIME, and DROP_HEIGHT, RECORD_STATUS must equal "E"

  Error Message: **MON_DEFL_RGD_BAKCAL_POINT**-E-2, Matching records in **MON_DEFL_RGD_BAKCAL_BASIN** are not at Level E.

Tables: MON_DEFL_RGD_BAKCAL_POINT, MON_DEFL_RGD_BAKCAL_LAYER

- One record must exist in **MON_DEFL_RGD_BAKCAL_LAYER** with matching SHRP_ID, STATE_CODE, and CONSTRUCTION_NO with RECORD_STATUS = E

  Error Message: **MON_DEFL_RGD_BAKCAL_POINT**-E-1, No matching records in **MON_DEFL_RGD_BAKCAL_LAYER** with RECORD_STATUS = E.

Tables: MON_DEFL_RGD_BAKCAL_SECT, MON_DEFL_MASTER

- For records in **MON_DEFL_MASTER** with matching STATE_CODE, SHRP_ID, and TEST_DATE, RECORD_STATUS must equal "E"

  Error Message: **MON_DEFL_RGD_BAKCAL_SECT**-E-2, Matching records in **MON_DEFL_MASTER** are not at level E.

Tables: MON_DEFL_RGD_BAKCAL_SECT, MON_DEFL_RGD_BAKCAL_POINT

- More than three records must exist in **MON_DEFL_RGD_BAKCAL_POINT** with matching STATE_CODE, SHRP_ID, CONSTRUCTION_NO, TEST_DATE, and FWD_PASS with RECORD_STATUS = E

  Error Message: **MON_DEFL_RGD_BAKCAL_SECT**-E-3, At least three matching records do not exist in **MON_DEFL_RGD_BAKCAL_POINT** with RECORD_STATUS = E.

Tables: MON_DEFL_RGD_BAKCAL_SECT, MON_DEFL_RGD_BAKCAL_LAYER

- For every record in **MON_DEFL_RGD_BAKCAL_LAYER** with matching STATE_CODE, SHRP_ID, and CONSTRUCTION_NO with RECORD_STATUS = E, -0.1 < **MON_DEFL_RGD_BAKCAL_ LAYER**.MODULUS_RATIO - MODULUS_RATIO < 0.1

  Error Message: **MON_DEFL_RGD_BAKCAL_SECT**-E-4, EPCC to EBASE modulus ratio is different from the ratio in the matching record in **MON_DEFL_RGD_BAKCAL_LAYER**, or the latter does not exist.

Table: MON_DEFL_RGD_BAKCAL_SECT

- For the same record, NO_DL_ACCEPT <= TOT_NO_BASINS

  Error Message: **MON_DEFL_RGD_BAKCAL_SECT**-E-6, NO_DL_ACCEPT = {value) > TOT_NO_BASINS = {value).

- For the same record, NO_ES_ACCEPT <= TOT_NO_BASINS

  Error Message: **MON_DEFL_RGD_BAKCAL_SECT**-E-7, NO_ES_ACCEPT = {value) > TOT_NO_BASINS = {value).

- For the same record, NO_EPCC_DL_ACCEPT <= NO_DL_ACCEPT

  Error Message: **MON_DEFL_RGD_BAKCAL_SECT**-E-8, NO_EPCC_DL_ACCEPT = {value) > NO_DL_ACCEPT = {value).

- For the same record, NO_EPCC_ES_ACCEPT <= NO_ES_ACCEPT

  Error Message: **MON_DEFL_RGD_BAKCAL_SECT**-E-9, NO_EPCC_ES_ACCEPT = {value) > NO_ES_ACCEPT = {value).

- For the same record, if NO_DL_ACCEPT < 0.3 * TOT_NO_BASINS, then DL_STAT_FLAG = 2

  Error Message: **MON_DEFL_RGD_BAKCAL_SECT**-E-10, Invalid combination of NO_DL_ACCEPT = {value), TOT_NO_BASINS = {value), and DL_STAT_FLAG = {value).

- For the same record, if NO_ES_ACCEPT < 0.3 * TOT_NO_BASINS, then ES_STAT_FLAG = 2

  Error Message: **MON_DEFL_RGD_BAKCAL_SECT**-E-11, Invalid combination of NO_ES_ACCEPT = {value), TOT_NO_BASINS = {value), and ES_STAT_FLAG = {value).

- For the same record, K_VAL_MIN <= K_VAL_MEAN <= K_VAL_MAX

  Error Message: **MON_DEFL_RGD_BAKCAL_SECT**-E-20, Invalid combination of K_VAL_MIN = {value), K_VAL_MEAN = {value), and K_VAL_MAX = {value).

- For the same record, ESUBGR_MIN <= ESUBGR_MEAN <= ESUBGR_MAX

  Error Message: **MON_DEFL_RGD_BAKCAL_SECT**-E-21, Invalid combination of ESUBGR_MIN = {value), ESUBGR_MEAN = {value), and ESUBGR_MAX = {value).

- For the same record, RAD_REL_STIFF_DL_MIN <= RAD_REL_STIFF_DL_MEAN <= RAD_REL_STIFF_DL_MAX

  Error Message: **MON_DEFL_RGD_BAKCAL_SECT**-E-22, Invalid combination of RAD_REL_STIFF_DL_MIN = {value), RAD_REL_STIFF_DL_MEAN = {value), and RAD_REL_STIFF_DL_MAX = {value).

- For the same record, RAD_REL_STIFF_ES_MIN <= RAD_REL_STIFF_ES_MEAN <= RAD_REL_STIFF_ES_MAX

Error Message: **MON_DEFL_RGD_BAKCAL_SECT**-E-23, Invalid combination of RAD_REL_STIFF_ES_MIN = {value), RAD_REL_STIFF_ES_MEAN = {value), and RAD_REL_STIFF_ES_MAX = {value).

- For the same record, EPCC_DL_MIN <= EPCC_DL_MEAN <= EPCC_DL_MAX

  Error Message: **MON_DEFL_RGD_BAKCAL_SECT**-E-24, Invalid combination of EPCC_DL_MIN = {value), EPCC_DL_MEAN = {value), and EPCC_DL_MAX = {value).

- For the same record, EPCC_ES_MIN <= EPCC_ES_MEAN <= EPCC_ES_MAX

  Error Message: **MON_DEFL_RGD_BAKCAL_SECT**-E-25, Invalid combination of EPCC_ES_MIN = {value), EPCC_ES_MEAN = {value), and EPCC_ES_MAX = {value).

- For the same record, EBASE_DL_MIN <= EBASE_DL_MEAN <= EBASE_DL_MAX

  Error Message: **MON_DEFL_RGD_BAKCAL_SECT**-E-26, Invalid combination of EBASE_DL_MIN = {value), EBASE_DL_MEAN = {value), and EBASE_DL_MAX = {value).

- For the same record, EBASE_ES_MIN <= EBASE_ES_MEAN <= EBASE_ES_MAX

  Error Message: **MON_DEFL_RGD_BAKCAL_SECT**-E-27, Invalid combination of EBASE_ES_MIN = {value), EBASE_ES_MEAN = {value), and EBASE_ES_MAX = {value).

Table: MON_DEFL_TEMP_DEPTHS

- LAYER_TEMP_DEPTH_1 <> Null or 0

  Error message: **MON_DEFL_TEMP_DEPTHS**-E-103 The level C and D checks on LAYER_TEMPERATURE_DEPTH_1 should never be manually upgraded when it is Null or zero for {STATE_CODE, SHRP_ID, TEST_DATE, POINT_LOC}.

- If LAYER_TEMP_DEPTH_1 and LAYER_TEMP_DEPTH_2 are Not Null, then LAYER_TEMP_DEPTH_1 < LAYER_TEMP_DEPTH_2

  Error message: **MON_DEFL_TEMP_DEPTHS**-E-101 LAYER_TEMP_DEPTH_1 = {LAYER_TEMP_DEPTH_1} is deeper than LAYER_TEMP_DEPTH_2 = {LAYER_TEMP_DEPTH-2} for {STATE_CODE, SHRP_ID, TEST_DATE, POINT_LOC}; this error should not be manually upgraded.

- If LAYER_TEMP_DEPTH_2 and LAYER_TEMP_DEPTH_3 are Not Null, then LAYER_TEMP_DEPTH_2 < LAYER_TEMP_DEPTH_3

  Error message: **MON_DEFL_TEMP_DEPTHS**-E-102 LAYER_TEMP_DEPTH_2 = {LAYER_TEMP_DEPTH_2} is deeper than LAYER_TEMP_DEPTH_3 = {LAYER_TEMP_DEPTH_3} for {STATE_CODE, SHRP_ID, TEST_DATE, POINT_LOC}; this error should not be manually upgraded.

- If LAYER_TEMP_DEPTH_3 and LAYER_TEMP_DEPTH_4 are Not Null, then LAYER_TEMP_DEPTH_3 < LAYER_TEMP_DEPTH_4

  Error message: **MON_DEFL_TEMP_DEPTHS**-E-105 LAYER_TEMP_DEPTH_3 = {LAYER_TEMP_DEPTH_3} is deeper than LAYER_TEMP_DEPTH_4 =

{LAYER_TEMP_DEPTH_4} for {STATE_CODE, SHRP_ID, TEST_DATE, POINT_LOC}; this error should not be manually upgraded.

- If LAYER_TEMP_DEPTH_4 and LAYER_TEMP_DEPTH_5 are Not Null, then LAYER_TEMP_DEPTH_4 < LAYER_TEMP_DEPTH_5

  Error message: **MON_DEFL_TEMP_DEPTHS**-E-106 LAYER_TEMP_DEPTH_4 = {LAYER_TEMP_DEPTH_4} is deeper than LAYER_TEMP_DEPTH_5 = {LAYER_TEMP_DEPTH_5} for {STATE_CODE, SHRP_ID, TEST_DATE, POINT_LOC}; this error should not be manually upgraded.

Tables: MON_DEFL_TEMP_DEPTHS, EXPERIMENT_SECTION

- For records in **MON_DEFL_TEMP_DEPTHS**, if the record in **EXPERIMENT_SECTION** with matching STATE_CODE and SHRP_ID where CONSTRUCTION_NO = 1[3] and GPS_SPS = "G" -31 < **MON_DEFL_TEMP_DEPTHS**.POINT_LOC and < 0, OR 152 < **MON_DEFL_TEMP_ DEPTHS**.POINT_LOC < 183

  Error message: **MON_DEFL_TEMP_DEPTHS**-E-107 Temp location is either within the monitoring section, or more than 31m from either end of test section, temperature may not be representative, confirm location for {STATE_CODE, SHRP_ID, TEST_DATE, POINT_LOC}.

Tables: MON_DEFL_TEMP_DEPTHS, EXPERIMENT_SECTION, SPS_PROJECT_STATIONS

*Note to Programmer: To implement these checks at this time, perform a check to see if matching records exists in SPS_PROJECT_STATIONS, if it does not, then print the following error message **MON_DEFL_TEMP_DEPTHS**-E-108. Location of temperature relative to section cannot be determined. No record for {TEST_SECTION} in **SPS_PROJECT_STATIONS**; manual review of location required {STATE_CODE, SHRP_ID, TEST_DATE, POINT_LOC}.*

- For records in **MON_DEFL_TEMP_DEPTHS**, if the record in **EXPERIMENT_SECTION** with matching STATE_CODE and SHRP_ID where CONSTRUCTION_NO = 1[3] and GPS_SPS = "S" for **SPS_PROJECT_STATIONS**.TEST_SECTION equal the combination of **MON_DEFL_LOC_INFO**.STATE_CODE and **MON_DEFL_LOC_INFO**.SHRP_ID, then -31 < **MON_DEFL_TEMP_DEPTHS**.POINT_LOC <0, OR
  SPS_PROJECT_STATIONS.END_STATION -
  SPS_PROJECT_STATIONS.START_STATION <=
  MON_DEFL_TEMP_DEPTHS.POINT_LOC <=
  SPS_PROJECT_STATIONS.END_STATION -
  SPS_PROJECT_STATIONS.START_STATION + 31

  Error message: **MON_DEFL_TEMP_DEPTHS**-E-109 Temp location is either within the monitoring section or more than 31m from either end of test section as determined by section length from **SPS_PROJECT_STATIONS,** confirm location for **MON_DEFL_TEMP_DEPTHS** {STATE_CODE, SHRP_ID, TEST_DATE, POINT_LOC}.

Tables: MON_DEFL_TEMP_DEPTHS, MON_DEFL_MASTER

[3] This check does NOT match CONSTRUCTION_NO values between tables. Locations for deflection testing are based on original experimental assignment. Thus all values of CONSTRUCTION_NO in MON_DEFL_LOC_INFO should have the same test locations.

- For each record in **MON_DEFL_TEMP_DEPTHS** at least one record must exist in **MON_DEFL_MASTER** with matching STATE_CODE, SHRP_ID and TEST_DATE

  Error message: **MON_DEFL_TEMP_DEPTHS**-E-110 No matching record exists in **MON_DEFL_MASTER** for record in **MON_DEFL_TEMP_DEPTHS** {STATE_CODE, SHRP_ID, TEST_DATE}.

*Note to Progammer: At this point, set RECORD_STATUS = E for all **MON_DEFL_TEMP_DEPTHS** records passing the previous level E checks.*

Tables: MON_DEFL_TEMP_VALUES, MON_DEFL_MASTER

- For each record in **MON_DEFL_TEMP_VALUES** at least one record must exist in **MON_DEFL_MASTER** with matching STATE_CODE, SHRP_ID and TEST_DATE

  Error message: **MON_DEFL_TEMP_VALUES**-E-101 No matching record exists in **MON_DEFL_MASTER** for record in **MON_DEFL_TEMP_VALUES** {STATE_CODE, SHRP_ID, TEST_DATE}.

Tables: MON_DEFL_TEMP_VALUES, MON_DEFL_LOC_INFO

- For each record in **MON_DEFL_TEMP_VALUES** at least one record must exist in **MON_DEFL_LOC_INFO** with matching STATE_CODE, SHRP_ID and TEST_DATE

  Error message: **MON_DEFL_TEMP_VALUES**-E-102 No matching record exists in **MON_DEFL_LOC_INFO** for record in **MON_DEFL_TEMP_VALUES** {STATE_CODE, SHRP_ID, TEST_DATE}.

- For each record in **MON_DEFL_TEMP_VALUES** where **MON_DEFL_TEMP_VALUES**.LAYER_TEMPERATURE_1 is not null, then for all records in **MON_DEFL_LOC_INFO** with matching STATE_CODE, SHRP_ID, and TEST_DATE -15<= **MON_DEFL_TEMP_VALUES**.LAYER_TEMPERATURE_1 - **MON_DEFL_LOC_INFO**.PVMT_SURF_TEMP -15 <=15

  Error message: **MON_DEFL_TEMP_VALUES**-E-103 For {STATE_CODE, SHRP_ID, TEST_DATE} absolute difference in surface temp. {PVMT_SURF_TEMP} and 1st layer temp {LAYER_TEMPERATURE_1} exceeds 15 degrees C.

Tables: MON_DEFL_TEMP_VALUES, MON_DEFL_TEMP_DEPTHS

- For each record in **MON_DEFL_TEMP_VALUES** a record in **MON_DEFL_TEMP_DEPTHS** with matching SHRP_ID, STATE_CODE, TEMPERATURE_DATE, and LOCATION_NO must exist

  Error message: **MON_DEFL_TEMP_VALUES**-E-104 Matching record does not exist in **MON_DEFL_TEMP_DEPTHS** for **MON_DEFL_TEMP_VALUES** = {SHRP_ID, STATE_CODE, TEST_DATE, POINT_LOC, TIME_LAYER_TEMP}.

- For each record in **MON_DEFL_TEMP_VALUES** the following conditions must exist for record in **MON_DEFL_TEMP_DEPTHS** with matching SHRP_ID, STATE_CODE, TEST_DATE, and POINT_LOC: If **MON_DEFL_TEMP_VALUES.**LAYER_TEMPERATURE_1 is Not Null, then

MON_DEFL_TEMP_DEPTHS.LAYER_TEMP_DEPTH_1 must be Not Null
And
If **MON_DEFL_TEMP_VALUES.**LAYER_TEMPERATURE_2 is Not Null, then
MON_DEFL_TEMP_DEPTHS.LAYER_TEMP_DEPTH_2 must be Not Null
And
If **MON_DEFL_TEMP_VALUES.**LAYER_TEMPERATURE_3 is Not Null, then
MON_DEFL_TEMP_DEPTHS.LAYER_TEMP_DEPTH_3 must be Not Null
And
If **MON_DEFL_TEMP_VALUES.**LAYER_TEMPERATURE_4 is Not Null, then
MON_DEFL_TEMP_DEPTHS.LAYER_TEMP_DEPTH_4 must be Not Null
And
If **MON_DEFL_TEMP_VALUES.**LAYER_TEMPERATURE_5 is Not Null, then
MON_DEFL_TEMP_DEPTHS.LAYER_TEMP_DEPTH_5 must be Not Null

Error message: **MON_DEFL_TEMP_VALUES**-E-105 Missing temperature measurement depth in **MON_DEFL_TEMP_DEPTHS** for **MON_DEFL_TEMP_VALUES** {SHRP_ID, STATE_CODE, TEST_DATE, POINT_LOC, TIME_LAYER_TEMP}.

- For each record in **MON_DEFL_TEMP_DEPTHS** at least one record must exist in **MON_DEFL_TEMP_VALUES** for matching SHRP_ID, STATE_CODE, TEST_DATE, POINT_LOC

  Error message: **MON_DEFL_TEMP_VALUES**-E-106 Missing temperature measurement records in **MON_DEFL_TEMP_VALUES** for **MON_DEFL_TEMP_DEPTHS** {SHRP_ID, STATE_CODE, TEST_DATE, POINT_LOC}.

Note to Progammer: At this point, set RECORD_STATUS = E for all ***MON_DEFL_TEMP_VALUES*** *records passing the previous level E checks.*

Table: All FWD tables

The following intra-module checks must be made for each deflection test (i.e., for each record in **MON_DEFL_MASTER**). Only after all of the checks have been satisfied, can each of the associated records be stepped up to Level E indicating that a particular deflection test has passed the intra-module checks.

- For each **MON_DEFL_MASTER** record, a matching record in **MON_DEFL_LOC_INFO** where LANE_NO <> S*, G*, P*, L* and SHRP_ID <> ?3– or ?4– should have a matching and valid record (i.e., a record that has reached level D) in both **MON_DEFL_TEMP_DEPTHS** and **MON_DEFL_TEMP_VALUES**

- Check that at least one valid record exists in **MON_DEFL_DROP_DATA** for each record in **MON_DEFL_LOC_INFO**

- Check that valid records exist in **MON_DEFL_DEV_CONFIG** and **MON_DEFL_DEV_SENSORS** for each record in **MON_DEFL_LOC_INFO**

5.2 Manual Upgrade Guidelines

The following actions can be taken whenever data with known errors has been uploaded or when records fail the various QC checks:

Delete Data	Single data fields, multiple fields and complete records can be removed.
Edit Data	Change data elements.
Manually Upgrade Data	After inspection of records failing checks, SQL statements can be applied to increase RECORD_STATUS to the next level. In some instances, a record failing a check may be left at its highest level of RECORD_STATUS without removal from the database.

Delete Data

Erroneous data caused by measurement and equipment errors should be removed from the IMS. In some cases single or groups of data elements within a record can be removed, and in other cases the entire record should be deleted. If records are to be modified, then the modification should occur prior to running the QC check programs. If records are modified after running the QC programs, then all related records for the field measurement set in the other **MON_DEFL_*** tables must have their RECORD_STATUS reset to A and the QC programs re-executed. If changes are made to a data set and it is reloaded, then **MON_DEFL_MASTER**.LOAD_DATE should be set to the current date. Some examples of deletions of FWD data include:

- Bad air or surface temperature measurements from the on-board FWD temperature sensors should be deleted
- Within a drop data set record in **MON_DEFL_DROP_DATA**, peak deflection measurements can be removed under the following conditions:
  - Measurements contained in the PEAK_DEFL_1 field can be deleted from a record if the value exceeds 2032 microns. Note that this is based on the maximum limit of accuracy for the deflection sensors stated by the manufacturer
  - If PEAK_DEFL_2 exceeds 2032 microns, and PEAK_DEFL_1 also exceeds 2032 microns, and if the test is a basin measurement, then both PEAK_DEFL_1 and PEAK_DEFL_2 can be deleted from a record
  - If the test is a load transfer measurement, then the complete record must be deleted if any of the PEAK_DEFL_* values exceed 2032 microns
  - If the test is a basin test and PEAK_DEFL_*N* where *N* is 3 or greater exceeds 2032 microns, then the complete record must be removed
  - If any of the PEAK_DEFL_* readings are negative, the complete record should be deleted
- For records in **MON_DEFL_DROP_DATA** failing the minimum level D range check on PEAK_DEFL_*, the entire drop data set should be examined for reasonableness. It has been found that drop data sets which contain zero peak deflections are most often associated with equipment errors and have irregular deflection basin shapes. Records with anomalous or erroneous deflection basins should be deleted. In some cases it is useful to refer to the COMMENTS_1 and COMMENTS_2 field in the related record in **MON_DEFL_LOC_INFO** to see if the field operator has identified the drop set as being erroneous. In many cases such as this, the entire drop set should be deleted as well as the related record in **MON_DEFL_LOC_INFO**.
- In general, single fields or values in the **MON_DEFL_DEV_SENSORS** and

MON_DEFL_DEV_CONFIG tables should never be deleted. Deletions to these tables should be made to complete records if needed. However since multiple FWD data sets from measurements performed on different days at different sites can share the same records in these tables; i.e. have the same CONFIGURATION_NO, these deletions should be performed with caution. If records in either one of these tables are deleted, then the record with matching CONFIGURATION_NO in the other table must be deleted as well as complete FWD data sets with matching CONFIGURATION_NO in the **MON_DEFL_LOC_INFO**.

Edit Data

Within this context, editing data means changing the value of a field in the data base. This should only be performed when there is overwhelmingly convincing evidence available which supports the change. If records are to be modified, then the modification should occur prior to running the QC check programs. In general, if data fields in a record are modified after running the QC programs, then all related records for the field measurement set in the other **MON_DEFL_*** tables must have their RECORD_STATUS reset to A and the QC programs re-executed. There are a few edits that can be made without the need to reset RECORD_STATUS, as noted below. If changes are made to a data set after they have been previously uploaded to the IMS, then **MON_DEFL_MASTER**.LOAD_DATE should be set to the current date.

- The following edits can be made without need to reset RECORD_STATUS:
  - Changes to the comments fields in **MON_DEFL_LOC_INFO**
  - Changes to the values in **MON_DEFL_DROP_DATA**.HISTORY_STORED, although an edit to this field should not normally be needed
  - Entry of or changes to values in **MON_DEFL_DEV_SENSORS**.CENTER_OFFSET_FLAG of 1 or 2
  - Changes to **MON_DEFL_TEMP_VALUES**.WEATHER_CONDITION
- The following fields can be edited, provided convincing evidence is available supporting the change. If any of these fields are modified, the RECORD_STATUS of all other related records in the **MON_DEFL_*** tables should be reset to A. (Note that for some of these changes, the IMS will automatically reset the record status back to A.)
  - LANE_NO in **MON_DEFL_LOC_INFO** and **MON_DEFL_DROP_DATA**. Note that if changes are made to this field in either table, then the change must also be made to related records in the other table. Since LANE_NO is a key field, it can not be changed to a value for another existing record.
  - If a value of 3 is entered in **MON_DEFL_DEV_SENSORS**.CENTER_OFFSET_FLAG field, then the record status in **MON_DEFL_DEV_SENSORS** should be reset to A so that the QC will check for matching record(s) in **MON_DEFL_EST_SENSOR_OFFSET** table
  - Correction of entries to .LAYER_TEMP_DEPTH* or LOCATION_NO in **MON_DEFL_TEMP_DEPTHS**. The QC needs to be re-run to check related entries in **MON_DEFL_TEMP_VALUES** and valid range.
  - Correction of entries to LAYER_TEMPERATURE_* or LOCATION_NO in **MON_DEFL_TEMP_VALUES.** The QC needs to be re-run to check related entries in **MON_DEFL_TEMP_DEPTHS** and valid range.

Manually Upgrade Data

The following tables should never be manually upgraded: **MON_DEFL_FLX_*.**

One concept in development of the QC checks is to flag data extremes, illogical relationships, and data relationships which violate LTPP test protocols. The FWD QC specifications were significantly revised based on problems that have been identified with the FWD data. Some of the checks were set to catch the "symptoms" of errant or abnormal data, but because of the structure and nature of the data, data failing a check does not always mean the data is bad. Therefore, the RCOCs must exercise judgment in the upgrade decision. In most cases an investigation of the data will be required to differentiate good from bad data and to make the decision on whether or not to apply a manual upgrade, remove the errant data, or leave the data in the IMS at a sub-level E status. The following examples are not exhaustive; other conditions may exist which may dictate another action. When in doubt, FHWA guidance and approval should be sought.

The following are some examples of when data failing a QC check should **not** be upgraded.

- In general, data failing a level C check should not be upgraded. The level C checks are considered mandatory data elements. Records failing these checks, and those in other related tables should be considered for removal from the IMS.

- When a peak deflection value exceeds 2,032 microns. See previous discussion on deletion of fields with excessive deflection.

- Crack and joint opening measurements which exceed 25-mm. This is the maximum value that can be entered by protocol. Values greater than 25-mm generally indicate that the measurements were not performed using a metric measurement device.

- Data sets for which the deflection sensors relative gain values exceed the level D specifications. In this situation, consideration should be given to either removing the peak deflection values of the offending sensor, or leaving the entire FWD data set at level C.

- Data sets for which the POINT_LOC values exceed the level D specification. The level D ranges have been set so that measurements occurring more than 31 m (100 feet) in front of or after a 304 m (1000 foot) test section are flagged. More precise level E checks are also performed, in which the actual length of SPS test sections are determined from the **SPS_PROJECT_STATIONS** table. Thus, records for SPS test sections failing the POINT_LOC level E criteria may be due to an error in the **SPS_PROJECT_STATIONS** table, which should be corrected. In those cases where measurements outside the monitoring portion of the test section were performed for LANE_NO like J0 and F0, it is recommended that the matching records in **MON_DEFL_POINT_LOC** and **MON_DEFL_DROP_DATA** be left in the data base below level E, since some of these tests were performed as part of pre-SMP installation testing. Since these measurements were performed outside the monitoring portion of the test section, the objective of this action is to make them harder to obtain so that they are not automatically included in general data releases.

- Data sets with LANE_NO values which fail the level D check should not be upgraded. Instead the LANE_NO should be corrected in accordance with LTPP protocol. SPR's should be issued for valid LANE_NO that are not defined in the level D QC check.

- Records which fail logical (i.e. less than, greater than, equal to) level E date relationship checks should never be upgraded. The cause for these errors should be found and corrected.

- Records which fail the **MON_DEFL_LOC_INFO** level E check on CRACK_JOINT_OPEN_WIDTH. Crack and joint opening measurements should not be included for data sets in which the LANE_NO is not C4, C5, J4, or J5.

- Records which fail the **MON_DEFL_TEMP_DEPTHS** level E checks on relationship between LAYER_TEMP_DEPTH_(N) and LAYER_TEMP_DEPTH_(N + 1). These depths should be corrected so that LAYER_TEMP_DEPTH_(N) is shallower than LAYER_TEMP_DEPTH_(N + 1).

- Records which fail the level D check on **MON_DEFL_DEV_CONFIG**.PLATE_RADIUS. The LTPP FWDs are equipped with only the two defined size load plates. Records should not normally fail this check.

The following are examples of when records failing the QC should be manually upgraded:

- **MON_DEFL_DROP_DATA** records in which the peak deflections for the outer most sensors fail the minimum range check. In this case the deflection basin must pass an engineering reasonableness test in which the entire deflection basin must either all contain very small deflections, or the deflection basin suggests a very weak deflection signature with a very steep deflection-distance curvature. This check was added since it was found that the majority of data sets with zero, or very low, deflection responses were errant.

- Data sets which fail the level E check between LANE_NO and CENTER_OFFSET. This should only be done in the case where the RCOC has compelling evidence to suggest or prove that the data was collected with non-standard sensor spacings.

- Data sets which exhibit strange or abnormal behavior which cannot be attributed to equipment or measurement errors, provided they pass the test of engineering reasonableness

6.0 TRANSVERSE PROFILE AND RUTTING QC PROGRAMS

6.1 Level 1

A. Initial Level

Records in the IMS are at Level A when they first enter the system and are set back to A when changes are made to a given record or to selected related records.

B. Dependency Checks

No B Level checks are identified.

C. Minimum Data Elements

Tables and accompanying fields that must be included in a data record are identified below. Explanations are provided for those fields having certain conditions as to when they are required (i.e., X = always; * = conditionally).

Table	Field	Condition
MON_RUT_DEPTH_POINT	LEFT_RUT_DEPTH	X
	RIGHT_RUT_DEPTH	X
MON_T_PROF_CROSS_SLOPE	No level C checks	
MON_T_PROF_DEV_CONFIG	No level C checks	
MON_T_PROF_INDEX_POINT	No level C checks	
MON_T_PROF_INDEX_SECTION	No level C checks	
MON_T_PROF_MASTER	DEVICE_CODE	X
	NO_PROFILES	X
MON_T_PROF_PROFILE	X1	X
	X2	X
	X3	X
	X4	X
	X5	X
	X6	X
	X7	X
	X8	X
	X9	X
	X10	X
	Y1	X
	Y2	X

Y3	X
Y4	X
Y5	X
Y6	X
Y7	X
Y8	X
Y9	X
Y10	X

D. Expanded Range Checks

Expanded range checks are applied to certain fields to identify data element values that fall outside an expected range. Field names are listed below the bolded table name.

Table	Units	Range
MON_RUT_DEPTH_POINT		
LEFT_RUT_DEPTH	mm	0 - 76
RIGHT_RUT_DEPTH	mm	0 - 76
MON_T_PROF_CROSS_SLOPE		
ELEVATION_DIFF	mm	-200 - 200
T_PROF_WIDTH	mm	3000 - 5000
MON_T_PROF_DEV_CONFIG		
DIGITIZING_DATE		> 01-JAN-1988
MON_T_PROF_MASTER		
FOOTPAD_SPACING	mm	null, 300 - 310
PVMT_WIDTH	mm	null, 3000 - 5000
MON_T_PROF_PROFILE		
POINT_LOC		-8.0 - 307.0
X1	mm	0 - 5000
X2	mm	0 - 5000
X3	mm	0 - 5000
X4	mm	0 - 5000
X5	mm	0 - 5000
X6	mm	0 - 5000
X7	mm	0 - 5000
X8	mm	0 - 5000
X9	mm	0 - 5000
X10	mm	0 - 5000
X11	mm	null, 0 - 5000
X12	mm	null, 0 - 5000
X13	mm	null, 0 - 5000
X14	mm	null, 0 - 5000
X15	mm	null, 0 - 5000
X16	mm	null, 0 - 5000
X17	mm	null, 0 - 5000
X18	mm	null, 0 - 5000
X19	mm	null, 0 - 5000
X20	mm	null, 0 - 5000
X21	mm	null, 0 - 5000

X22	mm	null, 0 - 5000
X23	mm	null, 0 - 5000
X24	mm	null, 0 - 5000
X25	mm	null, 0 - 5000
X26	mm	null, 0 - 5000
X27	mm	null, 0 - 5000
X28	mm	null, 0 - 5000
X29	mm	null, 0 - 5000
X30	mm	null, 0 - 5000

MON_T_PROF_INDEX_POINT

NEGATIVE_AREA	mm^2	-110000 - 0
NEGATIVE_AREA_FLAG		1, 2
POSITIVE_AREA	mm^2	0 - 110000
POSITIVE_AREA_FLAG		1, 2
FILL_AREA	mm^2	0 - 110000
FILL_AREA_FLAG		1, 2
LLH_DEPTH_1_8	mm	0 - 100
LLH_DEPTH_1_8_FLAG		1, 2
LLH_OFFSET_1_8	mm	1370 - 4600
LLH_OFFSET_1_8_FLAG		1, 2
LLH_WIDTH_1_8	mm	0 - 1800
LLH_WIDTH_1_8_FLAG		1, 2
RLH_DEPTH_1_8	mm	0 - 100
RLH_DEPTH_1_8_FLAG		1, 2
RLH_OFFSET_1_8	mm	0 - 2300
RLH_OFFSET_1_8_FLAG		1, 2
RLH_WIDTH_1_8	mm	0 - 1800
RLH_WIDTH_1_8_FLAG		1, 2
LLH_DEPTH_WIRE_REF	mm	0 - 100
LLH_DEPTH_WIRE_REF_FLAG		1, 2
LLH_OFFSET_WIRE_REF	mm	1370 - 4600
LLH_OFFSET_WIRE_REF_FLAG		1, 2
LLH_WIDTH_WIRE_REF	mm	0 - 4600
LLH_WIDTH_WIRE_REF_FLAG		1, 2
RLH_DEPTH_WIRE_REF	mm	0 - 100
RLH_DEPTH_WIRE_REF_FLAG		1, 2
RLH_OFFSET_WIRE_REF	mm	0 - 2300
RLH_OFFSET_WIRE_REF_FLAG		1, 2
RLH_WIDTH_WIRE_REF	mm	0 - 4600
RLH_WIDTH_WIRE_REF_FLAG		1, 2
TRANS_PROFILE_MEASURE_LENGTH	mm	0 - 4600
DATA_PROCESS_EXTRACT_DATE	date	> July 4, 1998
SECTION_STAT_INCLUDE_FLAG		1, 2

MON_T_PROF_INDEX_SECTION

T_PROF_DEVICE_CODE		D or P
NO_PROFILES		0 - 22
NEGATIVE_AREA_MEAN	mm^2	-110000 - 0
NEGATIVE_AREA_STD	mm^2	0 - 40000
NEGATIVE_AREA_MIN	mm^2	-110000 - 0
NEGATIVE_AREA_MAX	mm^2	-110000 - 0
POSITIVE_AREA_MEAN	mm^2	0 - 110000
POSITIVE_AREA_STD	mm^2	0 - 40000
POSITIVE_AREA_MIN	mm^2	0 - 110000
POSITIVE_AREA_MAX	mm^2	0 - 110000

FILL_AREA_MEAN	mm^2	0 - 110000
FILL_AREA_STD	mm^2	0 - 40000
FILL_AREA_MIN	mm^2	0 - 110000
FILL_AREA_MAX	mm^2	0 - 110000
LLH_DEPTH_1_8_MEAN	mm	0 - 100
LLH_DEPTH_1_8_STD	mm	0 - 40
LLH_DEPTH_1_8_MIN	mm	0 - 100
LLH_DEPTH_1_8_MAX	mm	0 - 100
RLH_DEPTH_1_8_MEAN	mm	0 - 100
RLH_DEPTH_1_8_STD	mm	0 - 40
RLH_DEPTH_1_8_MIN	mm	0 - 100
RLH_DEPTH_1_8_MAX	mm	0 - 100
MAX_MEAN_DEPTH_1_8	mm	0 - 100
LLH_WIDTH_1_8_MEAN	mm	0 - 1800
LLH_WIDTH_1_8_STD	mm	0 - 800
LLH_WIDTH_1_8_MIN	mm	0 - 1800
LLH_WIDTH_1_8_MAX	mm	0 - 1800
LLH_OFFSET_1_8_MEAN	mm	1370 - 4600
LLH_OFFSET_1_8_STD	mm	0 - 800
LLH_OFFSET_1_8_MIN	mm	1370 - 4600
LLH_OFFSET_1_8_MAX	mm	1370 - 4600
RLH_WIDTH_1_8_MEAN	mm	0 - 1800
RLH_WIDTH_1_8_STD	mm	0 - 800
RLH_WIDTH_1_8_MIN	mm	0 - 1800
RLH_WIDTH_1_8_MAX	mm	0 - 1800
RLH_OFFSET_1_8_MEAN	mm	0 - 2300
RLH_OFFSET_1_8_STD	mm	0 - 800
RLH_OFFSET_1_8_MIN	mm	0 - 2300
RLH_OFFSET_1_8_MAX	mm	0 - 2300
LLH_DEPTH_WIRE_REF_MEAN	mm	0 - 100
LLH_DEPTH_WIRE_REF_STD	mm	0 - 40
LLH_DEPTH_WIRE_REF_MIN	mm	0 - 100
LLH_DEPTH_WIRE_REF_MAX	mm	0 - 100
RLH_DEPTH_WIRE_REF_MEAN	mm	0 - 100
RLH_DEPTH_WIRE_REF_STD	mm	0 - 40
RLH_DEPTH_WIRE_REF_MIN	mm	0 - 100
RLH_DEPTH_WIRE_REF_MAX	mm	0 - 100
MAX_MEAN_DEPTH_WIRE_REF	mm	0 - 100
LLH_WIDTH_WIRE_REF_MEAN	mm	0 - 4600
LLH_WIDTH_WIRE_REF_STD	mm	0 - 1500
LLH_WIDTH_WIRE_REF_MIN	mm	0 - 4600
LLH_WIDTH_WIRE_REF_MAX	mm	0 - 4600
LLH_OFFSET_WIRE_REF_MEAN	mm	1370 - 4600
LLH_OFFSET_WIRE_REF_STD	mm	0 - 800
LLH_OFFSET_WIRE_REF_MIN	mm	1370 - 4600
LLH_OFFSET_WIRE_REF_MAX	mm	1370 – 4600
RLH_WIDTH_WIRE_REF_MEAN	mm	0 - 4600
RLH_WIDTH_WIRE_REF_STD	mm	0 - 1500
RLH_WIDTH_WIRE_REF_MIN	mm	0 - 4600
RLH_WIDTH_WIRE_REF_MAX	mm	0 - 4600
RLH_OFFSET_WIRE_REF_MEAN	mm	0 - 2300
RLH_OFFSET_WIRE_REF_STD	mm	0 - 800
RLH_OFFSET_WIRE_REF_MIN	mm	0 - 2300
RLH_OFFSET_WIRE_REF_MAX	mm	0 - 2300
DATA_PROCESS_EXTRACT_DATE	date	> July 4, 1998

E. Intramodular Checks

Each E-type check is separated by a single line. In general, each bullet represents a procedure, action, etc., of the check.

Table: MON_T_PROF_MASTER

- If DEVICE_CODE = “D” then FOOTPAD_SPACING must be NON-NULL
- If DEVICE_CODE = “D” then PVMT_WIDTH must be NON-NULL
- If DEVICE_CODE = “P” then FOOTPAD_SPACING must be NULL
- If DEVICE_CODE = “P” then PVMT_WIDTH must be NON-NULL

Note to Programmer: If above checks fail, set UPDATE_MASTER_FLAG= .F. If above checks pass and all checks below pass for each SHRP_ID, STATE_CODE, SURVEY_DATE, set ***MON_T_PROF_MASTER****.RECORD_STATUS = ‘E’*

Tables: MON_T_PROF_MASTER, MON_T_PROF_DEV_CONFIG

For SHRP_ID, STATE_CODE, and SURVEY_DATE:

- Where DEVICE_CODE = “P”, check that a matching record exists in **MON_T_PROF_DEV_CONFIG**, and set RECORD_STATUS = “E” in **MON_T_PROF_DEV_CONFIG**
- Where DEVICE_CODE = “D”, check that a matching record exists in **MON_T_PROF_DEV_CONFIG**, and set RECORD_STATUS = “E” in **MON_T_PROF_DEV_CONFIG**

Note to Programmer: If above checks fail, set UPDATE_MASTER_FLAG = .F.

Tables: MON_T_PROF_MASTER, MON_T_PROF_PROFILE

For SHRP_ID, STATE_CODE, SURVEY_DATE:

- If DEVICE_CODE = “D” then NO_PROFILES must equal the total number of POINT_LOCs within **MON_T_PROF_PROFILE**
- If DEVICE_CODE = “P” then NO_PROFILES must equal the total number of POINT_LOCs within **MON_T_PROF_PROFILE**

Note to Programmer: If above checks fail, set UPDATE_MASTER_FLAG = .F. and UPDATE_RUT_XY = .F.

For SHRP_ID, STATE_CODE, SURVEY_DATE, POINT_LOC:

Access **MON_T_PROF_MASTER** and identify DEVICE_CODE, PVMT_WIDTH, and FOOTPAD_SPACING

- If DEVICE_CODE = “D”, then there must be valid non-null entries in MON_T_PROF_PROFILE. X1 through X(1 + truncated (PVMT_WIDTH/FOOTPAD_SPACING)), and Y1 through Y(1 + truncated (PVMT_WIDTH/FOOTPAD_SPACING))

  [Example: PVMT_WIDTH = 3800 mm, FOOTPAD_SPACING = 305 mm; truncated value = 12, valid entries should then exist in X1 through X13 and Y1 through Y13]

- If DEVICE_CODE = “D”, then check to ensure X1 < X2 < X3 <X4 <----------X(1 + truncated (PVMT_WIDTH/FOOTPAD_SPACING))

- If DEVICE_CODE = “P”, then there should be valid non-null entries in X1 through X24 and Y1 through Y24

- If DEVICE_CODE = “P”, then check to ensure X1 < X2 < X3 < X4 <----------X29 < X30

- For all DEVICE_CODEs, (PVMT_WIDTH - 16mm) <= X?(last used) <= (PVMT_WIDTH + 16mm)

  [For example, if X15 is the last NON-NULL X-coordinate, then (PVMT_WIDTH - 16mm) <= X15 <= (PVMT_WIDTH + 16mm)]

*Note to Programmer: If above checks fail, set UPDATE_MASTER_FLAG = .F. else if UPDATE_RUT_XY = .T., set **MON_T_PROF_PROFILE**.RECORD_STATUS = ‘E’*

Tables: MON_T_PROF_MASTER, MON_T_PROF_PROFILE, MON_T_PROF_DEV_CONFIG

- All records in **MON_T_PROF_PROFILE** and **MON_T_PROF_DEV_CONFIG**, reaching Level E, whose parent record in **MON_T_PROF_MASTER** is not at Level E will be set back to Level D.

The QC checks for **MON_T_PROF_PROFILE** and **MON_T_PROF_MASTER** must be executed before running the following level E QC checks. Manual upgrades should not be permitted for records failing these level E checks.

Tables: MON_T_PROF_CROSS_SLOPE, MON_T_PROF_MASTER

- For matching STATE_CODE, SHRP_ID, and SURVEY_DATE, **MON_T_PROF_CROSS_SLOPE**.T_PROF_WIDTH <= **MON_T_PROF_MASTER**.PVMT_WIDTH

  Error Message: **MON_T_PROF_CROSS_SLOPE**-E-101, {STATE_CODE, SHRP_ID, SURVEY_DATE} Recorded transverse profile width is greater than pavement width in **MON_T_PROF_MASTER**

Tables: MON_T_PROF_CROSS_SLOPE, MON_T_PROF_PROFILE

- For matching STATE_CODE, SHRP_ID, SURVEY_DATE, and POINT_LOC, There must be a record in **MON_T_PROF_PROFILE** with RECORD_STATUS = ‘E’

Error Message: **MON_T_PROF_CROSS_SLOPE**-E-102, {STATE_CODE, SHRP_ID, SURVEY_DATE, POINT_LOC} RECORD_STATUS in **MON_T_PROF_PROFILE** is not = E

The QC checks for **MON_T_PROF_PROFILE** and **MON_T_PROF_MASTER** must be executed before running the following level E QC checks.

Table: MON_T_PROF_INDEX_POINT

- For matching STATE_CODE, SHRP_ID, SURVEY_DATE, POINT_LOC, record in **MON_T_PROF_PROFILE** , **MON_T_PROF_PROFILE**.RECORD_STATUS = "E"

  Error Message: Matching record does not exist in **MON_T_PROF_PROFILE** with RECORD_STATUS = E.

- For matching STATE_CODE, SHRP_ID, SURVEY_DATE, record in **MON_T_PROF_MASTER**, **MON_T_PROF_MASTER**.RECORD_STATUS = "E"

  Error Message: matching record does not exist in **MON_T_PROF_MASTER** with RECORD_STATUS = E.

- LLH_DEPTH_1_8<= LLH_DEPTH_WIRE_REF

  Error Message: LLH_DEPTH_1_8 = {value} is not less than or equal to LLH_DEPTH_WIRE_REF = {value}

- RLH_DEPTH_1_8 <= RLH_DEPTH_WIRE_REF

  Error Message: RLH_DEPTH_1_8 = {value} is not less than or equal to RLH_DEPTH_WIRE_REF = {value}

- FILL_AREA >= ABSOLUTE VALUE [NEGATIVE_AREA]

  Error Message: Fill area= {value} is not greater than or equal to the absolute value of the negative area = {value}.

- LLH_WIDTH_1_8 <= LLH_WIDTH_WIRE_REF

  Error Message: LLH_WIDTH_1_8= {value} is not less than or equal to LLH_WIDTH_WIRE_REF = {value}.

- RLH_WIDTH_1_8 <= RLH_WIDTH_WIRE_REF

  Error Message: RLH_WIDTH_1_8 = {value} is not less than or equal to RLH_WIDTH_WIRE_REF = {value}.

- TRANS_PROFILE_MEASURE_LENGTH / 2<= LLH_OFFSET_1_8 <= TRANS_PROFILE_MEASURE_LENGTH

  Error Message: LLH_OFFSET_1_8 = {value} is not in the interval from TRANS_PROFILE_MEASURE_LENGTH / 2 and TRANS_PROFILE_MEASURE_LENGTH = {value}.

- LLH_WIDTH_1_8 <= TRANS_PROFILE_MEASURE_LENGTH

Error Message: LLH_WIDTH_1_8= {value} is not less than or equal to TRANS_PROFILE_MEASURE_LENGTH = {value}.

- RLH_OFFSET_1_8 <= TRANS_PROFILE_MEASURE_LENGTH / 2

  Error Message: RLH_OFFSET_1_8 = {value} is not less than or equal to TRANS_PROFILE_MEASURE_LENGTH / 2 = {value}.

- RLH_WIDTH_1_8 <= TRANS_PROFILE_MEASURE_LENGTH

  Error Message: RLH_WIDTH_1_8 = {value} is not less than or equal to TRANS_PROFILE_MEASURE_LENGTH = {value}.

- TRANS_PROFILE_MEASURE_LENGTH/2 <= LLH_OFFSET_WIRE_REF <= TRANS_PROFILE_MEASURE_LENGTH

  Error Message: LLH_OFFSET_WIRE_REF is not in the interval from TRANS_PROFILE_MEASURE_LENGTH/2 and TRANS_PROFILE_MEASURE_LENGTH = {value}.

- LLH_WIDTH_WIRE_REF <= TRANS_PROFILE_MEASURE_LENGTH

  Error Message: LLH_WIDTH_WIRE_REF = {value} is not less than or equal to TRANS_PROFILE_MEASURE_LENGTH = {value}.

- RLH_OFFSET_WIRE_REF <= TRANS_PROFILE_MEASURE_LENGTH / 2

  Error Message: RLH_OFFSET_WIRE_REF = {value} is not less than or equal to TRANS_PROFILE_MEASURE_LENGTH / 2 = {value}.

- RLH_WIDTH_WIRE_REF <= TRANS_PROFILE_MEASURE_LENGTH

  Error Message: RLH_WIDTH_WIRE_REF = {value} is not less than or equal to TRANS_PROFILE_MEASURE_LENGTH = {value}.

The QC checks for **MON_T_PROF_PROFILE** and **MON_T_PROF_MASTER** must be executed before running the following level E QC checks:

Table: MON_T_PROF_INDEX_SECTION

- For matching STATE_CODE, SHRP_ID, SURVEY_DATE record in **MON_T_PROF_MASTER**, **MON_T_PROF_MASTER**.RECORD_STATUS = “E”

  Error Message: Matching record in **MON_T_PROF_MASTER** does not have RECORD_STATUS = E.

- For matching STATE_CODE, SHRP_ID, SURVEY_DATE records in **MON_T_PROF_INDEX_POINT** where **MON_T_PROF_INDEX_POINT**.SECTION_STAT_INCLUDE_FLAG = 1 , **MON_T_PROF_INDEX_POINT**.RECORD_STATUS = “E” (one to many check)

  Error Message: All matching records in **MON_T_PROF_INDEX_SECTION** with SECTION_STAT_INCLUDE_FLAG=1 do not have RECORD_STATUS = E.

- NEGATIVE_AREA_MAX < NEGATIVE_AREA_MEAN < NEGATIVE_AREA_MIN

  Error Message: NEGATIVE_AREA_MAX = {value} is not less than NEGATIVE_AREA_MEAN = {value} or, NEGATIVE_AREA_MEAN = {value} is not less than NEGATIVE_AREA_MIN = {value}.

- POSITIVE_AREA_MIN <= POSITIVE_AREA_MEAN <= POSITIVE_AREA_MAX

  Error Message: POSITIVE_AREA_MIN = {value} is not less than or equal to POSITIVE_AREA_MEAN = {value} or, is not less than or equal to POSITIVE_AREA_MAX = {value}.

- FILL_AREA_MIN <= FILL_AREA_MEAN <= FILL_AREA_MAX

  Error Message: FILL_AREA_MIN = {value} is not less than or equal to FILL_AREA_MEAN = {value} or, is not less than or equal to FILL_AREA_MAX = {value}.

- LLH_DEPTH_1_8_MIN <= LLH_DEPTH_1_8_MEAN <= LLH_DEPTH_1_8_MAX

  Error Message: LLH_DEPTH_1_8_MIN = {value} is not less than or equal to LLH_DEPTH_1_8_MEAN = {value} or, is not less than or equal to LLH_DEPTH_1_8_MAX = {value}.

- RLH_DEPTH_1_8_MIN <= RLH_DEPTH_1_8_MEAN <= RLH_DEPTH_1_8_MAX

  Error Message: RLH_DEPTH_1_8_MIN = {value} is not less than or equal to RLH_DEPTH_1_8_MEAN = {value} or, is not less than or equal to RLH_DEPTH_1_8_MAX = {value}.

- MAX_MEAN_DEPTH_1_8 >= LLH_DEPTH_1_8_MEAN

  Error Message: MAX_MEAN_DEPTH_1_8 = {value} is not greater than or equal to LLH_DEPTH_1_8_MEAN = {value}.

- MAX_MEAN_DEPTH_1_8 >= RLH_DEPTH_1_8_MEAN

  Error Message: MAX_MEAN_DEPTH_1_8 = {value} is not greater than or equal to RLH_DEPTH_1_8_MEAN = {value}.

- LLH_WIDTH_1_8_MIN <= LLH_WIDTH_1_8_MEAN <= LLH_WIDTH_1_8_MAX

  Error Message: LLH_WIDTH_1_8_MIN = {value} is not less than or equal to LLH_WIDTH_1_8_MEAN = {value} or, is not less than or equal to LLH_WIDTH_1_8_MAX = {value}.

- RLH_WIDTH_1_8_MIN <= RLH_WIDTH_1_8_MEAN <= RLH_WIDTH_1_8_MAX

  Error Message: RLH_WIDTH_1_8_MIN = {value} is not less than or equal to RLH_WIDTH_1_8_MEAN = {value} or, is not less than or equal to RLH_WIDTH_1_8_MAX = {value}.

- LLH_DEPTH_WIRE_REF_MIN <= LLH_DEPTH_WIRE_REF_MEAN <= LLH_DEPTH_WIRE_REF_MAX

Error Message: LLH_DEPTH_WIRE_REF_MIN = {value} is not less than or equal to LLH_DEPTH_WIRE_REF_MEAN = {value} or, is not less than or equal to LLH_DEPTH_WIRE_REF_MAX = {value}.

- RLH_DEPTH_WIRE_REF_MIN <= RLH_DEPTH_WIRE_REF_MEAN <= RLH_DEPTH_WIRE_REF_MAX

  Error Message: RLH_DEPTH_WIRE_REF_MIN = {value} is not less than or equal to RLH_DEPTH_WIRE_REF_MEAN = {value} or, is not less than or equal to RLH_DEPTH_WIRE_REF_MAX = {value}.

- MAX_MEAN_DEPTH_WIRE_REF >= LLH_DEPTH_WIRE_REF_MEAN

  Error Message: MAX_MEAN_DEPTH_WIRE_REF = {value} is not greater than or equal to LLH_DEPTH_WIRE_REF_MEAN = {value}.

- MAX_MEAN_DEPTH_ WIRE_REF >= RLH_DEPTH_WIRE_REF_MEAN

  Error Message: MAX_MEAN_DEPTH_ WIRE_REF = {value} is not greater than or equal to RLH_DEPTH_WIRE_REF_MEAN = {value}.

- LLH_WIDTH_WIRE_REF_MIN <= LLH_WIDTH_WIRE_REF_MEAN <= LLH_WIDTH_WIRE_REF_MAX

  Error Message: LLH_WIDTH_WIRE_REF_MIN = {value} is not less than or equal to LLH_WIDTH_WIRE_REF_MEAN = {value} or, is not less than or equal to LLH_WIDTH_WIRE_REF_MAX = {value}.

- RLH_WIDTH_WIRE_REF_MIN <= RLH_WIDTH_WIRE_REF_MEAN <= RLH_WIDTH_WIRE_REF_MAX

  Error Message: RLH_WIDTH_WIRE_REF_MIN = {value} is not less than or equal to RLH_WIDTH_WIRE_REF_MEAN = {value} or, is not less than or equal to RLH_WIDTH_WIRE_REF_MAX = {value}.

7.0 SURFACE DISTRESS QC PROGRAMS

7.1 Level 1

A. Initial Level

Records in the IMS are at Level A when they first enter the system and are set back to A when changes are made to a given record or to selected related records.

B. Dependency Checks

No dependency checks are performed.

C. Minimum Data Elements

Tables and accompanying fields that must be included in a data record are identified below. Explanations are provided for those fields having certain conditions as to when they are required (i.e., X = always; * = conditionally). Fields with a marker (†) are required with a value greater than 0 under the given condition.

Table	Field	Condition
MON_DIS_AC_REV	AFTER_TEMP	* if SURVEY_DATE > 6/1/92
	BEFORE_TEMP	* if SURVEY_DATE > 6/1/92
	PATCH_A_H†	* if PATCH_NO_H > 0
	PATCH_NO_H†	* if PATCH_A_H > 0
	PATCH_A_L†	* if PATCH_NO_L > 0
	PATCH_NO_L†	* if PATCH_A_L > 0
	PATCH_A_M†	* if PATCH_NO_M > 0
	PATCH_NO_M†	* if PATCH_A_M > 0
	POTHOLES_A_H†	* if POTHOLES_NO_H > 0
	POTHOLES_NO_H†	* if POTHOLES_A_H > 0
	POTHOLES_A_L†	* if POTHOLES_NO_L > 0
	POTHOLES_NO_L†	* if POTHOLES_A_L > 0
	POTHOLES_A_M†	* if POTHOLES_NO_M > 0
	POTHOLES_NO_M†	* if POTHOLES_A_M > 0
	PUMPING_L†	* if PUMPING_NO > 0
	PUMPING_NO†	* if PUMPING_L > 0
	TRANS_CRACK_L_H†	* if TRANS_CRACK_ NO_H > 0
	TRANS_CRACK_NO_H†	* if TRANS_CRACK_L_H > 0
	TRANS_CRACK_L_L†	* if TRANS_CRACK_NO_L > 0
	TRANS_CRACK_NO_L†	* if TRANS_CRACK_L_L > 0
	TRANS_CRACK_L_M†	* if TRANS_CRACK_NO_M > 0
	TRANS_CRACK_NO_M†	* if TRANS_CRACK_L_M > 0
MON_DIS_CRCP_REV	AFTER_ TEMP	* if SURVEY_DATE > 6/1/92
	BEFORE_TEMP	* if SURVEY_DATE > 6/1/92

	DURAB_CRACK_A_H†	*	if DURAB_CRACK_NO_H > 0
	DURAB_CRACK_NO_H†	*	if DURAB_CRACK_A_H > 0
	DURAB_CRACK_A_L†	*	if DURAB_CRACK_NO_L > 0
	DURAB_CRACK_NO_L†	*	if DURAB_CRACK_A_L > 0
	DURAB_CRACK_A_M†	*	if DURAB_CRACK_NO_M > 0
	DURAB_CRACK_NO_M†	*	if DURAB_CRACK_A_M > 0
	LONG_JT_SEAL_NO†	*	if LONG_JT_SEAL_DAM_L >0
	MAP_CRACK_A†	*	if MAP_CRACK_NO > 0
	MAP_CRACK_NO†	*	if MAP_CRACK_A > 0
	PATCH_FLEX_A_H†	*	if PATCH_FLEX_NO_H > 0
	PATCH_FLEX_NO_H†	*	if PATCH_FLEX_A_H > 0
	PATCH_FLEX_A_L†	*	if PATCH_FLEX_NO_L > 0
	PATCH_FLEX_NO_L†	*	if PATCH_FLEX_A_L > 0
	PATCH_FLEX_A_M†	*	if PATCH_FLEX_NO_M > 0
	PATCH_FLEX_NO_M†	*	if PATCH_FLEX_A_M > 0
	PATCH_RIGID_A_H†	*	if PATCH_RIGID_NO_H > 0
	PATCH_RIGID_NO_H†	*	if PATCH_RIGID_A_H > 0
	PATCH_RIGID_A_L†	*	if PATCH_RIGID_NO_L > 0
	PATCH_RIGID_NO_L†	*	if PATCH_RIGID_A_L > 0
	PATCH_RIGID_A_M†	*	if PATCH_RIGID_NO_M > 0
	PATCH_RIGID_NO_M†	*	if PATCH_RIGID_A_M > 0
	PUMPING_L†	*	if PUMPING_NO > 0
	PUMPING_NO†	*	if PUMPING_L > 0
	SCALING_A†	*	if SCALING_NO > 0
	SCALING_NO†	*	if SCALING_A > 0
	TRANS_CRACK_L_H†	*	if TRANS_CRACK_NO_H >0
	TRANS_CRACK_NO_H†	*	if TRANS_CRACK_L_H > 0
	TRANS_CRACK_L_L†	*	if TRANS_CRACK_NO_L >0
	TRANS_CRACK_NO_L†	*	if TRANS_CRACK_L_L > 0
	TRANS_CRACK_L_M†	*	if TRANS_CRACK_NO_M >0
	TRANS_CRACK_NO_M†	*	if TRANS_CRACK_L_M > 0
MON_DIS_JPCC_FAULT	EDGE_AVG_MM	*	One of these
	WHEELPATH_AVG_MM	*	is required
	FAULT_MEASURE_DEVICE		X
MON_DIS_JPCC_FAULT_SECT	AVG_EDGE_FAULT	*[1]	
	AVG_WHEELPATH_FAULT	*[2]	
	DATA_PROCESS_EXTRACT_DATE		X
	EDGE_FAULT_STATUS		X
	MIN_EDGE_FAULT	*[1]	
	MAX_EDGE_FAULT	*[1]	
	MIN_WHEELPATH_FAULT	*[2]	
	MAX_WHEELPATH_FAULT	*[2]	
	NO_ NULL_EDGE_FAULT		X

[1] AVG_EDGE_FAULT, MIN_EDGE_FAULT, MAX_EDGE_FAULT, and STD_EDGE_FAULT are required only if field EDGE_FAULT_STATUS code is equal to 1.

[2] AVG_WHEELPATH_FAULT, MIN_WHEELPATH_FAULT, MAX_WHEELPATH_FAULT, and STD_WHEELPATH_FAULT are required only if field WHEELPATH_FAULT_STATUS code is equal to 1.

	NO_ NEG2_EDGE_FAULT	X	
	NO_ PASSED_EDGE_FAULT	X	
	NO_NEG2_WHEELPATH_FAULT	X	
	NO_NULL_WHEELPATH_FAULT	X	
	NO_PASSED_ WHEELPATH_FAULT		X
	NO_TOTAL_POINT_LOC	X	
	STD_EDGE_FAULT	*[1]	
	STD_WHEELPATH_FAULT	*[2]	
	WHEELPATH_FAULT_STATUS	X	
MON_DIS_JPCC_REV	AFTER_TEMP	* if SURVEY_DATE > 6/1/92	
	BEFORE_TEMP	* if SURVEY_DATE > 6/1/92	
	JT_SEALED	* if SURVEY_DATE > 6/1/92	
	DURAB_CRACK_A_H†	* if DURAB_CRACK_NO_H > 0	
	DURAB_CRACK_NO_H†	* if DURAB_CRACK_A_H > 0	
	DURAB_CRACK_A_L†	* if DURAB_CRACK_NO_L >0	
	DURAB_CRACK_NO_L†	* if DURAB_CRACK_A_L > 0	
	DURAB_CRACK_A_M†	* if DURAB_CRACK_NO_M >0	
	DURAB_CRACK_NO_M†	* if DURAB_CRACK_A_M > 0	
	MAP_CRACK_A†	* if MAP_CRACK_NO > 0	
	MAP_CRACK_NO†	* if MAP_CRACK_A > 0	
	PATCH_FLEX_A_H†	* if PATCH_FLEX_NO_H > 0	
	PATCH_FLEX_NO_H†	* if PATCH_FLEX_A_H > 0	
	PATCH_FLEX_A_L†	* if PATCH_FLEX_NO_L > 0	
	PATCH_FLEX_NO_L†	* if PATCH_FLEX_A_L > 0	
	PATCH_FLEX_A_M†	* if PATCH_FLEX_NO_H > 0	
	PATCH_FLEX_NO_H†	* if PATCH_FLEX_A_M > 0	
	PATCH_RIGID_A_H†	* if PATCH_RIGID_NO_H > 0	
	PATCH_RIGID_NO_H†	* if PATCH_RIGID_A_H > 0	
	PATCH_RIGID_A_L†	* if PATCH_RIGID_NO_L > 0	
	PATCH_RIGID_NO_L†	* if PATCH_RIGID_A_L > 0	
	PATCH_RIGID_A_M†	* if PATCH_RIGID_NO_M > 0	
	PATCH_RIGID_NO_M†	* if PATCH_RIGID_A_M > 0	
	PUMPING_L†	* if PUMPING_NO > 0 and SURVEY_DATE > 6/1/92	
	PUMPING_NO†	* if PUMPING_L > 0	
	SCALING_A†	* if SCALING_NO > 0	
	SCALING_NO†	* if SCALING_A > 0	
	TRANS_CRACK_L_H†	* if TRANS_CRACK_NO_H > 0	
	TRANS_CRACK_NO_H†	* if TRANS_CRACK_L_H > 0	
	TRANS_CRACK_L_L†	* if TRANS_CRACK_NO_L > 0	
	TRANS_CRACK_NO_L†	* if TRANS_CRACK_L_L > 0	
	TRANS_CRACK_L_M†	* if TRANS_CRACK_NO_M > 0	
	TRANS_CRACK_NO_M†	* if TRANS_CRACK_L_M > 0	
	TRANS_SPALLING_L_H†	* if TRANS_SPALLING_NO_ H > 0 and SURVEY_DATE > 6/1/92	
	TRANS_SPALLING_NO_H†	* if TRANS_SPALLING_L_H > 0	
	TRANS_SPALLING_L_L†	* if TRANS_SPALLING_NO_L > 0 and SURVEY_DATE > 6/1/92	
	TRANS_SPALLING_NO_L†	* if TRANS_SPALLING_L_L > 0	
	TRANS_SPALLING_L_M†	* if TRANS_SPALLING_NO _M > 0 and SURVEY_DATE > 6/1/92	
	TRANS_SPALLING_NO_M†	* if TRANS_SPALLING_L_M > 0	
MON_DIS_LINK	No level C checks		
MON_DROP_SEP	DROPOFF	X	

MON_DIS_PADIAS_AC	PATCH_A_H†	* if PATCH_NO_H > 0
	PATCH_NO_H†	* if PATCH_A_H > 0
	PATCH_A_L†	* if PATCH_NO_L > 0
	PATCH_NO_L†	* if PATCH_A_L > 0
	PATCH_A_M†	* if PATCH_NO_M > 0
	PATCH_NO_M†	* if PATCH_A_M > 0
	POTHOLES_A†	* if POTHOLES_NO > 0
	POTHOLES_NO†	* if POTHOLES_A > 0
	SHOVING_A†	* if SHOVING_NO > 0
	SHOVING_NO†	* if SHOVING_A > 0
	TRANS_CRACK_L_H†	* if TRANS_CRACK_NO_H > 0
	TRANS_CRACK_NO_H†	* if TRANS_CRACK_L_H > 0
	TRANS_CRACK_L_L†	* if TRANS_CRACK_NO_L > 0
	TRANS_CRACK_NO_L†	* if TRANS_CRACK_L_L > 0
	TRANS_CRACK_L_M†	* if TRANS_CRACK_NO_M > 0
	TRANS_CRACK_NO_M†	* if TRANS_CRACK_L_M > 0
	WATER_BLEED_PUMP_L†	* if WATER_BLEED_PUMP_ NO > 0
	WATER_BLEED_PUMP_NO†	* if WATER_BLEED_PUMP_ L > 0
MON_DIS_PADIAS_CRCP	DURAB_CRACK_A_H†	* if DURAB_CRACK_NO_H > 0
	DURAB_CRACK_NO_H†	* if DURAB_CRACK_A_H > 0
	DURAB_CRACK_A_L†	* if DURAB_CRACK_NO_L > 0
	DURAB_CRACK_NO_L†	* if DURAB_CRACK_A_L > 0
	DURAB_CRACK_A_M†	* if DURAB_CRACK_NO_M > 0
	DURAB_CRACK_NO_M†	* if DURAB_CRACK_A_M > 0
	PATCH_FLEX_A_H†	* if PATCH_FLEX_NO_H > 0
	PATCH_FLEX_NO_H†	* if PATCH_FLEX_A_H > 0
	PATCH_FLEX_A_L†	* if PATCH_FLEX_NO_L > 0
	PATCH_FLEX_NO_L†	* if PATCH_FLEX_A_L > 0
	PATCH_FLEX_A_M†	* if PATCH_FLEX_NO_M > 0
	PATCH_FLEX_NO_M†	* if PATCH_FLEX_A_M > 0
	PATCH_RIGID_A_H†	* if PATCH_RIGID_NO_H > 0
	PATCH_RIGID_NO_H†	* if PATCH_RIGID_A_H > 0
	PATCH_RIGID_A_L†	* if PATCH_RIGID_NO_L > 0
	PATCH_RIGID_NO_L†	* if PATCH_RIGID_A_L > 0
	PATCH_RIGID_A_M†	* if PATCH_RIGID_NO_M > 0
	PATCH_RIGID_NO_M†	* if PATCH_RIGID_A_M > 0
	TRANS_CRACK_L_H†	* if TRANS_CRACK_NO_H >0
	TRANS_CRACK_NO_H†	* if TRANS_CRACK_L_H > 0
	TRANS_CRACK_L_L†	* if TRANS_CRACK_NO_L >0
	TRANS_CRACK_NO_L†	* if TRANS_CRACK_L_L > 0
	TRANS_CRACK_L_M†	* if TRANS_CRACK_NO_M >0
	TRANS_CRACK_NO_M†	* if TRANS_CRACK_L_M > 0
	WATER_BLEED_PUMP_L†	* if WATER_BLEED_PUMP_ NO > 0
	WATER_BLEED_PUMP_NO†	* if WATER_BLEED_PUMP_ L > 0
MON_DIS_PADIAS_JPCC	DURAB_CRACK_A_H†	* if DURAB_CRACK_NO_H >0
	DURAB_CRACK_NO_H†	* if DURAB_CRACK_A_H > 0
	DURAB_CRACK_A_L†	* if DURAB_CRACK_NO_L > 0
	DURAB_CRACK_NO_L†	* if DURAB_CRACK_A_L > 0
	DURAB_CRACK_A_M†	* if DURAB_CRACK_NO_M > 0
	DURAB_CRACK_NO_M†	* if DURAB_CRACK_A_M > 0
	PATCH_FLEX_A_H†	* if PATCH_FLEX_NO_H > 0

	PATCH_FLEX_NO_H†	* if PATCH_FLEX_A_H > 0
	PATCH_FLEX_A_L†	* if PATCH_FLEX_NO_L > 0
	PATCH_FLEX_NO_L†	* if PATCH_FLEX_A_L > 0
	PATCH_FLEX_A_M†	* if PATCH_FLEX_NO_M > 0
	PATCH_FLEX_NO_M†	* if PATCH_FLEX_A_M > 0
	PATCH_RIGID_A_H†	* if PATCH_RIGID_NO_H > 0
	PATCH_RIGID_NO_H†	* if PATCH_RIGID_A_H > 0
	PATCH_RIGID_A_L†	* if PATCH_RIGID_NO_M > 0
	PATCH_RIGID_NO_M†	* if PATCH_RIGID_A_L > 0
	TRANS_CRACK_L_H†	* if TRANS_CRACK_NO_H > 0
	TRANS_CRACK_NO_H†	* if TRANS_CRACK_L_H > 0
	TRANS_CRACK_L_L†	* if TRANS_CRACK_NO_L > 0
	TRANS_CRACK_NO_L†	* if TRANS_CRACK_L_L > 0
	TRANS_CRACK_L_M†	* if TRANS_CRACK_NO_M > 0
	TRANS_CRACK_NO_M†	* if TRANS_CRACK_L_M > 0
	TRANS_SPALLING_L_H†	* if TRANS_SPALLING_NO_H > 0
	TRANS_SPALLING_NO_H†	* if TRANS_SPALLING_ L_H > 0
	TRANS_SPALLING_L_L†	* if TRANS_SPALLING_NO_L > 0
	TRANS_SPALLING_NO_L†	* if TRANS_SPALLING_ L_L > 0
	TRANS_SPALLING_L_M†	* if TRANS_SPALLING_NO_M > 0
	TRANS_SPALLING_NO_M†	* if TRANS_SPALLING_ L_M > 0
	WATER_BLEED_PUMP_L†	* if WATER_BLEED_PUMP_ NO >0
	WATER_BLEED_PUMP_NO†	* if WATER_BLEED_PUMP_L > 0
MON_DIS_PADIAS42_AC	PATCH_A_H†	* if PATCH_NO_H > 0
	PATCH_NO_H†	* if PATCH_A_H > 0
	PATCH_A_L†	* if PATCH_NO_L > 0
	PATCH_NO_L†	* if PATCH_A_L > 0
	PATCH_A_M†	* if PATCH_NO_M > 0
	PATCH_NO_M†	* if PATCH_A_M > 0
	POTHOLES_A_H†	* if POTHOLES_NO_H > 0
	POTHOLES_NO_H†	* if POTHOLES_A_H > 0
	POTHOLES_A_L†	* if POTHOLES_NO_L > 0
	POTHOLES_NO_L†	* if POTHOLES_A_L > 0
	POTHOLES_A_M†	* if POTHOLES_NO_M > 0
	POTHOLES_NO_M†	* if POTHOLES_A_M > 0
	PUMPING_L†	* if PUMPING_NO > 0
	PUMPING_NO†	* if PUMPING_L > 0
	TRANS_CRACK_L_H†	* if TRANS_CRACK_NO_H > 0
	TRANS_CRACK_NO_H†	* if TRANS_CRACK_L_H > 0
	TRANS_CRACK_L_L†	* if TRANS_CRACK_NO_L > 0
	TRANS_CRACK_NO_L†	* if TRANS_CRACK_L_L > 0
	TRANS_CRACK_L_M†	* if TRANS_CRACK_NO_M > 0
	TRANS_CRACK_NO_M†	* if TRANS_CRACK_L_M > 0
MON_DIS_PADIAS42_CRCP	DURAB_CRACK_A_H†	* if DURAB_CRACK_NO_H > 0
	DURAB_CRACK_NO_H†	* if DURAB_CRACK_A_H > 0
	DURAB_CRACK_A_L†	* if DURAB_CRACK_NO_L > 0
	DURAB_CRACK_NO_L†	* if DURAB_CRACK_A_L > 0
	DURAB_CRACK_A_M†	* if DURAB_CRACK_NO_M > 0
	DURAB_CRACK_NO_M†	* if DURAB_CRACK_A_M > 0
	MAP_CRACK_A†	* if MAP_CRACK_NO > 0
	MAP_CRACK_NO†	* if MAP_CRACK_A > 0
	PATCH_FLEX_A_H†	* if PATCH_FLEX_NO_L > 0
	PATCH_FLEX_NO_L†	* if PATCH_FLEX_A_H > 0

	PATCH_FLEX_A_M†	* if PATCH_FLEX_NO_M > 0
	PATCH_FLEX_NO_M†	* if PATCH_FLEX_A_M > 0
	PATCH_RIGID_A_H†	* if PATCH_RIGID_NO_H > 0
	PATCH_RIGID_NO_H†	* if PATCH_RIGID_A_H > 0
	PATCH_RIGID_A_L†	* if PATCH_RIGID_NO_L > 0
	PATCH_RIGID_NO_L†	* if PATCH_RIGID_A_L > 0
	PATCH_RIGID_A_M†	* if PATCH_RIGID_NO_M > 0
	PATCH_RIGID_NO_M†	* if PATCH_RIGID_A_M > 0
	PUMPING_L†	* if PUMPING_NO > 0
	PUMPING_NO†	* if PUMPING_L > 0
	SCALING_A†	* if SCALING_NO > 0
	SCALING_NO†	* if SCALING_A > 0
	TRANS_CRACK_L_H†	* if TRANS_CRACK_NO_H > 0
	TRANS_CRACK_NO_H†	* if TRANS_CRACK_L_H > 0
	TRANS_CRACK_L_L†	* if TRANS_CRACK_NO_L > 0
	TRANS_CRACK_NO_L†	* if TRANS_CRACK_L_L > 0
	TRANS_CRACK_L_M†	* if TRANS_CRACK_NO_M > 0
	TRANS_CRACK_NO_M†	* if TRANS_CRACK_L_M > 0
MON_DIS_PADIAS42_JPCC	JT_SEALED	* if SURVEY_DATE > 6/1/92
	DURAB_CRACK_A_H†	* if DURAB_CRACK_NO_H >0
	DURAB_CRACK_NO_H†	* if DURAB_CRACK_A_H >0
	DURAB_CRACK_A_L†	* if DURAB_CRACK_NO_L > 0
	DURAB_CRACK_NO_L†	* if DURAB_CRACK_A_L > 0
	DURAB_CRACK_A_M†	* if DURAB_CRACK_NO_M > 0
	DURAB_CRACK_NO_M†	* if DURAB_CRACK_A_M > 0
	MAP_CRACK_A†	* if MAP_CRACK_NO > 0
	MAP_CRACK_NO†	* if MAP_CRACK_A > 0
	PATCH_FLEX_A_H†	* if PATCH_FLEX_NO_H > 0
	PATCH_FLEX_NO_H†	* if PATCH_FLEX_A_H > 0
	PATCH_FLEX_A_L†	* if PATCH_FLEX_NO_L > 0
	PATCH_FLEX_NO_L†	* if PATCH_FLEX_A_L > 0
	PATCH_FLEX_A_M†	* if PATCH_FLEX_NO_M > 0
	PATCH_FLEX_NO_M†	* if PATCH_FLEX_A_M > 0
	PATCH_RIGID_A_H†	* if PATCH_RIGID_NO_H > 0
	PATCH_RIGID_NO_H†	* if PATCH_RIGID_A_H > 0
	PATCH_RIGID_A_L†	* if PATCH_RIGID_NO_L > 0
	PATCH_RIGID_NO_L†	* if PATCH_RIGID_A_L > 0
	PATCH_RIGID_A_M†	* if PATCH_RIGID_NO_M > 0
	PATCH_RIGID_NO_M†	* if PATCH_RIGID_A_M > 0
	PUMPING_L†	* if PUMPING_NO > 0
	PUMPING_NO†	* if PUMPING_L > 0
	TRANS_CRACK_L_H†	* if TRANS_CRACK_NO_H > 0
	TRANS_CRACK_NO_H†	* if TRANS_CRACK_L_H > 0
	TRANS_CRACK_L_L†	* if TRANS_CRACK_NO_L > 0
	TRANS_CRACK_NO_L†	* if TRANS_CRACK_L_L > 0
	TRANS_CRACK_L_M†	* if TRANS_CRACK_NO_M > 0
	TRANS_CRACK_NO_M†	* if TRANS_CRACK_L_M > 0
	TRANS_SPALLING_L_H†	* if TRANS_SPALLING_ NO_H > 0
	TRANS_SPALLING_NO_H†	* if TRANS_SPALLING_ L_H > 0
	TRANS_SPALLING_L_L†	* if TRANS_SPALLING_ NO_L > 0
	TRANS_SPALLING_NO_L†	* if TRANS_SPALLING_L_L > 0
	TRANS_SPALLING_L_M†	* if TRANS_SPALLING_NO_M > 0
	TRANS_SPALLING_NO_M†	* if TRANS_SPALLING_ L_M > 0

D. Expanded Range Checks

Expanded range checks are applied to certain fields to identify data element values that fall outside an expected range. Field names are listed below the bolded table name.

Table	Units	Range
MON_DIS_AC_REV		
AFTER_TEMP	deg C	-20 - 60
BEFORE_TEMP	deg C	-20 - 60
BLEEDING	sq m	0.0 - 420.0
BLK_CRACK_A_H	sq m	0.0 - 650.0
BLK_CRACK_A_L	sq m	0.0 - 650.0
BLK_CRACK_A_M	sq m	0.0 - 650.0
EDGE_CRACK_L_H	m	0.0 - 155.0
EDGE_CRACK_L_L	m	0.0 - 155.0
EDGE_CRACK_L_M	m	0.0 - 155.0
GATOR_CRACK_A_H	sq m	0.0 - 650.0
GATOR_CRACK_A_L	sq m	0.0 - 650.0
GATOR_CRACK_A_M	sq m	0.0 - 650.0
LONG_CRACK_NWP_L_H	m	0.0 - 465.0
LONG_CRACK_NWP_L_L	m	0.0 - 465.0
LONG_CRACK_NWP_L_M	m	0.0 - 465.0
LONG_CRACK_NWP_SEAL_L_H	m	0.0 - 465.0
LONG_CRACK_NWP_SEAL_L_L	m	0.0 - 465.0
LONG_CRACK_NWP_SEAL_L_M	m	0.0 - 465.0
LONG_CRACK_WP_L_H	m	0.0 - 310.0
LONG_CRACK_WP_L_L	m	0.0 - 310.0
LONG_CRACK_WP_L_M	m	0.0 - 310.0
LONG_CRACK_WP_SEAL_L_H	m	0.0 - 310.0
LONG_CRACK_WP_SEAL_L_L	m	0.0 - 310.0
LONG_CRACK_WP_SEAL_L_M	m	0.0 - 310.0
PATCH_A_H	sq m	0.0 - 325.0
PATCH_A_L	sq m	0.0 - 325.0
PATCH_A_M	sq m	0.0 - 325.0
PATCH_NO_H		0 - 100
PATCH_NO_L		0 - 100
PATCH_NO_M		0 - 100
POLISH_AGG_A	sq m	0.0 - 325.0
POTHOLES_A_H	sq m	0.0 - 165.0
POTHOLES_A_L	sq m	0.0 - 165.0
POTHOLES_A_M	sq m	0.0 - 165.0
POTHOLES_NO_H		0 - 100
POTHOLES_NO_L		0 - 100
POTHOLES_NO_M		0 - 100
PUMPING_L	m	0.0 - 375.0
PUMPING_NO		0 - 200
RAVELING	sq m	0.0 - 650.0
SHOVING_A	sq m	0.0 - 217.0
SHOVING_NO		0 - 100
SURVEY_WIDTH	m	2.5 - 5.0
TRANS_CRACK_L_H	m	0.0 - 690.0
TRANS_CRACK_L_L	m	0.0 - 690.0
TRANS_CRACK_L_M	m	0.0 - 690.0
TRANS_CRACK_NO_H		0 - 150
TRANS_CRACK_NO_L		0 - 150

TRANS_CRACK_NO_M		0 - 150
TRANS_CRACK_SEAL_L_H	m	0.0 - 690.0
TRANS_CRACK_SEAL_L_L	m	0.0 - 690.0
TRANS_CRACK_SEAL_L_M	m	0.0 - 690.0

MON_DIS_CRCP_REV

AFTER_TEMP	deg C	-20 - 50
BEFORE_TEMP	deg C	-20 - 50
BLOWUPS_NO		0 - 50
CONST_JOINT_NO_H		0 - 2
CONST_JOINT_NO_L		0 - 2
CONST_JOINT_NO_M		0 -
DURAB_CRACK_A_H	sq m	0.0 - 217.0
DURAB_CRACK_A_L	sq m	0.0 - 217.0
DURAB_CRACK_A_M	sq m	0.0 - 217.0
DURAB_CRACK_NO_H		0 - 100
DURAB_CRACK_NO_L		0 - 100
DURAB_CRACK_NO_M		0 - 100
LONG_CRACK_L_H	m	0.0 - 620.0
LONG_CRACK_L_L	m	0.0 - 620.0
LONG_CRACK_L_M	m	0.0 - 620.0
LONG_CRACK_SEAL_L_H	m	0.0 - 620.0
LONG_CRACK_SEAL_L_L	m	0.0 - 620.0
LONG_CRACK_SEAL_L_M	m	0.0 - 620.0
LONG_JT_SEAL_DAM_L	m	0.0 - 310.0
LONG_JT_SEAL_NO		0 - 2
LONG_SPALLING_L_H	m	0.0 - 310.0
LONG_SPALLING_L_L	m	0.0 - 310.0
LONG_SPALLING_L_M	m	0.0 - 310.0
MAP_CRACK_A	sq m	0.0 - 650.0
MAP_CRACK_NO		0 - 50
PATCH_FLEX_A_H	sq m	0.0 - 325.0
PATCH_FLEX_A_L	sq m	0.0 - 325.0
PATCH_FLEX_A_M	sq m	0.0 - 325.0
PATCH_FLEX_NO_H		0 - 100
PATCH_FLEX_NO_L		0 - 100
PATCH_FLEX_NO_M		0 - 100
PATCH_RIGID_A_H	sq m	0.0 - 325.0
PATCH_RIGID_A_L	sq m	0.0 - 325.0
PATCH_RIGID_A_M	sq m	0.0 - 325.0
PATCH_RIGID_NO_H		0 - 100
PATCH_RIGID_NO_L		0 - 100
PATCH_RIGID_NO_M		0 - 100
POLISH_AGG_A	sq m	0.0 - 325.0
PUMPING_L	m	0.0 - 370.0
PUMPING_NO		0 - 50
PUNCHOUTS_NO_H		0 - 75
PUNCHOUTS_NO_L		0 - 75
PUNCHOUTS_NO_M		0 - 75
SCALING_A	sq m	0.0 - 650.0
SCALING_NO		0 - 50
SURVEY_WIDTH	m	2.5 - 5.0
TRANS_CRACK_L_H	m	0.0 - 920.0
TRANS_CRACK_L_L	m	0.0 - 920.0
TRANS_CRACK_L_M	m	0.0 - 920.0
TRANS_CRACK_NO_H		0 - 250

TRANS_CRACK_NO_L		0 - 250
TRANS_CRACK_NO_M		0 - 250
TRANS_CRACK_TOTAL_NO		0 - 250

MON_DIS_JPCC_FAULT

CRACK_OR_JOINT		C, J
EDGE_AVG_MM	mm	-30 - 30
LENGTH	m	0.0 - 5.1
SPALLED_LENGTH_H	m	0.0 - 5.1
SPALLED_LENGTH_L	m	0.0 - 5.1
SPALLED_LENGTH_M	m	0.0 - 5.1
WELL_SEALED		Y, N
WHEELPATH_AVG_MM	mm	-30 - 30

MON_DIS_JPCC_FAULT_SECT

NO_TOTAL_POINT_LOC		1 - 150
AVG_EDGE_FAULT	mm	null, -1.0 - 30.0
MIN_EDGE_FAULT	mm	null, -1.0 - 30.0
MAX_EDGE_FAULT	mm	null, -1.0 - 30.0
STD_EDGE_FAULT	mm	null, -1.0 - 30.0
NO_ PASSED_EDGE_FAULT		0 - 150
NO_ NULL_EDGE_FAULT		0 - 150
NO_ NEG2_EDGE_FAULT		0 - 150
EDGE_FAULT_STATUS		1 - 4
AVG_WHEELPATH_FAULT	mm	null, -1.0 - 30.0
MIN_WHEELPATH_FAULT	mm	null, -1.0 - 30.0
MAX_WHEELPATH_FAULT	mm	null, -1.0 - 30.0
STD_WHEELPATH_FAULT	mm	null, -1.0 - 30.0
NO_PASSED_WHEELPATH_FAULT		0 - 150
NO_NULL_WHEELPATH_FAULT		0 - 150
NO_NEG2_WHEELPATH_FAULT		0 - 150
WHEELPATH_FAULT_STATUS		1 - 4
DATA_PROCESS_EXTRACT_DATE		> July 4, 1998

MON_DIS_JPCC_REV

AFTER_TEMP	deg C	-20 - 50
BEFORE_TEMP	deg C	-20 - 50
BLOWUPS_NO		0 - 50; 0 - 100 (SPS ?602, ?605)
CORNER_BREAKS_NO_H		0 - 50; 0 - 100 (SPS ?602, ?605)
CORNER_BREAKS_NO_L		0 - 50; 0 - 100 (SPS ?602, ?605)
CORNER_BREAKS_NO_M		0 - 50; 0 - 100 (SPS ?602, ?605)
DURAB_CRACK_A_H	sq m	0.0 - 217.0; 0 - 435.0 (SPS ?602, ?605)
DURAB_CRACK_A_L	sq m	0.0 - 217.0; 0 - 435.0 (SPS 602, ?605)
DURAB_CRACK_A_M	sq m	0.0 - 217.0; 0 - 435.0 (SPS ?602, ?605)
DURAB_CRACK_NO_H		0 - 100; 0 - 200 (SPS ?602, ?605)
DURAB_CRACK_NO_L		0 - 100; 0 - 200 (SPS ?602, ?605)
DURAB_CRACK_NO_M		0 - 100; 0 - 200 (SPS ?602, ?605)
JOINT_SEAL_TRANS_NO_H		0 - 300; 0 - 600 (SPS ?602, ?605)
JOINT_SEAL_TRANS_NO_L		0 - 300; 0 - 600 (SPS ?602, ?605)
JOINT_SEAL_TRANS_NO_M		0 - 300; 0 - 600 (SPS ?602, ?605)
JT_SEALED		Y,N
LONG_CRACK_L_H	m	0.0 - 620.0; 0.0 - 1240.0 (SPS ?602, ?605)
LONG_CRACK_L_L	m	0.0 - 620.0; 0.0 - 1240.0 (SPS ?602, ?605)

LONG_CRACK_L_M	m	0.0 - 620.0; 0.0 - 1240.0 (SPS ?602, ?605)
LONG_CRACK_SEAL_L_H	m	0.0 - 620.0; 0.0 - 1240.0 (SPS ?602, ?605)
LONG_CRACK_SEAL_L_L	m	0.0 - 620.0; 0.0 - 1240.0 (SPS ?602, ?605)
LONG_CRACK_SEAL_L_M	m	0.0 - 620.0; 0.0 - 1240.0 (SPS ?602, ?605)
LONG_JT_SEAL_DAM	m	0.0 - 310.0; 0.0 - 620.0 (SPS ?602, ?605)
LONG_JT_SEAL_NO		0 - 2
LONG_SPALLING_L_H	m	0.0 - 310.0; 0.0 - 620.0 (SPS ?602, ?605)
LONG_SPALLING_L_L	m	0.0 - 310.0; 0.0 - 620.0 (SPS ?602, ?605)
LONG_SPALLING_L_M	m	0.0 - 310.0; 0.0 - 620.0 (SPS ?602, ?605)
MAP_CRACK_A	sq m	0.0 - 650.0; 0.0 - 1300.0 (SPS ?602, ?605)
MAP_CRACK_NO		0 - 50;0 - 100 (SPS ?602, ?605)
PATCH_FLEX_A_H	sq m	0.0 - 325.0 ;0 - 650.0 (SPS ?602, ?605)
PATCH_FLEX_A_L	sq m	0.0 - 325.0; 0 - 650.0 (SPS ?602, ?605)
PATCH_FLEX_A_M	sq m	0.0 - 325.0; 0 - 650.0 (SPS ?602, ?605)
PATCH_FLEX_NO_H		0 - 100; 0 - 200 (SPS ?602, ?605)
PATCH_FLEX_NO_L		0 - 100; 0 - 200 (SPS ?602, ?605)
PATCH_FLEX_NO_M		0 - 100; 0 - 200 (SPS ?602, ?605)
PATCH_RIGID_A_H	sq m	0.0 - 325.0; 0 - 650.0 (SPS ?602, ?605)
PATCH_RIGID_A_L	sq m	0.0 - 325.0; 0 - 650.0 (SPS ?602, ?605)
PATCH_RIGID_A_M	sq m	0.0 - 325.0; 0 - 650.0 (SPS ?602, ?605)
PATCH_RIGID_NO_H		0 - 100; 0 - 200 (SPS ?602, ?605)
PATCH_RIGID_NO_L		0 - 100; 0 - 200 (SPS ?602, ?605)
PATCH_RIGID_NO_M		0 - 100; 0 - 200 (SPS ?602, ?605)
POLISH_AGG_A	sq m	0.0 - 325.0; 0 - 650.0 (SPS ?602, ?605)
PUMPING_L	m	0.0 - 370.0; 0.0 - 740.0 (SPS ?602, ?605)
PUMPING_NO		0 - 50; 0 - 100 (SPS ?602, ?605)
SCALING_A	sq m	0.0 - 650.0; 0.0 - 1300.0 (SPS ?602, ?605)
SCALING_NO		0 - 50; 0 - 100(SPS ?602, ?605)
SURVEY_WIDTH	m	2.5 - 5.0
TRANS_CRACK_L_H	m	0.0 - 765.0; 0 - 1530.0 (SPS ?602, ?605)
TRANS_CRACK_L_L	m	0.0 - 765.0; 0 - 1530.0 (SPS ?602, ?605)
TRANS_CRACK_L_M	m	0.0 - 765.0; 0 - 1530.0 (SPS ?602, ?605)
TRANS_CRACK_NO_H		0 - 100; 0 - 200 (SPS ?602, ?605)
TRANS_CRACK_NO_L		0 - 100; 0 - 200 (SPS ?602, ?605)
TRANS_CRACK_NO_M		0 - 100; 0 - 200 (SPS ?602, ?605)
TRANS_CRACK_SEAL_L_H	m	0.0 - 765.0; 0 - 1530.0 (SPS ?602, ?605)
TRANS_CRACK_SEAL_L_L	m	0.0 - 765.0; 0 - 1530.0 (SPS ?602, ?605)
TRANS_CRACK_SEAL_L_M	m	0.0 - 765.0; 0 - 1530.0 (SPS ?602, ?605)

TRANS_SPALLING_L_H	m	0.0 - 230.0; 0.0 - 460.0 (SPS ?602, ?605)
TRANS_SPALLING_L_L	m	0.0 - 230.0; 0.0 - 460.0 (SPS ?602, ?605)
TRANS_SPALLING_L_M	m	0.0 - 230.0; 0.0 - 460.0 (SPS ?602, ?605)
TRANS_SPALLING_NO_H		0 - 50; 0 - 100 (SPS ?602, ?605)
TRANS_SPALLING_NO_L		0 - 50; 0 - 100 (SPS ?602, ?605)
TRANS_SPALLING_NO_M		0 - 50; 0 - 100 (SPS ?602, ?605)

MON_DIS_LINK

No level D checks

MON_DIS_PADIAS_AC

BLEEDING	sq m	0.0 - 420.0
BLK_CRACK_A_H	sq m	0.0 - 650.0
BLK_CRACK_A_L	sq m	0.0 - 650.0
BLK_CRACK_A_M	sq m	0.0 - 650.0
EDGE_CRACK_L_H	m	0.0 - 155.0
EDGE_CRACK_L_L	m	0.0 - 155.0
EDGE_CRACK_L_M	m	0.0 - 155.0
GATOR_CRACK_A_H	sq m	0.0 - 650.0
GATOR_CRACK_A_L	sq m	0.0 - 650.0
GATOR_CRACK_A_M	sq m	0.0 - 650.0
LONG_CRACK_L_H	m	0.0 - 610.0
LONG_CRACK_L_L	m	0.0 - 610.0
LONG_CRACK_L_M	m	0.0 - 610.0
PATCH_A_H	sq m	0.0 - 325.0
PATCH_A_L	sq m	0.0 - 325.0
PATCH_A_M	sq m	0.0 - 325.0
PATCH_NO_H		0 - 100
PATCH_NO_L		0 - 100
PATCH_NO_M		0 - 100
POLISH_AGG_A		0.0 - 325.0
POTHOLES_NO		0 - 100
POTHOLES_A	sq m	0.0 - 165.0
RAVELING	sq m	0.0 - 650.0
SHOVING_NO		0 - 100
SHOVING_A		0.0 - 217.0
SURVEY_WIDTH	m	2.5 - 5.0
TRANS_CRACK_L_H	m	0.0 - 690.0
TRANS_CRACK_L_L	m	0.0 - 690.0
TRANS_CRACK_L_M	m	0.0 - 690.0
TRANS_CRACK_NO_H		0 - 150
TRANS_CRACK_NO_L		0 - 150
TRANS_CRACK_NO_M		0 - 150
WATER_BLEED_PUMP_L	m	0.0 - 155.0
WATER_BLEED_PUMP_NO		0 - 50

MON_DIS_PADIAS_CRCP

BLOWUPS_NO	0 - 50
CONST_JOINT_NO_H	0 - 2
CONST_JOINT_NO_L	0 - 2
CONST_JOINT_NO_M	0 - 2

DURAB_CRACK_NO_H		0 - 100
DURAB_CRACK_NO_L		0 - 100
DURAB_CRACK_NO_M		0 - 100
DURAB_CRACK_A_H	sq m	0.0 - 217.0
DURAB_CRACK_A_L	sq m	0.0 - 217.0
DURAB_CRACK_A_M	sq m	0.0 - 217.0
LONG_CRACK_L_H	m	0.0 - 2000.0
LONG_CRACK_L_L	m	0.0 - 2000.0
LONG_CRACK_L_M	m	0.0 - 2000.0
LONG_SPALLING_L_H	m	0.0 - 1000.0
LONG_SPALLING_L_L	m	0.0 - 1000.0
LONG_SPALLING_L_M	m	0.0 - 1000.0
PATCH_FLEX_NO_H		0 - 100
PATCH_FLEX_NO_L		0 - 100
PATCH_FLEX_NO_M		0 - 100
PATCH_FLEX_A_H	sq m	0.0 - 325.0
PATCH_FLEX_A_L	sq m	0.0 - 325.0
PATCH_FLEX_A_M	sq m	0.0 - 325.0
POLISH_AGG_A	sq m	0.0 - 3000.0
PUNCHOUTS_NO_H		0 - 75
PUNCHOUTS_NO_L		0 - 75
PUNCHOUTS_NO_M		0 - 75
PATCH_RIGID_NO_H		0 - 100
PATCH_RIGID_NO_L		0 - 100
PATCH_RIGID_NO_M		0 - 100
PATCH_RIGID_A_H	sq m	0.0 - 3000.0
PATCH_RIGID_A_L	sq m	0.0 - 3000.0
PATCH_RIGID_A_M	sq m	0.0 - 3000.0
SCALING_A	sq m	0.0 - 650.0
SURVEY_WIDTH	m	2.5 - 5.0
TRANS_CRACK_L_H	m	0.0 - 3000.0
TRANS_CRACK_L_L	m	0.0 - 3000.0
TRANS_CRACK_L_M	m	0.0 - 3000.0
TRANS_CRACK_NO_H		0 - 250
TRANS_CRACK_NO_L		0 - 250
TRANS_CRACK_NO_M		0 - 250
WATER_BLEED_PUMP_L	m	0.0 - 365.0
WATER_BLEED_PUMP_NO		0 - 50

MON_DIS_PADIAS_JPCC

BLOWUPS_NO		0 - 50; 0 - 100 (SPS ?602, ?605)
CORNER_BREAKS_NO_H		0 - 50; 0 - 100 (SPS ?602, ?605)
CORNER_BREAKS_NO_L		0 - 50; 0 - 100 (SPS ?602, ?605)
CORNER_BREAKS_NO_M		0 - 50; 0 - 100 (SPS ?602, ?605)
DURAB_CRACK_NO_H		0 - 100; 0 - 200 (SPS ?602, ?605)
DURAB_CRACK_NO_L		0 - 100; 0 - 200 (SPS ?602, ?605)
DURAB_CRACK_NO_M		0 - 100; 0 - 200 (SPS ?602, ?605)
DURAB_CRACK_A_H	sq m	0.0 - 217.0; 0.0 - 435.0 (SPS ?602, ?605)
DURAB_CRACK_A_L	sq m	0.0 - 217.0; 0.0 - 435.0 (SPS ?602, ?605)
DURAB_CRACK_A_M	sq m	0.0 - 217.0; 0.0 - 435.0 (SPS ?602, ?605)
JOINT_SEAL_TRANS_NO_H		0 - 300; 0 - 600 (SPS ?602, ?605)
JOINT_SEAL_TRANS_NO_L		0 - 300; 0 - 600 (SPS ?602, ?605)
JOINT_SEAL_TRANS_NO_M		0 - 300; 0 - 600 (SPS ?602, ?605)

LONG_CRACK_L_H	m	0.0 - 610.0; 0.0 - 1220.0 (SPS ?602, ?605)
LONG_CRACK_L_L	m	0.0 - 610.0; 0.0 - 1220.0 (SPS ?602, ?605)
LONG_CRACK_L_M	m	0.0 - 610.0; 0.0 - 1220.0 (SPS ?602, ?605)
LONG_SPALLING_L_H	m	0.0 - 310.0; 0.0 - 620.0 (SPS ?602, ?605)
LONG_SPALLING_L_L	m	0.0 - 310.0; 0.0 - 620.0 (SPS ?602, ?605)
LONG_SPALLING_L_M	m	0.0 - 310.0; 0.0 - 620.0 (SPS ?602, ?605)
PATCH_FLEX_NO_H		0 - 100; 0 - 200 (SPS ?602, ?605)
PATCH_FLEX_NO_L		0 - 100; 0 - 200 (SPS ?602, ?605)
PATCH_FLEX_NO_M		0 - 100; 0 - 200 (SPS ?602, ?605)
PATCH_FLEX_A_H	sq m	0.0 - 325.0; 0.0 - 650.0 (SPS ?602, ?605)
PATCH_FLEX_A_L	sq m	0.0 - 325.0; 0.0 - 650.0 (SPS ?602, ?605)
PATCH_FLEX_A_M	sq m	0.0 - 325.0; 0.0 - 650.0 (SPS ?602, ?605)
PATCH_RIGID_NO_H		0 - 100; 0 - 200 (SPS ?602, ?605)
PATCH_RIGID_NO_L		0 - 100; 0 - 200 (SPS ?602, ?605)
PATCH_RIGID_NO_M		0 - 100; 0 - 200 (SPS ?602, ?605)
PATCH_RIGID_A_H	sq m	0.0 - 325.0; 0.0 - 650.0 (SPS ?602, ?605)
PATCH_RIGID_A_L	sq m	0.0 - 325.0; 0.0 - 650.0 (SPS ?602, ?605)
PATCH_RIGID_A_M	sq m	0.0 - 325.0; 0.0 - 650.0 (SPS ?602, ?605)
POLISH_AGG_A	sq m	0.0 - 325.0; 0.0 - 650.0 (SPS ?602, ?605)
SCALING_A	sq m	0.0 - 560.0; 0.0 - 1120.0 (SPS ?602,?605)
SURVEY_WIDTH	m	2.5 - 5.0
TRANS_CRACK_L_H	m	0.0 - 765.0; 0.0 - 1530.0 (SPS ?602, ?605)
TRANS_CRACK_L_L	m	0.0 - 765.0; 0.0 - 1530.0 (SPS ?602, ?605)
TRANS_CRACK_L_M	m	0.0 - 765.0; 0.0 - 1530.0 (SPS ?602, ?605)
TRANS_CRACK_NO_H		0 - 100; 0 - 200 (SPS ?602, ?605)
TRANS_CRACK_NO_L		0 - 100; 0 - 200 (SPS ?602, ?605)
TRANS_CRACK_NO_M		0 - 100; 0 - 200 (SPS ?602, ?605)
TRANS_SPALLING_L_H	m	0.0 - 230.0; 0.0 - 460.0 (SPS ?602, ?605)
TRANS_SPALLING_L_L	m	0.0 - 230.0; 0.0 - 460.0 (SPS ?602, ?605)
TRANS_SPALLING_L_M	m	0.0 - 230.0; 0.0 - 460.0 (SPS ?602, ?605)
TRANS_SPALLING_NO_H		0 - 50; 0 - 100 (SPS ?602, ?605)
TRANS_SPALLING_NO_L		0 - 50; 0 - 100 (SPS ?602, ?605)
TRANS_SPALLING_NO_M		0 - 50; 0 - 100 (SPS ?602, ?605)
WATER_BLEED_PUMP_L	m	0.0 - 365.0; 0.0 - 730.0 (SPS ?602, ?605)
WATER_BLEED_PUMP_NO		0 - 50; 0 - 100 (SPS ?602, ?605)

MON_DIS_PADIAS42_AC

BLEEDING	sq m	0.0 - 420.0
BLK_CRACK_A_H	sq m	0.0 - 650.0
BLK_CRACK_A_L	sq m	0.0 - 650.0
BLK_CRACK_A_M	sq m	0.0 - 650.0
EDGE_CRACK_L_H	m	0.0 - 155.0
EDGE_CRACK_L_L	m	0.0 - 155.0
EDGE_CRACK_L_M	m	0.0 - 155.0
GATOR_CRACK_A_H	sq m	0.0 - 650.0
GATOR_CRACK_A_L	sq m	0.0 - 650.0
GATOR_CRACK_A_M	sq m	0.0 - 650.0
LONG_CRACK_NWP_L_H	m	0.0 - 465.0
LONG_CRACK_NWP_L_L	m	0.0 - 465.0
LONG_CRACK_NWP_L_M	m	0.0 - 465.0
LONG_CRACK_NWP_SEAL_L_H	m	0.0 - 465.0
LONG_CRACK_NWP_SEAL_L_L	m	0.0 - 465.0
LONG_CRACK_NWP_SEAL_L_M	m	0.0 - 465.0
LONG_CRACK_WP_L_H	m	0.0 - 310.0
LONG_CRACK_WP_L_L	m	0.0 - 310.0
LONG_CRACK_WP_L_M	m	0.0 - 310.0
LONG_CRACK_WP_SEAL_L_H	m	0.0 - 310.0
LONG_CRACK_WP_SEAL_L_L	m	0.0 - 310.0
LONG_CRACK_WP_SEAL_L_M	m	0.0 - 310.0
PATCH_A_H	sq m	0.0 - 325.0
PATCH_A_L	sq m	0.0 - 325.0
PATCH_A_M	sq m	0.0 - 325.0
PATCH_NO_H		0 - 100
PATCH_NO_L		0 - 100
PATCH_NO_M		0 - 100
POLISH_AGG_A		0.0 - 325.0
POTHOLES_A_H	sq m	0.0 - 165.0
POTHOLES_A_L	sq m	0.0 - 165.0
POTHOLES_A_M	sq m	0.0 - 165.0
POTHOLES_NO_H		0 - 100
POTHOLES_NO_L		0 - 100
POTHOLES_NO_M		0 - 100
PUMPING_L	m	0.0 - 375.0
PUMPING_NO		0 - 200
RAVELING	sq m	0.0 - 650.0
SHOVING_A	sq m	0.0 - 217.0
SHOVING_NO		0 - 100
SURVEY_WIDTH	m	2.5 - 5.0
TRANS_CRACK_L_H	m	0.0 - 690.0
TRANS_CRACK_L_L	m	0.0 - 690.0
TRANS_CRACK_L_M	m	0.0 - 690.0
TRANS_CRACK_NO_H		0 - 150
TRANS_CRACK_NO_L		0 - 150
TRANS_CRACK_NO_M		0 - 150
TRANS_CRACK_SEAL_L_H	m	0.0 - 690.0
TRANS_CRACK_SEAL_L_L	m	0.0 - 690.0
TRANS_CRACK_SEAL_L_M	m	0.0 - 690.0

MON_DIS_PADIAS42_CRCP

BLOWUPS_NO		0 - 50
CONST_JOINT_NO_H		0 - 2

CONST_JOINT_NO_L		0 - 2
CONST_JOINT_NO_M		0 - 2
DURAB_CRACK_A_H	sq m	0.0 - 217.0
DURAB_CRACK_A_L	sq m	0.0 - 217.0
DURAB_CRACK_A_M	sq m	0.0 - 217.0
DURAB_CRACK_NO_H		0 - 100
DURAB_CRACK_NO_L		0 - 100
DURAB_CRACK_NO_M		0 - 100
LONG_CRACK_L_H	m	0.0 - 620.0
LONG_CRACK_L_L	m	0.0 - 620.0
LONG_CRACK_L_M	m	0.0 - 620.0
LONG_CRACK_SEAL_L_H	m	0.0 - 620.0
LONG_CRACK_SEAL_L_L	m	0.0 - 620.0
LONG_CRACK_SEAL_L_M	m	0.0 - 620.0
LONG_SPALLING_L_H	m	0.0 - 310.0
LONG_SPALLING_L_L	m	0.0 - 310.0
LONG_SPALLING_L_M	m	0.0 - 310.0
MAP_CRACK_A	sq m	0.0 - 650.0
MAP_CRACK_NO		0 - 50
PATCH_FLEX_A_H	sq m	0.0 - 325.0
PATCH_FLEX_A_L	sq m	0.0 - 325.0
PATCH_FLEX_A_M	sq m	0.0 - 325.0
PATCH_FLEX_NO_H		0 - 100
PATCH_FLEX_NO_L		0 - 100
PATCH_FLEX_NO_M		0 - 100
PATCH_RIGID_A_H	sq m	0.0 - 325.0
PATCH_RIGID_A_L	sq m	0.0 - 325.0
PATCH_RIGID_A_M	sq m	0.0 - 325.0
PATCH_RIGID_NO_H		0 - 100
PATCH_RIGID_NO_L		0 - 100
PATCH_RIGID_NO_M		0 - 100
POLISH_AGG_A	sq m	0.0 - 325.0
PUMPING_L	m	0.0 - 370.0
PUMPING_NO		0 - 50
PUNCHOUTS_NO_H		0 - 75
PUNCHOUTS_NO_L		0 - 75
PUNCHOUTS_NO_M		0 - 75
SCALING_A	sq m	0.0 - 650.0
SCALING_NO		0 - 50
SURVEY_WIDTH	m	2.5 - 5.0
TRANS_CRACK_L_H	m	0.0 - 920.0
TRANS_CRACK_L_L	m	0.0 - 920.0
TRANS_CRACK_L_M	m	0.0 - 920.0
TRANS_CRACK_NO_H		0 - 250
TRANS_CRACK_NO_L		0 - 250
TRANS_CRACK_NO_M		0 - 250
TRANS_CRACK_TOTAL_NO		0 - 250

MON_DIS_PADIAS42_JPCC

BLOWUPS_NO		0 - 50; 0 - 100 (SPS ?602, ?605)
CORNER_BREAKS_NO_H		0 - 50; 0 - 100 (SPS ?602, ?605)
CORNER_BREAKS_NO_L		0 - 50; 0 - 100 (SPS ?602, ?605)
CORNER_BREAKS_NO_M		0 - 50; 0 - 100 (SPS ?602, ?605)
DURAB_CRACK_A_H	sq m	0.0 - 217.0; 0 - 435.0 (SPS ?602, ?605)
DURAB_CRACK_A_L	sq m	0.0 - 217.0; 0 - 435.0 (SPS ?602, ?605)
DURAB_CRACK_A_M	sq m	0.0 - 217.0; 0 - 435.0 (SPS ?602, ?605)

DURAB_CRACK_NO_H		0 - 100; 0 - 200 (SPS ?602, ?605)
DURAB_CRACK_NO_L		0 - 100; 0 - 200 (SPS ?602, ?605)
DURAB_CRACK_NO_M		0 - 100; 0 - 200 (SPS ?602, ?605)
LONG_CRACK_L_H	m	0.0 - 620.0; 0.0 - 1240.0 (SPS ?602, ?605)
LONG_CRACK_L_L	m	0.0 - 620.0; 0.0 - 1240.0 (SPS ?602, ?605)
LONG_CRACK_L_M	m	0.0 - 620.0; 0.0 - 1240.0 (SPS ?602, ?605)
LONG_CRACK_SEAL_L_H	m	0.0 - 620.0; 0.0 - 1240.0 (SPS ?602, ?605)
LONG_CRACK_SEAL_L_L	m	0.0 - 620.0; 0.0 - 1240.0 (SPS ?602, ?605)
LONG_CRACK_SEAL_L_M	m	0.0 - 620.0; 0.0 - 1240.0 (SPS ?602, ?605)
LONG_SPALLING_L_H	m	0.0 - 310.0; 0.0 - 620.0 (SPS ?602, ?605)
LONG_SPALLING_L_L	m	0.0 - 310.0; 0.0 - 620.0 (SPS ?602, ?605)
LONG_SPALLING_L_M	m	0.0 - 310.0; 0.0 - 620.0 (SPS ?602, ?605)
MAP_CRACK_A	sq m	0.0 - 650.0; 0.0 - 1300.0 (SPS ?602, ?605)
MAP_CRACK_NO		0 - 50; 0 - 100 (SPS ?602, ?605)
PATCH_FLEX_A_H	sq m	0.0 - 325.0; 0 - 650.0 (SPS ?602, ?605)
PATCH_FLEX_A_L	sq m	0.0 - 325.0; 0 - 650.0(SPS ?602, ?605)
PATCH_FLEX_A_M	sq m	0.0 - 325.0; 0 - 650.0 (SPS ?602, ?605)
PATCH_FLEX_NO_H		0 - 100; 0 - 200 (SPS ?602, ?605)
PATCH_FLEX_NO_L		0 - 100; 0 - 200 (SPS ?602, ?605)
PATCH_FLEX_NO_M		0 - 100; 0 - 200 (SPS ?602, ?605)
PATCH_RIGID_A_H	sq m	0.0 - 325.0; 0 - 650.0 (SPS ?602, ?605)
PATCH_RIGID_A_L	sq m	0.0 - 325.0; 0 - 650.0 (SPS ?602, ?605)
PATCH_RIGID_A_M	sq m	0.0 - 325.0; 0 - 650.0 (SPS ?602, ?605)
PATCH_RIGID_NO_H		0 - 100; 0 - 200 (SPS ?602, ?605)
PATCH_RIGID_NO_L		0 - 100; 0 - 200 (SPS ?602, ?605)
PATCH_RIGID_NO_M		0 - 100; 0 - 200 (SPS ?602, ?605)
POLISH_AGG_A	sq m	0.0 - 325.0; 0 - 650.0 (SPS ?602, ?605)
PUMPING_L	m	0.0 - 370.0; 0.0 - 740.0 (SPS ?602, ?605)
PUMPING_NO		0 - 50; 0 - 100 (SPS ?602, ?605)
SCALING_A	sq m	0.0 - 650.0; 0.0 - 1300.0 (SPS ?602, ?605)
SCALING_NO		0 - 50; 0 - 100 (SPS ?602, ?605)
		SURVEY_WIDTH
		m 2.5 - 5.0
TRANS_CRACK_L_H	m	0.0 - 765.0; 0 - 1530.0 (SPS ?602, ?605)
TRANS_CRACK_L_L	m	0.0 - 765.0; 0 - 1530.0 (SPS ?602, ?605)
TRANS_CRACK_L_M	m	0.0 - 765.0; 0 - 1530.0 (SPS ?602, ?605)
TRANS_CRACK_NO_H		0 - 100; 0 - 200 (SPS ?602, ?605)
TRANS_CRACK_NO_L		0 - 100; 0 - 200 (SPS ?602, ?605)
TRANS_CRACK_NO_M		0 - 100; 0 - 200 (SPS ?602, ?605)
TRANS_CRACK_SEAL_L_H	m	0.0 - 765.0; 0 - 1530.0 (SPS ?602, ?605)

TRANS_CRACK_SEAL_L_L	m	0.0 - 765.0; 0 - 1530.0 (SPS ?602, ?605)
TRANS_CRACK_SEAL_L_M	m	0.0 - 765.0; 0 - 1530.0(SPS ?602, ?605)
TRANS_SPALLING_L_H	m	0.0 - 230.0; 0.0 - 460.0 (SPS ?602, ?605)
TRANS_SPALLING_L_L	m	0.0 - 230.0; 0.0 - 460.0 (SPS ?602, ?605)
TRANS_SPALLING_L_M	m	0.0 - 230.0; 0.0 - 460.0 (SPS ?602, ?605)
TRANS_SPALLING_NO_H		0 - 50; 0 - 100 (SPS ?602, ?605)
TRANS_SPALLING_NO_L		0 - 50; 0 - 100 (SPS ?602, ?605)
TRANS_SPALLING_NO_M		0 - 50; 0 - 100 (SPS ?602, ?605)

MON_DROP_SEP

DROPOFF	mm	-30 - 125
SEPARATION	mm	0 - 125

E. Intramodular Checks

Each E-type check is separated by a single line. In general, each bullet represents a procedure, action, etc., of the check.

Note: A check has been added after level E processing to check each record, regardless of record_status, for a match in the MON_DIS_LINK table. Any record without a match is listed in the QC output file, but the record status is not changed.

Table: MON_DIS_AC_REV

- The summation of low (L), moderate (M), and high (H) severity levels for data elements should meet the following range checks:

Data Elements	Range
BLK_CRACK_A_i	0.0 - 650.0
EDGE_CRACK_L_i	0.0 - 155.0
GATOR_CRACK_A_i	0.0 - 650.0
LONG_CRACK_NWP_i	0.0 - 465.0
LONG_CRACK_NWP_SEAL_L_i	0.0 - 465.0
LONG_CRACK_WP_L_i	0.0 - 310.0
LONG_CRACK_WP_SEAL_L_i	0.0 - 310.0
PATCH_A_i	0.0 - 325.0
PATCH_NO_i	0 - 100
POTHOLES_A_i	0.0 - 165.0
POTHOLES_NO_i	0 - 100
TRANS_CRACK_L_i	0.0 - 690.0
TRANS_CRACK_NO_i	0 - 150
TRANS_CRACK_SEAL_L_i	0.0 - 690.0

  Example:

  0.0 <= (GATOR_CRACK_A_L + GATOR_CRACK_A_M + GATOR_CRACK_A_H) <= 650.0

- Sum of GATOR and BLK must be between 0.0 - 650.0

- Sum of BLEEDING, RAVELING, POLISH_AGG_A must be between 0.0 - 650.0
- Sum of LONG_CRACK_WP_SEAL_L (L, M, H) must be <= Sum LONG_CRACK_WP_L (L, M, H)
- LONG_CRACK_WP_SEAL_L_L must be <= LONG_CRACK_WP_L_L
- LONG_CRACK_WP_SEAL_L_M must be <= LONG_CRACK_WP_L_M
- LONG_CRACK_WP_SEAL_L_H must be <= LONG_CRACK_WP_L_H
- Sum of LONG_CRACK_NWP_SEAL_L (L, M, H) must be <= Sum LONG_CRACK_NWP_L (L, M, H)
- LONG_CRACK_NWP_SEAL_L_L must be <= LONG_CRACK_NWP_L_L
- LONG_CRACK_NWP_SEAL_L_M must be <= LONG_CRACK_NWP_L_M
- LONG_CRACK_NWP_SEAL_L_H must be <= LONG_CRACK_NWP_L_H
- Sum of TRANS_CRACK_SEAL_L (L, M, H) must be <= Sum TRANS_CRACK_L (L, M, H)
- TRANS_CRACK_SEAL_L_L must be <= TRANS_CRACK_L_L
- TRANS_CRACK_SEAL_L_M must be <= TRANS_CRACK_L_M
- TRANS_CRACK_SEAL_L_H must be <= TRANS_CRACK_L_H
- In **EXPERIMENT_SECTION** (not supplementals):
  For matching STATE_CODE, SHRP_ID, CONSTRUCTION_NO check that the experiment assignment is in (G1, G2, G6A, G6B, G6C, G6D, G6S, 7A, 7B, 7C, 7D, 7F, 7S, S1, S3, S5, S6, S8, S9C, S9J, S9N, S9O)

Tables: MON_DIS_AC_REV, EXPERIMENT_SECTION, TST_L05B (not supplementals)

- For SPS 9C and SPS 9J for matching STATE_CODE, SHRP_ID and CONSTRUCTION_NO in **TST_L05B**, select MAX(LAYER_NO) for DESCRIPTION = 1 or 3 and check that MATL_CODE = 1, 2, 13 or 700

Tables: MON_DIS_AC_REV, MON_DIS_LINK

- For each record in **MON_DIS_AC_REV**, there must be a record in **MON_DIS_LINK** with matching STATE_CODE, SHRP_ID, and SURVEY_DATE and TABLENAME = 'MON_DIS_AC_REV'

  Error message: MON_DIS_AC_REV-E-101 {STATE_CODE, SHRP_ID, SURVEY_DATE} There is no matching record in **MON_DIS_LINK**.

Table: MON_DIS_CRCP_REV

- The summation of low (L), moderate (M), and high (H) severity levels for data elements should meet the following range checks:

Data Elements	Range
DURAB_CRACK_A_i	0.0 - 217.0
DURAB_CRACK_NO_i	0 - 100
CONST_JOINT_NO_i	0 - 2
LONG_CRACK_L_i	0.0 - 620.0
LONG_CRACK_SEAL_L_i	0.0 - 620.0
LONG_SPALLING_L_i	0.0 - 310.0
PATCH_FLEX_A_i	0.0 - 325.0
PATCH_FLEX_NO_i	0 - 100
PATCH_RIGID_A_i	0.0 - 325.0
PATCH_RIGID_NO_i	0 - 100
PUNCHOUTS_NO_i	0 - 75
TRANS_CRACK_L_i	0.0 - 920.0

  Example:

  0.0 <= (DURAB_CRACK_A_L + DURAB_CRACK_A_M + DURAB_CRACK_A_H) <= 217.0

- The summation of low (L), moderate (M), and high (H) severity levels of SCALING_A and POLISH_AGG_A and MAP_CRACK_A cannot exceed 650.0

  0.0 <= (SCALING_A + POLISH_AGG_A) <= 650.0

- The summation of low (L), moderate (M), and high (H) severity levels of LONG_CRACK_SEAL_L_i cannot exceed the summation of LONG_CRACK_L_i

  0.0 <= (LONG_CRACK_SEAL_L_L + LONG_CRACK_SEAL_L_M + LONG_CRACK_SEAL_L_H) <= (LONG_CRACK_L_L + LONG_CRACK_L_M + LONG_CRACK_L_H)

- LONG_CRACK_SEAL_L_L cannot exceed LONG_CRACK_L_L

  LONG_CRACK_SEAL_L_L <= LONG_CRACK_L_L

- LONG_CRACK_SEAL_L_M cannot exceed LONG_CRACK_L_M

  LONG_CRACK_SEAL_L_M <= LONG_CRACK_L_M

- LONG_CRACK_SEAL_L_H cannot exceed LONG_CRACK_L_H

  LONG_CRACK_SEAL_L_H <= LONG_CRACK_L_H

- The summation of low (L), moderate (M), and high (H) severity levels of TRANS_CRACK_NO_i must equal TRANS_CRACK_TOTAL_NO

  0 <= (TRANS_CRACK_NO_L + TRANS_CRACK_NO_M + TRANS_CRACK_NO_H) = TRANS_CRACK_TOTAL_NO

- The summation of low (L), moderate (M), and high (H) severity levels of PATCH_FLEX_A_i

and PATCH_RIGID_A_i cannot exceed 325.0

- <= (PATCH_FLEX_A_L + PATCH_FLEX_A_M + PATCH_FLEX_A_H + PATCH_RIGID_A_L + PATCH_RIGID_A_M + PATCH_RIGID_A_H) <= 325.0

- In **EXPERIMENT_SECTION** (not supplementals):
  For matching STATE_CODE, SHRP_ID, CONSTRUCTION_NO, check that the experiment assignment is in (G5, G7R, G9, S7, S9C)

Tables: MON_DIS_CRCP_REV, EXPERIMENT_SECTION, TST_L05B (not supplementals)

- For SPS 9C for matching STATE_CODE, SHRP_ID, CONSTRUCTION_NO in **TST_L05B**, select MAX(LAYER_NO) for DESCRIPTION = 1 or 3 and check that MATL_CODE = 6 or 730.

Tables: MON_DIS_CRCP_REV, MON_DIS_LINK

- For each record in **MON_DIS_CRCP_REV**, there must be a record in **MON_DIS_LINK** with matching STATE_CODE, SHRP_ID, and SURVEY_DATE and TABLENAME = 'MON_DIS_CRCP_REV'

  Error message: MON_DIS_CRCP_REV-E-101 {STATE_CODE, SHRP_ID, SURVEY_DATE} There is no matching record in **MON_DIS_LINK**.

Table: MON_DIS_JPCC_FAULT

- The summation of low (L), moderate (M), and high (H) severity levels for data elements should meet the following range checks:

Data Elements	Range
SPALLED_LENGTH_i	0.0 - 5.1

- In **EXPERIMENT_SECTION** (not supplementals):
  For matching STATE_CODE, SHRP_ID, CONSTRUCTION_NO, check that the experiment assignment is in (G3, G4, G7R, G9, S2, S4, S6, S7, S8 for SHRP_ID like ?807 - ?812, S9J)

Tables: MON_DIS_JPCC_FAULT, EXPERIMENT_SECTION, TST_L05B

- For SPS 9J for matching STATE_CODE, SHRP_ID, CONSTRUCTION_NO in **TST_L05B**, select MAX(LAYER_NO) for DESCRIPTION = 1 or 3 and check that MATL_CODE = 4, 5, or 730

Tables: MON_DIS_JPCC_FAULT, MON_DIS_LINK

- For each record in **MON_DIS_JPCC_FAULT**, there must be a record in **MON_DIS_LINK** with matching STATE_CODE, SHRP_ID, and SURVEY_DATE and TABLENAME = 'MON_DIS_JPCC_FAULT'

  Error message: MON_DIS_JPCC_FAULT-E-101 {STATE_CODE, SHRP_ID,

SURVEY_DATE} There is no matching record in **MON_DIS_LINK**.

Tables: MON_DIS_JPCC_REV, MON_DIS_LINK

- For each record in **MON_DIS_JPCC_REV**, there must be a record in **MON_DIS_LINK** with matching STATE_CODE, SHRP_ID, and SURVEY_DATE and TABLENAME = 'MON_DIS_JPCC_REV'

  Error message: MON_DIS_JPCC_REV-E-101 {STATE_CODE, SHRP_ID, SURVEY_DATE} There is no matching record in **MON_DIS_LINK**.

Table: MON_DIS_JPCC_FAULT_SECT

- NO_TOTAL_POINT_LOC = NO_PASSED_EDGE_FAULT + NO_NULL_EDGE_FAULT+ NO_ NEG2_EDGE_FAULT

  Error message: Invalid number of total point locations NO_TOTAL_POINT_LOC.

- NO_TOTAL_POINT_LOC = NO_PASSED_WHEELPATH_FAULT + NO_NULL_WHEELPATH_FAULT+ NO_NEG2_WHEELPATH_FAULT

  Error message: Invalid Number of total point locations NO_TOTAL_POINT_LOC.

- MIN_EDGE_FAULT <= AVG_EDGE_FAULT <= MAX_EDGE_FAULT

  Error message: Edge fault section statistics fail minimum <= average <= maximum test.

- MIN_WHEELPATH_FAULT <= AVG_WHEELPATH_FAULT<= MAX_WHEELPATH_FAULT

  Error message: Wheelpath fault section statistics fail minimum <= average <= maximum test.

Tables: MON_DIS_JPCC_FAULT_SECT, **MON_DIS_JPCC_FAULT**

- For records in **MON_DIS_JPCC_FAULT_SECT** where EDGE_FAULT_STATUS = 1 or WHEELPATH_FAULT_STATUS = 1, records in **MON_DIS_JPCC_FAULT** with matching STATE_CODE, SHRP_ID, SURVEY_DATE, CRACK_OR_JOINT, and WHEELPATH_AVG_MM or EDGE_AVG_MM not null (a one to many comparison), **MON_DIS_JPCC_FAULT**.RECORD_STATUS = E

  Error Message: All matching records in **MON_DIS_JPCC_FAULT** do not have RECORD_STATUS = E.

Table: MON_DIS_JPCC_REV

- The summation of low (L), moderate (M), and high (H) severity levels for data elements should meet the following range checks:

Data Elements	Range
CORNER_BREAKS_NO_i	0 - 50; 0 - 100 (SPS ?602, ?605)
DURAB_CRACK_A_i	0.0 - 217.0; 0.0 - 435.0 (SPS ?602, ?605)

DURAB_CRACK_NO_i	0 - 100; 0 - 200 (SPS ?602, ?605)
JOINT_SEAL_TRANS_NO_i	0 - 300; 0 - 600 (SPS ?602, ?605)
LONG_CRACK_L_i	0.0 - 620.0; 0.0 - 1240.0 (SPS ?602, ?605)
LONG_CRACK_SEAL_L_i	0.0 - 620.0; 0.0 - 1240.0 (SPS ?602, ?605)
LONG_SPALLING_L_i	0.0 - 310.0; 0.0 - 620.0 (SPS ?602, ?605)
PATCH_FLEX_A_i	0.0 - 325.0; 0.0 - 650.0 (SPS ?602, ?605)
PATCH_FLEX_NO_i	0 - 100; 0 - 200 (SPS ?602, ?605)
PATCH_RIGID_A_i	0.0 - 325.0; 0.0 - 650.0 (SPS ?602, ?605)
PATCH_RIGID_NO_i	0 - 100; 0 - 200 (SPS ?602, ?605)
TRANS_CRACK_L_i	0.0 - 765.0; 0.0 - 1530.0 (SPS ?602, ?605)
TRANS_CRACK_NO_i	0 - 100; 0 - 200 (SPS ?602, ?605)
TRANS_CRACK_SEAL_L_i	0.0 - 765.0; 0.0 - 1530.0 (SPS ?602, ?605)
TRANS_SPALLING_L_i	0.0 - 230.0; 0.0 - 460.0 (SPS ?602, ?605)
TRANS_SPALLING_NO_i	0 - 50; 0 - 100 (SPS ?602, ?605)

Example:

0.0 <= (DURAB_CRACK_A_L + DURAB_CRACK_A_M + DURAB_CRACK_A_H) <= 190.0

- The summation of low (L), moderate (M), and high (H) severity levels of SCALING_A and POLISH_AGG_A and MAP_CRACK_A cannot exceed 650 or 1300 for SPS ?602, ?605

  0.0 <= (SCALING_A + POLISH_AGG_A) <= 650.0 or 1300.0 for SPS ?602, ?605

- The summation of low (L), moderate (M), and high (H) severity levels of LONG_CRACK_SEAL_L_i cannot exceed the summation of LONG_CRACK_L_i

  0.0 <= (LONG_CRACK_SEAL_L_L + LONG_CRACK_SEAL_L_M + LONG_CRACK_SEAL_L_H) <= (LONG_CRACK_L_L + LONG_CRACK_L_M + LONG_CRACK_L_H)

- LONG_CRACK_SEAL_L_L cannot exceed LONG_CRACK_L_L

  LONG_CRACK_SEAL_L_L <= LONG_CRACK_L_L

- LONG_CRACK_SEAL_L_M cannot exceed LONG_CRACK_L_M

  LONG_CRACK_SEAL_L_M <= LONG_CRACK_L_M

- LONG_CRACK_SEAL_L_H cannot exceed LONG_CRACK_L_H

  LONG_CRACK_SEAL_L_H <= LONG_CRACK_L_H

- The summation of low (L), moderate (M), and high (H) severity levels of TRANS_CRACK_SEAL_L_i cannot exceed the summation of TRANS_CRACK_L_i

  0.0 <= (TRANS_CRACK_SEAL_L_L + TRANS_CRACK_SEAL_L_M + TRANS_CRACK_SEAL_L_H) <= (TRANS_CRACK_L_L + TRANS_CRACK_L_M + TRANS_CRACK_L_H)

- TRANS_CRACK_SEAL_L_L cannot exceed TRANS_CRACK_L_L

  TRANS_CRACK_SEAL_L_L <= TRANS_CRACK_L_L

- TRANS_CRACK_SEAL_L_M cannot exceed TRANS_CRACK_L_M

  TRANS_CRACK_SEAL_L_M <= TRANS_CRACK_L_M

- TRANS_CRACK_SEAL_L_H cannot exceed TRANS_CRACK_L_H

  TRANS_CRACK_SEAL_L_H <= TRANS_CRACK_L_H

- The summation of low (L), moderate (M), and high (H) severity levels of PATCH_FLEX_A_i and PATCH_RIGID_A_i cannot exceed 325.0 or 650.0 for SPS ?602, ?605

  0.0 <= (PATCH_FLEX_A_L + PATCH_FLEX_A_M + PATCH_FLEX_A_H + PATCH_RIGID_A_L + PATCH_RIGID_A_M + PATCH_RIGID_A_H) <= 325.0 or 650.0 for SPS ?602, ?605

- In **EXPERIMENT_SECTION** (not supplementals):
  For matching STATE_CODE, SHRP_ID, CONSTRUCTION_NO, check that the experiment assignment is in (G3, G4, G7R, G9, S2, S4, S6, S7, S8 for SHRP_ID like ?807 - ?812, S9J)

Tables: MON_DIS_JPCC_REV, EXPERIMENT_SECTION, TST_L05B (not supplementals)

- For SPS 9J for matching STATE_CODE, SHRP_ID, CONSTRUCTION_NO in **TST_L05B**, select MAX(LAYER_NO) for DESCRIPTION = 1 or 3 and check that MATL_CODE = 4, 5, or 730

Tables: MON_DIS_JPCC_REV, MON_DIS_LINK

- For each record in **MON_DIS_JPCC_REV**, there must be a record in **MON_DIS_LINK** with matching STATE_CODE, SHRP_ID, and SURVEY_DATE and TABLENAME = 'MON_DIS_JPCC_REV'

  Error message: MON_DIS_JPCC_REV-E-101 {STATE_CODE, SHRP_ID, SURVEY_DATE} There is no matching record in **MON_DIS_LINK**.

Table: MON_DIS_LINK

- For each combination of STATE_CODE, SHRP_ID, and SURVEY_ID, there can be only one value of CONSTRUCTION_NO

  Error message: MON_DIS_LINK-E-101 {STATE_CODE, SHRP_ID, SURVEY_ID} Each SURVEY_ID can have only one CONSTRUCTION_NO.

- For each combination of STATE_CODE, SHRP_ID, and SURVEY_ID, there can be only one entry in TABLENAME in ('MON_DIS_AC_REV', 'MON_DIS_CRCP_REV', 'MON_DIS_JPCC_REV', 'MON_DIS_PADIAS_AC', 'MON_DIS_PADIAS_CRCP', 'MON_DIS_PADIAS_JPCC', 'MON_DIS_PADIAS42_AC', 'MON_DIS_PADIAS42_CRCP', 'MON_DIS_PADIAS42_JPCC')

  Error message: MON_DIS_LINK-E-102 {STATE_CODE, SHRP_ID, SURVEY_ID} Each SURVEY_ID can have only one distress survey associated with it.

Tables: MON_DIS_LINK, MON_DIS_AC_REV, MON_DIS_CRCP_REV, MON_DIS_JPCC_REV, MON_DIS_PADIAS_AC, MON_DIS_PADIAS_CRCP, MON_DIS_PADIAS_JPCC, MON_DIS_PADIAS42_AC, MON_DIS_PADIAS42_CRCP, MON_DIS_PADIAS42_JPCC, MON_DIS_JPCC_FAULT, MON_DROP_SEP, MON_RUT_DEPTH_POINT, MON_T_PROF_MASTER

- For each record in **MON_DIS_LINK**, there must be a record in the table recorded in TABLENAME with matching STATE_CODE, SHRP_ID, and SURVEY_DATE

  Error message: MON_DIS_LINK-E-103 {STATE_CODE, SHRP_ID, SURVEY_ID} There is no matching record in {**TABLENAME**}.

Table: MON_DIS_PADIAS_AC

- The ANALYSIS_DATE must be later than the SURVEY_DATE

- The summation of low (L), medium (M), and high (H) severity levels for data elements should meet the following range checks:

Data Elements	Range
BLK_CRACK_A_i	0.0 - 650.0
EDGE_CRACK_L_i	0.0 - 155.0
GATOR_CRACK_A_i *	0.0 - 650.0
LONG_CRACK_L_i	0.0 - 610.0
PATCH_A_i	0.0 - 325.0
TRANS_CRACK_L_i	0.0 - 690.0

  Example:

  0.0 <= (GATOR_CRACK_A_L + GATOR_CRACK_A_M + GATOR_CRACK_A_H) <= 650.0

- The summation of low (L), medium (M), and high (H) severity levels of GATOR_CRACK_A_i and BLK_CRACK_A_i cannot exceed 650.0

  i.e., 0.0 < (GATOR_CRACK_A_L + GATOR_CRACK_A_M + GATOR_CRACK_A_H + BLK_CRACK_A_L + BLK_CRACK_A_M + BLK_CRACK_A_H) < 650.0

- The sum of BLEEDING, POLISH_AGG_A, and RAVELING cannot exceed 650.0

  i.e., 0.0 < (BLEEDING + POLISH_AGG_A + RAVELING) < 650.0

- In **EXPERIMENT_SECTION** (not supplementals):
  For matching STATE_CODE, SHRP_ID, CONSTRUCTION_NO check that the experiment assignment is in (G1, G2, G6A, G6B, G6C, G6D, G6S, 7A, 7B, 7C, 7D, 7F, 7S, S1, S3, S5, S6,
  S8 with SHRP_ID like ?801 - ?806, S9C, S9J, S9N, S9O)

Tables: MON_DIS_PADIAS_AC, EXPERIMENT_SECTION, TST_L05B (not supplementals)

- For SPS 9C and SPS 9J for matching STATE_CODE, SHRP_ID and CONSTRUCTION_NO in **TST_L05B**, select MAX(LAYER_NO) for DESCRIPTION = 1 or 3 and check that MATL_CODE = 1, 2, 13 or 700

Tables: MON_DIS_PADIAS_AC, MON_DIS_LINK

- For each record in **MON_DIS_PADIAS_AC**, there must be a record in **MON_DIS_LINK** with matching STATE_CODE, SHRP_ID, and SURVEY_DATE and TABLENAME = 'MON_DIS_PADIAS_AC'

  Error message: MON_DIS_PADIAS_AC-E-101 {STATE_CODE, SHRP_ID, SURVEY_DATE} There is no matching record in **MON_DIS_LINK**.

Table: MON_DIS_PADIAS_CRCP

- The ANALYSIS_DATE must be later than the SURVEY_DATE

- The summation of low (L), moderate (M), and high (H) severity levels for data elements should meet the following range checks:

Data Elements	Range
CONST_JOINT_NO_i	0 - 2
DURAB_CRACK_NO_i	0 - 100
LONG_CRACK_L_i	0.0 - 620.0
LONG_SPALLING_L_i	0.0 - 310.0
PATCH_FLEX_NO_i	0 - 100
PATCH_FLEX_A_i	0.0 - 325.0
PATCH_RIGID_NO_i	0 - 100
PATCH_RIGID_A_i	0.0 - 325.0
SCALING_A_i	0.0 - 560.0
TRANS_CRACK_L_i	0.0 - 920.0
TRANS_CRACK_NO_i	0 - 250

- In **EXPERIMENT_SECTION** (not supplementals):
  For matching STATE_CODE, SHRP_ID, CONSTRUCTION_NO check that the experiment assignment is in (G5, G7R, S7, S9C)

Tables: MON_DIS_PADIAS_CRCP, EXPERIMENT_SECTION, TST_L05B (not supplementals)

- For SPS 9C for matching STATE_CODE, SHRP_ID and CONSTRUCTION_NO in **TST_L05B**, select MAX(LAYER_NO) for DESCRIPTION = 1 or 3 and check that MATL_CODE = 6 or 730.

Tables: MON_DIS_PADIAS_CRCP, MON_DIS_LINK

- For each record in **MON_DIS_PADIAS_CRCP**, there must be a record in **MON_DIS_LINK** with matching STATE_CODE, SHRP_ID, and SURVEY_DATE and TABLENAME = 'MON_DIS_PADIAS_CRCP'

  Error message: MON_DIS_PADIAS_CRCP-E-101 {STATE_CODE, SHRP_ID, SURVEY_DATE} There is no matching record in **MON_DIS_LINK**.

Table: MON_DIS_PADIAS_JPCC

- The ANALYSIS_DATE must be later than the SURVEY_DATE

- The summation of low (L), medium (M), and high (H) severity levels for data elements should meet the following range limits:

Data Elements	Range
CORNER_BREAKS_NO_i *	0 - 50; 0 - 100 (SPS ?602, ?605)
DURAB_CRACK_NO_i	0 - 100; 0 - 200 (SPS ?602, ?605)
DURAB_CRACK_A_i	0.0 - 217.0; 0.0 - 435.0 (SPS ?602, ?605)
PATCH_FLEX_NO_i	0 - 100; 0 - 200 (SPS ?602, ?605)
PATCH_FLEX_A_i	0.0 - 325.0; 0.0 - 650.0 (SPS ?602, ?605)
JOINT_SEAL_TRANS_NO_i	0 - 300; 0 - 600 (SPS ?602, ?605)
LONG_CRACK_L_i	0.0 - 620.0; 0.0 - 1240.0 (SPS ?602, ?605)
LONG_SPALLING_L_i	0.0 - 310.0; 0.0 - 620.0 (SPS ?602, ?605)
PATCH_RIGID_NO_i	0 - 100; 0 - 200 (SPS ?602, ?605)
PATCH_RIGID_A_i	0.0 - 325.0; 0.0 - 650.0 (SPS ?602, ?605)
TRANS_CRACK_L_i	0.0 - 765.0; 0.0 - 1530.0 (SPS ?602, ?605)
TRANS_CRACK_NO_i	0 - 100; 0 - 200 (SPS ?602, ?605)
TRANS_SPALLING_L_i	0.0 - 230.0; 0.0 - 460.0 (SPS ?602, ?605)
TRANS_SPALLING_NO_i	0 - 50; 0 - 100 (SPS ?602, ?605)

  Example:

  0<= (CORNER_BREAKS_NO_L + CORNER_BREAKS_NO_M + CORNER_BREAKS_NO_H) <= 50

- The sum of SCALING_A and POLISH_AGG_A cannot exceed 560.0 or 1120.0 for SPS ?602, ?605

  i.e., 0.0 < (SCALING_A + POLISH_AGG_A) < 560.0

- In **EXPERIMENT_SECTION** (not supplementals):
  For matching STATE_CODE, SHRP_ID, CONSTRUCTION_NO check that the experiment assignment is in (G3, G4, G7R, G9, S2, S4, S6, S7, S8 for SHRP_ID like ?807 - ?812, S9J)

Tables: MON_DIS_PADIAS_JPCC, EXPERIMENT_SECTION, TST_L05B (not supplementals)

- For SPS 9J for matching STATE_CODE, SHRP_ID and CONSTRUCTION_NO in **TST_L05B**, select MAX(LAYER_NO) for DESCRIPTION = 1 or 3 and check that MATL_CODE = 4, 5 or 730

Tables: MON_DIS_PADIAS_JPCC, MON_DIS_LINK

- For each record in **MON_DIS_PADIAS_JPCC**, there must be a record in **MON_DIS_LINK** with matching STATE_CODE, SHRP_ID, and SURVEY_DATE and TABLENAME = 'MON_DIS_PADIAS_JPCC'

  Error message: MON_DIS_PADIAS_JPCC-E-101 {STATE_CODE, SHRP_ID, SURVEY_DATE} There is no matching record in **MON_DIS_LINK**.

Table: MON_DIS_PADIAS42_AC

- The summation of low (L), moderate (M), and high (H) severity levels for data elements should meet the following range checks:

Data Elements	Range
BLK_CRACK_A_i	0 - 650.0
EDGE_CRACK_L_i	0 - 155.0
GATOR_CRACK_A_i	0 - 650.0
LONG_CRACK_NWP_i	0 - 465.0
LONG_CRACK_NWP_SEAL_L_i	0 - 465.0
LONG_CRACK_WP_L_i	0 - 310.0
LONG_CRACK_WP_SEAL_L_i	0 - 310.0
PATCH_A_i	0 - 325.0
PATCH_NO_i	0 - 100
POTHOLES_A_i	0 - 165.0
POTHOLES_NO_i	0 - 100
TRANS_CRACK_L_i	0 - 690.0
TRANS_CRACK_NO_i	0 - 150
TRANS_CRACK_SEAL_L_i	0 - 690.0

  Example:

  0.0 <= (GATOR_CRACK_A_L + GATOR_CRACK_A_M + GATOR_CRACK_A_H) <= 650.0

- Sum of GATOR and BLK must be between 0.0 - 650.0
- Sum of BLEEDING, RAVELING, POLISH_AGG_A must be between 0.0 - 650.0
- Sum of LONG_CRACK_WP_SEAL_L (L, M, H) must be <= Sum LONG_CRACK_WP_L (L, M, H)
- LONG_CRACK_WP_SEAL_L_L must be <= LONG_CRACK_WP_L_L
- LONG_CRACK_WP_SEAL_L_M must be <= LONG_CRACK_WP_L_M
- LONG_CRACK_WP_SEAL_L_H must be <= LONG_CRACK_WP_L_H
- Sum of LONG_CRACK_NWP_SEAL_L (L, M, H) must be <= Sum LONG_CRACK_NWP_L (L, M, H)
- LONG_CRACK_NWP_SEAL_L_L must be <= LONG_CRACK_NWP_L_L
- LONG_CRACK_NWP_SEAL_L_M must be <= LONG_CRACK_NWP_L_M
- LONG_CRACK_NWP_SEAL_L_H must be <= LONG_CRACK_NWP_L_H
- Sum of TRANS_CRACK_SEAL_L (L, M, H) must be <= Sum TRANS_CRACK_L (L, M, H)
- TRANS_CRACK_SEAL_L_L must be <= TRANS_CRACK_L_L
- TRANS_CRACK_SEAL_L_M must be <= TRANS_CRACK_L_M

- TRANS_CRACK_SEAL_L_H must be <= TRANS_CRACK_L_H

- In **EXPERIMENT_SECTION** (not supplementals):
  For matching STATE_CODE, SHRP_ID, CONSTRUCTION_NO check that the experiment assignment is in (G1, G2, G6A, G6B, G6C, G6D, G6S, 7A, 7B, 7C, 7D, 7F, 7S, S1, S3, S5, S6,
  S8 with SHRP_ID like ?801 - ?806, S9C, S9J, S9N, S9O)

Tables: MON_DIS_PADIAS42_AC, EXPERIMENT_SECTION, TST_L05B (not supplementals)

- For SPS 9C and SPS 9J for matching STATE_CODE, SHRP_ID and CONSTRUCTION_NO in **TST_L05B**, select MAX(LAYER_NO) for DESCRIPTION = 1 or 3 and check that MATL_CODE = 1, 2, 13 or 700

Tables: MON_DIS_PADIAS42_AC, MON_DIS_LINK

- For each record in **MON_DIS_PADIAS42_AC** there must be a record in **MON_DIS_LINK** with matching STATE_CODE, SHRP_ID, and SURVEY_DATE and TABLENAME = 'MON_DIS_PADIAS42_AC'

  Error message: MON_DIS_PADIAS42_AC-E-101 {STATE_CODE, SHRP_ID, SURVEY_DATE} There is no matching record in **MON_DIS_LINK**.

Table: MON_DIS_PADIAS42_CRCP

- The summation of low (L), moderate (M), and high (H) severity levels for data elements should meet the following range checks:

Data Elements	Range
DURAB_CRACK_A_i	0.0 - 217.0
DURAB_CRACK_NO_i	0 - 100
CONST_JOINT_NO_i	0 - 2
LONG_CRACK_L_i	0.0 - 620.0
LONG_CRACK_SEAL_L_i	0.0 - 620.0
LONG_SPALLING_L_i	0.0 - 310.0
PATCH_FLEX_A_i	0.0 - 325.0
PATCH_FLEX_NO_i	0 - 100
PATCH_RIGID_A_i	0.0 - 325.0
PATCH_RIGID_NO_i	0 - 100
TRANS_CRACK_L_i	0.0 - 920.0

  Example:

  0.0 <= (DURAB_CRACK_A_L + DURAB_CRACK_A_M + DURAB_CRACK_A_H) <= 217.0

- The sum of SCALING_A and POLISH_AGG_A and MAP_CRACK_A cannot exceed 650

  0.0 <= (SCALING_A + POLISH_AGG_A + MAP_CRACK_A) <= 650.0

- The summation of low (L), moderate (M), and high (H) severity levels of LONG_CRACK_SEAL_L_i cannot exceed the summation of LONG_CRACK_L_i

0.0 <= (LONG_CRACK_SEAL_L_L + LONG_CRACK_SEAL_L_M + LONG_CRACK_SEAL_L_H) <= (LONG_CRACK_L_L + LONG_CRACK_L_M + LONG_CRACK_L_H)

- LONG_CRACK_SEAL_L_L cannot exceed LONG_CRACK_L_L

  LONG_CRACK_SEAL_L_L <= LONG_CRACK_L_L

- LONG_CRACK_SEAL_L_M cannot exceed LONG_CRACK_L_M

  LONG_CRACK_SEAL_L_M <= LONG_CRACK_L_M

- LONG_CRACK_SEAL_L_H cannot exceed LONG_CRACK_L_H

  LONG_CRACK_SEAL_L_H <= LONG_CRACK_L_H

- The summation of low (L), moderate (M), and high (H) severity levels of TRANS_CRACK_NO_i must equal TRANS_CRACK_TOTAL_NO

  0 <= (TRANS_CRACK_NO_L + TRANS_CRACK_NO_M + TRANS_CRACK_NO_H) = TRANS_CRACK_TOTAL_NO

- The summation of low (L), moderate (M), and high (H) severity levels of PATCH_FLEX_A_i and PATCH_RIGID_A_i cannot exceed 325.0

- <= (PATCH_FLEX_A_L + PATCH_FLEX_A_M + PATCH_FLEX_A_H + PATCH_RIGID_A_L + PATCH_RIGID_A_M + PATCH_RIGID_A_H) <= 325.0

- In **EXPERIMENT_SECTION** (not supplementals):
  For matching STATE_CODE, SHRP_ID, CONSTRUCTION_NO check that the experiment assignment is in (G5, G7R, G9, S7, S9C)

Tables: MON_DIS_PADIAS42_CRCP, EXPERIMENT_SECTION, TST_L05B (not supplementals)

- For SPS 9C for matching STATE_CODE, SHRP_ID and CONSTRUCTION_NO in **TST_L05B**, select MAX(LAYER_NO) for DESCRIPTION = 1 or 3 and check that MATL_CODE = 6 or 730

Tables: MON_DIS_PADIAS42_CRCP, MON_DIS_LINK

- For each record in **MON_DIS_PADIAS42_CRCP** there must be a record in **MON_DIS_LINK** with matching STATE_CODE, SHRP_ID, and SURVEY_DATE and TABLENAME = 'MON_DIS_PADIAS42_CRCP'

  Error message: MON_DIS_PADIAS42_CRCP-E-101 {STATE_CODE, SHRP_ID, SURVEY_DATE} There is no matching record in **MON_DIS_LINK**.

Table: MON_DIS_PADIAS42_JPCC

- The summation of low (L), moderate (M), and high (H) severity levels for data elements

should meet the following range checks:

Data Elements	Range
CORNER_BREAKS_NO_i	0 - 50; 0 - 100 (SPS ?602, ?605)
DURAB_CRACK_A_i	0.0 - 217.0; 0.0 - 435.0 (SPS ?602, ?605)
DURAB_CRACK_NO_i	0 - 100; 0 - 200 (SPS ?602, ?605)
LONG_CRACK_L_i	0.0 - 620.0; 0.0 - 1240.0 (SPS ?602, ?605)
LONG_CRACK_SEAL_L_i	0.0 - 620.0; 0.0 - 1240.0 (SPS ?602, ?605)
LONG_SPALLING_L_i	0.0 - 310.0; 0.0 - 620.0 (SPS ?602, ?605)
PATCH_FLEX_A_i	0.0 - 325.0; 0.0 - 650.0 (SPS ?602, ?605)
PATCH_FLEX_NO_i	0 - 100; 0 - 200 (SPS ?602, ?605)
PATCH_RIGID_A_i	0.0 - 325.0; 0.0 - 650.0 (SPS ?602, ?605)
PATCH_RIGID_NO_i	0 - 100; 0 - 200 (SPS ?602, ?605)
TRANS_CRACK_L_i	0.0 - 765.0; 0.0 -1530.0 (SPS ?602, ?605)
TRANS_CRACK_NO_i	0 - 100; 0 - 200 (SPS ?602, ?605)
TRANS_CRACK_SEAL_L_i	0.0 - 765.0; 0.0 - 1530.0 (SPS ?602, ?605)
TRANS_SPALLING_L_i	0.0 - 230.0; 0.0 - 460.0 (SPS ?602, ?605)
TRANS_SPALLING_NO_i	0 - 50; 0 - 100 (SPS ?602, ?605)

Example:

0.0 <= (DURAB_CRACK_A_L + DURAB_CRACK_A_M + DURAB_CRACK_A_H) <= 190.0

- The sum of SCALING_A and POLISH_AGG_A and MAP_CRACK_A cannot exceed 650.0 or 1300.0 for SPS ?602, ?605

  0.0 <= (SCALING_A + POLISH_AGG_A + MAP_CRACK_A) <= 650.0 or 1300.0 for SPS ?602, ?605

- The summation of low (L), moderate (M), and high (H) severity levels of LONG_CRACK_SEAL_L_i cannot exceed the summation of LONG_CRACK_L_i

  0.0 <= (LONG_CRACK_SEAL_L_L + LONG_CRACK_SEAL_L_M + LONG_CRACK_SEAL_L_H) <= (LONG_CRACK_L_L + LONG_CRACK_L_M + LONG_CRACK_L_H)

- LONG_CRACK_SEAL_L_L cannot exceed LONG_CRACK_L_L

  LONG_CRACK_SEAL_L_L <= LONG_CRACK_L_L

- LONG_CRACK_SEAL_L_M cannot exceed LONG_CRACK_L_M

  LONG_CRACK_SEAL_L_M <= LONG_CRACK_L_M

- LONG_CRACK_SEAL_L_H cannot exceed LONG_CRACK_L_H

  LONG_CRACK_SEAL_L_H <= LONG_CRACK_L_H

- The summation of low (L), moderate (M), and high (H) severity levels of TRANS_CRACK_SEAL_L_i cannot exceed the summation of TRANS_CRACK_L_i

0.0 <= (TRANS_CRACK_SEAL_L_L + TRANS_CRACK_SEAL_L_M + TRANS_CRACK_SEAL_L_H) <= (TRANS_CRACK_L_L + TRANS_CRACK_L_M + TRANS_CRACK_L_H)

- TRANS_CRACK_SEAL_L_L cannot exceed TRANS_CRACK_L_L

  TRANS_CRACK_SEAL_L_L <= TRANS_CRACK_L_L

- TRANS_CRACK_SEAL_L_M cannot exceed TRANS_CRACK_L_M

  TRANS_CRACK_SEAL_L_M <= TRANS_CRACK_L_M

- TRANS_CRACK_SEAL_L_H cannot exceed TRANS_CRACK_L_H

  TRANS_CRACK_SEAL_L_H <= TRANS_CRACK_L_H

- The summation of low (L), moderate (M), and high (H) severity levels of PATCH_FLEX_A_i and PATCH_RIGID_A_i cannot exceed 325.0 or 650.0 for SPS ?602, ?605

  0.0 <= (PATCH_FLEX_A_L + PATCH_FLEX_A_M + PATCH_FLEX_A_H + PATCH_RIGID_A_L + PATCH_RIGID_A_M + PATCH_RIGID_A_H) <= 325.0 or 650.0 for SPS ?602, ?605

- In **EXPERIMENT_SECTION** (not supplementals):
  For matching STATE_CODE, SHRP_ID, CONSTRUCTION_NO check that the experiment assignment is in (G3, G4, G7R, G9, S2, S4, S6, S7, S8 for SHRP_ID like ?807 - ?812, S9J)

Tables: MON_DIS_PADIAS42_JPCC, EXPERIMENT_SECTION, TST_L05B (not supplementals)

- For SPS 9J for matching STATE_CODE, SHRP_ID and CONSTRUCTION_NO in **TST_L05B**, select MAX(LAYER_NO) for DESCRIPTION = 1 or 3 and check that MATL_CODE = 4, 5 or 730

Tables: MON_DIS_PADIAS42_JPCC, MON_DIS_LINK

- For each record in **MON_DIS_PADIAS42_JPCC** there must be a record in **MON_DIS_LINK** with matching STATE_CODE, SHRP_ID, and SURVEY_DATE and TABLENAME = 'MON_DIS_PADIAS42_JPCC'

  Error message: MON_DIS_PADIAS42_JPCC-E-101 {STATE_CODE, SHRP_ID, SURVEY_DATE} There is no matching record in **MON_DIS_LINK**.

Table: MON_DROP_SEP

- In **EXPERIMENT_SECTION**:

  Determine CONSTRUCTION_NO for SURVEY_DATE
  -In **TST_L05B**, select record having MAX(LAYER_NO) for DESCRIPTION = 1 or 3
  -For a non-null entry in MON_DROP_SEP. SEPARATION check that **TST_L05B**.MATL_CODE = 4 - 6, 90, 730

Tables: MON_DROP_SEP, MON_DIS_LINK

- For each record in **MON_DROP_SEP** there must be a record in **MON_DIS_LINK** with matching STATE_CODE, SHRP_ID, and SURVEY_DATE and TABLENAME = 'MON_DROP_SEP'

  Error message: MON_DROP_SEP-E-101 {STATE_CODE, SHRP_ID, SURVEY_DATE} There is no matching record in **MON_DIS_LINK**.

Tables: MON_RUT_DEPTH_POINT, MON_DIS_LINK

- For each record in **MON_RUT_DEPTH_POINT** there must be a record in **MON_DIS_LINK** with matching STATE_CODE, SHRP_ID, and SURVEY_DATE and TABLENAME = 'MON_RUT_DEPTH_POINT'

  Error message: MON_RUT_DEPTH_POINT-E-101 {STATE_CODE, SHRP_ID, SURVEY_DATE} There is no matching record in **MON_DIS_LINK**.

Tables: MON_T_PROF_MASTER, MON_DIS_LINK

- For each record in **MON_T_PROF_MASTER** there must be a record in **MON_DIS_LINK** with matching STATE_CODE, SHRP_ID, and SURVEY_DATE and TABLENAME = 'MON_T_PROF_MASTER'

  Error message: MON_T_PROF_MASTER -E-101 {STATE_CODE, SHRP_ID, SURVEY_DATE} There is no matching record in **MON_DIS_LINK**.

8.0 FRICTION QC PROGRAMS

8.1 Level 1

A. Initial Level

Records in the IMS are at Level A when they first enter the system and are set back to A when changes are made to a given record or to selected related records.

B. Dependency Checks

No dependency checks are performed.

C. Minimum Data Elements

Tables and accompanying fields that must be included in a data record are identified below. Explanations are provided for those fields having certain conditions as to when they are required (i.e., X = always; * = conditionally).

Table	Field	Condition
MON_FRICTION	CALIBRATION_DATE	X
	FRICTION_METHOD	X
	FRICTION_NO_BEGIN	X
	FRICTION_NO_END	X
	FRICTION_SPEED	X

D. Expanded Range Checks

Expanded range checks are applied to certain fields to identify data element values that fall outside an expected range. Field names are listed below the bolded table name.

Table	Units	Range
MON_FRICTION		
FRICTION_NO_BEGIN[1]	%	25 - 100
FRICTION_NO_END[1]	%	25 - 100
FRICTION_SPEED	mph	35 - 55

[1] This range combines two ranges, that which is appropriate for AASHTO T242 or ASTM E274 specified units (25 - 60) and that which is appropriate for other devices (50 - 100).

E. Intramodular Checks

Each E-type check is separated by a single line. In general, each bullet represents a procedure, action, etc., of the check.

Table: MON_FRICTION

For SHRP_ID, STATE_CODE, and CONSTRUCTION_NO:

- If the FRICTION_METHOD in **MON_FRICTION** = 3, there must be a valid entry in FRICTION_METHOD_OTHER

9.0 MAINTENANCE QC PROGRAMS

9.1 Level 1

A. Initial Level

Records in the IMS are at Level A when they first enter the system and are set back to A when changes are made to a given record or to selected related records.

B. Dependency Checks

No dependency checks are performed.

C. Minimum Data Elements

Tables and accompanying fields that must be included in a data record are identified below. Explanations are provided for those fields having certain conditions as to when they are required (i.e., X = always; * = conditionally).

Table	Field	Condition
MNT_ASPHALT_CRACK_SEAL	CRACK_SEAL_MATL	X
	CRACK_SEVERITY	X
	CRACK_TYPE	X
	DATE_COMPLETE	X
MNT_ASPHALT_PATCH	AC_PC_NO	*
	AC_PC_SF	*
	*Either AC_PC_NO or AC_PC_SF is required	
	FULL_DEPTH_NO	*
	FULL_DEPTH_SF	*
	*Either FULL_DEPTH_NO or FULL_DEPTH_SF is required	
	SURFACE_OVERLAID_NO	**
	SURFACE_OVERLAID_SF	**
	**Either SURFACE_OVERLAID_NO or SURFACE_ OVERLAID_SF is required	
	SURFACE_PATCHES_NO	***
	SURFACE_PATCHES_SF	***
	***Either SURFACE PATCHES_NO or SURFACE_ PATCHES_SF is required	
MNT_ASPHALT_SEAL	AGG_RATE	*
	*if REASON = 1	
	AIR_TEMP	X
	CEMENT_MATL_RATE	X
	CRACK_SEVERITY	*

	*if REASON = 1	
	DATE_COMPLETE	X
	PERCENT_SEALED	X
	REASON	X
	SEAL_CURE_TIME	X
	SEAL_THICKNESS	X
	SEAL_TYPE	X
	SURFACE_MOISTURE	X
MNT_COST	DATE_COMPLETE	X
MNT_GMG	AVG_DEPTH	X
	DATE_COMPLETE	X
	METHOD	X
	PAVE_TYPE	X
MNT_HIST	MAINT_LOC	X
	MAJOR_IMP_TYPE	X
	MAJOR_IMP_YEAR	X
MNT_IMP	No level C checks	
MNT_PCC_CRACK_SEAL	CRACK_SEAL_TYPE	X
	SEAL_RES_DEPTH	X
	SEAL_RES_WIDTH	X
	TOTAL_FEET_CRACKS _SEALED	X
MNT_PCC_FULL_DEPTH	AIR_TEMP_HIGH	X
	AIR_TEMP_LOW	X
	BOND_BREAKER	X
	DATE_COMPLETE	X
	FLEX_STRENGTH	X
	PATCH_MATL	X
	SURFACE_MOISTURE	X
	TRANSFER_SYS_LONG	X
	TRANSFER_SYS_TRANS	X
MNT_PCC_JOINT_RESEAL	DATE_COMPLETE	X
MNT_PCC_PART_DEPTH	AIR_TEMP_HIGH	*
	AIR_TEMP_LOW	*
	*Either the high or low value is required	
	BOND_AGENT	X
	DATE_COMPLETE	X
	PATCH_MATL	X
	PATCH_NO	X
	PATCH_SF	X
	SURFACE_MOISTURE	X
	REASON	X

D. Expanded Range Checks

Expanded range checks are applied to certain fields to identify data element values that fall outside an expected range. Field names are listed below the bolded table name.

Table	Units	Range
MNT_ASPHALT_CRACK_SEAL		
AIR_TEMP_HIGH	deg F	40 - 120
AIR_TEMP_LOW	deg F	40 - 120
MNT_ASPHALT_PATCH		
AC_PC_SF	sq ft	0 - 3000
FULL_DEPTH_SF	sq ft	0 - 3000
SURFACE_OVERLAID_SF	sq ft	0 - 3000
SURFACE_PATCHES_SF	sq ft	0 - 3000
MNT_ASPHALT_SEAL		
AGG_RATE	lb/sq yd	0.0 - 75.0
AIR_TEMP	deg F	45 - 110
CEMENT_MATL_RATE	gal/sq yd	0.0 - 2.0
SEAL_THICKNESS	in	0.1 - 2.0
MNT_COST		
AC_BASE_QNTY	sq yd	0 - 500
AC_FULL_QNTY	sq yd	0 - 500
AC_SURFACE_QNTY	sq yd	0 - 500
CRACK_SEAL_QNTY	lf	0 - 500
MNT_GMG		
AVG_DEPTH	in	0.0 - 2.0
HEAD_WIDTH	in	3.0 - 144.0
MNT_HIST		
MAJOR_IMP_COST	1000s $/lane mile	0 - 500
MAJOR_IMP_THICKNESS	in	0.0 - 24.0
MNT_IMP		
IMP_TYPE		1 - 7, 12, 13, 21 - 37, 53, 54, 57
CONSTRUCTION_NO		> 1
DATA_AVAIL_IMS		Y, N
MNT_PCC_CRACK_SEAL		
BOND_BREAK		1 - 4
CRACK_CLEAN		1 - 6
CRACK_SEAL_TYPE		1 - 7
SEAL_DEPTH	in	0 - 0.5
SEAL_RES_DEPTH	in	0.1 - 2.0
SEAL_RES_WIDTH	in	0.1 - 2.0
MNT_PCC_FULL_DEPTH		
AIR_CONTENT_MAX	%	0.0 - 12.0
AIR_CONTENT_MEAN	%	2.0 - 10.0
AIR_CONTENT_MIN	%	0.0 - 12.0
AIR_TEMP_HIGH	deg F	40 - 120
AIR_TEMP_LOW	deg F	40 - 120
CAGG_MIX	lb/cu yd	500 - 3000

CEMENT_MIX	lb/cu yd	300 - 1000
FAGG_MIX	lb/cu yd	500 - 2000
FLEX_CURE_TIME	days	1 - 28
FLEX_STRENGTH	psi	300 - 2000
MAX_AGG_SIZE	in	0.2 - 9.9
PATCH_SF_BASE	sq ft	0 - 3000
PATCH_SF_SLAB	sq ft	0 - 3000
SAW_CUT_DEPTH	in	0.2 - 24.0
SF_BASE_REPLACED	sq ft	0 - 3000
SF_SLABS_REPLACED	sq ft	0 - 3000
TRAFFIC_OPEN_TIME	hr	4 - 9999
WATER_MIX	gal/cu yd	10 - 60
MNT_PCC_JOINT_RESEAL		
SEAL_DEPTH	in	0.2 - 1.0
SEAL_RES_DEPTH	in	0.2 - 6.0
SEAL_RES_WIDTH	in	0.0 - 1.5
MNT_PCC_PART_DEPTH		
AIR_CONTENT_MAX	%	null, 0.0 - 12.0
AIR_CONTENT_MEAN	%	null, 0.0 - 12.0
AIR_CONTENT_MIN	%	null, 0.0 - 12.0
AIR_TEMP_HIGH	deg F	40 - 120
AIR_TEMP_LOW	deg F	40 - 120
CAGG_MIX	lb/cu yd	500 - 3000
CEMENT_MIX	lb/cu yd	300 - 1000
FAGG_MIX	lb/cu yd	500 - 2000
MAX_AGG_SIZE	in	0.2 - 9.9
PATCH_AVG_DEPTH	in	0.0 - 24.0
PATCH_COMP_STRENGTH	psi	null, 2000 - 9999
PATCH_CURE_TIME	days	null, 1 - 42
PATCH_SF	sq ft	0 - 3000
TRAFFIC_OPEN_TIME	hr	4 - 9999
WATER_MIX	gal/cu yd	null, 0 - 40

E. Intramodular Checks

Each E-type check is separated by a single line. In general, each bullet represents a procedure, action, etc., of the check.
*Note: **MNT_IMP**.DATA_AVAIL_IMS is set before level E checks are run. Refer to the following table:*

Table	IMP_TYPE
SPS3_CRACK	1
SPS3_CHIP	31
SPS3_SLURRY	33
SPS4_CRACK_SEAL_GENERAL	1, 2, 3

Table	IMP_TYPE
SPS4_UNDERSEAL_GENERAL	14
SPS5_AC_PATCHES	21 - 27
SPS6_PCC_CRACK_SEAL	1
SPS6_PCC_FULL_DEPTH	4, 7
SPS6_PCC_JOINT_RESEAL	2
SPS6_PCC_PART_DEPTH	6
SPS6_SAW_AND_SEAL	57
SPS7_PCC_CRACK_SEAL	1
SPS7_PCC_FULL_DEPTH	5, 7
SPS7_PCC_JOINT_RESEAL	2
SPS7_PCC_PART_DEPTH	6, 54
MNT_ASPHALT_CRACK_SEAL	1, 57
MNT_PCC_JOINT_RESEAL	2, 3
MNT_PCC_PART_DEPTH	6, 54
MNT_PCC_FULL_DEPTH	4, 5, 7
MNT_GMG	12, 13
MNT_ASPHALT_PATCH	21, 27
MNT_ASPHALT_SEAL	28, 37

Table: MNT_ASPHALT_CRACK_SEAL

- Check to ensure that DATE_BEGAN < = DATE_COMPLETE

  Error Message: **MNT_ASPHALT_CRACK_SEAL**-E-1, DATE_BEGAN must be <= DATE_COMPLETE.

- For SHRP_ID, STATE_CODE, and CONSTRUCTION_NO, refer to **TST_L05B** and select record for MAX (LAYER_NO) for DESCRIPTION = 1 or 3. Check that MATL_CODE = 1 or 13.

Error Message: **MNT_ASPHALT_CRACK_SEAL**-E-4, For SHRP_ID,STATE_CODE and CONSTRUCTION_NO, refer to TST_L05B and select record for MAX(LAYER_NO) for DESCRIPTION = 1 or 3. Check that MATL_CODE = 1 or 13.

- Check that AIR_TEMP_HIGH > = AIR_TEMP_LOW, provided valid (not null) entries exist in each field

  Error Message: **MNT_ASPHALT_CRACK_SEAL**-E-5, AIR_TEMP_HIGH must be >= AIR_TEMP_LOW.

- Check that a record exists in MNT_IMP with matching STATE_CODE, SHRP_ID, DATE_COMPLETE and IMP_TYPE in (1, 57)

  Error Message: **MNT_ASPHALT_CRACK_SEAL**-E-10, Entry required in MNT_IMP for STATE_CODE, SHRP_ID, DATE_COMPLETE and IMP_TYPE 1, 57.

Table: MNT_ASPHALT_PATCH

- DATE_BEGAN < = DATE_COMPLETE

  Error Message: **MNT_ASPHALT_PATCH**-E-1, DATE_BEGAN must be <= DATE_COMPLETE.

- For SHRP_ID, STATE_CODE, and CONSTRUCTION_NO, refer to **TST_L05B** and select record for MAX (LAYER_NO) for DESCRIPTION = 1 or 3. Check that MATL_CODE = 1 or 13.

  Error Message: **MNT_ASPHALT_PATCH**-E-4, For SHRP_ID,STATE_CODE and CONSTRUCTION_NO, refer to TST_L05B and select record for MAX(LAYER_NO) for DESCRIPTION = 1 or 3. Check that MATL_CODE = 1 or 13.

- If SURFACE_PATCHES_SF > 0 then SURFACE_PATCHES_NO > 0

  Error Message: **MNT_ASPHALT_PATCH**-E-5, if surface_patches_sf > 0 then surface_patches_no > 0.

- If SURFACE_OVERLAID_SF > 0 then SURFACE_OVERLAID_NO > 0

  Error Message: **MNT_ASPHALT_PATCH**-E-6, if surface_overlaid_sf > 0 then surface_overlaid_no > 0.

- If AC_PC_SF > 0 then AC_PC_NO > 0

  Error Message: **MNT_ASPHALT_PATCH**-E-7, if ac_pc_sf > 0 then ac_pc_no > 0.

- If FULL_DEPTH_SF > 0 then FULL_DEPTH_NO > 0

  Error Message: **MNT_ASPHALT_PATCH**-E-8, if full_depth_sf > 0 then full_depth_no > 0.

- Check that a record exists in MNT_IMP with matching STATE_CODE, SHRP_ID, DATE_COMPLETE and IMP_TYPE = 21 - 27

  Error Message: **MNT_ASPHALT_PATCH**-E-15, Entry required in MNT_IMP for STATE_CODE, SHRP_ID, DATE_COMPLETE and IMP_TYPE 21 - 27.

Table: MNT_ASPHALT_SEAL

- DATE_BEGAN < = DATE_COMPLETE

  Error Message: **MNT_ASPHALT_SEAL**-E-1, DATE_BEGAN must be <= DATE_COMPLETE.

- For SHRP_ID, STATE_CODE, and CONSTRUCTION_NO, refer to **TST_L05B** and select record for MAX (LAYER_NO) for DESCRIPTION = 1 or 3. Check that MATL_CODE = 1 or 13.

  Error Message: **MNT_ASPHALT_SEAL**-E-4, For SHRP_ID,STATE_CODE and CONSTRUCTION_NO, refer to TST_L05B and select record for MAX(LAYER_NO) for DESCRIPTION = 1 or 3. Check that MATL_CODE = 1 or 13.

- For STATE_CODE, SHRP_ID, and DATE_COMPLETE, a matching record must exist in MNT_IMP with IMP_TYPE in (28, 29, 30, 31, 32, 33, 34, 35, 36, 37)

  Error Message: **MNT_ASPHALT_SEAL**-E-11, Entry required in MNT_IMP for STATE_CODE, SHRP_ID, DATE_COMPLETE and IMP_TYPE 28 - 37.

Table: MNT_COST

- No level E checks

Table: MNT_GMG

- DATE_BEGAN < = DATE_COMPLETE

  Error Message: **MNT_GMG**-E-1, DATE_BEGAN must be <= DATE_COMPLETE.

- For STATE_CODE, SHRP_ID, and DATE_COMPLETE, a matching record must exist in MNT_IMP with IMP_TYPE in (12, 13)

  Error Message: **MNT_GMG**-E-7, Entry required in MNT_IMP for STATE_CODE, SHRP_ID, DATE_COMPLETE and IMP_TYPE 12 or 13.

Tables: MNT_GMG, MNT_COST

- For STATE_CODE, SHRP_ID, and DATE_COMPLETE, check that there is a matching record in **MNT_COST**

  Error Message: **MNT_GMG**-E-2, No associated cost data in **MNT_COST**.

Table: MNT_HIST

- No level E checks

Table: MNT_IMP

- **MNT_IMP**.IMP_TYPE must exist in the **CODES** table where CODETYPE = MAINT_WORK

  Error Message: **MNT_IMP**-E-100, IMP_TYPE must exist in the **CODES** table for CODETYPE=MAINT_WORK.

Table: MNT_IMP, EXPERIMENT_SECTION

- A record with matching STATE_CODE, SHRP_ID, and CONSTRUCTION_NO must exist in **EXPERIMENT_SECTION**

  Error Message: **MNT_IMP**-E-101, A corresponding record with matching STATE_CODE,SHRP_ID,CONSTRUCTION_NO must exist in **EXPERIMENT_SECTION**.

- For matching STATE_CODE, SHRP_ID, and CONSTRUCTION_NO in **EXPERIMENT_SECTION**, **EXPERIMENT_SECTION**.CN_ASSIGN_DATE (CN) <= **MNT_IMP**.IMP_DATE (CN) < **EXPERIMENT_SECTION**.CN_ASSIGN_DATE (CN + 1) or current date if CN + 1 does not exist.

  Error Message: **MNT_IMP**-E-102a, The following date relationship should exist: **EXPERIMENT_SECTION**.CN_ASSIGN_DATE(CN){Date} <= **MNT_IMP**.IMP_DATE(CN){Date} < **EXPERIMENT_SECTION**.CN_ASSIGN_DATE(CN+1){Date}.

  Error Message: **MNT_IMP**-E-102b, The following date relationship should exist: **EXPERIMENT_SECTION**.CN_ASSIGN_DATE(CN){Date} <= **MNT_IMP**.IMP_DATE(CN){Date} < SYSDATE.

- For matching STATE_CODE, SHRP_ID, and CONSTRUCTION_NO in **EXPERIMENT_SECTION**, **MNT_IMP**.IMP_TYPE must exist in **EXPERIMENT_SECTION**.CN_CHANGE_REASON

  Error Message: (If **EXPERIMENT_SECTION**.CN_CHANGE_REASON is null) **MNT_IMP**-E-103a, **MNT_IMP**.IMP_TYPE must exist in the list in the **EXPERIMENT_SECTION**.CN_CHANGE_REASON.

  Error Message: (If IMP_TYPE not in **EXPERIMENT_SECTION**.CN_CHANGE_REASON) **MNT_IMP**-E-103b, **MNT_IMP**.IMP_TYPE{IMP_TYPE} must exist in the list in the **EXPERIMENT_SECTION**.CN_CHANGE_REASON{list of entries}.

Table: MNT_PCC_CRACK_SEAL

- DATE_COMPLETE >= DATE_BEGAN

  Error Message: **MNT_PCC_CRACK_SEAL**-E-1, DATE_COMPLETE < DATE_BEGAN

- SEAL_RES_WIDTH <= SEAL_RES_DEPTH

  Error Message: **MNT_PCC_CRACK_SEAL**-E-2, SEAL_RES_WIDTH > SEAL_RES_DEPTH

- For STATE_CODE, SHRP_ID, and DATE_COMPLETE, a matching record must exist in MNT_IMP with IMP_TYPE = 1

Error Message: **MNT_PCC_CRACK_SEAL**-E-3, Entry required in MNT_IMP for STATE_CODE, SHRP_ID, DATE_COMPLETE and IMP_TYPE 1.

Tables: MNT_PCC_JOINT_RESEAL

- Check to ensure that DATE_BEGAN < = DATE_COMPLETE

  Error Message: **MNT_PCC_JOINT_RESEAL**-E-1, DATE_BEGAN must be <= DATE_COMPLETE.

- For SHRP_ID, STATE_CODE, and CONSTRUCTION_NO, refer to TST_L05B and select record for MAX (LAYER_NO) for DESCRIPTION = 1 or 3. Check that MATL_CODE = 4 - 6 or 90.

  Error Message: **MNT_PCC_JOINT_RESEAL**-E-4, For SHRP_ID,STATE_CODE and CONSTRUCTION_NO, refer to TST_L05B and select record for MAX(LAYER_NO) for DESCRIPTION = 1 or 3. Check that MATL_CODE = 4-6 or 90.

- If PATCH_SF_SLAB > 0, then PATCH_NO_SLAB > 0

  Error Message: **MNT_PCC_JOINT_RESEAL**-E-5, If PATCH_SF_SLAB > 0, then PATCH_NO_SLAB > 0.

- For STATE_CODE, SHRP_ID, and DATE_COMPLETE, a matching record must exist in MNT_IMP with IMP_TYPE in (2, 3)

  Error Message: **MNT_PCC_JOINT_RESEAL**-E-10, Entry required in MNT_IMP for STATE_CODE, SHRP_ID, DATE_COMPLETE and IMP_TYPE = 2 or 3.

Table: MNT_PCC_PART_DEPTH

- Check to ensure that DATE_BEGAN < = DATE_COMPLETE

  Error Message: **MNT_PCC_PART_DEPTH**-E-1, DATE_BEGAN must be <= DATE_COMPLETE.

- For SHRP_ID, STATE_CODE, and CONSTRUCTION_NO, refer to TST_L05B and select record for MAX (LAYER_NO) for DESCRIPTION = 1 or 3. Check that MATL_CODE = 4 - 6 or 90.

  Error Message: **MNT_PCC_PART_DEPTH**-E-4, For SHRP_ID,STATE_CODE and CONSTRUCTION_NO, refer to TST_L05B and select record for MAX(LAYER_NO) for DESCRIPTION = 1 or 3. Check that MATL_CODE = 4 - 6 or 90.

- AIR_CONTENT_MAX > AIR_CONTENT_MEAN > AIR_CONTENT_MIN

  Error Message: **MNT_PCC_PART_DEPTH**-E-5, AIR_CONTENT_MAX must be > AIR_CONTENT_MEAN must be > AIR_CONTENT_MIN.

- Check that if PATCH_SF > 0 then PATCH_NO > 0

  Error Message: **MNT_PCC_PART_DEPTH**-E-6, if patch_sf > 0 then patch_no > 0.

- For STATE_CODE, SHRP_ID, and DATE_COMPLETE, a matching record must exist in MNT_IMP with IMP_TYPE in (6, 54)

  Error Message: **MNT_PCC_PART_DEPTH**-E-20, Entry required in MNT_IMP for STATE_CODE, SHRP_ID, DATE_COMPLETE and IMP_TYPE 6 or 54.

Table: MNT_PCC_FULL_DEPTH

- Check to ensure that DATE_BEGAN < = DATE_COMPLETE

  Error Message: **MNT_PCC_FULL_DEPTH**-E-1, DATE_BEGAN must be <= DATE_COMPLETE.

- For SHRP_ID, STATE_CODE, and CONSTRUCTION_NO, refer to TST_L05B and select record for MAX (LAYER_NO) for DESCRIPTION = 1 or 3. Check that MATL_CODE = 4 - 6 or 90.

  Error Message: **MNT_PCC_FULL_DEPTH**-E-4, For SHRP_ID,STATE_CODE and CONSTRUCTION_NO, refer to TST_L05B and select record for MAX(LAYER_NO) for DESCRIPTION = 1 or 3. Check that MATL_CODE = 4 - 6 or 90.

- AIR_CONTENT_MAX > AIR_CONTENT_MEAN > AIR_CONTENT_MIN

  Error Message: **MNT_PCC_FULL_DEPTH**-E-5, AIR_CONTENT_MAX must be > AIR_CONTENT_MEAN must be > AIR_CONTENT_MIN.

- Check that if PATCH_SF_SLAB > 0 then PATCH_NO_SLAB > 0

  Error Message: **MNT_PCC_FULL_DEPTH**-E-6, if patch_sf_slab > 0 then patch_no_slab > 0.

- Check that if PATCH_SF_BASE > 0 then PATCH_NO_BASE > 0

  Error Message: **MNT_PCC_FULL_DEPTH**-E-7, if patch_sf_base > 0 then patch_no_base > 0.

- Check that if SF_SLABS_REPLACED > 0 then NO_SLABS_REPLACED > 0

  Error Message: **MNT_PCC_FULL_DEPTH**-E-8, if sf_slabs_replaced > 0 then no_slabs_replaced > 0.

- Check that if SF_BASE_REPLACED > 0 then NO_BASE_REPLACED > 0

  Error Message: **MNT_PCC_FULL_DEPTH**-E-9, if sf_base_replaced > 0 then no_base_replaced > 0.

- Either PATCH_NO_BASE and PATCH_SF_BASE or PATCH_NO_SLAB and PATCH_SF_SLAB must be non-null

  Error Message: **MNT_PCC_FULL_DEPTH**-E-25, Either PATCH_NO_BASE and PATCH_SF_BASE or PATCH_NO_SLAB and PATCH_SF_SLAB must be NON-NULL.

- Either NO_BASE_REPLACED and SF_BASE_REPLACED or NO_SLAB_REPLACED and SF_SLABS_REPLACED must be non-null

Error Message: **MNT_PCC_FULL_DEPTH**-E-26, Either NO_BASE_REPLACED and SF_BASE_REPLACED or NO_SLAB_REPLACED and SF_SLABS_REPLACED must be NON-NULL.

- For STATE_CODE, SHRP_ID, and DATE_COMPLETE, a matching record must exist in MNT_IMP with IMP_TYPE in (4, 5, 7)

  Error Message: **MNT_PCC_FULL_DEPTH**-E-27, Entry required in MNT_IMP for STATE_CODE, SHRP_ID, DATE_COMPLETE and IMP_TYPE 4, 5, or 7.

Table: (Listed)

For SHRP_ID, STATE_CODE, CONSTRUCTION_NO, DATE_COMPLETE:

In Table/Error Code In	If Data Element	Has a Code Of	Then Valid Entry Must Exist In
MNT_ASPHALT_CRACK_SEAL			
E-6	CRACK_SEAL_MATL	6 or 7	MANUFACTURER_NAME
E-7	CRACK_SEAL_MATL	6 or 7	MANUFACTURER_MATERIAL
E-8	CRACK_SEAL_MATL	8	CRACK_SEAL_MATL_OTHER
E-9	CLEAN_METHOD	7	CLEAN_METHOD_OTHER
MNT_ASPHALT_PATCH			
E-9	REASON	17	REASON_OTHER
E-10	SECONDARY_REASON	17	SECONDARY_REASON_OTHER
E-11	SURFACE_MATL_1	7	SURFACE_MATL_OTHER
E-12	COMPACTION	7	COMPACTION_OTHER
E-13	LOC_SIZE_METHOD	4	LOC_SIZE_METHOD_OTHER
E-14	CUT_METHOD	5	CUT_METHOD_OTHER
MNT_ASPHALT_SEAL			
E-5	REASON	6	REASON_OTHER
E-6	SEAL_TYPE	6	SEAL_TYPE_OTHER
E-7	ASPHALT_GRADE	17, 35, 99	ASPHALT_GRADE_OTHER
E-8	SEAL_ROLLER	5	SEAL_ROLLER_OTHER
E-9	INITIAL_PREP	5	INITIAL_PREP_OTHER
E-10	FINAL_PREP	6	FINAL_PREP_OTHER
MNT_GMG			
E-4G	MG_REASON	5	GMG_REASON_OTHER
E-6G	MG_EXTENT	4	GMG_EXTENT_OTHER
MNT_PCC_FULL_DEPTH			
E-10	REASON	38	REASON_OTHER
E-11	SECONDARY_REASON	38	SECONDARY_REASON_OTHER
E-12	PATCH_MATL	5	PATCH_MATL_OTHER
E-13	SLAB_REPLACE_MATL	4	REPLACE_MATL_OTHER

E-14	BOUNDARY_METHOD	5	
BOUDARY_METHOD_OTHER			
E-15	CUT_METHOD	5	CUT_METHOD_OTHER
E-16	TRANSFER_SYS_TRANS or TRANSFER_SYS_LONG	6	TRANSFER_SYS_OTHER
E-17	TRANSFER_DEVICE	4	
TRANSFER_DEVICE_OTHER			
E-18	DOWEL_COAT_TRANS or DOWEL_COAT_LONG	7	DOWEL_COAT_OTHER
E-19	CONC_BREAK_METHOD	5	
	CONC_BREAK_METHOD_OTHER		
E-20	CONC_REMOVAL	3	CONC_REMOVAL_OTHER
E-21	JOINT_METHOD_SH or JOINT_METHOD_TRANS or JOINT_METHOD_LONG	7	JOINT_METHOD_OTHER
E-22	CURE_METHOD_1 or CURE_METHOD_2	10	CURE_METHOD_OTHER
E-23	CONSOLIDATE_METHOD	6	
CONSOLIDATE_METHOD_OTHER			
E-24	FINISH_METHOD	4	FINISH_METHOD_OTHER

MNT_PCC_JOINT_RESEAL

E-6	REMOVAL_METHOD	9	
REMOVAL_METHOD_OTHER			
E-7	REFACED	4	REFACED_OTHER
E-8	SIDEWALL_CLEAN	4	
SIDEWALL_CLEAN_OTHER			
E-9	JOINT_SEAL_TYPE	7	
JOINT_SEAL_TYPE_OTHER			

MNT_PCC_PART_DEPTH

E-7	REASON	38	REASON_OTHER
E-8	SECONDARY_REASON	38	
SECONDARY_REASON_OTHER			
E-9	BOUNDARY_METHOD	4B	
OUNDARY_METHOD_OTHER			
E-10	CUT_METHOD	6	CUT_METHOD_OTHER
E-11	BREAK_METHOD	3	BREAK_METHOD_OTHER
E-12	CLEAN_METHOD	4	CLEAN_METHOD_OTHER
E-13	PATCH_MATL	5	PATCH_MATL_OTHER
E-14	BOND_AGENT	5	BOND_AGENT_OTHER
E-15	CURE_METHOD_1 or CURE_METHOD_2	10	CURE_METHOD_OTHER
E-16	CONSOLIDATE_METHOD	6	
CONSOLIDATE_METHOD_OTHER			
E-17	FINISH_METHOD	4	FINISH_METHOD_OTHER
E-18	JOINT_METHOD_TRANS or JOINT_METHOD_SH or JOINT_METHOD_LONG	7	JOINT_METHOD_OTHER
E-19	PATCH_MATL	1, 2, 3	
PATCH_COMP_STRENGTH			

10.0 REHABILITATION QC PROGRAMS

10.1 Level 1

A. Initial Level

Records in the IMS are at Level A when they first enter the system and are set back to A when changes are made to a given record or to selected related records.

B. Dependency Checks

No dependency checks are performed.

C. Minimum Data Elements

Tables and accompanying fields that must be included in a data record are identified below. Explanations are provided for those fields having certain conditions as to when they are required (i.e., X = always; * = conditionally).

Table	Field	Condition
RHB_*	LAYER_NO	X
RHB_ACO_AGGR_PROP	AGGR_COMP_PERCENT_C1	*
	*required if AGGR_COMP_TYPE_C1 is non-null	
	AGGR_COMP_PERCENT_F1	*
	*required if AGGR_COMP_TYPE_F1 is non-null	
	FIVE_EIGHTHS_PASSING	*
	*for each record, at least three sieve fields must be entered.	
	MINERAL_FILLER	X
	NO_100_PASSING	*
	NO_10_PASSING	*
	NO_16_PASSING	*
	NO_200_PASSING	*
	NO_30_PASSING	*
	NO_40_PASSING	*
	NO_4_PASSING	*
	NO_50_PASSING	*
	NO_80_PASSING	*
	NO_8_PASSING	*
	ONE_AND_HALF_PASSING	*
	ONE_HALF_PASSING	*
	ONE_PASSING	*
	SEVEN_EIGHTS_PASSING	*
	THREE_EIGHTHS_PASSING	*
	THREE_FOURTHS_PASSING	*

	TWO_PASSING	*
RHB_ACO_MIX_PROP	ASPHALT_CONTENT_MEAN	X
	PCT_AIR_VOIDS_MEAN	X
RHB_ACO_PROP	ASPHALT_GRADE	X
	ASPHALT_SPECIFIC_GRAVITY	X
	MODIFIER_QTY_1	*
	*required if entry in MODIFIER_1	
RHB_ACO_LAB_MIX	MAX_SPEC_GRAVITY	X
	BULK_SPEC_GRAVITY	X
	ASPHALT_CONTENT	X
	PERCENT_AIR_VOIDS	X
RHB_ACO_SP_AGGR_PROP	No level C checks	
RHB_ACO_SP_MIX_PROP	No level C checks	
RHB_ACO_SP_PROP	PG_HIGH_TEMP	X
	PG_LOW_TEMP	X
	SOURCE	X
RHB_CAUSE_INFO	No level C checks	
RHB_CMRAP_COMBINED_AGG	AMOUNT_UNTREAT_AGGR	X
	FIVE_EIGHTHS_PASSING	*
	* for each record, at least three sieve fields must be entered.	
	NO_100_PASSING	*
	NO_10_PASSING	*
	NO_16_PASSING	*
	NO_200_PASSING	*
	NO_30_PASSING	*
	NO_40_PASSING	*
	NO_4_PASSING	*
	NO_50_PASSING	*
	NO_80_PASSING	*
	NO_8_PASSING	*
	ONE_AND_HALF_PASSING	*
	ONE_HALF_PASSING	*
	ONE_PASSING	*
	SEVEN_EIGHTHS_PASSING	*
	THREE_EIGHTHS_PASSING	*
	THREE_FOURTHS_PASSING	*
	TWO_PASSING	*
RHB_CMRAP_COMBINE_AC	AC_AMOUNT_NEW	X
	ASPHALT_SPECIFIC_GRAVITY	X
	MODIFIER_QTY_1	*
	*required if entry in MODIFIER_1	
	RECYCLE_TYPE	X
RHB_CMRAP_GEN_INFO	BREAKUP_METHOD	X
	FIVE_EIGHTHS_PASSING	*

	*for each record, at least three sieve fields must be entered.	
	NO_100_PASSING	*
	NO_10_PASSING	*
	NO_16_PASSING	*
	NO_200_PASSING	*
	NO_30_PASSING	*
	NO_40_PASSING	*
	NO_4_PASSING	*
	NO_50_PASSING	*
	NO_80_PASSING	*
	NO_8_PASSING	*
	ONE_AND_HALF_PASSING	*
	ONE_HALF_PASSING	*
	ONE_PASSING	*
	PAVEMENT_PROCESSING	X
	SEVEN_EIGHTHS_PASSING	*
	THREE_EIGHTHS_PASSING	*
	THREE_FOURTHS_PASSING	*
	TWO_PASSING	*
RHB_CMRAP_LAB_MIX	ASPHALT_CONTENT	X
	PERCENT_AIR_VOIDS	X
RHB_CMRAP_MIX_PROP	ANTISTRIP_AGENT_TYPE	X
	ASPHALT_CONTENT_MEAN	X
	PCT_AIR_VOIDS_MEAN	X
RHB_CMRAP_NEW_AC_PROP	ASPHALT_GRADE	X
	ASPHALT_SPECIFIC_GRAVITY	X
RHB_CMRAP_RECLAIM_AC	ASPHALT_SPECIFIC_GRAVITY	X
RHB_CMRAP_UNTREAT_AGGR	AGGR_COMP_PERCENT_C1	*
	*required if AGGR_COMP_TYPE_C1 is non-null	
	AGGR_COMP_PERCENT_F1	**
	**required if AGGR_COMP_TYPE_F1 is non-null	
	FIVE_EIGHTHS_PASSING	*
	*for each record, at least three sieve fields must be entered	
	MINERAL_FILLER	X
	NO_100_PASSING	*
	NO_10_PASSING	*
	NO_16_PASSING	*
	NO_200_PASSING	*
	NO_30_PASSING	*
	NO_40_PASSING	*
	NO_4_PASSING	*
	NO_50_PASSING	*
	NO_80_PASSING	*
	NO_8_PASSING	*
	ONE_AND_HALF_PASSING	*
	ONE_HALF_PASSING	*
	ONE_PASSING	X
	SEVEN_EIGHTHS_PASSING	*
	THREE_EIGHTHS_PASSING	*

	THREE_FOURTHS_PASSING	*
	TWO_PASSING	*
RHB_CRACK_SEAT_PCC	BREAKER_TYPE	X
	PCC_BREAKAGE_LENGTH	X
	PCC_BREAKAGE_WIDTH	X
RHB_HEATER_SCARIF	DEPTH_SCARIFICATION	X
	REJUVENATE_AGENT	X
	SURFACE_TREAT_TYPE	X
RHB_HMRAP_COMBINED_AGG	AMOUNT_UNTREAT_AGGR	X
	FIVE_EIGHTHS_PASSING	*
	* for each record, at least three sieve fields must be entered	
	NO_100_PASSING	*
	NO_10_PASSING	*
	NO_16_PASSING	*
	NO_200_PASSING	*
	NO_30_PASSING	*
	NO_40_PASSING	*
	NO_4_PASSING	*
	NO_50_PASSING	*
	NO_80_PASSING	*
	NO_8_PASSING	*
	ONE_AND_HALF_PASSING	*
	ONE_HALF_PASSING	*
	ONE_PASSING	*
	SEVEN_EIGHTHS_PASSING	*
	THREE_EIGHTHS_PASSING	*
	THREE_FOURTHS_PASSING	*
	TWO_PASSING	*
RHB_HMRAP_COMBINE_AC	AC_AMOUNT_NEW	X
	ASPHALT_SPECIFIC_GRAVITY	X
	MODIFIER_QTY_1	*
	*required if entry in MODIFIER_1	
	RECYCLE_AGENT_TYPE	X
RHB_HMRAP_GEN_INFO	BREAKUP_METHOD	X
	FIVE_EIGHTHS_PASSING	*
	*for each record, at least three sieve fields must be entered.	
	NO_100_PASSING	*
	NO_10_PASSING	*
	NO_16_PASSING	*
	NO_200_PASSING	*
	NO_30_PASSING	*
	NO_40_PASSING	*
	NO_4_PASSING	*
	NO_50_PASSING	*
	NO_80_PASSING	*
	NO_8_PASSING	*
	ONE_AND_HALF_PASSING	*
	ONE_HALF_PASSING	*
	ONE_PASSING	*

	PAVEMENT_PROCESSING	X
	SEVEN_EIGHTHS_PASSING	*
	THREE_EIGHTHS_PASSING	*
	THREE_FOURTHS_PASSING	*
	TWO_PASSING	*
RHB_HMRAP_LAB_MIX	ASPHALT_CONTENT	X
	PERCENT_AIR_VOIDS	X
RHB_HMRAP_MIX_PROP	ASPHALT_CONTENT_MEAN	X
	PCT_AIR_VOIDS_MEAN	X
RHB_HMRAP_NEW_AC_PROP	ASPHALT_GRADE	X
	ASPHALT_SPECIFIC_GRAVITY	X
RHB_HMRAP_RECLAIM_AC	ASPHALT_SPECIFIC_GRAVITY	X
RHB_HMRAP_UNTREAT_AGGR	AGGR_COMP_PERCENT_C1	*
	*required if AGGR_COMP_TYPE_C1 is non-null	
	AGGR_COMP_PERCENT_F1	**
	**required if AGGR_COMP_TYPE_F1 is non-null	
	FIVE_EIGHTHS_PASSING	*
	*for each record, at least three sieve fields must be entered	
	MINERAL_FILLER	X
	NO_100_PASSING	*
	NO_10_PASSING	*
	NO_16_PASSING	*
	NO_200_PASSING	*
	NO_30_PASSING	*
	NO_40_PASSING	*
	NO_4_PASSING	*
	NO_50_PASSING	*
	NO_80_PASSING	*
	NO_8_PASSING	*
	ONE_AND_HALF_PASSING	*
	ONE_HALF_PASSING	*
	ONE_PASSING	*
	SEVEN_EIGHTHS_PASSING	*
	THREE_EIGHTHS_PASSING	*
	THREE_FOURTHS_PASSING	*
	TWO_PASSING	*
RHB_IMP	IMP_DATE	X
	IMP_THICKNESS	*
	*required if IMP_TYPE = 19, 20, 43 - 48, 51, 52, 55, or 56	
	IMP_TYPE	X
RHB_LAYER	DESCRIPTION	X
	MATERIAL_TYPE	X
RHB_LOAD_TRANSFER	INSTALL_FREQUENCY	X
	RESTORATION_TYPE	X
RHB_MILL_AND_GRIND	AVG_CUT_DEPTH	X

	METHOD_USED	X
	SURFACE_PREP_EXTENT	X
RHB_PCCO_AGGR	AGGR_COMP_C1	X
	AGGR_COMP_TYPE_F1	X
	FIVE_EIGHTHS_PASSING	*
	*for each record, at least three sieve fields must be entered	
	NO_100_PASSING	*
	NO_10_PASSING	*
	NO_16_PASSING	*
	NO_200_PASSING	*
	NO_30_PASSING	*
	NO_4_PASSING	*
	NO_40_PASSING	*
	NO_50_PASSING	*
	NO_80_PASSING	*
	NO_8_PASSING	*
	ONE_AND_HALF_PASSING	*
	ONE_HALF_PASSING	*
	ONE_PASSING	*
	SEVEN_EIGHTHS_PASSING	*
	THREE_EIGHTHS_PASSING	*
	THREE_FOURTHS_PASSING	*
	TWO_PASSING	*
RHB_PCCO_CONSTRUCTION	AIR_TEMP_MEAN	X
	BOND_CONDITION	X
	CONCRETE_CURE_METHOD	X
	GROUT_TYPE	X
	PAVER_TYPE	X
	SURFACE_PREP	X
RHB_PCCO_JOINT_DATA	AVG_CONTRACTION_SPACING	X
	BUILT_IN_EXPANSION_SPACING	X
	JOINT_SKEWNESS	X
	LONG_TYPE	X
	SH_TRAFFIC_LANE_TYPE	X
	TRANS_CONT_JLTS	X
	TRANS_METHOD	X
	TRANS_SEAL_TYPE	X
RHB_PCCO_MIXTURE	ADMIXTURE_AMT_1	*
	*at least one ADMIXTURE entry is required	
	ADMIXTURE_AMT_2	*
	ADMIXTURE_AMT_3	*
	CEMENT_TYPE	X
	ENTRAINED_AIR_MEAN	X
	MIX_DESIGN_CEMENT	X
	MIX_DESIGN_COARSE	X
	MIX_DESIGN_FINE	X
	MIX_DESIGN_WATER	X
	SLUMP_MEAN	X
RHB_PCCO_STEEL	REINFORCING_TYPE	X

RHB_PCCO_STRENGTH	COMP_STRENGTH_AGE	X
	COMP_STRENGTH_MEAN	X
	FLEXURAL_STRENGTH_AGE	X
	FLEXURAL_STRENGTH_MEAN	X
	FLEXURAL_STRENGTH_TYPE	X
RHB_PMA_CONSTRUCTION	LAYDOWN_TEMP_MEAN	X
	MEAN_MIXING_TEMP	X
RHB_PRESSURE_RELIEF	PRESSURE_RELIEF_REASON	X
RHB_RCYPCC_COMBINED_AGGR	FIVE_EIGHTHS_PASSING	*
	*for each record, at least three sieve fields must be entered	
	NO_100_PASSING	*
	NO_10_PASSING	*
	NO_16_PASSING	*
	NO_200_PASSING	*
	NO_30_PASSING	*
	NO_40_PASSING	*
	NO_4_PASSING	*
	NO_50_PASSING	*
	NO_80_PASSING	*
	NO_8_PASSING	*
	ONE_AND_HALF_PASSING	*
	ONE_HALF_PASSING	*
	ONE_PASSING	*
	SEVEN_EIGHTHS_PASSING	*
	THREE_EIGHTHS_PASSING	*
	THREE_FOURTHS_PASSING	*
	TWO_PASSING	*
RHB_RCYPCC_CONSTRUCTION	AIR_TEMP_MEAN	X
	BREAKUP_EQUIPMENT	X
RHB_RCYPCC_JOINT	AVG_CONTRACTION_SPACING	X
	BUILT_IN_EXPANSION_SPACING	X
	JOINT_SKEWNESS	X
	LONG_TYPE	X
	SH_TRAFFIC_LANE_TYPE	X
	TRANS_CONT_JLTS	X
	TRANS_METHOD	X
RHB_RCYPCC_MIXTURE	ADMIXTURE_AMT_1	*
	*at least one ADMIXTURE entry is required	
	ADMIXTURE_AMT_2	*
	ADMIXTURE_AMT_3	*
	CEMENT_TYPE	X
	ENTRAINED_AIR_MEAN	X
	MIX_DESIGN_CEMENT	X
	MIX_DESIGN_COARSE	X
	MIX_DESIGN_FINE	X
	MIX_DESIGN_WATER	X
	SLUMP_MEAN	X
RHB_RCYPCC_NEW_AGGR	AGGR_COMP_C1	X

	AGGR_COMP_TYPE_F1	X
	FIVE_EIGHTHS_PASSING	*
	*for each record, at least three sieve fields must be entered	
	NO_100_PASSING	*
	NO_10_PASSING	*
	NO_16_PASSING	*
	NO_200_PASSING	*
	NO_30_PASSING	*
	NO_40_PASSING	*
	NO_4_PASSING	*
	NO_50_PASSING	*
	NO_80_PASSING	*
	NO_8_PASSING	*
	ONE_AND_HALF_PASSING	*
	ONE_HALF_PASSING	*
	ONE_PASSING	*
	SEVEN_EIGHTHS_PASSING	*
	THREE_EIGHTHS_PASSING	*
	THREE_FOURTHS_PASSING	*
	TWO_PASSING	*
RHB_RCYPCC_STEEL	REINFORCING_TYPE	X
RHB_RCYPCC_STRENGTH	COMP_STRENGTH_AGE	X
	COMP_STRENGTH_MEAN	X
	FLEXURAL_STRENGTH_AGE	X
	FLEXURAL_STRENGTH_MEAN	X
	FLEXURAL_STRENGTH_TYPE	X
RHB_RESTORE_AC_SHOULDER	ACO_THICKNESS	*
	*required only if SHOULDER_ RESTORE_TYPE is 1, 2, or 4	
	I_SH_PAVED_WIDTH	*
	I_SH_SURFACE_THICKNESS	*
	I_SH_SURFACE_TYPE	*
	I_SH_WIDTH	*
	*I_ fields are required if SHOULDER_RESTORED is (2) Inside or (3) Both	
	O_SH_PAVED_WIDTH	**
	O_SH_SURFACE_THICKNESS	**
	O_SH_SURFACE_TYPE	**
	O_SH_WIDTH	**
	**O_ fields are required if SHOULDER_RESTORED is (1) Outside or (3) Both	
	SHOULDER_RESTORED	X
	SHOULDER_RESTORE_TYPE	X
RHB_RESTORE_PCC_SHOULDER	I_SH_PAVED_WIDTH	*
	I_SH_SURFACE_THICKNESS	*
	I_SH_SURFACE_TYPE	*
	I_SH_WIDTH	*
	*I_ fields are required if SHOULDER_RESTORED is (2) Inside or (3) Both	
	JOINT_TIE_SYSTEM_TYPE	X
	JOINT_TYPE	X

	O_SH_PAVED_WIDTH	**
	O_SH_SURFACE_THICKNESS	**
	O_SH_SURFACE_TYPE	**
	O_SH_WIDTH	**
	**O_ fields are required if SHOULDER_RESTORED is (1) Outside or (3) Both	
	SHOULDER_RESTORED	X
	SHOULDER_SYSTEM_TYPE	X
RHB_SUBDRAINAGE	HORIZ_PIPE_PLACEMENT	X
	PIPE_DEPTH	X
	SUBDRAIN_TYPE	X
RHB_SUBSEALING_PCC	AC_GRADE	X
	AVG_NO_HOLES_SLAB	X
	CEMENT_SAND_RATIO	X
	CEMENT_TYPE	X
	NO_HOLES_PER_FOOT	X
	SUBSEAL_MIXTURE_TYPE	X
	VOLUME_MATERIAL_PUMPED	X
	WATER_CEMENT_RATIO	X

D. Expanded Range Checks

Expanded range checks are applied to certain fields to identify data element values that fall outside an expected range. Field names are listed below the bolded table name.

Table	Units	Range
RHB_*		
CONSTRUCTION_NO		>= 2
DATE_COMPLETE		<= Today's date
LAYER_NO		1 - 20
RHB_ACO_AGGR_PROP		
AGGR_COMB_BULK_SPEC		1.5 - 3.2
AGGR_COMP_TYPE_C1		1 - 6
AGGR_COMP_TYPE_C2		1 - 6
AGGR_COMP_TYPE_C3		1 - 6
AGGR_COMP_TYPE_F1		1 - 4
AGGR_COMP_TYPE_F2		1 - 4
AGGR_COMP_TYPE_F3		1 - 4
AGGR_DUR_TYPE_C1		1 - 11
AGGR_DUR_TYPE_C2		1 - 11
AGGR_DUR_TYPE_C3		1 - 11
AGGR_DUR_TYPE_M1		1 - 11
COARSE_AGGR_BULK_SPEC		1.5 - 3.2
EFFECTIVE_SPEC_GRAVITY		1.5 - 3.2
FINE_AGGR_BULK_SPEC		1.5 - 2.9
GEOL_CLASS_COARSE_AGGR		1 - 22
MINERAL_FILLER		1 - 5
MINERAL_FILLER_BULK_SPEC		1.500 - 2.800
NO_100_PASSING	%	0.0 - 99.0
NO_10_PASSING	%	0.0 - 99.0

NO_16_PASSING	%	0.0 - 99.0
NO_200_PASSING	%	0.0 - 99.0
NO_30_PASSING	%	0.0 - 99.0
NO_40_PASSING	%	0.0 - 99.0
NO_4_PASSING	%	0.0 - 99.0
NO_50_PASSING	%	0.0 - 99.0
NO_80_PASSING	%	0.0 - 99.0
NO_8_PASSING	%	0.0 - 99.0
SEVEN_EIGHTHS_PASSING	%	0.0 - 100.0

RHB_ACO_LAB_AGED_AC

LAB_AGE_TEST_PROC		1 - 3
LAB_PENETRATION_77.1	mm	20 - 100
LAB_RING_BALL_SOFTENING_PT	deg F	100 - 400
LAB_VISCOSITY_140	poises	750 - 20000
LAB_VISCOSITY_275	centistokes	140.00 - 1500.00

RHB_ACO_LAB_MIX

ASPHALT_CONTENT	%	1 - 10
BULK_SPEC_GRAVITY		1 - 4
EFF_ASPHALT_CONTENT	%	1.0 - 10.0
HVEEM_STABILITY		25 - 60
MAX_SPEC_GRAVITY		1.000 - 4.000
MARSHALL_FLOW	.01 in	0 - 25
MARSHALL_STABILITY	lb	1200 - 5000
NO_BLOWS		25 - 99
PERCENT_AIR_VOIDS	%	2 - 20
PG_HIGH_TEMP		46 - 84
PG_LOW_TEMP		-46 - -10
SUPERPAVE_N_DES		80 - 150
VOIDS_MINERAL_AGGR	%	10 - 20

RHB_ACO_MIX_PROP

ANTISTRIP_AGENT_CODE		1 - 2
ASPHALT_CONTENT_MAX	%	2.0 - 15.0
ASPHALT_CONTENT_MEAN	%	2.0 - 15.0
ASPHALT_CONTENT_MIN	%	2.0 - 15.0
ASPHALT_CONTENT_STD_DEV	%	0.0 - 5.0
ASPHALT_PLANT_TYPE		1 - 3
BULK_SPEC_GRAVITY_MAX		1.500 - 2.600
BULK_SPEC_GRAVITY_MEAN		1.500 - 2.600
BULK_SPEC_GRAVITY_MIN		1.500 - 2.600
BULK_SPEC_GRAVITY_STD_DEV		0.000 - 1.000
EFF_ASPHALT_CONTENT_MAX	%	1.5 - 12.0
EFF_ASPHALT_CONTENT_MEAN	%	1.5 - 12.0
EFF_ASPHALT_CONTENT_MIN	%	1.5 - 12.0
EFF_ASPHALT_CONTENT_STDEV	%	0.0 - 6.0
MAX_SPEC_GRAVITY		1.800 - 2.750
PCT_AIR_VOIDS_MAX	%	0.3 - 20.0
PCT_AIR_VOIDS_MEAN	%	0.3 - 20.0
PCT_AIR_VOIDS_MIN	%	0.3 - 20.0
PCT_AIR_VOIDS_STD_DEV	%	0.0 - 7.0
SAMPLE_TYPE		1 - 2
VOIDS_MINERAL_AGGR_MAX	%	8.0 - 25.0
VOIDS_MINERAL_AGGR_MEAN	%	8.0 - 25.0

VOIDS_MINERAL_AGGR_MIN	%	8.0 - 25.0
VOIDS_MINERAL_AGGR_STDEV	%	0.0 - 10.0

RHB_ACO_PROP

ASPHALT_GRADE		1 - 40, 99
ASPHALT_SPECIFIC_GRAVITY		0.930 - 1.100
ASPHALT_VISCOSITY_140	poises	150 - 5000
ASPHALT_VISCOSITY_275	centistokes	100.0 - 500.0
DUCTILITY_77	cm	20 - 150
MODIFIER_1		1 - 27
MODIFIER_2		1 - 27
PENETRATION_77	.1 mm	40 - 300
RING_BALL_SOFT_PT	deg F	100 - 999

RHB_ACO_SP_AGGR_PROP

ANGULARITY_COARSE_ONE_FACE	%	0.0 - 99.9
ANGULARITY_COARSE_TWO_FACES	%	0.0 - 99.9
ANGULARITY_FINE	%	0.0 - 99.9
CLAY_CONTENT	%	35.0 - 99.9
COARSE_AGGREGATE_TOUGHNESS	%	10.0 - 40.0
DELETERIOUS_MATERIALS	%	0.0 - 10.0
SOUNDNESS_COARSE	%	0.0 - 20.0
SOUNDNESS_FINE	%	0.0 - 20.0
THIN_ELONGATED_PARTICLES	%	0.0 - 9.9

RHB_ACO_SP_MIX_PROP

CONFINING_PRESSURE_4C	kPa	750 - 950
CONFINING_PRESSURE_20C	kPa	600 - 800
CONFINING_PRESSURE_40C	kPa	450 - 650
FREQ_SWP_PHASE_ANGLE_4C	deg	0.0 - 90.0
FREQ_SWP_PHASE_ANGLE_20C	deg	0.0 - 90.0
FREQ_SWP_PHASE_ANGLE_40C	deg	0.0 - 90.0
SIMPLE_SHEAR_SHEAR_STRESS_4C	kPa	300 - 400
SIMPLE_SHEAR_SHEAR_STRESS_20C	kPa	90 - 120
SIMPLE_SHEAR_SHEAR_STRESS_40C	kPa	30 - 40
UNIAXIAL_STRESS_4C	kPa	550 - 750
UNIAXIAL_STRESS_20C	kPa	400 - 600
UNIAXIAL_STRESS_40C	kPa	300 - 400

RHB_ACO_SP_PROP

ASPHALT_SPECIFIC_GRAVITY		1.000 - 4.000
BBR_STIFFNESS_MODULUS_PAV	MPa	100 - 400
BBR_SLOPE_PAV		0.000 - 1.000
DSR_COMPLEX_MODULUS_PAV	kPa	1000 - 6000
DSR_COMPLEX_PHASE_ANGLE_PAV	deg	0 - 90
DSR_COMPLEX_MODULUS_RTFO	kPa	1.00 - 5.00
DSR_COMPLEX_PHASE_ANGLE_RTFO	deg	0 - 90
DSR_COMPLEX_MODULUS_TANK	kPa	1.00 - 5.00
DSR_COMPLEX_PHASE_ANGLE_TANK	deg	0 - 90
DT_TENSILE_STRENGTH_PAV	kPa	1000.0 - 2500.0
DT_PERCENT_TENSILE_STRAIN_PAV	%	0.50 - 1.50
PG_HIGH_TEMP		46 - 84
PG_LOW_TEMP		-46 - -10

RHB_CAUSE_INFO

PRIMARY_REASON_RHB		1 - 3

GEN_PAVEMENT_RHB_CAUSE		Null, 1 - 5
DATE_RHB_SCHEDULED		yyyy >=1998
RHB_CMRAP_COMBINED_AGG		
AGGR_COMB_BULK_SPEC		1.5 - 3.2
COARSE_AGGR_BULK_SPEC		1.5 - 3.2
EFFECTIVE_SPEC_GRAVITY		1.5 - 3.2
FINE_AGGR_BULK_SPEC		1.5 - 2.9
MINERAL_FILLER_BULK_SPEC		1.500 - 2.800
NO_100_PASSING	%	0.0 - 99.0
NO_10_PASSING	%	0.0 - 99.0
NO_16_PASSING	%	0.0 - 99.0
NO_200_PASSING	%	0.0 - 99.0
NO_30_PASSING	%	0.0 - 99.0
NO_40_PASSING	%	0.0 - 99.0
NO_4_PASSING	%	0.0 - 99.0
NO_50_PASSING	%	0.0 - 99.0
NO_80_PASSING	%	0.0 - 99.0
NO_8_PASSING	%	0.0 - 99.0
TWO_PASSING	%	0.0 - 100.0
RHB_CMRAP_COMBINE_AC		
AC_AMOUNT_NEW	%	0.0 - 20.0
ASPHALT_SPECIFIC_GRAVITY		0.930 - 1.100
ASPHALT_VISCOSITY_140	poises	150 - 5000
ASPHALT_VISCOSITY_275	centistokes	100.0 - 500.0
DUCTILITY_77	cm	20 - 150
MODIFIER_1		1 - 27
MODIFIER_2		1 - 27
PENETRATION_77	.1 mm	40 - 300
RECYCLE_AGENT_TYPE		42 - 48
RING_BALL_SOFT_PT	deg F	100 - 999
RHB_CMRAP_GEN_INFO		
AGGR_COMB_BULK_SPEC		1.5 - 3.2
BREAKUP_METHOD		1 - 5
COARSE_AGGR_BULK_SPEC		1.5 - 3.2
EFFECTIVE_SPEC_GRAVITY		1.5 - 3.2
FINE_AGGR_BULK_SPEC		1.5 - 2.9
MINERAL_FILLER_BULK_SPEC		1.500 - 2.800
NO_100_PASSING	%	0.0 - 99.0
NO_10_PASSING	%	0.0 - 99.0
NO_16_PASSING	%	0.0 - 99.0
NO_200_PASSING	%	0.0 - 99.0
NO_30_PASSING	%	0.0 - 99.0
NO_40_PASSING	%	0.0 - 99.0
NO_4_PASSING	%	0.0 - 99.0
NO_50_PASSING	%	0.0 - 99.0
NO_80_PASSING	%	0.0 - 99.0
NO_8_PASSING	%	0.0 - 99.0
PAVEMENT_PROCESSING		1 - 5
RHB_CMRAP_LAB_AGED_AC		
LAB_AGE_TEST_PROC		1 - 3
LAB_PENETRATION_39	.1 mm	0 - 99
LAB_PENETRATION_77	.1 mm	20 - 100

LAB_RING_BALL_SOFTENING_PT	deg F	100 - 400
LAB_VISCOSITY_140	poises	750 - 20000
LAB_VISCOSITY_275	centistokes	140.00 - 1500.00

RHB_CMRAP_LAB_MIX

ASPHALT_CONTENT	%	2.0 - 15.0
BULK_SPEC_GRAVITY		1.5 - 2.5
HVEEM_STABILITY		30 - 65
MARSHALL_FLOW	.01 in	8 - 20
MARSHALL_STABILITY	lb	300 - 9999
MAX_SPEC_GRAVITY		1.800 - 2.750
NO_BLOWS		25 - 99
PERCENT_AIR_VOIDS	%	0.5 - 20.0

RHB_CMRAP_MIX_PROP

ANTISTRIP_AGENT_TYPE		0 - 70
ASPHALT_CONTENT_MAX	%	2.0 - 15.0
ASPHALT_CONTENT_MEAN	%	2.0 - 15.0
ASPHALT_CONTENT_MIN	%	2.0 - 15.0
ASPHALT_CONTENT_STD_DEV	%	0.0 - 1.0
BULK_SPEC_GRAVITY_MAX		1.500 - 2.600
BULK_SPEC_GRAVITY_MEAN		1.500 - 2.600
BULK_SPEC_GRAVITY_MIN		1.500 - 2.600
BULK_SPEC_GRAVITY_STD_DEV		0.000 - 1.000
EFF_ASPHALT_CONTENT_MAX	%	1.5 - 12.0
EFF_ASPHALT_CONTENT_MEAN	%	1.5 - 12.0
EFF_ASPHALT_CONTENT_MIN	%	1.5 - 12.0
EFF_ASPHALT_CONTENT_STDEV	%	0.0 - 6.0
MAX_SPEC_GRAVITY		1.800 - 2.750
NO_SAMP_ASPHALT_CONTENT		1 - 99
PCT_AIR_VOIDS_MAX	%	0.3 - 20.0
PCT_AIR_VOIDS_MEAN	%	0.3 - 20.0
PCT_AIR_VOIDS_MIN	%	0.3 - 20.0
PCT_AIR_VOIDS_STD_DEV	%	0.0 - 7.0
VOIDS_MINERAL_AGGR_MAX	%	8.0 - 25.0
VOIDS_MINERAL_AGGR_MEAN	%	8.0 - 25.0
VOIDS_MINERAL_AGGR_MIN	%	8.0 - 25.0
VOIDS_MINERAL_AGGR_STDEV	%	0.0 - 10.0

RHB_CMRAP_NEW_AC_PROP

ASPHALT_GRADE		1 - 40, 99
ASPHALT_SPECIFIC_GRAVITY		0.930 - 1.100
ASPHALT_VISCOSITY_140	poises	150 - 5000
ASPHALT_VISCOSITY_275	centistokes	100.0 - 500.0
DRY_AGG		1 - 3
DRY_AGG_AFTER_SPRAY		1 - 3
DUCTILITY_77	cm	20 - 150
PENETRATION_77	.1 mm	40 - 300
RING_BALL_SOFT_PT	deg F	100 - 999
WET_AGG		1 - 3
WET_AGG_AFTER_SPRAY		1 - 3

RHB_CMRAP_RECLAIM_AC

ASPHALT_SPECIFIC_GRAVITY		0.930 - 1.100
ASPHALT_VISCOSITY_140	poises	150 - 5000
ASPHALT_VISCOSITY_275	centistokes	100.0 - 500.0

DUCTILITY_77	cm	20 - 150
PENETRATION_77	.1 mm	40 - 300
RING_BALL_SOFT_PT	deg F	100 - 999

RHB_CMRAP_UNTREAT_AGGR

AGGR_COMB_BULK_SPEC		1.5 - 3.2
AGGR_COMP_TYPE_C1		1 - 6
AGGR_COMP_TYPE_C2		1 - 6
AGGR_COMP_TYPE_C3		1 - 6
AGGR_COMP_TYPE_F1		1 - 4
AGGR_COMP_TYPE_F2		1 - 4
AGGR_COMP_TYPE_F3		1 - 4
AGGR_DUR_TYPE_C1		1 - 11
AGGR_DUR_TYPE_C2		1 - 11
AGGR_DUR_TYPE_C3		1 - 11
AGGR_DUR_TYPE_M1		1 - 11
COARSE_AGGR_BULK_SPEC		1.5 - 3.2
COARSE_SOURCE		1 - 2
EFFECTIVE_SPEC_GRAVITY		1.5 - 3.2
FINE_AGGR_BULK_SPEC		1.5 - 2.9
FINE_SOURCE		1 - 2
GEOL_CLASS_COARSE_AGGR		1 - 22
MINERAL_FILLER		1 - 5
MINERAL_FILLER_BULK_SPEC		1.500 - 2.800
NO_100_PASSING	%	0.0 - 99.0
NO_10_PASSING	%	0.0 - 99.0
NO_16_PASSING	%	0.0 - 99.0
NO_200_PASSING	%	0.0 - 99.0
NO_30_PASSING	%	0.0 - 99.0
NO_40_PASSING	%	0.0 - 99.0
NO_4_PASSING	%	0.0 - 99.0
NO_50_PASSING	%	0.0 - 99.0
NO_80_PASSING	%	0.0 - 99.0
NO_8_PASSING	%	0.0 - 99.0

RHB_CRACK_SEAT_PCC

AFTER_BREAKING		1 - 2
AFTER_OVERLAY		1 - 2
AFTER_SEATING		1 - 2
BEFORE_BREAKING		1 - 2
BREAKER_TYPE		1 - 7
DEFLECTION_MEASURE_DEVICE		1 - 5
DEFLECTION_TEST_LOAD	lb	500 - 30000
PCC_BREAKAGE_LENGTH	in	6 - 96
PCC_BREAKAGE_WIDTH	in	3 - 96
ROLLER_TYPE		1 - 2
ROLLER_WEIGHT	tons	5 - 80
SURFACE_PREP		1 - 6

RHB_HEATER_SCARIF

BREAKDOWN_COVERAGE		0 - 40
BREAKDOWN_ROLLER_CODE		A - Q
FINAL_COVERAGE		1 - 40
FINAL_ROLLER_CODE		A - Q
HEAT_SCARIF_TYPE		1 - 2
INTERMED_COVERAGE		0 - 40

INTERMED_ROLLER_CODE		A - Q
REJUVENATE_AGENT		42 - 48
SURFACE_TREAT_TYPE		1 - 7

RHB_HMRAP_COMBINED_AGG

AGGR_COMB_BULK_SPEC		1.5 - 3.2
AMOUNT_UNTREAT_AGGR	%	0.0 - 99.9
COARSE_AGGR_BULK_SPEC		1.5 - 3.2
EFFECTIVE_SPEC_GRAVITY		1.5 - 3.2
FINE_AGGR_BULK_SPEC		1.5 - 2.9
MINERAL_FILLER_BULK_SPEC		1.500 - 2.800
NO_100_PASSING	%	0.0 - 99.0
NO_10_PASSING	%	0.0 - 99.0
NO_16_PASSING	%	0.0 - 99.0
NO_200_PASSING	%	0.0 - 99.0
NO_30_PASSING	%	0.0 - 99.0
NO_40_PASSING	%	0.0 - 99.0
NO_4_PASSING	%	0.0 - 99.0
NO_50_PASSING	%	0.0 - 99.0
NO_80_PASSING	%	0.0 - 99.0
NO_8_PASSING	%	0.0 - 99.0

RHB_HMRAP_COMBINE_AC

AC_AMOUNT_NEW	%	0.0 - 20.0
ASPHALT_SPECIFIC_GRAVITY		0.930 - 1.100
ASPHALT_VISCOSITY_140	poises	150 - 5000
ASPHALT_VISCOSITY_275	centistokes	100.0 - 500.0
DUCTILITY_77	cm	20 - 150
MODIFIER_1		1 - 27
MODIFIER_2		1 - 27
PENETRATION_77	.1 mm	40 - 300
RECYCLE_AGENT_TYPE		42 - 48
RING_BALL_SOFT_PT	deg F	100 - 999

RHB_HMRAP_GEN_INFO

AGGR_COMB_BULK_SPEC		1.5 - 3.2
BREAKUP_METHOD		1 - 5
COARSE_AGGR_BULK_SPEC		1.5 - 3.2
EFFECTIVE_SPEC_GRAVITY		1.5 - 3.2
FINE_AGGR_BULK_SPEC		1.5 - 2.9
MINERAL_FILLER_BULK_SPEC		1.500 - 2.800
NO_100_PASSING	%	0.0 - 99.0
NO_10_PASSING	%	0.0 - 99.0
NO_16_PASSING	%	0.0 - 99.0
NO_200_PASSING	%	0.0 - 99.0
NO_30_PASSING	%	0.0 - 99.0
NO_40_PASSING	%	0.0 - 99.0
NO_4_PASSING	%	0.0 - 99.0
NO_50_PASSING	%	0.0 - 99.0
NO_80_PASSING	%	0.0 - 99.0
NO_8_PASSING	%	0.0 - 99.0
PAVEMENT_PROCESSING		1 - 5

RHB_HMRAP_LAB_AGED_AC

LAB_AGE_TEST_PROC		1 - 3
LAB_PENETRATION_77	.1 mm	20 - 100

LAB_RING_BALL_SOFTENING_PT	deg F	100 - 400
LAB_VISCOSITY_140	poises	750 - 20000
LAB_VISCOSITY_275	centistokes	140.00 - 1500.00

RHB_HMRAP_LAB_MIX

ASPHALT_CONTENT	%	2.0 - 15.0
BULK_SPEC_GRAVITY		1.5 - 2.5
HVEEM_STABILITY		30 - 65
MARSHALL_FLOW	.01 in	8 - 20
MARSHALL_STABILITY	lb	300 - 9999
MAX_SPEC_GRAVITY		1.800 - 2.750
NO_BLOWS		25 - 99
PERCENT_AIR_VOIDS	%	0.5 - 20.0

RHB_HMRAP_MIX_PROP

ANTISTRIP_AGENT_CODE		1 - 2
ASPHALT_CONTENT_MAX	%	2.0 - 15.0
ASPHALT_CONTENT_MEAN	%	2.0 - 15.0
ASPHALT_CONTENT_MIN	%	2.0 - 15.0
ASPHALT_CONTENT_STD_DEV	%	0.0 - 1.0
BULK_SPEC_GRAVITY_MAX		1.500 - 2.600
BULK_SPEC_GRAVITY_MEAN		1.500 - 2.600
BULK_SPEC_GRAVITY_MIN		1.500 - 2.600
BULK_SPEC_GRAVITY_STD_DEV		0.000 - 1.000
EFF_ASPHALT_CONTENT_MAX	%	1.5 - 12.0
EFF_ASPHALT_CONTENT_MEAN	%	1.5 - 12.0
EFF_ASPHALT_CONTENT_MIN	%	1.5 - 12.0
EFF_ASPHALT_CONTENT_STDEV	%	0.0 - 6.0
MAX_SPEC_GRAVITY		1.800 - 2.750
MOIST_SUSCEPT_TEST		1 - 5
PCT_AIR_VOIDS_MAX	%	0.3 - 20.0
PCT_AIR_VOIDS_MEAN	%	0.3 - 20.0
PCT_AIR_VOIDS_MIN	%	0.3 - 20.0
PCT_AIR_VOIDS_STD_DEV	%	1.0 - 7.0
SAMPLE_TYPE		1 - 2
VOIDS_MINERAL_AGGR_MAX	%	8.0 - 25.0
VOIDS_MINERAL_AGGR_MEAN	%	8.0 - 25.0
VOIDS_MINERAL_AGGR_MIN	%	8.0 - 25.0
VOIDS_MINERAL_AGGR_STDEV	%	0.0 - 10.0

RHB_HMRAP_NEW_AC_PROP

ASPHALT_GRADE		1 - 40, 99
ASPHALT_SPECIFIC_GRAVITY		0.930 - 1.100
ASPHALT_VISCOSITY_140	poises	150 - 5000
ASPHALT_VISCOSITY_275	centistokes	100.0 - 500.0
DUCTILITY_77	cm	20 - 150
PENETRATION_77	.1 mm	40 - 300
RING_BALL_SOFT_PT	deg F	100 - 999

RHB_HMRAP_RECLAIM_AC

ASPHALT_SPECIFIC_GRAVITY		0.930 - 1.100
ASPHALT_VISCOSITY_140	poises	150 - 5000
ASPHALT_VISCOSITY_275	centistokes	100.0 - 500.0
DUCTILITY_77	cm	20 - 150
PENETRATION_77	.1 mm	40 - 300
RING_BALL_SOFT_PT	deg F	100 - 999

RHB_HMRAP_UNTREAT_AGGR

AGGR_COMB_BULK_SPEC		1.5 - 3.2
AGGR_COMP_TYPE_C1		1 - 6
AGGR_COMP_TYPE_C2		1 - 6
AGGR_COMP_TYPE_C3		1 - 6
AGGR_COMP_TYPE_F1		1 - 4
AGGR_COMP_TYPE_F2		1 - 4
AGGR_COMP_TYPE_F3		1 - 4
AGGR_DUR_TYPE_C1		1 - 11
AGGR_DUR_TYPE_C2		1 - 11
AGGR_DUR_TYPE_C3		1 - 11
AGGR_DUR_TYPE_M1		1 - 11
COARSE_AGGR_BULK_SPEC		1.5 - 3.2
COARSE_SOURCE		1 - 2
EFFECTIVE_SPEC_GRAVITY		1.5 - 3.2
FINE_AGGR_BULK_SPEC		1.5 - 2.9
FINE_SOURCE		1 - 2
FIVE_EIGHTHS_PASSING	%	000.0 - 100.0
GEOL_CLASS_COARSE_AGGR		1 - 22
MINERAL_FILLER		1 - 5
MINERAL_FILLER_BULK_SPEC		1.500 - 2.800
NO_100_PASSING	%	0.0 - 99.0
NO_10_PASSING	%	0.0 - 99.0
NO_16_PASSING	%	0.0 - 99.0
NO_200_PASSING	%	0.0 - 99.0
NO_30_PASSING	%	0.0 - 99.0
NO_40_PASSING	%	0.0 - 99.0
NO_4_PASSING	%	0.0 - 99.0
NO_50_PASSING	%	0.0 - 99.0
NO_80_PASSING	%	0.0 - 99.0
NO_8_PASSING	%	0.0 - 99.0

RHB_IMP

IMP_DATE		<= Today's date
IMP_TYPE		8 - 11, 14 - 16, 19 - 20, 38 - 52, 55 - 56

RHB_LAYER

DESCRIPTION		1 - 12
MAX_THICKNESS	in	0.0 - 100.0
MEAN_THICKNESS	in	0.0 - 100.0
MIN_THICKNESS	in	0.0 - 100.0
STD_DEV_THICKNESS	in	0.0 - 30.0

RHB_LOAD_TRANSFER

BEFORE_1_1	%	1 - 100
BEFORE_1_2	%	1 - 100
BEFORE_1_3	%	1 - 100
BEFORE_2_1	%	1 - 100
BEFORE_2_2	%	1 - 100
BEFORE_2_3	%	1 - 100
BEFORE_3_1	%	1 - 100
BEFORE_3_2	%	1 - 100
BEFORE_3_3	%	1 - 100
BEFORE_4_1	%	1 - 100
BEFORE_4_2	%	1 - 100

BEFORE_4_3	%	1 - 100
DEVICES_PER_JOINT		1 - 20
DOWEL_(1 - 12)	in	1 - 192
DOWEL_DIAMETER	in	0.25 - 2.00
DOWEL_LENGTH	in	12.0 - 36.0
POINT_DISTANCE_1		0 - 1000
POINT_DISTANCE_2		0 - 1000
POINT_DISTANCE_3		0 - 1000
POINT_DISTANCE_4		0 - 1000
RHB_MILL_AND_GRIND		
AVG_CUT_DEPTH	in	0.1 - 9.9
METHOD_USED		1 - 3
SURFACE_PREP_EXTENT		1 - 4
RHB_PCCO_AGGR		
AGGR_COMP_C1		1 - 7
AGGR_COMP_C2		1 - 7
AGGR_COMP_C3		1 - 7
AGGR_COMP_TYPE_F1		1 - 4
AGGR_COMP_TYPE_F2		1 - 4
AGGR_COMP_TYPE_F3		1 - 4
AGGR_DUR_TYPE_C1		1 - 11
AGGR_DUR_TYPE_C2		1 - 11
AGGR_DUR_TYPE_C3		1 - 11
AGGR_DUR_TYPE_M1		1 - 11
COARSE_AGGR_BULK_SPEC		2.0 - 3.0
FINE_AGGR_BULK_SPEC		2.0 - 3.0
GEOL_CLASS_COARSE_AGGR		1 - 22
NO_100_PASSING	%	0.0 - 99.0
NO_10_PASSING	%	0.0 - 99.0
NO_16_PASSING	%	0.0 - 99.0
NO_200_PASSING	%	0.0 - 99.0
NO_30_PASSING	%	0.0 - 99.0
NO_40_PASSING	%	0.0 - 99.0
NO_4_PASSING	%	0.0 - 99.0
NO_50_PASSING	%	0.0 - 99.0
NO_80_PASSING	%	0.0 - 99.0
NO_8_PASSING	%	0.0 - 99.0
RHB_PCCO_CONSTRUCTION		
AIR_TEMP_MAX	deg F	32 - 130
AIR_TEMP_MEAN	deg F	32 - 130
AIR_TEMP_MIN	deg F	32 - 130
CURING_PERIOD	days	1 - 28
OVERLAY_AGE	days	1 - 100
RHB_PCCO_JOINT_DATA		
AVG_CONTRACTION_SPACING	ft	10.0 - 120.0
AVG_SAWED_SPACING	ft	10.0 - 25.0
BUILT_IN_EXPANSION_SPACING	ft	40 - 700
DOWEL_LENGTH	in	12.0 - 36.0
DOWEL_MLTD_SPACING	in	12 - 20
JOINT_SEAL_BACKER_DIAM	in	0.20 - 3.00
JOINT_SKEWNESS		0.0 - 5.0
LONG_SEAL_RESVR_DEPTH	in	0.20 - 3.00

LONG_SEAL_RESVR_WIDTH	in	0.20 - 1.50
ROUND_DOWEL_DIAMETER	in	0.50 - 2.00
SH_TRAFFIC_SEAL_RESVR_DEPTH	in	0.0 - 4.0
SH_TRAFFIC_SEAL_RESVR_WIDTH	in	0.0 - 1.5
SH_TRAFFIC_TIE_BARS_DIAMETER	in	0.25 - 0.75
SH_TRAFFIC_TIE_BARS_LENGTH	in	18 - 36
SH_TRAFFIC_TIE_BARS_SPACING	in	18 - 60
TIE_BAR_DIAMETER	in	0.25 - 0.75
TIE_BAR_LENGTH	in	12 - 36
TIE_BAR_SPACING	in	18.0 - 48.0
TRANS_SEAL_RESVR_DEPTH	in	0.20 - 3.00
TRANS_SEAL_RESVR_WIDTH	in	0.20 - 1.50

RHB_PCCO_MIXTURE

ADMIXTURE_AMT_1	%	0.0 - 99.0
ADMIXTURE_AMT_2	%	0.0 - 99.0
ADMIXTURE_AMT_3	%	0.0 - 99.0
ADMIXTURE_TYPE_1		1 - 13
ADMIXTURE_TYPE_2		1 - 13
ADMIXTURE_TYPE_3		1 - 13
CEMENT_TYPE		41 - 55
ENTRAINED_AIR_MAX	%	1.0 - 8.0
ENTRAINED_AIR_MEAN	%	3.5 - 6.5
ENTRAINED_AIR_MIN	%	0.0 - 6.5
MIX_DESIGN_CEMENT	lb	350 - 900
MIX_DESIGN_COARSE	lb	1750 - 5000
MIX_DESIGN_FINE	lb	900 - 1400
MIX_DESIGN_WATER	lb	150 - 250
NO_SLUMP_TESTS		1 - 100
SLUMP_MAX	in	1.0 - 6.0
SLUMP_MEAN	in	1.0 - 5.0
SLUMP_MIN	in	0.0- 4.0
SLUMP_STD_DEV	in	0.0 - 2.50

RHB_PCCO_STEEL

DEPTH_TO_REINFORCEMENT	in	2.5 - 7.0
DESIGN_PERCENT_LONG_STEEL	%	0.05 - 0.75
LONG_BAR_DIAMETER	in	0.25 - 0.90
LONG_BAR_SPACING	in	6.0 - 24.0
REINFORCE_PLACE_METHOD		1 - 4
REINFORCE_YIELD_STRENGTH	ksi	35.0 - 99.9
REINFORCING_TYPE		1 - 3
STEEL_LAP_LENGTH	in	12 - 60
TRANSVERSE_BAR_DIAMETER	in	0.25 - 0.75
TRANSVERSE_BAR_SPACING	in	9.0 - 36.0

RHB_PCCO_STRENGTH

COMP_STRENGTH_AGE	days	1 - 28
COMP_STRENGTH_MAX	psi	2000 - 9999
COMP_STRENGTH_MEAN	psi	2000 - 9999
COMP_STRENGTH_MIN	psi	1000 - 9999
COMP_STRENGTH_STD_DEV	psi	0 - 1000
ELASTIC_MOD_MAX	ksi	500 - 7000
ELASTIC_MOD_MEAN	ksi	500 - 7000
ELASTIC_MOD_METHOD		1 - 4
ELASTIC_MOD_MIN	ksi	500 - 7000

ELASTIC_MOD_STD_DEV	ksi	0 - 1000
FLEXURAL_STRENGTH_AGE	days	1 - 28
FLEXURAL_STRENGTH_MAX	psi	450 - 2000
FLEXURAL_STRENGTH_MEAN	psi	300 - 1750
FLEXURAL_STRENGTH_MIN	psi	250 - 1500
FLEXURAL_STRENGTH_STD_DEV	psi	0.0 - 300.0
FLEXURAL_STRENGTH_TYPE		1 - 2
TENSILE_STRENGTH_AGE	psi	1 - 28
TENSILE_STRENGTH_MAX	psi	200 - 1000
TENSILE_STRENGTH_MEAN	psi	200 - 1000
TENSILE_STRENGTH_MIN	psi	100 - 800
TENSILE_STRENGTH_STD_DEV	psi	0 - 300

RHB_PMA_COMPACTION

BREAKDOWN_COVERAGE		0 - 10 (0 - 40 For IMP_TYPE = 44)
BREAKDOWN_ROLLER_CODE		A - Q
COMPACTED_THICK	in	0.5 - 6.0
CURING_PERIOD	days	0 - 28
FINAL_COVERAGE		1 - 10 (1 - 40 For IMP_TYPE = 44)
FINAL_ROLLER_CODE		A - Q
INTERMED_COVERAGE		0 - 40
INTERMED_ROLLER_CODE		A - Q
LIFT_NO		1 - 4
MEAN_AIR_TEMP	deg F	40 - 135

RHB_PMA_CONSTRUCTION

ASPHALT_PLANT_TYPE		1 - 3
LAYDOWN_TEMP_MAX	deg F	200 - 350
LAYDOWN_TEMP_MEAN	deg F	200 - 350
LAYDOWN_TEMP_MIN	deg F	200 - 350
LAYDOWN_TEMP_STD_DEV	deg F	0 - 120
MEAN_MIXING_TEMP	deg F	250 - 350
MIX_PROCEDURE		1 - 4
NO_TESTS_LAYDOWN_TEMP		1 - 99
RECYCLING_TYPE		1 - 2
SPREAD_MIX_METHOD		1 - 5

RHB_PMA_ROLLER

ROLLER_AMP	in	0.010 - 0.030
ROLLER_CODE		A - Q
ROLLER_FREQ	vib/min	2500 - 3500
ROLLER_GROSS_WT	tons	0 - 20
ROLLER_SPEED	mph	1.0 - 5.0
ROLLER_TIRE_PRES	psi	80 - 110

RHB_PRESSURE_RELIEF

AGG_EXPANSIVE		1 - 2
CUT_REMOVE_METHOD		1 - 4
DISTANCE_TO_WORK_JOINT	ft	0.5 - 999.9
JOINT_FILLER_TYPE		1 - 6
JOINT_SEALANT_TYPE		1 - 7
PRESSURE_RELIEF_REASON		1 - 5
RELIEF_JOINT_DEPTH	in	0.25 - 6.00
RELIEF_JOINT_INTERVAL	ft	100 - 10000

RELIEF_JOINT_WIDTH	in	0.20 - 3.00

RHB_RCYPCC_COMBINED_AGGR

AGGR_DUR_TYPE_C1		1 - 11
AGGR_DUR_TYPE_C2		1 - 11
AGGR_DUR_TYPE_C3		1 - 11
AGGR_DUR_TYPE_M1		1 - 11
COARSE_AGGR_BULK_SPEC		2.0 - 3.0
FINE_AGGR_BULK_SPEC		2.0 - 3.0
NO_100_PASSING	%	0.0 - 99.0
NO_10_PASSING	%	0.0 - 99.0
NO_16_PASSING	%	0.0 - 99.0
NO_200_PASSING	%	0.0 - 99.0
NO_30_PASSING	%	0.0 - 99.0
NO_40_PASSING	%	0.0 - 99.0
NO_4_PASSING	%	0.0 - 99.0
NO_50_PASSING	%	0.0 - 99.0
NO_80_PASSING	%	0.0 - 99.0
NO_8_PASSING	%	0.0 - 99.0

RHB_RCYPCC_CONSTRUCTION

AIR_TEMP_MAX	deg F	32 - 130
AIR_TEMP_MEAN	deg F	32 - 130
AIR_TEMP_MIN	deg F	32 - 130
AVG_LENGTH_PCC_PIECES	in	1 - 24
AVG_WIDTH_PCC_PIECES	in	1 - 24
CURING_PERIOD	days	0 - 2

RHB_RCYPCC_JOINT

AVG_CONTRACTION_SPACING	ft	10.0 - 120.0
AVG_SAWED_SPACING	ft	10.0 - 25.0
BUILT_IN_EXPANSION_SPACING	ft	40 - 700
DOWEL_DISTANCE	in	00.0 - 99.9
DOWEL_LENGTH	in	12.0 - 36.0
DOWEL_MLTD_SPACING	in	12 - 20
I_BEAM_WIDTH	in	0.00 - 9.99
JOINT_SEAL_BACKER_DIAM	in	0.20 - 3.00
JOINT_SKEWNESS		0.0 - 5.0
LONG_SEAL_RESVR_DEPTH	in	0.20 - 3.00
LONG_SEAL_RESVR_WIDTH	in	0.20 - 1.50
LONG_TYPE		1 - 5
MLTD_METHOD		1 - 3
ROUND_DOWEL_DIAMETER	in	0.50 - 2.00
SH_TRAFFIC_SEAL_RESVR_DEPTH	in	0.0 - 4.0
SH_TRAFFIC_SEAL_RESVR_WIDTH	in	0.0 - 1.5
SH_TRAFFIC_TIE_BARS_DIAMETER	in	0.25 - 0.75
SH_TRAFFIC_TIE_BARS_LENGTH	in	18 - 36
SH_TRAFFIC_TIE_BARS_SPACING	in	18 - 60
TIE_BAR_DIAMETER	in	0.25 - 0.75
TIE_BAR_LENGTH	in	12 - 36
TIE_BAR_SPACING	in	18.0 - 48.0
TRANS_SEAL_RESVR_DEPTH	in	0.20 - 3.00
TRANS_SEAL_RESVR_WIDTH	in	0.20 - 1.50

RHB_RCYPCC_MIXTURE

ADMIXTURE_AMT_1	%	0.0 - 99.0

ADMIXTURE_AMT_2	%	0.0 - 99.0
ADMIXTURE_AMT_3	%	0.0 - 99.0
ADMIXTURE_TYPE_1		1 - 13
ADMIXTURE_TYPE_2		1 - 13
ADMIXTURE_TYPE_3		1 - 13
ALKALI_CONTENT_CEMENT	%	0.0 - 99.9
CEMENT_TYPE		41 - 55
ENTRAINED_AIR_MAX	%	1.0 - 8.0
ENTRAINED_AIR_MEAN	%	3.5 - 6.5
ENTRAINED_AIR_MIN	%	0.0 - 6.5
MIX_DESIGN_CEMENT	lb	350 - 900
MIX_DESIGN_COARSE	lb	1750 - 5000
MIX_DESIGN_FINE	lb	900 - 1400
MIX_DESIGN_WATER	lb	150 - 250
NO_SLUMP_TESTS		1 - 100
SLUMP_MAX	in	1.0 - 6.0
SLUMP_MEAN	in	1.0 - 5.0
SLUMP_MIN	in	0.0 - 4.0
SLUMP_STD_DEV	in	0.0 - 2.50

RHB_RCYPCC_NEW_AGGR

AGGR_COMP_C1		1 – 7
AGGR_COMP_C2		1 - 7
AGGR_COMP_C3		1 - 7
AGGR_COMP_TYPE_F1		1 - 4
AGGR_COMP_TYPE_F2		1 - 4
AGGR_COMP_TYPE_F3		1 - 4
AGGR_DUR_TYPE_C1		1 - 11
AGGR_DUR_TYPE_C2		1 - 11
AGGR_DUR_TYPE_C3		1 - 11
AGGR_DUR_TYPE_M1		1 - 11
COARSE_AGGR_BULK_SPEC		2.0 - 3.0
FINE_AGGR_BULK_SPEC		2.0 - 3.0
GEOL_CLASS_COARSE_AGGR		1 - 22
INSOLUBLE_RESIDUE	%	0 - 100
NO_100_PASSING	%	0.0 - 99.0
NO_10_PASSING	%	0.0 - 99.0
NO_16_PASSING	%	0.0 - 99.0
NO_200_PASSING	%	0.0 - 99.0
NO_30_PASSING	%	0.0 - 99.0
NO_40_PASSING	%	0.0 - 99.0
NO_4_PASSING	%	0.0 - 99.0
NO_50_PASSING	%	0.0 - 99.0
NO_80_PASSING	%	0.0 - 99.0
NO_8_PASSING	%	0.0 - 99.0

RHB_RCYPCC_STEEL

DEPTH_TO_REINFORCEMENT	in	2.5 - 7.0
DESIGN_PERCENT_LONG_STEEL	%	0.05 - 0.75
LONG_BAR_DIAMETER	in	0.25 - 0.90
LONG_BAR_SPACING	in	6.0 - 24.0
REINFORCE_PLACE_METHOD		1 - 4
REINFORCE_YIELD_STRENGTH	ksi	35.0 - 99.9
REINFORCING_TYPE		1 - 3
STEEL_LAP_LENGTH	in	12 - 60
TRANSVERSE_BAR_DIAMETER	in	0.25 - 0.75

TRANSVERSE_BAR_SPACING	in	9.0 - 36.0

RHB_RCYPCC_STRENGTH

COMP_STRENGTH_AGE	days	1 - 28
COMP_STRENGTH_MAX	psi	2000 - 9999
COMP_STRENGTH_MEAN	psi	2000 - 9999
COMP_STRENGTH_MIN	psi	1000 - 9999
COMP_STRENGTH_STD_DEV	psi	0 - 1000
ELASTIC_MOD_MAX	ksi	500 - 7000
ELASTIC_MOD_MEAN	ksi	500 - 7000
ELASTIC_MOD_METHOD		1 - 4
ELASTIC_MOD_MIN	ksi	500 - 7000
ELASTIC_MOD_STD_DEV	ksi	0 – 1000
FLEXURAL_STRENGTH_AGE	days	1 - 28
FLEXURAL_STRENGTH_MAX	psi	450 - 2000
FLEXURAL_STRENGTH_MEAN	psi	300 - 1750
FLEXURAL_STRENGTH_MIN	psi	250 - 1500
FLEXURAL_STRENGTH_STD_DEV	psi	0.0 - 300.0
FLEXURAL_STRENGTH_TYPE		1 - 2
NO_ELASTIC_MOD_TESTS		1 - 999
NO_TENSILE_STRENGTH_TESTS		1 - 999
TENSILE_STRENGTH_AGE	psi	1 - 28
TENSILE_STRENGTH_MAX	psi	200 - 1000
TENSILE_STRENGTH_MEAN	psi	200 - 1000
TENSILE_STRENGTH_MIN	psi	100 - 800
TENSILE_STRENGTH_STD_DEV	psi	0 - 300

RHB_RESTORE_AC_SHOULDER

IMP_TYPE		10, 11
I_SH_BASE_THICKNESS	in	0.00 - 48.0
I_SH_PAVED_WIDTH	ft	0 - 16
I_SH_SURFACE_THICKNESS	in	0.5 - 24.0
I_SH_WIDTH	ft	1 - 36
LANE_SH_RES_DEPTH	in	0.0 - 4.0
LANE_SH_RES_WIDTH	in	0.0 - 1.5
O_SH_BASE_THICKNESS	in	0.00 - 48.0
O_SH_PAVED_WIDTH	ft	0 - 16
O_SH_SURFACE_THICKNESS	in	0.5 - 24.0
O_SH_WIDTH	ft	1 - 36

RHB_RESTORE_PCC_SHOULDER

AVG_JOINT_SPACING	ft	10 - 200
BAR_DIAMETER	in	0.25 - 0.75
BAR_LENGTH	in	12 - 36
BAR_SPACING	in	18 - 60
IMP_TYPE		8, 9
I_SH_BASE_THICKNESS	in	0.00 - 48.00
I_SH_PAVED_WIDTH	ft	0 - 16
I_SH_SURFACE_THICKNESS	in	0.5 - 24.0
I_SH_WIDTH	ft	1 - 36
JOINT_SEALANT_DIMENSION	in	0.25 - 1.50
JOINT_SKEWNESS		0.0 - 4.0
O_SH_BASE_THICKNESS	in	0.00 - 48.00
O_SH_PAVED_WIDTH	ft	0 - 16
O_SH_SURFACE_THICKNESS	in	0.5 - 24.0
O_SH_WIDTH	ft	1 - 36

RESERVOIR_DEPTH	in	0.0 - 4.0
RESERVOIR_WIDTH	in	0.0 - 4.0
RHB_SUBDRAINAGE		
MAX_PARTICLE_SIZE	in	0.2 - 2.0
OUTLET_INTERVAL	ft	5 - 999
PIPE_DEPTH	in	1.0 - 48.0
PIPE_DIAMETER	in	1.0 - 24.0
RHB_SUBSEALING_PCC		
ADDITIVE_AMOUNT	%	0 - 20
ADDITIVE_TYPE		1 - 13
AVG_NO_HOLES_SLAB		1 - 50
CEMENT_SAND_RATIO		0.1 - 1.0
COMP_STRENGTH_PC_GROUT	psi	100 - 999
FLUIDITY_PC_GROUT	s	2.0 - 50.0
GROUT_CURE_PERIOD	days	0 - 28
MAX_PUMP_PRESSURE	psi	25 - 200
MAX_SURGE_PRESSURE	psi	25 - 400
NO_HOLES_PER_FOOT		0.1 - 5.0
NO_SLABS_SUBSEALED		1 - 100
PENETRATION_77	.1 mm	40 - 300
RING_BALL_SOFT_POINT	deg F	100 - 999
SUBSEAL_HOLE_DEPTH	in	3.00 - 48.00
TOTAL_NO_SLABS		1 - 100
TYPICAL_NO_HOLES		1 - 25
VOLUME_MATERIAL_PUMPED	cu ft	0.1 - 99.9
WATER_CEMENT_RATIO	%	0.10 - 9.99

E. Intramodular Checks

Each E-type check is separated by a single line. In general, each bullet represents a procedure, action, etc., of the check.

Table: RHB_ACO_LAB_MIX

- If ASPHALT_GRADE is in (17, 35, 99), then ASPHALT_GRADE_OTHER must be non-null

  Error Message: RHB_ACO_LAB_MIX-E-1 {STATE_CODE, SHRP_ID, DATE_COMPLETE, LAYER_NO} ASPHALT_GRADE = {ASPHALT_GRADE} requires non-null entry in ASPHALT_GRADE_OTHER.

Tables: RHB_ACO_SP_AGGR_PROP, RHB_ACO_AGGR_PROP

- A record must exist in **RHB_ACO_AGGR_PROP** with matching STATE_CODE, SHRP_ID, DATE_COMPLETE, and LAYER_NO

  Error message: RHB_ACO_SP_AGGR_PROP-E-1 {STATE_CODE, SHRP_ID, DATE_COMPLETE, LAYER_NO} Matching record does not exist in RHB_ACO_AGGR_PROP.

Tables: RHB_ACO_SP_MIX_PROP, RHB_ACO_MIX_PROP

- A record must exist in **RHB_ACO_MIX_PROP** with matching STATE_CODE, SHRP_ID, DATE_COMPLETE, LAYER_NO, and SAMPLE_TYPE

  Error message: RHB_ACO_SP_MIX_PROP-E-1 {STATE_CODE, SHRP_ID, DATE_COMPLETE, LAYER_NO, SAMPLE_TYPE} Matching record does not exist in RHB_ACO_MIX_PROP.

Tables: RHB_ACO_SP_PROP

- If SOURCE = 77, then SOURCE_OTHER must be non-null

  Error Message: RHB_ACO_SP_PROP-E-1 {STATE_CODE, SHRP_ID, DATE_COMPLETE, LAYER_NO} SOURCE = {SOURCE} requires non-null entry in SOURCE_OTHER.

Tables: RHB_ACO_SP_PROP, RHB_ACO_PROP

- A record must exist in **RHB_ACO_PROP** with matching STATE_CODE, SHRP_ID, DATE_COMPLETE, and LAYER_NO

  Error message: RHB_ACO_SP_PROP-E-2 {STATE_CODE, SHRP_ID, DATE_COMPLETE, LAYER_NO} Matching record does not exist in RHB_ACO_PROP.

Table: RHB_CAUSE_INFO

- If PRIMARY_REASON_RHB = 1 or 2, GEN_PAVEMENT_RHB_CAUSE must be non-null

  Error Message: GEN_PAVEMENT_RHB_CAUSE cannot be null when PRIMARY_REASON_RHB is pavement condition

- If PRIMARY_REASON_RHB = 1 or 2, a “Y” should be entered for at least one of the RHB_DIS_* fields

  Error Message: At least one type of RHB_DIS_* must exist when PRIMARY_REASON_RHB is pavement condition

- If RHB_DIS_OTHER is “Y”, the RHB_DIS_OTHER_TYPE must be non-null and not blank

  Error Message: When RHB_DIS_OTHER exists, its description must be in RHB_DIS_OTHER_TYPE.

- If PRIMARY_REASON_RHB = 3, GEN_PAVEMENT_RHB_CAUSE must be null

  Error Message: When PRIMARY_REASON_RHB is not pavement condition, GEN_PAVEMENT_RHB_CAUSE must be null.

- If PRIMARY_REASON_RHB = 3, all the RHB_DIS_* fields must be “N” except RHB_DIS_OTHER_TYPE which must be null

  Error Message: When PRIMARY_REASON_RHB is not pavement condition, RHB_DIS_* cannot exist.

- If PRIMARY_REASON_RHB = 3, a “Y” should be entered for at least one of the RHB_REASON_* fields

  Error Message: If PRIMARY_REASON_RHB is not pavement condition, at least one reason must be identified in RHB_REASON_*.

- If RHB_REASON_NON_PAVE_OTHER is “Y”, RHB_REASON_NON_PAVE_COMMENT must be non-null and not blank

  Error Message: When RHB_REASON_NON_PAVE_OTHER is true, its description must be in RHB_REASON_NON_PAVE_COMMENT.

Table: RHB_IMP

- If IMP_TYPE = 8 or 9, a matching record must exist in **RHB_RESTORE_PCC_SHOULDER**

  Error Message: **RHB_IMP**-W-1, for IMP_TYPE = 8 or 9, a record with matching key fields must exist in **RHB_RESTORE_PCC_SHOULDER**.

- If IMP_TYPE = 10 or 11, a matching record must exist in **RHB_RESTORE_AC_SHOULDER**

  Error Message: **RHB_IMP**-W-2, for IMP_TYPE = 10 or 11, a record with matching key fields must exist in **RHB_RESTORE_AC_SHOULDER**.

- If IMP_TYPE = 14, a matching record must exist in **RHB_SUBSEALING_PCC, SPS4_UNDERSEAL_GENERAL, SPS4_UNDERSEAL_INIT_GROUT, SPS4_UNDERSEAL_PRES_GROUT, SPS4_UNDERSEAL_REGROUT, SPS6_UNDERSEALING** or **SPS7_UNDERSEALING**

  Error Message: **RHB_IMP**-W-3, for IMP_TYPE = 14, a record with matching key fields must exist in **RHB_SUBSEALING_PCC, SPS4_UNDERSEAL_GENERAL, SPS4_UNDERSEAL_INIT_GROUT, SPS4_UNDERSEAL_PRES_GROUT, SPS4_UNDERSEAL_REGROUT, SPS6_UNDERSEALING** or **SPS7_UNDERSEALING**.

- If IMP_TYPE = 16, a matching record must exist in **RHB_SUBSEALING_PCC**

  Error Message: **RHB_IMP**-W-3, for IMP_TYPE = 16, a record with matching key fields must exist in **RHB_SUBSEALING_PCC**.

- If IMP_TYPE = 14 or 16, a record with matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO must exist in **RHB_LAYER** with MATERIAL_TYPE = 4 - 6 or 8, and DESCRIPTION = 3

  Error Message: **RHB_IMP**-W-4, for IMP_TYPE = 14 or 16, a record with matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO must exist in **RHB_LAYER** with MATERIAL_TYPE = 4 - 6 or 8, and DESCRIPTION = 3

- If IMP_TYPE = 15, a record with matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO must exist in **RHB_LAYER** with MATERIAL_TYPE = 4 or 5 and DESCRIPTION = 3

Error Message: **RHB_IMP**-W-5, for IMP_TYPE = 15, a record with matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO must exist in **RHB_LAYER** with MATERIAL_TYPE = 4 or 5, and DESCRIPTION = 3

- If IMP_TYPE = 19, for SPS5, a record with matching key fields must exist in **RHB_ACO_AGGR_PROP**

  Error Message: **RHB_IMP**-W-6a, for SPS5, IMP_TYPE = 19, a record with matching key fields must exist in **RHB_ACO_AGGR_PROP**.

- If IMP_TYPE = 19, for SPS5, a record with matching key fields must exist in **RHB_ACO_PROP**

  Error Message: **RHB_IMP**-W-7a, for SPS5, IMP_TYPE = 19, a record with matching key fields must exist in **RHB_ACO_PROP**.

- If IMP_TYPE = 19, for SPS6, a record with matching key fields must exist in **RHB_ACO_LAB_MIX** or **SPS6_LAYER**

  Error Message: **RHB_IMP**-W-7b, for SPS6, IMP_TYPE = 19, a record with matching key fields must exist in **RHB_ACO_LAB_MIX** or **SPS6_LAYER**.

- If IMP_TYPE = 19, for SPS9, a record with matching key fields must exist in **RHB_ACO_LAB_MIX** or **SPS9_LAYER**

  Error Message: **RHB_IMP**-W-7b, for SPS9, IMP_TYPE = 19, a record with matching key fields must exist in **RHB_ACO_LAB_MIX** or **SPS9_LAYER**.

For all sections other than SPS5, SPS6, or SPS9:

- If IMP_TYPE = 19, a record with matching key fields must exist in **RHB_ACO_AGGR_PROP**

  Error Message: **RHB_IMP**-W-6c, for IMP_TYPE = 19, a record with matching key fields must exist in **RHB_ACO_AGGR_PROP**.

- If IMP_TYPE = 19, a record with matching key fields must exist in **RHB_ACO_PROP**

  Error Message: **RHB_IMP**-W-7c, for IMP_TYPE = 19, a record with matching key fields must exist in **RHB_ACO_PROP**.

- If IMP_TYPE = 19, a record with matching key fields must exist in **RHB_ACO_MIX_PROP**

  Error Message: **RHB_IMP**-W-9, for IMP_TYPE = 19, a record with matching key fields must exist in **RHB_ACO_MIX_PROP**.

- If IMP_TYPE = 19, a record with matching key fields must exist in **RHB_PMA_COMPACTION**

  Error Message: RHB_IMP-W-10, for IMP_TYPE = 19, a record with matching key fields must exist in **RHB_PMA_COMPACTION**.

- If IMP_TYPE = 19, a record with matching key fields must exist in **RHB_PMA_CONSTRUCTION**

Error Message: **RHB_IMP**-W-11, for IMP_TYPE = 19, a record with matching key fields must exist in **RHB_PMA_CONSTRUCTION**.

- If IMP_TYPE = 19, a record with matching key fields must exist in **RHB_PMA_ROLLER**

  Error Message: **RHB_IMP**-W-12, for IMP_TYPE = 19, a record with matching key fields must exist in **RHB_PMA_ROLLER**.

For all sections:

- If IMP_TYPE = 19, a record with matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO must also exist in **RHB_LAYER** with MATERIAL_TYPE = 1 and DESCRIPTION = 1, 4, or 8

  Error Message: **RHB_IMP**-W-13, for IMP_TYPE = 19, a record with matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO must exist in **RHB_LAYER** with MATERIAL_TYPE = 1 and DESCRIPTION = 1, 4, or 8.

- If IMP_TYPE = 19, IMP_THICKNESS must be between 0.5 and 12.0 inches

  Error Message: **RHB_IMP**-E-120, for IMP_TYPE = 19, IMP_THICKNESS fails allowable thickness range (0.5 - 12.0).

- If IMP_TYPE = 20, a record with matching key fields must exist in **RHB_PCCO_MIXTURE**

  Error Message: **RHB_IMP**-W-14, for IMP_TYPE = 20, a record with matching key fields must exist in **RHB_PCCO_MIXTURE**.

- If IMP_TYPE = 20, a record with matching key fields must exist in **RHB_PCCO_AGGR**

  Error Message: **RHB_IMP**-W-15, for IMP_TYPE = 20, a record with matching key fields must exist in **RHB_PCCO_AGGR**.

For SPS7 sections only:

- If IMP_TYPE = 20, a record with matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO must exist in **RHB_LAYER** with MATERIAL_TYPE = 4 - 6, 8 or 90 and DESCRIPTION = 1

  If no matching record found:

  Error Message: **RHB_LAYER**-W-18a, for SPS7 records with IMP_TYPE = 20, a record with matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO must exist in **RHB_LAYER** with MATERIAL_TYPE = 4, 5, 6, 8, or 90, and DESCRIPTION = 1.

  If multiple matching records found:

  Error Message: **RHB_LAYER**-E-18b, multiple records with matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO exist in **RHB_LAYER** with MATERIAL_TYPE = 4, 5, 6, 8, or 90, and DESCRIPTION = 1.

For all sections other than SPS7:

- If IMP_TYPE = 20, a record with matching key fields must exist in **RHB_PCCO_CONSTRUCTION**

Error Message: **RHB_IMP**-W-16, for IMP_TYPE = 20, a record with matching key fields must exist in **RHB_PCCO_CONSTRUCTION**.

- If IMP_TYPE = 20, a record with matching key fields must exist in **RHB_PCCO_STRENGTH**

  Error Message: **RHB_IMP**-W-17, for IMP_TYPE = 20, a record with matching key fields must exist in **RHB_PCCO_STRENGTH**.

- If IMP_TYPE = 20, a record with matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO must exist in **RHB_LAYER** with MATERIAL_TYPE = 4 - 6 or 8 and DESCRIPTION = 1

  If no matching record found:

  Error Message: **RHB_LAYER**-W-18c, for SPS7 records with IMP_TYPE = 20, a record with matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO must exist in **RHB_LAYER** with MATERIAL_TYPE = 4, 5, 6, or 8, and DESCRIPTION = 1.

  If multiple matching records found:

  Error Message: **RHB_LAYER**-E-19, multiple records with matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO exist in **RHB_LAYER** with MATERIAL_TYPE = 4, 5, 6, or 8, and DESCRIPTION = 1.

- If IMP_TYPE = 20, for matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO, extract MATERIAL_TYPE for DESCRIPTION = 1 in **RHB_LAYER** (if no matching record or multiple matches, fail as above) and perform the following checks:

- If MATERIAL_TYPE = 4 or 8, then a record with matching key fields* must exist in **RHB_PCCO_JOINT_DATA**

  Error Message: **RHB_LAYER**-W-20, for IMP_TYPE = 20 and a record with matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO in **RHB_LAYER** with DESCRIPTION = 1 and MATERIAL_TYPE = 4 or 8, a record must exist in **RHB_PCCO_JOINT_DATA**.

- If MATERIAL_TYPE = 5, then a record with matching key fields* must exist in **RHB_PCCO_JOINT_DATA**

  Error Message: **RHB_LAYER**-W-21, for IMP_TYPE = 20 and a record with matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO in **RHB_LAYER** with DESCRIPTION = 1 and MATERIAL_TYPE = 5, a record must exist in **RHB_PCCO_JOINT_DATA**.

- If MATERIAL_TYPE = 5, then a record with matching key fields* must exist in **RHB_PCCO_STEEL**

  Error Message: **RHB_LAYER**-W-22, for IMP_TYPE = 20 and a record with matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO in **RHB_LAYER** with DESCRIPTION = 1 and MATERIAL_TYPE = 5, a record must exist in **RHB_PCCO_STEEL**.

- If MATERIAL_TYPE = 6, then a record with matching key fields* must exist in **RHB_PCCO_STEEL**

Error Message: **RHB_LAYER**-W-23, for IMP_TYPE = 20 and a record with matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO in **RHB_LAYER** with DESCRIPTION = 1 and MATERIAL_TYPE = 6, a record must exist in **RHB_PCCO_STEEL**.

- If IMP_TYPE = 38, a record with matching key fields must exist in **RHB_SUBDRAINAGE, SPS6_SUBDRAINAGE or SPS7_SUBDRAINAGE**

  Error Message: **RHB_IMP**-W-24, for IMP_TYPE = 38, a record with matching key fields must exist in **RHB_SUBDRAINAGE, SPS6_SUBDRAINAGE or SPS7_SUBDRAINAGE**.

- If IMP_TYPE = 39, 40, 41, or 42, a record with matching key fields must exist in **RHB_SUBDRAINAGE**

  Error Message: **RHB_IMP**-W-200, for IMP_TYPE = 39 - 42, a record with matching key fields must exist in **RHB_SUBDRAINAGE**.

For all sections:

- If IMP_TYPE = 43, a record with matching key fields must exist in **RHB_HMRAP_GEN_INFO**

  Error Message: **RHB_IMP**-W-25, for IMP_TYPE = 43, a record with matching key fields must exist in **RHB_HMRAP_GEN_INFO**.

- If IMP_TYPE = 43, a record with matching key fields must exist in **RHB_HMRAP_UNTREAT_AGGR**

  Error Message: **RHB_IMP**-W-26, for IMP_TYPE = 43, a record with matching key fields must exist in **RHB_HMRAP_UNTREAT_AGGR**.

- If IMP_TYPE = 43, a record with matching key fields must exist in **RHB_HMRAP_COMBINED_AGG**

  Error Message: **RHB_IMP**-W-27, for IMP_TYPE = 43, a record with matching key fields must exist in **RHB_HMRAP_COMBINED_AGG**.

- If IMP_TYPE = 43, a record with matching key fields must exist in **RHB_HMRAP_RECLAIM_AC**

  Error Message: **RHB_IMP**-W-28, for IMP_TYPE = 43, a record with matching key fields must exist in **RHB_HMRAP_RECLAIM_AC**.

- If IMP_TYPE = 43, a record with matching key fields must exist in **RHB_HMRAP_NEW_AC_PROP**

  Error Message: **RHB_IMP**-W-29, for IMP_TYPE = 43, a record with matching key fields must exist in **RHB_HMRAP_NEW_AC_PROP**.

- If IMP_TYPE = 43, a record with matching key fields must exist in **RHB_HMRAP_COMBINE_AC**

  Error Message: **RHB_IMP**-W-30, for IMP_TYPE = 43, a record with matching key fields must exist in **RHB_HMRAP_COMBINE_AC**.

- If IMP_TYPE = 43, IMP_THICKNESS must be between 0.5 and 12.0 inches

Error Message: **RHB_IMP**-E-122, for IMP_TYPE = 43, IMP_THICKNESS fails allowable thickness range (0.5 - 12.0).

For SPS5 sections:

- If IMP_TYPE =43, a record with matching SHRP_ID, STATE_CODE, and CONSTRUCTION_NO must exist in **RHB_LAYER** with MATERIAL_TYPE = 13 and DESCRIPTION = 1 or 4

  Error Message: **RHB_IMP**-W-37, for IMP_TYPE = 43, a record with matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO must exist in **RHB_LAYER** with MATERIAL_TYPE = 13 and DESCRIPTION = 1 or 4.

- If IMP_TYPE = 43, a record with matching key fields must exist in **RHB_HMRAP_LAB_MIX**

  Error Message: **RHB_IMP**-W-32, for IMP_TYPE = 43, a record with matching key fields must exist in **RHB_HMRAP_LAB_MIX**.

- If IMP_TYPE = 43, a record with matching key fields must exist in **RHB_HMRAP_MIX_PROP**

  Error Message: **RHB_IMP**-W-33, for IMP_TYPE = 43, a record with matching key fields must exist in **RHB_HMRAP_MIX_PROP**.

- If IMP_TYPE = 43, a record with matching key fields must exist in **RHB_PMA_CONSTRUCTION**

  Error Message: **RHB_IMP**-W-34, for IMP_TYPE = 43, a record with matching key fields must exist in **RHB_PMA_CONSTRUCTION**.

- If IMP_TYPE = 43, a record with matching key fields must exist in **RHB_PMA_COMPACTION**

  Error Message: **RHB_IMP**-W-35, for IMP_TYPE = 43, a record with matching key fields must exist in **RHB_PMA_COMPACTION**.

- If IMP_TYPE = 43, a record with matching key fields must exist in **RHB_PMA_ROLLER**

  Error Message: **RHB_IMP**-W-36, for IMP_TYPE = 43, a record with matching key fields must exist in **RHB_PMA_ROLLER**.

- If IMP_TYPE = 44, a record with matching key fields must exist in **RHB_CMRAP_GEN_INFO**

  Error Message: **RHB_IMP**-W-38, for IMP_TYPE = 44, a record with matching key fields must exist in **RHB_CMRAP_GEN_INFO**.

- If IMP_TYPE = 44, a record with matching key fields must exist in **RHB_CMRAP_UNTREAT_AGGR**

  Error Message: **RHB_IMP**-W-39, for IMP_TYPE = 44, a record with matching key fields must exist in **RHB_CMRAP_UNTREAT_AGGR**.

- If IMP_TYPE = 44, a record with matching key fields must exist in **RHB_CMRAP_COMBINED_AGG**

Error Message: **RHB_IMP**-W-40, for IMP_TYPE = 44, a record with matching key fields must exist in **RHB_CMRAP_COMBINED_AGG**.

- If IMP_TYPE = 44, a record with matching key fields must exist in **RHB_CMRAP_RECLAIM_AC**

  Error Message: **RHB_IMP**-W-41, for IMP_TYPE = 44, a record with matching key fields must exist in **RHB_CMRAP_RECLAIM_AC**.

- If IMP_TYPE = 44, a record with matching key fields must exist in **RHB_CMRAP_NEW_AC_PROP**

  Error Message: **RHB_IMP**-W-42, for IMP_TYPE = 44, a record with matching key fields must exist in **RHB_CMRAP_NEW_AC_PROP**.

- If IMP_TYPE = 44, a record with matching key fields must exist in **RHB_CMRAP_LAB_AGED_AC**

  Error Message: **RHB_IMP**-W-43, for IMP_TYPE = 44, a record with matching key fields must exist in **RHB_CMRAP_LAB_AGED_AC**.

- If IMP_TYPE = 44, a record with matching key fields must exist in **RHB_CMRAP_LAB_MIX**

  Error Message: **RHB_IMP**-W-44, for IMP_TYPE = 44, a record with matching key fields must exist in **RHB_CMRAP_LAB_MIX**.

- If IMP_TYPE = 44, a record with matching key fields must exist in **RHB_CMRAP_MIX_PROP**

  Error Message: **RHB_IMP**-W-45, for IMP_TYPE = 44, a record with matching key fields must exist in **RHB_CMRAP_MIX_PROP**.

- If IMP_TYPE = 44, a record with matching key fields must exist in **RHB_PMA_CONSTRUCTION**

  Error Message: **RHB_IMP**-W-46, for IMP_TYPE = 44, a record with matching key fields must exist in **RHB_PMA_CONSTRUCTION**.

- If IMP_TYPE = 44, a record with matching key fields must exist in **RHB_PMA_COMPACTION**

  Error Message: **RHB_IMP**-W-47, for IMP_TYPE = 44, a record with matching key fields must exist in **RHB_PMA_COMPACTION**.

- If IMP_TYPE = 44, a record with matching key fields must exist in **RHB_PMA_ROLLER**

  Error Message: **RHB_IMP**-W-48, for IMP_TYPE = 44, a record with matching key fields must exist in **RHB_PMA_ROLLER**.

- If IMP_TYPE =44, a record with matching SHRP_ID, STATE_CODE, and CONSTRUCTION_NO must exist in **RHB_LAYER** with MATERIAL_TYPE = 9, 10, 14, or 15, and DESCRIPTION = 1 or 4

  Error Message: **RHB_IMP**-W-49, for IMP_TYPE = 44, a record with matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO must exist in **RHB_LAYER** with MATERIAL_TYPE = 9, 10, 14, or 15 and DESCRIPTION = 1 or 4.

- If IMP_TYPE = 44, IMP_THICKNESS must be between 0.5 and 12.0 inches

  Error Message: **RHB_IMP**-E-123, for IMP_TYPE = 44, IMP_THICKNESS fails allowable thickness range (0.5 - 12.0).

- If IMP_TYPE = 45, a record with matching key fields must exist in **RHB_HEATER_SCARIF**

  Error Message: **RHB_IMP**-W-50, for IMP_TYPE = 45, a record with matching key fields must exist in **RHB_HEATER_SCARIF**.

- If IMP_TYPE = 45, a record with matching SHRP_ID, STATE_CODE, and CONSTRUCTION_NO must exist in **RHB_LAYER** with MATERIAL_TYPE = 1, 13, or 99, and DESCRIPTION = 3

  Error Message: **RHB_IMP**-W-51, for IMP_TYPE = 45, a record with matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO must exist in **RHB_LAYER** with MATERIAL_TYPE = 1, 13, or 99, and DESCRIPTION = 3.

- If IMP_TYPE = 45, a record with matching SHRP_ID, STATE_CODE, and CONSTRUCTION_NO must exist in **RHB_LAYER** with MATERIAL_TYPE = 16 and DESCRIPTION = 1

  Error Message: **RHB_IMP**-W-52, for IMP_TYPE = 45, a record with matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO must exist in **RHB_LAYER** with MATERIAL_TYPE = 16 and DESCRIPTION = 1.

- If IMP_TYPE = 45, IMP_THICKNESS must be between 0.5 and 12.0 inches

  Error Message: **RHB_IMP**-E-124, for IMP_TYPE = 45, IMP_THICKNESS fails allowable thickness range (0.5 - 12.0).

- If IMP_TYPE = 46, a record with matching key fields must exist in **RHB_CRACK_SEAT_PCC**

  Error Message: **RHB_IMP**-W-53a, for IMP_TYPE = 46, a record with matching key fields must exist in **RHB_CRACK_SEAT_PCC**, **SPS6_CRACK_SEAT_PCC** or **SPS9_LAYER**.

- If IMP_TYPE = 46, a record with matching key fields must exist in **SPS6_CRACK_SEAT_PCC**

  Error Message: **RHB_IMP**-W-53b, for IMP_TYPE = 46, a record with matching key fields must exist in **RHB_CRACK_SEAT_PCC**, **SPS6_CRACK_SEAT_PCC** or **SPS9_LAYER**.

- If IMP_TYPE = 46, a record with matching key fields must exist in **SPS9_LAYER**

  Error Message: **RHB_IMP**-W-53c, for IMP_TYPE = 46, a record with matching key fields must exist in **RHB_CRACK_SEAT_PCC**, **SPS6_CRACK_SEAT_PCC** or **SPS9_LAYER**.

- If IMP_TYPE = 46 - 47, a record with matching SHRP_ID, STATE_CODE, and CONSTRUCTION_NO must exist in **RHB_LAYER** with MATERIAL_TYPE = 4, 5, 6, or 8 and DESCRIPTION = 3

Error Message: **RHB_IMP**-W-54, for IMP_TYPE = 46 or 47, a record with matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO must exist in **RHB_LAYER** with MATERIAL_TYPE = 4, 5, 6, or 8 and DESCRIPTION = 3.

- If IMP_TYPE = 47, IMP_THICKNESS must be between 0.0 and 18.0 inches

  Error Message: **RHB_IMP**-E-130, for IMP_TYPE = 47, IMP_THICKNESS fails allowable thickness range (0.0 - 18.0).

- If IMP_TYPE = 47, a record with matching key fields must exist in **RHB_CRACK_SEAT_PCC**

  Error Message: **RHB_IMP**-W-53, for IMP_TYPE = 46 or 47, a record with matching key fields must exist in **RHB_CRACK_SEAT_PCC**.

- If IMP_TYPE = 48, a record with matching key fields must exist in **RHB_RCYPCC_MIXTURE**

  Error Message: **RHB_IMP**-W-55, for IMP_TYPE = 48, a record with matching key fields must exist in **RHB_RCYPCC_MIXTURE**.

- If IMP_TYPE = 48, a record with matching key fields must exist in **RHB_RCYPCC_NEW_AGGR**

  Error Message: **RHB_IMP**-W-56, for IMP_TYPE = 48, a record with matching key fields must exist in **RHB_RCYPCC_NEW_AGGR**.

- If IMP_TYPE = 48, a record with matching key fields must exist in **RHB_RCYPCC_COMBINED_AGGR**

  Error Message: **RHB_IMP**-W-57, for IMP_TYPE = 48, a record with matching key fields must exist in **RHB_RCYPCC_COMBINED_AGGR**.

- If IMP_TYPE = 48, a record with matching key fields must exist in **RHB_RCYPCC_CONSTRUCTION**

  Error Message: **RHB_IMP**-W-58, for IMP_TYPE = 48, a record with matching key fields must exist in **RHB_RCYPCC_CONSTRUCTION**.

- If IMP_TYPE = 48, a record with matching key fields must exist in **RHB_RCYPCC_STRENGTH**

  Error Message: **RHB_IMP**-W-59, for IMP_TYPE = 48, a record with matching key fields must exist in **RHB_RCYPCC_STRENGTH**.

- If IMP_TYPE = 48, a record with matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO must also exist in **RHB_LAYER** with MATERIAL_TYPE = 17, 18, 19 and DESCRIPTION = 1

  If no matching record found:

  Error Message: **RHB_LAYER**-W-61, for IMP_TYPE = 48, a record with matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO must exist in **RHB_LAYER** with MATERIAL_TYPE = 17, 18, or 19, and DESCRIPTION = 1.

  If multiple matching records found:

Error Message: **RHB_LAYER**-E-61, multiple records exist with matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO in **RHB_LAYER** with MATERIAL_TYPE = 17, 18, or 19, and DESCRIPTION = 1.

- If IMP_TYPE = 48, for matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO, extract MATERIAL_TYPE for DESCRIPTION = 1 in **RHB_LAYER** (if no matching record or multiple matches, fail as above) and perform the following checks:

- If MATERIAL_TYPE = 17, then a record with matching key fields must exist in **RHB_PCCO_JOINT_DATA**

  Error Message: **RHB_IMP**-W-62, for IMP_TYPE = 48 and a record with matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO in **RHB_LAYER** with DESCRIPTION = 1 and MATERIAL_TYPE = 17, a record must exist in **RHB_PCCO_JOINT_DATA**.

- If MATERIAL_TYPE = 18, then a record with matching key fields must exist in **RHB_PCCO_JOINT_DATA**

  Error Message: **RHB_IMP**-W-63, for IMP_TYPE = 48 and a record with matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO in **RHB_LAYER** with DESCRIPTION = 1 and MATERIAL_TYPE = 18, a record must exist in **RHB_PCCO_JOINT_DATA**.

- If MATERIAL_TYPE = 18, then a record with matching key fields must exist in **RHB_PCCO_STEEL**

  Error Message: **RHB_IMP**-W-64, for IMP_TYPE = 48 and a record with matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO in **RHB_LAYER** with DESCRIPTION = 1 and MATERIAL_TYPE = 18, a record must exist in **RHB_PCCO_STEEL**.

- If MATERIAL_TYPE = 19, then a record with matching key fields must exist in **RHB_PCCO_STEEL**

  Error Message: **RHB_IMP**-W-65, for IMP_TYPE = 48 and a record with matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO in **RHB_LAYER** with DESCRIPTION = 1 and MATERIAL_TYPE = 19, a record must exist in **RHB_PCCO_STEEL**.

- If IMP_TYPE = 48, IMP_THICKNESS must be between 4.0 and 18.0 inches

  Error Message: **RHB_IMP**-E-129, for IMP_TYPE = 48, IMP_THICKNESS fails allowable thickness range (4.0 - 18.0).

- If IMP_TYPE = 49, a record with matching key fields must exist in **RHB_PRESSURE_RELIEF**

  Error Message: **RHB_IMP**-W-66, for IMP_TYPE = 49, a record with matching key fields must exist in **RHB_PRESSURE_RELIEF**.

- If IMP_TYPE = 49, a record with matching SHRP_ID, STATE_CODE, and CONSTRUCTION_NO must exist in **RHB_LAYER** with MATERIAL_TYPE = 4, 5, 6, 8, or 99, and DESCRIPTION = 1 or 3

  Error Message: **RHB_IMP**-W-67, for IMP_TYPE = 49, a record with matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO must exist in **RHB_LAYER** with MATERIAL_TYPE = 4, 5, 6, 8, or 99, and DESCRIPTION = 1 or 3.

- If IMP_TYPE = 50, a record with matching key fields must either exist in **RHB_LOAD_TRANSFER** or for SPS6 sections, a record with matching key fields must exist in **SPS6_LOAD_TRANSFER**

  Error Message: **RHB_IMP**-W-68, for IMP_TYPE = 50, a record with matching key fields must exist in **RHB_LOAD_TRANSFER** or **SPS6_LOAD_TRANSFER**.

- If IMP_TYPE = 50, a record with matching SHRP_ID, STATE_CODE, and CONSTRUCTION_NO must exist in **RHB_LAYER** with MATERIAL_TYPE = 4, 5, 8, or 99, and DESCRIPTION = 1 or 3

  Error Message: **RHB_IMP**-W-68, for IMP_TYPE = 50, a record with matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO must exist in **RHB_LAYER** with MATERIAL_TYPE = 4, 5, 8, or 99, and DESCRIPTION = 1 or 3.

- If IMP_TYPE = 51, a record with matching key fields must exist in **RHB_MILL_AND_GRIND**

  Error Message: **RHB_IMP**-W-70, for IMP_TYPE = 51, a record with matching key fields must exist in **RHB_MILL_AND_GRIND**.

- If IMP_TYPE = 51, a record with matching key fields must exist in **RHB_ACO_AGGR_PROP**

  Error Message: **RHB_IMP**-W-71, for IMP_TYPE = 51, a record with matching key fields must exist in **RHB_ACO_AGGR_PROP**.

- If IMP_TYPE = 51, a record with matching key fields must exist in **RHB_ACO_PROP**

  Error Message: **RHB_IMP**-W-72, for IMP_TYPE = 51, a record with matching key fields must exist in **RHB_ACO_PROP**.

- If IMP_TYPE = 51, a record with matching key fields must exist in **RHB_PMA_COMPACTION**

  Error Message: **RHB_IMP**-W-74, for IMP_TYPE = 51, a record with matching key fields must exist in **RHB_PMA_COMPACTION**.

- If IMP_TYPE = 51, a record with matching key fields must exist in **RHB_PMA_CONSTRUCTION**

  Error Message: **RHB_IMP**-W-75, for IMP_TYPE = 51, a record with matching key fields must exist in **RHB_PMA_CONSTRUCTION**.

- If IMP_TYPE = 51, a record with matching key fields must exist in **RHB_PMA_ROLLER**

  Error Message: **RHB_IMP**-W-76, for IMP_TYPE = 51, a record with matching key fields must exist in **RHB_PMA_ROLLER**.

- If IMP_TYPE = 51, a record with matching SHRP_ID, STATE_CODE, and CONSTRUCTION_NO must exist in **RHB_LAYER** with MATERIAL_TYPE = 1 or 3, and DESCRIPTION = 1, and a record with matching SHRP_ID, STATE_CODE, and CONSTRUCTION_NO must also exist in **RHB_LAYER** with MATERIAL_TYPE = 1, 13, or 99, and DESCRIPTION = 3

Error Message: **RHB_IMP**-W-78, for IMP_TYPE = 51, a record with matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO must exist in **RHB_LAYER** with MATERIAL_TYPE = 1, 13, or 99, and DESCRIPTION = 3.

- If IMP_TYPE = 51, IMP_THICKNESS must be between 0.0 and 12.0 inches

  Error Message: **RHB_IMP**-E-125, for IMP_TYPE = 51, IMP_THICKNESS fails allowable thickness range (0.0 - 12.0).

For SPS5 sections:

- If IMP_TYPE = 51, a matching record must exist in **SPS5_LAYER**

  Error Message: **RHB_IMP**-W-78a, for IMP_TYPE = 51, a record with matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO must exist in **SPS5_LAYER**.

- If IMP_TYPE = 51, a matching record must exist in **SPS5_MILLED_SECTIONS**

  Error Message: **RHB_IMP**-W-78b, for IMP_TYPE = 51, a record with matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO must exist in **SPS5_MILLED_SECTIONS**.

- If IMP_TYPE = 52, a matching record must exist in **RHB_MILL_AND_GRIND**

  Error Message: **RHB_IMP**-W-79, for IMP_TYPE = 52, a record with matching key fields must exist in **RHB_MILL_AND_GRIND**.

- If IMP_TYPE = 52, a matching record must exist in **RHB_PCCO_MIXTURE**

  Error Message: **RHB_IMP**-W-80, for IMP_TYPE = 52, a record with matching key fields must exist in **RHB_PCCO_MIXTURE**.

- If IMP_TYPE = 52, a matching record must exist in **RHB_PCCO_AGGR**

  Error Message: **RHB_IMP**-W-81, for IMP_TYPE = 52, a record with matching key fields must exist in **RHB_PCCO_AGGR**.

- If IMP_TYPE = 52, a matching record must exist in **RHB_PCCO_CONSTRUCTION**

  Error Message: **RHB_IMP**-W-82, for IMP_TYPE = 52, a record with matching key fields must exist in **RHB_PCCO_CONSTRUCTION**.

- If IMP_TYPE = 52, a matching record must exist in **RHB_PCCO_STRENGTH**

  Error Message: **RHB_IMP**-W-83, for IMP_TYPE = 52, a record with matching key fields must exist in **RHB_PCCO_STRENGTH**.

- If IMP_TYPE = 52, a record with matching SHRP_ID, STATE_CODE, and CONSTRUCTION_NO must exist in **RHB_LAYER** with MATERIAL_TYPE = 1, 13, or 99, and DESCRIPTION = 3

  Error Message: **RHB_IMP**-W-84, for IMP_TYPE = 52, a record with matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO must exist in **RHB_LAYER** with MATERIAL_TYPE = 1, 13, or 99, and DESCRIPTION = 3.

- If IMP_TYPE = 52, a record with matching SHRP_ID, STATE_CODE and

CONSTRUCTION_NO must exist in **RHB_LAYER** with MATERIAL_TYPE = 4, 5, 6, or 8, and DESCRIPTION = 1

If no matching record found:

Error Message: **RHB_LAYER**-W-85, for IMP_TYPE = 52, a record with matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO must exist in **RHB_LAYER** with MATERIAL_TYPE = 4, 5, 6, or 8, and DESCRIPTION = 1.

If multiple matching records found:

Error Message: **RHB_LAYER**-E-86, for IMP_TYPE = 52, multiple records with matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO in **RHB_LAYER** with MATERIAL_TYPE = 4, 5, 6, or 8, and DESCRIPTION = 1.

- If IMP_TYPE = 52, for matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO, extract MATERIAL_TYPE for DESCRIPTION = 1 in **RHB_LAYER** (if no matching record or multiple matches, fail as above) and perform the following checks:

- If MATERIAL_TYPE = 4 or 8, then a record with matching key fields must exist in **RHB_PCCO_JOINT_DATA**

  Error Message: **RHB_IMP**-W-87, for IMP_TYPE = 52 and a record with matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO in **RHB_LAYER** with DESCRIPTION = 1 and MATERIAL_TYPE = 4 or 8, a record must exist in **RHB_PCCO_JOINT_DATA**.

- If MATERIAL_TYPE = 5, then a record with matching key fields must exist in **RHB_PCCO_JOINT_DATA** and **RHB_PCCO_STEEL**

  Error Message: **RHB_IMP**-W-88, for IMP_TYPE = 52 and a record with matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO in **RHB_LAYER** with DESCRIPTION = 1 and MATERIAL_TYPE = 5, a record must exist in **RHB_PCCO_JOINT_DATA**.

- If MATERIAL_TYPE = 5, then a record with matching key fields must exist in **RHB_PCCO_STEEL**

  Error Message: **RHB_IMP**-W-89, for IMP_TYPE = 52 and a record with matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO in **RHB_LAYER** with DESCRIPTION = 1 and MATERIAL_TYPE = 5, a record must exist in **RHB_PCCO_STEEL**.

- If MATERIAL_TYPE = 6, then a record with matching key fields and DESCRIPTION = 1 must exist in **RHB_PCCO_STEEL**

  Error Message: **RHB_IMP**-W-90, for IMP_TYPE = 52 and a record with matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO in **RHB_LAYER** with DESCRIPTION = 1 and MATERIAL_TYPE = 6, a record must exist in **RHB_PCCO_STEEL**.

- If IMP_TYPE = 52, IMP_THICKNESS must be between 0.0 and 12.0 inches

  Error Message: **RHB_IMP**-E-126, for IMP_TYPE = 52, IMP_THICKNESS fails allowable thickness range (0.0 - 12.0).

- If IMP_TYPE = 53, a matching record must exist in **RHB_LAYER**, **SPS5_LAYER**, **SPS6_LAYER, SPS7_LAYER**, or **SPS9_LAYER**

Error Message: **RHB_IMP**-W-100, for IMP_TYPE = 53, a record with matching key fields must exist in **RHB_LAYER**, **SPS5_LAYER**, **SPS6_LAYER**, **SPS7_LAYER**, or **SPS9_LAYER**.

- If IMP_TYPE = 55, a matching record must exist in **RHB_HMRAP_GEN_INFO**

  Error Message: RHB_IMP-W-91, for IMP_TYPE = 55, a record with matching key fields must exist in **RHB_HMRAP_GEN_INFO**.

- If IMP_TYPE = 55, a matching record must exist in **RHB_HMRAP_UNTREAT_AGGR**

  Error Message: **RHB_IMP**-W-92, for IMP_TYPE = 55, a record with matching key fields must exist in **RHB_HMRAP_UNTREAT_AGGR**.

- If IMP_TYPE = 55, a matching record must exist in **RHB_HMRAP_COMBINED_AGG**

  Error Message: **RHB_IMP**-W-93, for IMP_TYPE = 55, a record with matching key fields must exist in **RHB_HMRAP_COMBINED_AGG**.

- If IMP_TYPE = 55, a matching record must exist in **RHB_HMRAP_RECLAIM_AC**

  Error Message: **RHB_IMP**-W-94, for IMP_TYPE = 55, a record with matching key fields must exist in **RHB_HMRAP_RECLAIM_AC**.

- If IMP_TYPE = 55, a matching record must exist in **RHB_HMRAP_NEW_AC_PROP**

  Error Message: **RHB_IMP**-W-95, for IMP_TYPE = 55, a record with matching key fields must exist in **RHB_HMRAP_NEW_AC_PROP**.

- If IMP_TYPE = 55, a matching record must exist in **RHB_HMRAP_COMBINE_AC**

  Error Message: **RHB_IMP**-W-96, for IMP_TYPE = 55, a record with matching key fields must exist in **RHB_HMRAP_COMBINE_AC**.

- If IMP_TYPE = 55, IMP_THICKNESS must be between 0.0 and 12.0 inches

  Error Message: **RHB_IMP**-E-127, for IMP_TYPE = 55, IMP_THICKNESS fails allowable thickness range (0.0 - 12.0).

For SPS5 sections:

- If IMP_TYPE = 55, a matching record must exist in **RHB_HMRAP_LAB_MIX**

  Error Message: **RHB_IMP**-W-98, for IMP_TYPE = 55, a record with matching key fields must exist in **RHB_HMRAP_LAB_MIX**.

- If IMP_TYPE = 55, a matching record must exist in **RHB_HMRAP_MIX_PROP**

  Error Message: **RHB_IMP**-W-99, for IMP_TYPE = 55, a record with matching key fields must exist in **RHB_HMRAP_MIX_PROP**.

- If IMP_TYPE = 55, a matching record must exist in **RHB_PMA_CONSTRUCTION**

  Error Message: **RHB_IMP**-W-100, for IMP_TYPE = 55, a record with matching key fields must exist in **RHB_PMA_CONSTRUCTION**.

- If IMP_TYPE = 55, a matching record must exist in **RHB_PMA_COMPACTION**

  Error Message: **RHB_IMP**-W-101, for IMP_TYPE = 55, a record with matching key fields must exist in **RHB_PMA_COMPACTION**.

- If IMP_TYPE = 55, a matching record must exist in **RHB_PMA_ROLLER**

  Error Message: **RHB_IMP**-W-102, for IMP_TYPE = 55, a record with matching key fields must exist in **RHB_PMA_ROLLER**.

- If IMP_TYPE = 55, a record with matching SHRP_ID, STATE_CODE, and CONSTRUCTION_NO must exist in **RHB_LAYER** with MATERIAL_TYPE = 1, 13, or 99, and DESCRIPTION = 3

  Error Message: **RHB_IMP**-W-104, for IMP_TYPE = 55, a record with matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO must exist in **RHB_LAYER** with MATERIAL_TYPE = 1, 13, or 99, and DESCRIPTION = 3.

- If IMP_TYPE = 56, a matching record must exist in **RHB_CMRAP_GEN_INFO**

  Error Message: **RHB_IMP**-W-105, for IMP_TYPE = 56, a record with matching key fields must exist in **RHB_CMRAP_GEN_INFO**.

- If IMP_TYPE = 56, a matching record must exist in **RHB_CMRAP_UNTREAT_AGGR**

  Error Message: **RHB_IMP**-W-106, for IMP_TYPE = 56, a record with matching key fields must exist in **RHB_CMRAP_UNTREAT_AGGR**.

- If IMP_TYPE = 56, a matching record must exist in **RHB_CMRAP_COMBINED_AGG**

  Error Message: **RHB_IMP**-W-107, for IMP_TYPE = 56, a record with matching key fields must exist in **RHB_CMRAP_COMBINED_AGG**.

- If IMP_TYPE = 56, a matching record must exist in **RHB_CMRAP_RECLAIM_AC**

  Error Message: **RHB_IMP**-W-108, for IMP_TYPE = 56, a record with matching key fields must exist in **RHB_CMRAP_RECLAIM_AC**.

- If IMP_TYPE = 56, a matching record must exist in **RHB_CMRAP_NEW_AC_PROP**

  Error Message: **RHB_IMP**-W-109, for IMP_TYPE = 56, a record with matching key fields must exist in **RHB_CMRAP_NEW_AC_PROP**.

- If IMP_TYPE = 56, a matching record must exist in **RHB_CMRAP_LAB_AGED_AC**

  Error Message: **RHB_IMP**-W-110, for IMP_TYPE = 56, a record with matching key fields must exist in **RHB_CMRAP_LAB_AGED_AC**.

- If IMP_TYPE = 56, a matching record must exist in **RHB_CMRAP_LAB_MIX**

  Error Message: **RHB_IMP**-W-111, for IMP_TYPE = 56, a record with matching key fields must exist in **RHB_CMRAP_LAB_MIX**.

- If IMP_TYPE = 56, a matching record must exist in **RHB_CMRAP_MIX_PROP**

Error Message: **RHB_IMP**-W-112, for IMP_TYPE = 56, a record with matching key fields must exist in **RHB_CMRAP_MIX_PROP**.

- If IMP_TYPE = 56, a matching record must exist in **RHB_PMA_CONSTRUCTION**

  Error Message: **RHB_IMP**-W-113, for IMP_TYPE = 56, a record with matching key fields must exist in **RHB_PMA_CONSTRUCTION**.

- If IMP_TYPE = 56, a matching record must exist in **RHB_PMA_COMPACTION**

  Error Message: **RHB_IMP**-W-114, for IMP_TYPE = 56, a record with matching key fields must exist in **RHB_PMA_COMPACTION**.

- If IMP_TYPE = 56, a matching record must exist in **RHB_PMA_ROLLER**

  Error Message: **RHB_IMP**-W-115, for IMP_TYPE = 56, a record with matching key fields must exist in **RHB_PMA_ROLLER**.

- If IMP_TYPE = 56, a record with matching SHRP_ID, STATE_CODE, and CONSTRUCTION_NO must exist in **RHB_LAYER** with MATERIAL_TYPE = 9, 10, 14, or 15, and DESCRIPTION = 1

  Error Message: **RHB_IMP**-W-116, for IMP_TYPE = 56, a record with matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO must exist in **RHB_LAYER** with MATERIAL_TYPE = 9, 10, 14, or 15, and DESCRIPTION = 1.

- If IMP_TYPE = 56, a record with matching SHRP_ID, STATE_CODE, and CONSTRUCTION_NO must exist in **RHB_LAYER** with MATERIAL_TYPE = 1, 13, or 99, and DESCRIPTION = 3

  Error Message: **RHB_IMP**-W-117, for IMP_TYPE = 56, a record with matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO must exist in **RHB_LAYER** with MATERIAL_TYPE = 1, 13, or 99, and DESCRIPTION = 3.

- If IMP_TYPE = 56, IMP_THICKNESS must be between 0.0 and 12.0 inches

  Error Message: **RHB_IMP**-E-128, for IMP_TYPE = 56, IMP_THICKNESS fails allowable thickness range (0.0 - 12.0).

- For each record in **RHB_IMP**, a record must exist in **RHB_LAYER** with matching STATE_CODE, SHRP_ID, and CONSTRUCTION_NO.

  Error message: **RHB_IMP**-E-131, for each record in **RHB_IMP**, a matching record must exist in **RHB_LAYER**.

Table: RHB_IMP, EXPERIMENT_SECTION

- A record with matching STATE_CODE, SHRP_ID, and CONSTRUCTION_NO must exist in **EXPERIMENT_SECTION**

  Error Message: **RHB_IMP**-E-132, A corresponding record with matching STATE_CODE,SHRP_ID,CONSTRUCTION_NO must exist in **EXPERIMENT_SECTION**.

- For matching STATE_CODE, SHRP_ID, and CONSTRUCTION_NO in **EXPERIMENT_SECTION**, **EXPERIMENT_SECTION**.CN_ASSIGN_DATE (CN) <= **RHB_IMP**.IMP_DATE (CN) < **EXPERIMENT_SECTION**.CN_ASSIGN_DATE (CN + 1) or current date if CN + 1 does not exist.

  Error Message: **RHB_IMP**-E-133, The following date relationship should exist: **EXPERIMENT_SECTION**.CN_ASSIGN_DATE(CN){Date} <= **RHB_IMP**.IMP_DATE(CN){Date} < SYSDATE.

  Error Message: **RHB_IMP**-E-133a, The following date relationship should exist: **EXPERIMENT_SECTION**.CN_ASSIGN_DATE(CN){Date} <= **RHB_IMP**.IMP_DATE(CN){Date} < **EXPERIMENT_SECTION**.CN_ASSIGN_DATE(CN+1){Date}.

  Error Message: **RHB_IMP**-E-102b, The following date relationship should exist: **EXPERIMENT_SECTION**.CN_ASSIGN_DATE(CN){Date} <= **RHB_IMP**.IMP_DATE(CN){Date} < SYSDATE.

- For matching STATE_CODE, SHRP_ID, and CONSTRUCTION_NO in **EXPERIMENT_SECTION**, **RHB_IMP**.IMP_TYPE must exist in **EXPERIMENT_SECTION**.CN_CHANGE_REASON

  Error Message: (If **EXPERIMENT_SECTION**.CN_CHANGE_REASON is null) **RHB_IMP**-E-133b, RHB_IMP.IMP_TYPE must exist in the list in the **EXPERIMENT_SECTION**.CN_CHANGE_REASON.

  Error Message: (If IMP_TYPE not in **EXPERIMENT_SECTION**.CN_CHANGE_REASON) **RHB_IMP**-E-133c, **RHB_IMP**.IMP_TYPE{IMP_TYPE} must exist in the list in the **EXPERIMENT_SECTION**.CN_CHANGE_REASON{list of entries}.

Table: RHB_LAYER

- For each STATE_CODE, SHRP_ID, and CONSTRUCTION_NO in RHB_LAYER, there can be only one value for DATE_COMPLETE

  Error message: **RHB_LAYER**-E-101, only one DATE_COMPLETE value can exist per construction event.

Table: RHB_RESTORE_AC_SHOULDER

- If SHOULDER_RESTORE_TYPE = 3 then ACO_THICKNESS is null

Table: (Listed)

For SHRP_ID, STATE_CODE, CONSTRUCTION_NO, DATE_COMPLETE:

In Table/Error Code	If Data Element	Has a Code Of	Then Valid Entry Must Exist In
RHB_ACO_AGGR_PROP			
	AGGR_COMP_TYPE_C1	6	AGGR_COMP_TYPE_C1_OTHER

AGGR_COMP_TYPE_C2	6	
AGGR_COMP_TYPE_C2_OTHER		
AGGR_COMP_TYPE_C3	6	
AGGR_COMP_TYPE_C3_OTHER		
AGGR_COMP_TYPE_F1	4	
AGGR_COMP_TYPE_F1_OTHER		
AGGR_COMP_TYPE_F2	4	
AGGR_COMP_TYPE_F2_OTHER		
AGGR_COMP_TYPE_F3	4	
AGGR_COMP_TYPE_F3_OTHER		
MINERAL_FILLER	5	MINERAL_FILLER_OTHER

RHB_ACO_LAB_AGED_AC

LAB_AGE_TEST_PROC	3	
LAB_AGE_TEST_PROC_OTHER		

RHB_ACO_MIX_PROP

ASPHALT_PLANT_TYPE	3	
ASPHALT_PLANT_TYPE_OTHER		
ANTISTRIP_AGENT_TYPE	70	
ANTISTRIP_AGENT_TYPE_OTHER		
MOIST_SUSCEPT_TEST	5	
MOIST_SUSCEPT_TEST_OTHER		

RHB_ACO_PROP

ASPHALT_GRADE	17, 35, 99	ASPHALT_GRADE_OTHER
SOURCE	77	SOURCE_OTHER
MODIFIER_1	27	MODIFIER_1_OTHER
MODIFIER_2	27	MODIFIER_2_OTHER

RHB_CMRAP_COMBINE_AC

RECYCLE_AGENT_TYPE	48	RECYCLE_AGENT_OTHER
MODIFIER_1	27	MODIFIER_1_OTHER
MODIFIER_2	27	MODIFIER_2_OTHER

RHB_CMRAP_GEN_INFO

BREAKUP_METHOD	5	
BREAKUP_METHOD_OTHER		
PAVEMENT_PROCESSING	5	PAVEMENT_PROC_OTHER

RHB_CMRAP_LAB_AGED_AC

LAB_AGE_TEST_PROC	3	
LAB_AGE_TEST_PROC_OTHER		

RHB_CMRAP_MIX_PROP

ANTISTRIP_AGENT_TYPE	70	
ANTISTRIP_AGENT_TYPE_OTHER		
MOIST_SUSCEPT_TEST	5	
MOIST_SUSCEPT_TEST_OTHER		

RHB_CMRAP_NEW_AC_PROP

ASPHALT_GRADE	17, 35, 99	ASPHALT_GRADE_OTHER
SOURCE	77	SOURCE_OTHER

RHB_CMRAP_UNTREAT_AGGR

AGGR_COMP_TYPE_C1	6	
AGGR_COMP_TYPE_C1_OTHER		
AGGR_COMP_TYPE_C2	6	
AGGR_COMP_TYPE_C2_OTHER		
AGGR_COMP_TYPE_C3	6	
AGGR_COMP_TYPE_C3_OTHER		
AGGR_COMP_TYPE_F1	4	
AGGR_COMP_TYPE_F1_OTHER		
AGGR_COMP_TYPE_F2	4	
AGGR_COMP_TYPE_F2_OTHER		
AGGR_COMP_TYPE_F3	4	
AGGR_COMP_TYPE_F3_OTHER		
MINERAL_FILLER	5	MINERAL_FILLER_OTHER
RHB_CRACK_SEAT_PCC		
BREAKER_TYPE	7	BREAKER_TYPE_OTHER
DEFLECTION_MEASURE_DEVICE	5	
DEFLECTION_MEASURE_OTHER		
SURFACE_PREP	6	SURFACE_PREP_OTHER
RHB_HEATER_SCARIF		
SURFACE_TREAT_TYPE	7	SURFACE_TREAT_OTHER
RHB_HMRAP_COMBINE_AC		
RECYCLE_AGENT_TYPE	48	RECYCLE_AGENT_OTHER
MODIFIER_1	27	MODIFIER_1_OTHER
MODIFIER_2	27	MODIFIER_2_OTHER
RHB_HMRAP_GEN_INFO		
BREAKUP_METHOD	5	
BREAKUP_METHOD_OTHER		
PAVEMENT_PROCESSING	5	
PAVEMENT_PROCESSING_OTHER		
RHB_HMRAP_LAB_AGED_AC		
LAB_AGE_TEST_PROC	3	
LAB_AGE_TEST_PROC_OTHER		
RHB_HMRAP_MIX_PROP		
ASPHALT_PLANT_TYPE	3	
ASPHALT_PLANT_TYPE_OTHER		
ANTISTRIP_AGENT_TYPE	70	
ANTISTRIP_AGENT_TYPE_OTHER		
MOIST_SUSCEPT_TEST	5	
MOIST_SUSCEPT_TEST_OTHER		
RHB_HMRAP_NEW_AC_PROP		
ASPHALT_GRADE	17, 35, 99	ASPHALT_GRADE_OTHER
SOURCE	77	SOURCE_OTHER
RHB_HMRAP_UNTREAT_AGGR		
AGGR_COMP_TYPE_C	16	
AGGR_COMP_TYPE_C1_OTHER		
AGGR_COMP_TYPE_C	26	
AGGR_COMP_TYPE_C2_OTHER		

AGGR_COMP_TYPE_C	36	
AGGR_COMP_TYPE_C3_OTHER		
AGGR_COMP_TYPE_F1	4	
AGGR_COMP_TYPE_F1_OTHER		
AGGR_COMP_TYPE_F2	4	
AGGR_COMP_TYPE_F2_OTHER		
AGGR_COMP_TYPE_F3	4	
AGGR_COMP_TYPE_F3_OTHER		
MINERAL_FILLER	5	MINERAL_FILLER_OTHER
RHB_LOAD_TRANSFER		
RESTORATION_TYPE	5	RESTORATION_OTHER
INSTALL_FREQUENCY	4	
INSTALL_FREQUENCY_OTHER		
BACKFILL_MATERIAL	4	BACKFILL_OTHER
BOND_AGENT	4	BOND_AGENT_OTHER
RHB_MILL_AND_GRIND		
METHOD_USED	3	METHOD_USED_OTHER
SURFACE_PREP_EXTENT	4	SURFACE_PREP_OTHER
RHB_PCCO_AGGR		
AGGR_COMP_C1	7	AGGR_COMP_C1_OTHER
AGGR_COMP_C2	7	AGGR_COMP_C2_OTHER
AGGR_COMP_C3	7	AGGR_COMP_C3_OTHER
AGGR_COMP_TYPE_F1	4	
AGGR_COMP_TYPE_F1_OTHER		
AGGR_COMP_TYPE_F2	4	
AGGR_COMP_TYPE_F2_OTHER		
AGGR_COMP_TYPE_F3	4	
AGGR_COMP_TYPE_F3_OTHER		
RHB_PCCO_CONSTRUCTION		
PAVER_TYPE	3	PAVER_TYPE_OTHER
CONCRETE_CURE_METHOD	8	CONCRETE_CURE_OTHER
CONCRETE_TEXTURE_METHOD	6	
CONCRETE_TEXTURE_OTHER		
SURFACE_PREP	8	SURFACE_PREP_OTHER
GROUT_TYPE	5	GROUT_TYPE_OTHER
BOND_PREVENT	3	BOND_PREVENT_OTHER
RHB_PCCO_JOINT_DATA		
TRANS_CONT_JLTS	6	
TRANS_CONT_JLTS_OTHER		
DOWEL_COATING	6	DOWEL_COATING_OTHER
MLTD_METHOD	3	MLTD_METHOD_OTHER
TRANS_METHOD	4	TRANS_METHOD_OTHER
LONG_TYPE	5	LONG_TYPE_OTHER
SH_TRAFFIC_LANE_TYPE	6	
SH_TRAFFIC_LANE_TYPE_OTHER		
TRANS_SEAL_TYPE	5	
TRANS_SEAL_TYPE_OTHER		
JOINT_SEAL_BACKER	5	
JOINT_SEAL_BACKER_OTHER		
RHB_PCCO_MIXTURE		

CEMENT_TYPE	55	CEMENT_TYPE_OTHER
ADMIXTURE_TYPE_1	12 or 13	
ADMIXTURE_TYPE_1_OTHER		
ADMIXTURE_TYPE_2	12 or 13	
ADMIXTURE_TYPE_2_OTHER		
ADMIXTURE_TYPE_3	12 or 13	
ADMIXTURE_TYPE_3_OTHER		

RHB_PCCO_STEEL

REINFORCING_TYPE	3	
REINFORCING_TYPE_OTHER		
REINFORCE_PLACE_METHOD	4	
		REINFORCE_PLACE_METHOD_ OTHER

RHB_PMA_CONSTRUCTION

MIX_PROCEDURE	4	MIX_PROCEDURE_OTHER
ASPHALT_PLANT_TYPE	3	ASPHALT_PLANT_OTHER
SPREAD_MIX_METHOD	5	
SPREAD_MIX_METHOD_OTHER		

RHB_PRESSURE_RELIEF

PRESSURE_RELIEF_REASON	5	
PRESSURE_RELIEF_OTHER		
CUT_REMOVE_METHOD	4	CUT_REMOVE_OTHER
JOINT_SEALANT_TYPE	7	JOINT_SEALANT_OTHER
JOINT_SEALANT_TYPE	3 & 4	
MANUFACTURER_NAME_SEAL		
JOINT_SEALANT_TYPE	3 & 4	SEALANT_NAME
JOINT_FILLER_TYPE	6	JOINT_FILLER_OTHER
JOINT_FILLER_TYPE	6 & 7	
MANUFACTURER_NAME_FILLER		
JOINT_FILLER_TYPE	6 & 7	FILLER_NAME

RHB_RCYPCC_CONSTRUCTION

BREAKUP_EQUIPMENT	7	
BREAKUP_EQUIPMENT_OTHER		
SEPARATE_METHOD	5	
SEPARATE_METHOD_OTHER		
PAVER_TYPE	3	PAVER_TYPE_OTHER
CONCRETE_CURE_METHOD	8	CONCRETE_CURE_OTHE
CONCRETE_TEXTURE_METHOD	6	
CONCRETE_TEXTURE_OTHER		

RHB_RCYPCC_JOINT

TRANS_CONT_JLTS	6	
TRANS_CONT_JLTS_OTHER		
DOWEL_COATING	6	DOWEL_COATING_OTHER
MLTD_METHOD	3	MLTD_METHOD_OTHER
TRANS_METHOD	4	TRANS_METHOD_OTHER
LONG_TYPE	5	LONG_TYPE_OTHER
SH_TRAFFIC_LANE_TYPE	6	
SH_TRAFFIC_LANE_TYPE_OTHER		
TRANS_SEAL_TYPE	5	
TRANS_SEAL_TYPE_OTHER		

JOINT_SEAL_BACKER	4	
JOINT_SEAL_BACKER_OTHER		
RHB_RCYPCC_MIXTURE		
CEMENT_TYPE	55	CEMENT_TYPE_OTHER
ADMIXTURE_TYPE_1	12 or 13	
ADMIXTURE_TYPE_1_OTHER		
ADMIXTURE_TYPE_2	12 or 13	
ADMIXTURE_TYPE_2_OTHER		
ADMIXTURE_TYPE_3	12 or 13	
ADMIXTURE_TYPE_3_OTHER		
RHB_RCYPCC_NEW_AGGR		
AGGR_COMP_C1	7	AGGR_COMP_C1_OTHER
AGGR_COMP_C2	7	AGGR_COMP_C2_OTHER
AGGR_COMP_C3	7	AGGR_COMP_C3_OTHER
AGGR_COMP_TYPE_F1	4	
AGGR_COMP_TYPE_F1_OTHER		
AGGR_COMP_TYPE_F2	4	
AGGR_COMP_TYPE_F2_OTHER		
AGGR_COMP_TYPE_F3	4	
AGGR_COMP_TYPE_F3_OTHER		
RHB_RCYPCC_STEEL		
REINFORCING_TYPE	3	
REINFORCING_TYPE_OTHER		
REINFORCE_PLACE_METHOD	4	
		REINFORCE_PLACE_METHOD_ OTHER
RHB_RCYPCC_STRENGTH		
ELASTIC_MOD_METHOD	4	
ELASTIC_MOD_METHOD_OTHER		
RHB_RESTORE_AC_SHOULDER		
SHOULDER_RESTORE_TYPE	5	
SHOULDER_RESTORE_OTHER		
AC_MATERIAL_TYPE	4	AC_MATERIAL_OTHER
LANE_SH_JOINT_SEALANT	4	LANE_SH_JOINT_OTHER
RHB_RESTORE_PCC_SHOULDER		
SHOULDER_SYSTEM_TYPE	4	
SHOULDER_SYSTEM_OTHER		
JOINT_TYPE	4	JOINT_TYPE_OTHER
JOINT_TIE_SYSTEM_TYPE	4	
JOINT_TIE_SYSTEM_OTHER		
JOINT_SEALANT	4	JOINT_SEALANT_OTHER
JOINT_SEAL_BACKER_TYPE	5	
JOINT_SEAL_BACKER_OTHER		
RHB_SUBDRAINAGE		
DRAINAGE_PIPE_TYPE	8	DRAINAGE_PIPE_OTHER
FILTER_TYPE	7	FILTER_TYPE_OTHER
TYPE_LOC_FILTER	3	TYPE_LOC_FILTER_OTHER
SUBDRAIN_PURPOSE	4	
SUBDRAIN_PURPOSE_OTHER		

RHB_SUBSEALING_PCC

SUBSEAL_MIXTURE_TYPE	6
SUBSEAL_MIXTURE_OTHER	
AREA_DETERMINATION	4
AREA_DETERMINATION_OTHER	

11.0 TRAFFIC QC PROGRAMS

11.1 Level 1

A. Initial Level

Records in the IMS are at Level A when they first enter the system and are set back to A when changes are made to a given record or to selected related records.

B. Dependency Checks

No dependency checks are performed.

C. Minimum Data Elements

Minimum data checks for all Traffic data tables are identified below. Data fields with a Condition of X must always contain a non-null value, however, data fields with a Condition of * are only required to contain a non-null value if a particular condition is met as specified in the accompanying field explanation.

Table	Field	Condition
TRF_BASIC_INFO	No level C checks	
TRF_CALIBRATION_AVC	AVC_METH_VOL_MEASURE	X
	UNCLASSIFIED_VEHICLES_PCT	X
TRF_CALIBRATION_WIM	DYNAMIC_STAT_GVW_DIFF	X
	DYNAMIC_STAT_GVW_DIFF_SD	X
	DYNAMIC_STAT_SINGLE_AXLE_DIFF	X
	DYNAMIC_STAT_SINGLE_DIFF_SD	X
	DYNAMIC_STAT_TANDEM_AXLE_DIFF	X
	DYNAMIC_STAT_TANDEM_DIFF_SD	X
	WIM_AUTO_CALIB	X
	WIM_CALIB_NO_SPEEDS	X
	WIM_CALIB_TECHNIQUE	X
TRF_EQUIPMENT_MASTER	REASON_CALIB	X
	SENSORS_LTPP_BENDING_PLATES	X
	SENSORS_LTPP_PIEZO_CABLE	X
	SENSORS_LTPP_QUARTZ_PIEZO	X
	SENSORS_LTPP_CAPACITANCE_PADS	X
	SENSORS_LTPP_INDUCTANCE_LOOPS	X
	SENSORS_LTPP_LOAD_CELLS	X
	SENSORS_LTPP_OTHER	X
	TYPE_EQUIP_CALIB	X

TRF_HIST_CLASS_DATA	No level C checks	
TRF_HIST_CLASS_MASTER	No level C checks	
TRF_HIST_EST_ESAL	No level C checks	
TRF_HIST_VOLUME_COUNT	COUNT_AADT	X
	COUNT_DURATION	X
	COUNT_DURATION_UNIT	X
TRF_HIST_WEIGHT_AXLES	No level C checks	
TRF_HIST_WEIGHT_DATA	No level C checks	
TRF_HIST_WEIGHT_MASTER	MILEPOST	X
	ROUTE_NO	X
	WEIGHT_END_DATE	X
	WEIGHT_END_TIME	X
TRF_MEPDG_AADTT_LTPP_LN	No Level C Checks	
TRF_MEPDG_AX_DIST	PERCENT_AXLES	X
TRF_MEPDG_AX_DIST_ANL	PERCENT_AXLES	X
TRF_MEPDG_AX_DIST_ANL_VAR	MEAN_PERCENT_AXLES	X
	NUM_YEARS	X
	VAR_POP_PERCENT_AXLES	X
TRF_MEPDG_AX_PER_TRUCK	No Level C Checks	
TRF_MEPDG_HOURLY_DIST	No Level C Checks	
TRF_MEPDG_MONTH_ADJ_FACTR	No Level C Checks	
TRF_MEPDG_VEH_CLASS_DIST	No Level C Checks	
TRF_MON_EST_ESAL	METH_EST_ESAL_VEH	X
	METH_EST_TRK_LTPP	X
TRF_MONITOR_AXLE_DISTRIB	No Level C Checks	
TRF_MONITOR_LTPP_LN	No Level C Checks	

D. Expanded Range Checks

Expanded range checks are applied to certain fields to identify data element values that fall outside an expected range. Field names are listed below the bolded table name.

Table	Units	Range
TRF_BASIC_INFO		
SHRP_ID		GPS section ID or SPS project ID other than SPS3 and SPS4
FUNC_CLASS		1, 2, 6 - 9, 11, 12, 14, 16, 17, 19
PAVE_TYPE_TRF		1 - 4
FUNC_CLASS_MOD		null, 1, 2, 6 - 9, 11, 12, 14, 16, 17
TRF_CALIBRATION_AVC		
AVC_METH_COUNT_LENGTH		1, 2
AVC_METH_VOL_MEASURE		1 - 3
DIFF_VOL_FHWA_8		null, -5 - 5
DIFF_VOL_FHWA_9		null, -5 - 5
LENGTH_COUNT_NO_TRUCKS		null, 100 - 250
LENGTH_COUNT_TIME	hr	null, >= 1
UNCLASSIFIED_VEHICLES_PCT	%	0.0 - 5.0
WIM_AVC_CALIB_DATE		<= Today's date
TRF_CALIBRATION_WIM[1],[2]		
DYNAMIC_STAT_GVW_DIFF	%	-5.0 - 5.0; (-10.0 - 10.0)
DYNAMIC_STAT_GVW_DIFF_SD	%	0.0 - 5.0; (0.0 - 5.0)
DYNAMIC_STAT_SINGLE_AXLE_DIFF	%	-5.0 - 5.0; (-10.0 - 10.0)
DYNAMIC_STAT_SINGLE_DIFF_SD	%	0.0 - 10.0; (0.0 - 15.0)
DYNAMIC_STAT_TANDEM_AXLE_DIFF	%	-5.0 - 5.0; (-10.0 - 10.0)
DYNAMIC_STAT_TANDEM_DIFF_SD	%	0.0 - 7.5; (0.0 - 10.0)
WIM_AUTO_CALIB		Y, N, U
WIM_AVC_CALIB_DATE		<= Today's date
WIM_CALIB_NO_SPEEDS		null, > 0
WIM_CALIB_NO_TRUCKS_COMP		null, >= 100
WIM_CALIB_NO_TEST_TRUCKS		null, >= 2
WIM_CALIB_PASS_PER_TRUCK		null, >= 10
WIM_CALIB_TECHNIQUE		A, B, C, D, I, L, M, S, T, U, Z
WIM_CALIB_TRUCK1_SUSPNSN		null, 1 - 3
WIM_CALIB_TRUCK2_SUSPNSN		null, 1 - 3
WIM_CALIB_TRUCK3_SUSPNSN		null, 1 - 3
WIM_CALIB_TRUCK1_TYPE		null, 9
WIM_CALIB_TRUCK2_TYPE		null, 5 - 13
WIM_CALIB_TRUCK3_TYPE		null, 5 - 13

[1] Ranges have been established for Class I and Class II equipment. If Class II equipment is installed, manual upgrades are allowed for values within the limits in parentheses.

[2] Manual upgrades for this table require a non-null entry in TRF_CALIBRATION_PROTOCOL other than 0. Upgrades should conform to the values for both type and range expected for the protocol identified.

TRF_EQUIPMENT_MASTER

REASON_CALIB		0 - 6, 8, 10, 11
SENSORS_LTPP_BENDING_PLATES		Y, N
SENSORS_LTPP_CAPACITANCE_PADS		Y, N
SENSORS_LTPP_INDUCTANCE_LOOPS		Y, N
SENSORS_LTPP_LOAD_CELLS		Y, N
SENSORS_LTPP_PIEZO_CABLE		1 - 6
SENSORS_LTPP_QUARTZ_PIEZO		Y, N
TRF_CAL_PROTOCOL		0, 12, 102, 100B, 101W1, 101W2, 101W3
TYPE_EQUIP_CALIB		1 - 3
WIM_AVC_CALIB_DATE		<= Today's date

TRF_HIST_CLASS_DATA

VEHICLE_CLASS		1 - 13, A - T
NO_VEHICLES_LTPP_LN		null, >= 0
NO_VEH_2WAY		null, >= 0
NO_VEH_LTPP_DIR		null, >= 0

TRF_HIST_CLASS_MASTER

CLASS_COUNT_BEGIN_TIME	hr, min	0000 - 2400
CLASS_COUNT_DURATION_HOUR	hr	> 0
CLASS_COUNT_END_TIME	hr, min	0000 - 2400
CLASS_COUNT_NO_LANES		> 0
CLASS_COUNT_TYPE		1 - 3
CLASS_EQUIPMENT_TYPE		1 - 6
CLASS_NO_TRUCKS		> 0
CLASS_NO_VEHICLES		> 0
CLASS_PCT_TRUCK	%	0.0 - 35.0
FUNC_CLASS		1, 2, 6 - 9, 11, 12, 14, 16, 17, 19
METH_VEHICLE_CLASS		1 - 3
NO_CLASS_BINS		null, > 1
TOT_NO_VEH_2WAY		null, >= 1
TOT_NO_VEH_LTPP_DIR		null, >= 1
TOT_NO_VEH_LTPP_LN		null, >= 1

TRF_HIST_EST_ESAL

AADT_ALL_VEHIC		null, > 0
AADT_ALL_VEHIC_2WAY		null, > 0
AADT_TRUCK_COMBO[3]		> 0
ANL_KESAL_LTPP_LN_YR[2]	kESAL	> 0
AADT_TRUCK_COMBO_2WAY		null, > 0
ESAL_EST_WGHTSCALE[4]		null, 1 - 4
ESAL_EST_WGHTSRC		null, 1 - 6
METH_EST_AADT_LTPP		null, 1 - 3
METH_EST_AADT_TOT		null, 1 - 8
METH_EST_ESAL_VEH		null, 1, 2, 4
METH_EST_TRK_LTPP		null, 1 - 3
METH_EST_TRK_TOT		null, 1 - 9

[3] Field may not be manually upgraded unless data is for an SPS8 project.

[4] Null valued ESAL_EST_WGHTSCALE may be manually upgraded when METH_EST_WGHTSRC is 3 - 6.

NO_CLASSES_ESAL_EST		null, 3 - 20
YEAR_HIST_EST		1965 - 1989
TRF_HIST_VOLUME_COUNT		
COUNT_AADT		> 0
COUNT_AADT_LTPP_LN		250 - 48000
COUNT_BEGIN_TIME	hr, min	0000 - 2400
COUNT_END_TIME	hr, min	0000 - 2400
COUNT_DURATION		> 0
COUNT_DURATION_UNIT		1 - 3
COUNT_TYPE		1 - 3
TOTAL_NO_VEHICLES_COUNT		> 0
DIRECTIONAL_DISTRIB_FACTOR		null, > 0.0000, <= 1.0000
LTPP_LANE_DISTRIB_FACTOR		null, > 0.0000, <= 1.0000
TRF_HIST_WEIGHT_MASTER		
FUNC_CLASS		1, 2, 6 - 9, 11, 12, 14, 16, 17, 19
DIRECTION_OF_TRAVEL		1 - 4
METH_VEHICLE_CLASS		1 - 3
NO_CLASS_BINS		null, 2 - 20
PAVE_TYPE_TRF		1 - 3
WEIGHT_BEGIN_DATE	mm/dd/yyyy	< 1-Jan-1990
WEIGHT_COUNT_DURATION_HOUR	hr	> 1
WEIGHT_COUNT_LANE		1 - 10
WEIGHT_COUNT_PURPOSE		1 - 3
WEIGHT_EQUIPMENT_TYPE		1 - 5
TRF_MEPDG_AADTT_LTPP_LN		
TRF_DATA_TYPE		0, 4, 7
YEAR		1990 - Today's Year
TRF_MEPDG_AX_DIST		
AXLE_GROUP		1 - 4
MONTH		1 - 12
PERCENT_AXLES		0 - 100
VEHICLE_CLASS		4 - 13
WEIGHT_BIN		1 - 39
YEAR		1990 - Today's Year
TRF_MEPDG_AX_DIST_ANL		
AXLE_GROUP		1 - 4
PERCENT_AXLES		0 - 100
VEHICLE_CLASS		4 - 13
WEIGHT_BIN		1 - 39
YEAR		1990 - Today's Year
TRF_MEPDG_AX_DIST_ANL_VAR		
AXLE_GROUP		1 - 4
MEAN_PERCENT_AXLES		0 - 100
NUM_YEARS		>= 2
VAR_POP_PERCENT_AXLES		> 0
VEHICLE_CLASS		4 - 13

TRF_MEPDG_AX_PER_TRUCK

AXLE_GROUP		1 - 4
AXLES_TRUCK		0.1 - 5.0
VEHICLE_CLASS		4 - 13
YEAR		1990 - Today's Year

TRF_MEPDG_HOURLY_DIST

HOUR		0 - 23
PCT_HOURLY		>= 0
YEAR		2004 - Today's Year

TRF_MEPDG_MONTH_ADJ_FACTR

MONTH		1 - 12
MONTHLY_RATIO		0, 0.5 - 2
TRF_DATA_TYPE		4, 7
VEHICLE_CLASS		4 - 13
YEAR		1990 - Today's Year

TRF_MEPDG_VEH_CLASS_DIST

PERCENT_OF_TRUCKS		0 - 75
TRF_DATA_TYPE		0, 4, 7
VEHICLE_CLASS		4 - 13
YEAR		1990 - Today's Year

TRF_MON_EST_ESAL

AADT_ALL_VEHIC		null, > 0
AADT_ALL_VEHIC_2WAY		null, > 0
AADT_TRUCK_COMBO[5]		> 0
ANL_KESAL_LTPP_LN_YR[4]	kESAL	>= 0
AADT_TRUCK_COMBO_2WAY		null, > 0
ESAL_EST_WGHTSCALE[6]		null, 1 - 4
ESAL_EST_WGHTSRC		null, 2 - 6
EST_ESAL_SING_AXLE	ESAL	null, 0.05 - 1.40
EST_ESAL_TAND_AXLE	ESAL	null, 0.05 - 1.40
EST_ESAL_TRID_AXLE	ESAL	null, 0.05 - 1.40
METH_EST_AADT_TOT		null, 1 - 8
METH_EST_ESAL_VEH		1 - 5
METH_EST_TRK_TOT		null, 1 - 9
METH_EST_TRK_LTPP		null, 1, 2, 3
NO_CLASSES_ESAL_EST		null, 3 - 20
YEAR_MON_EST		> 1989

TRF_MONITOR_AXLE_DISTRIB

AX_CT_01	axles	>= 0
AX_CT_02	axles	>= 0
AX_CT_03	axles	>= 0
AX_CT_04	axles	>= 0
AX_CT_05	axles	>= 0
AX_CT_06	axles	>= 0
AX_CT_07	axles	>= 0
AX_CT_08	axles	>= 0

[5] Field may not be manually upgraded unless data is for an SPS8 project.

[6] Null valued ESAL_EST_WGHTSCALE may be manually upgraded when METH_EST_WGHTSRC is 3 - 6.

AX_CT_09	axles	>= 0
AX_CT_10	axles	>= 0
AX_CT_11	axles	>= 0
AX_CT_12	axles	>= 0
AX_CT_13	axles	>= 0
AX_CT_14	axles	>= 0
AX_CT_15	axles	>= 0
AX_CT_16	axles	>= 0
AX_CT_17	axles	>= 0
AX_CT_18	axles	>= 0
AX_CT_19	axles	>= 0
AX_CT_20	axles	>= 0
AX_CT_21	axles	>= 0
AX_CT_22	axles	>= 0
AX_CT_23	axles	>= 0
AX_CT_24	axles	>= 0
AX_CT_25	axles	>= 0
AX_CT_26	axles	>= 0
AX_CT_27	axles	>= 0
AX_CT_28	axles	>= 0
AX_CT_28	axles	>= 0
AX_CT_30	axles	>= 0
AX_CT_31	axles	>= 0
AX_CT_32	axles	>= 0
AX_CT_33	axles	>= 0
AX_CT_34	axles	>= 0
AX_CT_35	axles	>= 0
AX_CT_36	axles	>= 0
AX_CT_37	axles	>= 0
AX_CT_38	axles	>= 0
AX_CT_39	axles	>= 0
AX_CT_40	axles	>= 0
AXLE_GROUP		1 - 4
VEHICLE_CLASS		4 - 13
YEAR		1990 - Today’s date

TRF_MONITOR_LTPP_LN

COUNT_DAYS	days	null, 1 - 366
CT_DAYS_RECEIVED		null, 1 - 366
DAYS_OF_WEEK_COUNTED		1 - 5
DAYS_OF_WEEK_WEIGHED		1 - 5
EST_TRUCKS_CT		null, > 0
EST_TRUCKS_WT		null, > 0
QUADPLUS_AX_COUNTED	axles	null, > 0
QUADPLUS_AX_EST	axles	null, > 0
SINGLE_AX_COUNTED	axles	null, > 0
SINGLE_AX_EST	axles	null, > 0
TANDEM_AX_COUNTED	axles	null, > 0
TANDEM_AX_EST	axles	null, > 0
TRIDEM_AX_COUNTED	axles	null, > 0
TRIDEM_AX_EST	axles	null, > 0
TRUCKS_COUNTED		null, > 0
TRUCKS_LTPP_LN		>= 0
TRUCKS_WEIGHED		null, > 0
VEHICLE_CLASS		4 - 13
WEIGHT_DAYS	days	null, 1 - 366

WT_DAYS_RECEIVED	null, 1 - 366
YEAR	1990 - Today's date

E. Intramodular Checks

Intramodular checks for all traffic data tables are specified below. Each E-type check is separated by a single line. In general, each bullet represents a procedure, action, etc., of the check. SPS 3 and 4 projects are excluded from the QC due to the redundancy of such a check when the linked GPS sections are already reviewed. Unless otherwise indicated, all records affected by these checks may be manually upgraded subject to verification of the data from the original data sheet submission.

Table: TRF_BASIC_INFO

- If FUNC_CLASS_MOD is not null, then FUNC_CLASS <> FUNC_CLASS_MOD

  Error message: **TRF_BASIC_INFO**-E-102, Functional class has not changed for {STATE_CODE, SHRP_ID}

- If FUNC_CLASS_MOD in (1, 2, 6, 7, 8, 9) then FUNC_CLASS_MOD < FUNC_CLASS

  Error message: **TRF_BASIC_INFO**-E-103, {STATE_CODE, SHRP_ID} has gone from a higher to lower rural functional class.

- If FUNC_CLASS in (11, 12, 14, 16, 17) then FUNC_CLASS_MOD in (11, 12, 14, 16) and FUNC_CLASS_MOD < FUNC_CLASS

  Error message: **TRF_BASIC_INFO**-E-104, {STATE_CODE, SHRP_ID} has either gone from urban to rural or from a higher to a lower urban class.

Table: TRF_BASIC_INFO and INV_GENERAL[7]

For matching STATE_CODE, SHRP_ID and the experiment for CN=1

EXPERIMENT	TRF_BASIC_INFO. PAVE_TYPE_TRF	INV_GENERAL. PAVEMENT_TYPE
GPS 1, 2, 6A	1	1 - 3, 7, 28 - 30
GPS 3, 4, 5, 9	2	11 - 25 or 31 - 39
GPS 7A	3	3, 10, 28 - 39, 49
SPS 5	1	1, 2, 7
SPS 6	3	17 - 21, 23, 24, 28, 29, 51, 52

[7] Sections with experiment designation 6B, 6C, 6D, 6S, 7D, 7F, 7R, 7S are not original construction and therefore have no entries in the referenced tables.

EXPERIMENT	TRF_BASIC_INFO. PAVE_TYPE_TRF	INV_GENERAL. PAVEMENT_TYPE
SPS 7	2	17 - 25, 28 - 30, 51 - 53
SPS 9 with sections like 9N, 9O	1	1, 2, 7
SPS 9 with sections like 9C, 9J	2	11 - 25 or 31 - 39

Error Message: **TRF_BASIC_INFO**-E-106, Pavement structural type {PAVE_TYPE_TRF} is inconsistent with original structure {PAVEMENT TYPE}.

- For matching STATE_CODE, SHRP_ID, **TRF_BASIC_INFO**.NO_LTPP_LANES = **INV_GENERAL**.NO_OF_LANES[8]

  Error Message: **TRF_BASIC_INFO**-E-107, Traffic location has {NO.LTPP.LANES} lanes and basic section information has {NO_OF_LANES}

Tables: TRF_BASIC_INFO and INV_ID[9]

- For matching STATE_CODE, SHRP_ID, county must match between **TRF_BASIC_INFO.**COUNTY_NAME and **INV_ID**.COUNTY

  Error Message: **TRF_BASIC_INFO**-E-108, FIPS code for county {County} does not match {COUNTY_NAME} for State {STATE_CODE}.

- For matching STATE_CODE, SHRP_ID, **TRF_BASIC_INFO**.FUNC_CLASS = **INV_ID**.FUNC_CLASS[10]

  Error Message: **TRF_BASIC_INFO**-E-109, Traffic location is functional class {**TRF_BASIC_INFO**. FUNC_CLASS} while basic section is {**INV_ID**.FUNC_CLASS}

- For matching STATE_CODE, SHRP_ID, direction of travel must match between **TRF_BASIC_INFO.**DIR_TRAV_LTPP and **INV_ID**.DIRECTION_OF_TRAVEL

  Error Message: **TRF_BASIC_INFO**-E-110, Travel direction is not the same for traffic location {DIR_TRAV_LTPP} and basic section {DIRECTION_OF_TRAVEL}

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[8] No manual upgrade allowed for this check.

[9] No manual upgrade allowed for any checks between these tables.

[10] This check specification assumes that the name in INV_ID will be changed from FUNCTIONAL_CLASS to FUNC_CLASS.

Tables: TRF_BASIC_INFO and SPS_GENERAL

- For matching STATE_CODE, SHRP_ID and the experiment for CN = 1,

EXPERIMENT	TRF_BASIC_INFO. PAVE_TYPE_TRF	SPS_GENERAL. PAVEMENT_TYPE
SPS 1	1	1, 2
SPS 2	2	17 - 21, 23
SPS 5	1	1, 2, 7
SPS 6	3	17 - 21, 23, 24, 28, 29, 51, 52
SPS 7	2	17 - 25, 28 - 30, 51 - 53
SPS 8 like ?801-?806	1	1
SPS 8 like ?807-?812	2	17
SPS 9 sections like 9N, 9O	1	1, 2, 7
SPS 9 sections like 9C, 9J	2	11 - 25 or 31 - 39

Error Message: **TRF_BASIC_INFO**-E-111, Pavement structural type {PAVE_TYPE_TRF} assumed for traffic calculations is inconsistent with original surface {PAVEMENT TYPE}.

Table: TRF_BASIC_INFO and SPS_ID[11]

- For matching STATE_CODE, SHRP_ID, **TRF_BASIC_INFO**.NO_LTPP_LANES = **SPS_ID**.NO_OF_LANES

  Error Message: **TRF_BASIC_INFO**-E-113, Traffic location has {NO_LTPP_LANES} lanes and basic section information has {NO_OF_LANES}

- For matching STATE_CODE, SHRP_ID, county must match between **TRF_BASIC_INFO**.COUNTY_NAME and **SPS_ID**.COUNTY

  Error Message: **TRF_BASIC_INFO**-E-114, FIPS code for county {County} does not match {COUNTY_NAME} for State {STATE_CODE}.

- For matching STATE_CODE, SHRP_ID, functional class must match between **TRF_BASIC_INFO**.FUNC_CLASS and **SPS_ID**.FUNC_CLASS[12]

[11] No manual upgrade allowed for any checks between these two tables.

[12] This check specification assumes that the name in SPS_ID will be changed from FUNCTIONAL_CLASS to FUNC_CLASS

Error Message: **TRF_BASIC_INFO**-E-115, Traffic location is functional class {**TRF_BASIC_INFO**. FUNC_CLASS} while basic section is {**SPS_ID**.FUNC_CLASS}

- For matching STATE_CODE, SHRP_ID, direction of travel must match between **TRF_BASIC_INFO**.DIR_TRAV_LTPP and **SPS_ID**.DIRECTION_OF_TRAVEL

  Error Message: **TRF_BASIC_INFO**-E-116, Travel direction is not the same for traffic location {DIR_TRAV_LTPP} and basic section {DIRECTION_OF_TRAVEL}

Table: TRF_CALIBRATION_AVC

- Only one of the following can be non-null: LENGTH_COUNT_TIME, LENGTH_COUNT_NO_TRUCKS

  Error message: **TRF_CALIBRATION_AVC**-E-101, Both methods used for classification check {STATE_CODE, SHRP_ID, WIM_AVC_CALIB_DATE}

- At least one of the DIFF_VOL_FHWA_* fields must be non-null

  Error message: **TRF_CALIBRATION_AVC**-E-103, Variability of data has not been quantified for {STATE_CODE, SHRP_ID, WIM_AVC_CALIB_DATE}

- If a record exists in **TRF_CALIBRATION_AVC**, a record must exist in **TRF_EQUIPMENT_MASTER** for matching STATE_CODE, SHRP_ID, WIM_AVC_CALIB_DATE

  Error message: **TRF_CALIBRATION_AVC**-E-104, No record of visit/site conditions for {STATE_CODE, SHRP_ID, WIM_AVC_CALIB_DATE}

Table: TRF_CALIBRATION_WIM[13]

- If WIM_CALIB_TECHNIQUE = 2, WIM_CALIB_NO_TEST_TRUCKS > 1

  Error message: **TRF_CALIBRATION_WIM**-E-101, Too few test trucks for LTPP protocol - {STATE_CODE, SHRP_ID, WIM_AVC_CALIB_DATE]

- If WIM_CALIB_TECHNIQUE=2, WIM_CALIB_PASS_PER_TRUCK * WIM_CALIB_NO_TEST_TRUCKS >= 40

  Error message: **TRF_CALIBRATION_WIM**-E-102, Too few passes for LTPP protocol for {STATE_CODE, SHRP_ID, WIM_AVC_CALIB_DATE}

- If WIM_CALIB_TRUCK1_SUSPNSN = 3, WIM_CALIB_TRUCK1_SUSPNSN_OTHER must be non-null

  Error message: **TRF_CALIBRATION_WIM**-E-103, Unknown truck suspension not described for truck 1 {STATE_CODE, SHRP_ID, WIM_AVC_CALIB_DATE}

- If WIM_CALIB_TRUCK2_SUSPNSN = 3, WIM_CALIB_TRUCK2_SUSPNSN_OTHER must be non-null

[13] Manual upgrades for this table require a non-null entry in TRF_CALIBRATION_PROTOCOL other than 0. Upgrades should conform to the values for both type and range expected for the protocol identified.

Error message: **TRF_CALIBRATION_WIM**-E-104, Unknown truck suspension not described for truck 2 {STATE_CODE, SHRP_ID, WIM_AVC_CALIB_DATE}

- If WIM_CALIB_TRUCK3_SUSPNSN = 3, WIM_CALIB_TRUCK3_SUSPNSN_OTHER must be non-null

  Error message: **TRF_CALIBRATION_WIM**-E-105, Unknown truck suspension not described for truck 3 {STATE_CODE, SHRP_ID, WIM_AVC_CALIB_DATE}

- If WIM_AUTO_CALIB = 'Y', WIM_AUTO_CALIB_DESC must be non-null and WIM_AUTO_CALIB_VALUE must be greater than 0

  Error message: **TRF_CALIBRATION_WIM**-E-106, Auto calibration used for {STATE_CODE, SHRP_ID, WIM_AVC_CALIB_DATE} without describing type and or factor.

- At least one of the DYNAMIC_STAT_GVW_DIFF, DYNAMIC_STAT_SINGLE_AXLE_DIFF, DYNAMIC_STAT_TANDEM_AXLE_DIFF is non-null

  Error message: **TRF_CALIBRATION_WIM**-E-107, Variability of data has not been quantified for {STATE_CODE, SHRP_ID, WIM_AVC_CALIB_DATE}

- If a record exists in **TRF_CALIBRATION_WIM**, a record must exist in **TRF_EQUIPMENT_MASTER** for matching STATE_CODE, SHRP_ID, WIM_AVC_CALIB_DATE

  Error message: **TRF_CALIBRATION_WIM**-E-108, No record of visit/site conditions for {STATE_CODE, SHRP_ID, WIM_AVC_CALIB_DATE}

Table: TRF_EQUIPMENT_MASTER

- At least one of SENSORS_LTPP_* must be Y or SENSORS_LTPP_PIEZO_CABLE <> 6

  Error message: **TRF_EQUIPMENT_MASTER**-E-101, No sensors for monitored data {STATE_CODE, SHRP_ID, WIM_AVC_CALIB_DATE}

- If REASON_CALIB = 8, REASON_CALIB_OTHER must be non-null

  Error message: **TRF_EQUIPMENT_MASTER**-E-102, OTHER calibration reason not specified for {STATE_CODE, SHRP_ID, WIM_AVC_CALIB_DATE}

- If SENSORS_LTPP_OTHER = 'Y', SENSORS_LTPP_OTHER_DESCRIPTION must be non-null

  Error message: **TRF_EQUIPMENT_MASTER**-E-103, Sensor type OTHER not defined for {STATE_CODE, SHRP_ID, WIM_AVC_CALIB_DATE}

- If TRF_CALIBRATION_PROTOCOL is not null, then a matching value for CODE value must exist in the CODES table under code name TRF_CALIB_PROTOCOL

  Error message: **TRF_EQUIPMENT_MASTER**-E-105, Validation protocol {TRF_CALIBRATION_PROTOCOL} not recognized.

Programmer's Note: This check should be applied to TRF_EQUIPMENT_MASTER records that have passed all other level E checks (i.e., chkFound=False)

Tables: TRF_EQUIPMENT_MASTER, **TRF_CALIBRATION_AVC**, **TRF_CALIBRATION_WIM**

- If a record exists in **TRF_EQUIPMENT_MASTER**, a record with RECORD_STATUS = E must exist in at least one of **TRF_CALIBRATION_AVC** or **TRF_CALIBRATION_WIM**, with RECORD_STATUS = E

  Error message **TRF_EQUIPMENT_MASTER**-E-110, Matching record does not exist in TRF_CALIBRATION_AVC or TRF_CALIBRATION_WIM with RECORD-STATUS=E

Table: TRF_HIST_CLASS_DATA

- For non-null values, NO_VEH_LTPP_LN <= NO_VEH_2WAY

  Error message: **TRF_HIST_CLASS_DATA**-E-101, {STATE_CODE, SHRP_ID, CLASS_COUNT_DATE, VEHICLE_CLASS} More data in LTPP lane {NO_VEH_LTPP_LN} than on road {NO_VEH_2WAY}

- For non-null values, NO_VEH_LTPP_LN <= NO_VEH_LTPP_DIR

  Error message: **TRF_HIST_CLASS_DATA**-E-102, {STATE_CODE, SHRP_ID, CLASS_COUNT_DATE, VEHICLE_CLASS} More data in LTPP lane {NO_VEH_LTPP_LN} than in LTPP direction {NO_VEH_LTPP_DIR}

Table: TRF_HIST_CLASS_MASTER

- If CLASS_COUNT_TYPE = 1, CLASS_EQUIPMENT_TYPE must be greater than 4

  Error message: **TRF_HIST_CLASS_MASTER**-E-101, Manual count was done with equipment {STATE_CODE, SHRP_ID, CLASS_COUNT_BEGIN_DATE}

- If CLASS_COUNT_TYPE = 2, CLASS_EQUIPMENT_TYPE cannot be greater than 4

  Error message: **TRF_HIST_CLASS_MASTER**-E-102, Automated equipment used for manual count {STATE_CODE, SHRP_ID, CLASS_COUNT_BEGIN_DATE}

- For non-null values, CLASS_NO_TRUCKS_LTPP_LN <= CLASS_NO_TRUCKS <= CLASS_NO_VEHICLES

  Error message: **TRF_HIST_CLASS_MASTER**-103, {STATE_CODE, SHRP_ID, CLASS_COUNT_BEGIN_DATE} violation of trucks LTPP ln {CLASS_NO_TRUCKS_LTPP_LN} <= trucks classified {CLASS_NO_TRUCKS} <= vehicles classified {CLASS_NO_VEHICLES}

- For non-null values, TOT_NO_VEH_LTPP_LN <= TOT_NO_VEH_LTPP_DIR < TOT_NO_VEH_2WAY

  Error message: **TRF_HIST_CLASS_MASTER**-E-104, {STATE_CODE, SHRP_ID, CLASS_COUNT_DATE} violation of vehicles LTPP lane must be {TOT_NO_VEH_LTPP_LN} <= veh LTPP direction {TOT_NO_VEH_LTPP_DIR} < total 2-way vehicles {TOT_NO_VEH_2WAY}

Tables: TRF_HIST_CLASS_MASTER, TRF_HIST_CLASS_DATA

For matching STATE_CODE, SHRP_ID, CLASS_COUNT_BEGIN_DATE:

- If **TRF_HIST_CLASS_MASTER**.METH_VEHICLE_CLASS = 2, at least 2 records must exist in **TRF_HIST_CLASS_DATA**

  Error message: **TRF_HIST_CLASS_MASTER**-E-105, {STATE_CODE, SHRP_ID, CLASS_COUNT_BEGIN_DATE} agency classification scheme requires multiple records in TRF_HIST_CLASS_DATA

- If **TRF_HIST_CLASS_MASTER**.METHOD_VEHICLE_CLASS = 2, **TRF_HIST_CLASS_DATA,** VEHICLE_CLASS must be in A -T

  Error message: **TRF_HIST_CLASS_MASTER**-E-106, {STATE_CODE, SHRP_ID, CLASS_COUNT_BEGIN_DATE} VEHICLE_CLASS {VEHICLE_CLASS} not agency specific

- If **TRF_HIST_CLASS_MASTER**.TOT_NO_VEH_2WAY is non-null, the sum of **TRF_HIST_CLASS_DATA**.NO_VEHICLES_2WAY for all classes must be equal to **TRF_HIST_CLASS_MASTER**.TOT_NO_VEH_2WAY

  Error message: **TRF_HIST_CLASS_MASTER**-E-107, Sum class counts 2-way not equal total vehicles 2-way {STATE_CODE, SHRP_ID, CLASS_COUNT_BEGIN_DATE}

- If TRF_HIST_CLASS_MASTER.TOT_NO_LTPP_DIR, the sum of **TRF_HIST_CLASS_DATA**.NO_VEH_LTPP_DIR for all classes must be equal to TRF_HIST_CLASS_MASTER.TOT_NO_LTPP_DIR

  Error message: **TRF_HIST_CLASS_MASTER**-E-108, Sum class counts LTPP direction not equal total vehicles LTPP direction {STATE_CODE, SHRP_ID, CLASS_COUNT_BEGIN_DATE}

- If **TRF_HIST_CLASS_MASTER**.TOT_NO_VEH_LTPP_LN is not null, the sum of **TRF_HIST_CLASS_DATA**.NO_VEH_LTPP_LN for all classes must be equal to **TRF_HIST_CLASS_MASTER**.TOT_NO_VEH_LTPP_LN

  Error message: **TRF_HIST_CLASS_MASTER**-E-109, Sum class counts LTPP lane not equal total vehicles LTPP lane {STATE_CODE, SHRP_ID, CLASS_COUNT_BEGIN_DATE}

Table: TRF_HIST_EST_ESAL

- If AADT_ALL_VEHIC_2WAY and AADT_TRUCK_COMBO_2WAY are not null, then AADT_TRUCK_COMBO_2WAY < AADT_ALL_VEHIC_2WAY

  Error Message: **TRF_HIST_EST_ESAL**-E-101, More trucks than total traffic for {STATE_CODE, SHRP_ID, YEAR_HIST_EST}

- If AADT_ALL_VEHIC and AADT_TRUCK_COMBO are not null, the AADT_TRUCK_COMBO < AADT_ALL_VEHIC

  Error Message: **TRF_HIST_EST_ESAL**-E-102, More trucks than traffic for LTPP lane for {STATE_CODE, SHRP_ID, YEAR_HIST_EST}

- ANL_KESAL_LTPP_LN_YR x 1000 / (AADT_TRUCK_COMBO x 365) < 3.0

  Error Message: **TRF_HIST_EST_ESAL**-E-103, Average ESALs / Vehicle ratio is excessive for {STATE_CODE, SHRP_ID, YEAR_HIST_EST}

- ANL_KESAL_LTPP_LN_YR x 1000 / (AADT_TRUCK_COMBO x 365) > 0.20

  Error Message: **TRF_HIST_EST_ESAL**-E-104, Average ESALs / Vehicle ratio is low for {STATE_CODE, SHRP_ID, YEAR_HIST_EST}

- If METH_EST_ESAL_VEH = 2, NO_CLASSES_ESAL_EST is non-null

  Error Message: **TRF_HIST_EST_ESAL**-E-105, Number of vehicle classes with per class ESAL estimate is null {STATE_CODE, SHRP_ID, YEAR_HIST_EST}

- If METH_EST_ESAL_VEH = 1, 4, or 5, NO_CLASSES_ESAL_EST is null

  Error Message: **TRF_HIST_EST_ESAL**-E-106, Non-null number of vehicle classes with per class ESAL estimate {STATE_CODE, SHRP_ID, YEAR_HIST_EST} not valid for METH_EST_ESAL_VEH {METH_EST_ESAL_VEH}

Before performing this check, the data should be sorted in ascending order by YEAR_HIST_EST for each site.

- ANL_KESAL_LTPP_LN_YR is greater than or equal to 90% of the previous year's value

  Error Message: **TRF_HIST_EST_ESAL**-E-107, Traffic loading this year is less than 90% of previous year's value {STATE_CODE, SHRP_ID, YEAR_HIST_EST}

Tables: TRF_HIST_EST_ESAL, TRF_BASIC_INFO

- **TRF_BASIC_INFO** record must exist at level D or E for matching section

  Error Message: **TRF_HIST_EST_ESAL**-E-108[14], **TRF_BASIC_INFO** is C or lower or non-existent for {STATE_CODE, SHRP_ID}

Table: TRF_HIST_VOLUME_COUNT

COUNT_DURATION_UNIT	COUNT_DURATION	FACTOR_24_HR_COUNT
1	< 24	>1
1	= 24	=1
1	> 24	< 1
2	1	1

[14] If this error occurs, the record may not be manually upgraded.

COUNT_DURATION_UNIT	COUNT_DURATION	FACTOR_24_HR_COUNT
2	> 1	< 1
3	> 0	< 1

Error message: **TRF_HIST_VOLUME_COUNT**-E-101, COUNT_DURATION_UNIT, COUNT_DURATION and FACTOR_24_HR _COUNT are inconsistent {STATE_CODE, SHRP_ID, COUNT_BEGIN_DATE}

- If FACTOR_OTHER is not null, then FACTOR_OTHER_TYPE must be non-null

  Error message: **TRF_HIST_VOLUME_COUNT**-E-102, Other adjustment factor applied but not described for {STATE_CODE, SHRP_ID, COUNT_BEGIN_DATE}

- COUNT_AADT_LTPP_LN < COUNT_AADT

  Error message: **TRF_HIST_VOLUME_COUNT**-E-103, {STATE_CODE, SHRP_ID, COUNT_BEGIN_DATE} LTPP lane AADT {COUNT_AADT_LTPP_LN} >= 2-way AADT {COUNT_AADT}

Table: TRF_HIST_WEIGHT_MASTER

- If METH_VEHICLE_CLASS = 1, NO_CLASS_BINS must be null

  Error message: **TRF_HIST_WEIGHT_MASTER**-E-101, No. bins known for FHWA Scheme F {STATE_CODE, SHRP_ID, WEIGHT_BEGIN_DATE}

Table: TRF_MEPDG_AADTT_LTPP_LN

- If TRF_DATA_TYPE = 0 at least one record with matching STATE_CODE, SHRP_ID, and YEAR and COUNT_DAYS >= 210 or WEIGHT_DAYS >= 210 exists in TRF_MONITOR_LTPP_LN at RECORD_STATUS = D or E

  Error message: TRF_MEPDG_ADTT_LTPP_LN-E-101: {STATE_CODE, SHRP_ID, YEAR} No or insufficient classification and or weight data.

- If TRF_DATA_TYPE = 4 at least one record with matching STATE_CODE, SHRP_ID, and YEAR and COUNT_DAYS >= 210 exists in TRF_MONITOR_LTPP_LN at RECORD_STATUS = D or E

  Error message: TRF_MEPDG_AADTT_LTPP_LN-E-102: {STATE_CODE, SHRP_ID, YEAR, DIR_TRF, VEHICLE_CLASS, YEAR} No or insufficient classification data.

- If TRF_DATA_TYPE = 7 at least one record with matching STATE_CODE, SHRP_ID, and YEAR and WEIGHT_DAYS >= 210 exists in TRF_MONITOR_LTPP_LN at RECORD_STATUS = D or E

  Error message: TRF_MEPDG_AADTT_LTPP_LN-E-103: {STATE_CODE, SHRP_ID, YEAR} No or insufficient weight data.

- AADTT / 24 <= 180.

  Error message TRF_MEPDG_AADTT_LTPP_LN -E-104: {STATE_CODE, SHRP_ID, YEAR} Unusually high number of trucks per day.

- For matching STATE_CODE, SHRP_ID and YEAR, TRF_DATA_TYPE = 7 AADTT >= 150, the AADTT for TRF_DATA_TYPE = 7 is between 0.85 and 1.15 times the AADTT for TRF_DATA_TYPE = 4.

  Error message TRF_MEPDG_AADTT_LTPP_LN -E-105: {STATE_CODE, SHRP_ID, YEAR} Unusually large difference in estimates of AADTT by data source.

Table: TRF_MEPDG_AX_DIST

- For a given STATE_CODE, SHRP_ID, YEAR, MONTH, VEHICLE_CLASS and AXLE_GROUP the sum of PERCENT_AXLES = 100

  Error message: TRF_MEPDG_AX_DIST-E-101: {STATE_CODE, SHRP_ID, YEAR, VEHICLE_CLASS, AXLE_GROUP} Total percentage of axles is not 100.0.

- At least one record with matching STATE_CODE, SHRP_ID, and YEAR and value of WEIGHT_DAYS >= 210 with RECORD_STATUS = D or E exists in TRF_MONITOR_LTPP_LN

  Error message: TRF_MEPDG_AX_DIST-E-102: {STATE_CODE, SHRP_ID, YEAR} No or insufficient data for an axle distribution estimate.

Table: TRF_MEPDG_AX_DIST_ANL

- For a given STATE_CODE, SHRP_ID, YEAR, VEHICLE_CLASS and AXLE_GROUP the sum of PERCENT_AXLES = 100

  Error message: TRF_MEPDG_AX_DIST_ANL-E-101: {STATE_CODE, SHRP_ID, YEAR, VEHICLE_CLASS, AXLE_GROUP} Total percentage of axles is not 100.0.

- At least one record with matching STATE_CODE, SHRP_ID, and YEAR and value of WEIGHT_DAYS >= 210 with RECORD_STATUS = D or E exists in TRF_MONITOR_LTPP_LN

  Error message: TRF_MEPDG_AX_DIST_ANL-E-102: {STATE_CODE, SHRP_ID, YEAR} No or insufficient data for an axle distribution estimate.

Table: TRF_MEPDG_AX_DIST_ANL_VAR

- For matching STATE_CODE, SHRP_ID, VEHICLE_CLASS, AXLE_GROUP and WEIGHT_BIN_LOW the sum of PERCENT_AXLES in TRF_MEPDG_AX_DIST_ANL > 0

  Error message: TRF_MEPDG_AX_DIST_ANL_VAR-E-101: {STATE_CODE, SHRP_ID, VEHICLE_CLASS, AXLE_GROUP, WEIGHT_BIN_LOW} Bin percentage always zero.

- For matching STATE_CODE, SHRP_ID, VEHICLE_CLASS, AXLE_GROUP and WEIGHT_BIN_LOW, NUM_YEARS = number of records in TRF_MEPDG_AX_DIST_ANL

  Error message: TRF_MEPDG_AX_DIST_ANL_VAR-E-102: {STATE_CODE, SHRP_ID, VEHICLE_CLASS, AXLE_GROUP, WEIGHT_BIN_LOW} Number of years in variance not equal number of input records.

- For matching STATE_CODE, SHRP_ID, VEHICLE_CLASS, AXLE_GROUP and WEIGHT_BIN_LOW at least two records exist in TRF_MEPDG_AX_DIST_ANL

  Error message: TRF_MEPDG_AX_DIST_ANL_VAR-E-103: {STATE_CODE, SHRP_ID, VEHICLE_CLASS, AXLE_GROUP, WEIGHT_BIN_LOW} Insufficient data to compute a variance.

- At least two records with matching STATE_CODE, SHRP_ID, different years and value of WEIGHT_DAYS >= 210 with RECORD_STATUS = D or E exist in TRF_MONITOR_LTPP_LN

  Error message: TRF_MEPDG_AX_DIST_ANL_VAR-E-104: {STATE_CODE, SHRP_ID, YEAR} No or insufficient data for an axle distribution estimate to base variance on.

Table: TRF_MEPDG_AX_PER_TRUCK

- At least one record with matching STATE_CODE, SHRP_ID, and YEAR and value of WEIGHT_DAYS >= 210 with RECORD_STATUS = D or E exists in TRF_MONITOR_LTPP_LN

  Error message: TRF_MEPDG_AX_PER_TRUCK-E-101: {STATE_CODE, SHRP_ID, YEAR} No or insufficient data for an average axle estimate.

- For a given STATE_CODE, SHRP_ID, YEAR, VEHICLE_CLASS, AXLE_GROUP = 1 exists

  Error message: TRF_MEPDG_AX_PER_TRUCK-E-102: {STATE_CODE, SHRP_ID, YEAR, VEHICLE_CLASS} Vehicle class without any single axles.

- For a given STATE_CODE, SHRP_ID, YEAR, VEHICLE_CLASS the average number of axles by axle group falls within the ranges in the table below.

Class	Singles	Tandems	Tridems	Quads
4	1.0 – 2.0	0 – 1.0	0 – 0.2	0
5	1.9 – 2.4	0 – 0.2	0 – 0.2	0
6	1.0 – 1.3	1.0 – 1.5	0 – 0.05	0
7	0.8 – 1.7	0 – 1.0	0.4 – 1.1	0 – 0.5
8	1.0 – 4.0	0 - 1.0	0 – 0.1	0 – 0.05
9	1.0 – 3.7	0.5 - 2.0	0 – 0.5	0 – 0.05
10	1.0 – 1.6	0.9 – 1.5	0.4 – 1.1	0 – 0.4
11	4.8 – 5.2	0 – 0.2	0 – 0.05	0 – 0.05
12	3.4 – 4.2	0.8 – 1.3	0 – 0.1	0 – 0.05
13	1.0 – 3.0	0.4 – 3.0	0 – 1.5	0 – 1.0

Error message TRF_MEPDG_AX_PER_TRUCK-E-103: {STATE_CODE, SHRP_ID, YEAR} Unlikely number of average axles per vehicle for vehicle class = VEHICLE_CLASS and axle group = AXLE_GROUP.

Table: TRF_MEPDG_HOURLY_DIST

- At least one record with matching STATE_CODE, SHRP_ID, and YEAR and COUNT_DAYS >= 210 exists in TRF_MONITOR_LTPP_LN at RECORD_STATUS = E.

  Error message TRF_MEPDG_HOURLY_DIST -E-101: {STATE_CODE, SHRP_ID, YEAR} No or insufficient classification data.

- For a given STATE_CODE, SHRP_ID, and YEAR the sum of HOURLY_PCT = 100.

  Error message TRF_MEPDG_HOURLY_DIST-E-102: {STATE_CODE, SHRP_ID, YEAR} Total percentage hourly values is not 100.

Table: TRF_MEPDG_MONTH_ADJ_FACTR

- For a given STATE_CODE, SHRP_ID, YEAR, VEHICLE_CLASS and TRF_DATA_TYPE the sum of MONTHLY_RATIO = number of months in MM_CT for matching STATE_CODE, SHRP_ID, YEAR and TRF_DATA_TYPE in the LTPP lane

  Error message: TRF_MEPDG_MONTH_ADJ_FACTR-E-101: {STATE_CODE, SHRP_ID, YEAR, VEHICLE_CLASS, TRF_DATA_TYPE} Total ratio is not equal to number of months of data for year for LTPP lane.

- For TRF_DATA_TYPE = 4 at least one record with matching STATE_CODE, SHRP_ID, and YEAR at least one value of COUNT_DAYS >= 210 with RECORD_STATUS = D or E exists in TRF_MONITOR_LTPP_LN

  Error message: TRF_MEPDG_MONTH_ADJ_FACTR-E-102: {STATE_CODE, SHRP_ID, YEAR} No or insufficient class data for monthly adjustment factors.

- For TRF_DATA_TYPE = 7 at least one record with matching STATE_CODE, SHRP_ID, and YEAR at least one value of WEIGHT_DAYS >= 210 with RECORD_STATUS = D or E exists in TRF_MONITOR_LTPP_LN

.

  Error message: TRF_MEPDG_MONTH_ADJ_FACTR-E-103: {STATE_CODE, SHRP_ID, YEAR} No or insufficient weight data for monthly adjustment factors.

Table: TRF_MEPDG_VEH_CLASS_DIST

- For a given STATE_CODE, SHRP_ID, YEAR, and TRF_DATA_TYPE the sum of PERCENT_OF_TRUCKS = 100

  Error message: TRF_MEPDG_VEHICLE_CLASS_DIST-E-101: {STATE_CODE, SHRP_ID, YEAR, TRF_DATA_TYPE} Total percentage of vehicles is not 100.0.

- For TRF_DATA_TYPE = 4 at least one record with matching STATE_CODE, SHRP_ID, and YEAR at least one value of COUNT_DAYS >= 210 with RECORD_STATUS = D or E exists in TRF_MONITOR_LTPP_LN

  Error message: TRF_MEPDG_VEHICLE_CLASS_DIST-E-102: {STATE_CODE, SHRP_ID, YEAR} No or insufficient class data for vehicle distribution computation.

- For TRF_DATA_TYPE = 7 at least one record with matching STATE_CODE, SHRP_ID, and YEAR at least one value of WEIGHT_DAYS >= 210 with RECORD_STATUS = D or E exists in TRF_MONITOR_LTPP_LN

  Error message: TRF_MEPDG_VEHICLE_CLASS_DIST-E-103: {STATE_CODE, SHRP_ID, YEAR} No or insufficient weight data for vehicle distribution computation.

- If TRF_DATA_TYPE = 0 at least one record with matching STATE_CODE, SHRP_ID, and YEAR and COUNT_DAYS >= 210 or WEIGHT_DAYS >= 210 exists in TRF_MONITOR_LTPP_LN at RECORD_STATUS = D or E

  Error message: TRF_MEPDG_VEHICLE_CLASS_DIST-E-104: {STATE_CODE, SHRP_ID, YEAR} No or insufficient classification and or weight data.

Table: TRF_MON_EST_ESAL

- If AADT_ALL_VEHIC_2WAY and AADT_TRUCK_COMBO_2WAY are not null, then AADT_TRUCK_COMBO_2WAY < AADT_ALL_VEHIC_2WAY

  Error Message: **TRF_MON_EST_ESAL**-E-101, More trucks than total traffic for {STATE_CODE, SHRP_ID, YEAR_MON_EST}

- If AADT_ALL_VEHIC and AADT_TRUCK_COMBO are not null, the AADT_TRUCK_COMBO < AADT_ALL_VEHIC

  Error Message: **TRF_MON_EST_ESAL**-E-102, More trucks than traffic for LTPP lane for {STATE_CODE, SHRP_ID, YEAR_MON_EST}

- ANL_KESAL_LTPP_LN_YR x 1000 / (AADT_TRUCK_COMBO x 365) < 3.0

  Error Message: **TRF_MON_EST_ESAL**-E-103, Average ESALs / Vehicle ratio is excessive for {STATE_CODE, SHRP_ID, YEAR_MON_EST}

- ANL_KESAL_LTPP_LN_YR x 1000 / (AADT_TRUCK_COMBO x 365) > 0.20

  Error Message: **TRF_MON_EST_ESAL**-E-104, Average ESALs / Vehicle ratio is low for {STATE_CODE, SHRP_ID, YEAR_MON_EST}

- If METH_EST_ESAL_VEH = 2, NO_CLASSES_ESAL_EST is non-null

  Error Message: **TRF_MON_EST_ESAL**-E-105, Number of vehicle classes with per class ESAL estimate is null {STATE_CODE, SHRP_ID, YEAR_MON_EST}

- If METH_EST_ESAL_VEH = 1, 3, 4, or 5, NO_CLASSES_ESAL_EST is null

  Error Message: **TRF_MON_EST_ESAL**-E-106, Non-null number of vehicle classes with per class ESAL estimate {STATE_CODE, SHRP_ID, YEAR_MON_EST} not valid for METH_EST_ESAL_VEH {METH_EST_ESAL_VEH}

- If METH_EST_ESAL_VEH = 3, EST_ESAL_SING_AXLE and EST_ESAL_TAND_AXLE are non-null

Error Message: **TRF_MON_EST_ESAL**-E-107, Missing ESAL/axle estimates single {EST_ESAL_SING_AXLE} and / or tandem axles {EST_ESAL_TAND_AXLE} {STATE_CODE, SHRP_ID, YEAR_MON_EST}

- If METH_EST_ESAL_VEH = 1, 2, 4, or 5 EST_ESAL_SING_AXLE, EST_ESAL_TAND_AXLE and EST_ESAL_TRID_AXLE are null

  Error Message: **TRF_MON_EST_ESAL**-E-108, Per axle ESAL estimate single {EST_ESAL_SING_AXLE}, tandem {EST_ESAL_TAND_AXLE}, tridem {EST_ESAL_TRID_AXLE} present and invalid for METH_EST_ESAL_VEH {METH_EST_ESAL_VEH}

Before performing this check, the data should be sorted in ascending order by YEAR_MON_EST for each site.

- ANL_KESAL_LTPP_LN_YR is greater than or equal to 90% of the previous year's value

  Error Message: **TRF_MON_EST_ESAL**-E-109, Traffic loading this year is less than 90% of previous year's value {STATE_CODE, SHRP_ID, YEAR_MON_EST}

Tables: TRF_MON_EST_ESAL, TRF_BASIC_INFO

- **TRF_BASIC_INFO** for section at level D or E

  Error message: **TRF_MON_EST_ESAL**-E-110[15], **TRF_BASIC_INFO** is C or lower or non-existent for {STATE_CODE, SHRP_ID}

Table: TRF_MONITOR_AXLE_DISTRIB

- Sum of AX_CT_01 to AX_CT_40 > 0

  Error Message: **TRF_MONITOR_AXLE_DISTRIB**-E-102, No found axles for axle group {AXLE_GROUP} in vehicle class {VEHICLE_CLASS}

- If **TRF_MONITOR_AXLE_DISTRIB**.AXLE_GROUP = 1 then **TRF_MONITOR_AXLE_DISTRIB**.WEIGHT_BIN_SIZE must equal 1000 OR
  If **TRF_MONITOR_AXLE_DISTRIB**.AXLE_GROUP = 2 then **TRF_MONITOR_AXLE_DISTRIB**.WEIGHT_BIN_SIZE must equal 2000 OR
  If **TRF_MONITOR_AXLE_DISTRIB**.AXLE_GROUP = 3 then **TRF_MONITOR_AXLE_DISTRIB**.WEIGHT_BIN_SIZE must equal 3000

  Error Message: **TRF_MONITOR_AXLE_DISTRIB**-E-104, The WEIGHT_BIN_SIZE must be {REQUIRED_WEIGHT_BIN_SIZE} for this axle group instead of {WEIGHT_BIN_SIZE}.

Table: TRF_MONITOR_AXLE_DISTRIB, TRF_MONITOR_LTPP_LN

- For matching STATE_CODE, SHRP_ID and YEAR a record must exist in **TRF_MONITOR_LTPP_LN** with RECORD_STATUS = E

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[15] These records can be manually upgraded until the time the RCOC's are instructed to enter data. RECORD_STATUS will be reset to "A" and QC re-run when Part 1 of the QC is coded.

Error Message: **TRF_MONITOR_AXLE_DISTRIB**-E-101, No matching record in **TRF_MONITOR_LTPP_LN**

Table: TRF_MONITOR_AXLE_DISTRIB, TRAFFIC_ANALYSIS_TRACKER

- For matching STATE_CODE, SHRP_ID and YEAR, **TRAFFIC_ANALYSIS_TRACKER**.IMS_DATE >= **TRAFFIC_ANALYSIS_TRACKER**.MM_CL_DATE, **TRAFFIC_ANALYSIS_TRACKER**.IMS_DATE >= **TRAFFIC_ANALYSIS_TRACKER**.MM_WT_DATE

  Error Message: **TRF_MONITOR_AXLE_DISTRIB**-E-103, IMS data not up to date.

- If **TRF_MONITOR_AXLE_DISTRIB.**AXLE_GROUP = 4 then for matching STATE_CODE, SHRP_ID, and YEAR in **TRAFFIC_ANALYSIS_TRACKER**, if 24-Oct-2002 <= **TRAFFIC_ANALYSIS_TRACKER**.DD_WT_DATE < 12-May-2004, then **TRF_MONITOR_AXLE_DISTRIB**.WEIGHT_BIN_SIZE must equal 4000 else **TRF_MONITOR_AXLE_DISTRIB**.WEIGHT_BIN_SIZE must equal 3000

  Error Message: **TRF_MONITOR_AXLE_DISTRIB**-E-104, The WEIGHT_BIN_SIZE must be {REQUIRED_WEIGHT_BIN_SIZE} for this axle group instead of {WEIGHT_BIN_SIZE}.

Tables: TRF_MONITOR_LTPP_LN, TRF_MONITOR_AADT, SHRP_INFO

- At least one of the sets TRUCKS_COUNTED, COUNT_DAYS, DAYS_OF_WEEK_COUNTED or TRUCKS_WEIGHED, WEIGHT_DAYS, DAYS_OF_WEEK_WEIGHED, CT_DAYS_RECEIVED, WT_DAYS_RECEIVED is non-null

  Error Message: **TRF_MONITOR_LTPP_LN**-E-101, {STATE_CODE, SHRP_ID, YEAR} Vehicle class {VEHICLE_CLASS} record created without record of source data

If TRF_MONITOR_AADT.NUMBER_OF_LANES = 2 or SHRP_INFO.LANES_LTPP_DIR is non-null and SHRP_INFO.LANES_NON_LTPP_DIR is non-null and LANES_LTPP_DIR + LANES_NON_LTPP_DIR = 2 then:

- TRUCKS_LTPP_LN < 125,000

  Error Message: **TRF_MONITOR_LTPP_LN**-E-103, {STATE_CODE, SHRP_ID, YEAR, VEHICLE_CLASS} Estimate annual trucks in the LTPP lane excessive for {NUMBER_OF_LANES} - lane roadway

- If TRUCKS_COUNTED is > 0, TRUCKS_COUNTED < 125,000

  Error Message: **TRF_MONITOR_LTPP_LN**-E-104, {STATE_CODE, SHRP_ID, YEAR, VEHICLE_CLASS} Total trucks counted is large for {NUMBER_OF_LANES} - lane roadway

- If TRUCKS_WEIGHED is > 0, TRUCKS_WEIGHED < 125,000

  Error Message: **TRF_MONITOR_LTPP_LN**-E-105, {STATE_CODE, SHRP_ID, YEAR, VEHICLE_CLASS} Total trucks weighed is large for {NUMBER_OF_LANES} - lane roadway

If TRF_MONITOR_AADT.NUMBER_OF_LANES = 4 or SHRP_INFO.LANES_LTPP_DIR is non-null and SHRP_INFO.LANES_NON_LTPP_DIR is non-null and LANES_LTPP_DIR + LANES_NON_LTPP_DIR = 4 or SHRP_INFO.LANES_LTPP_DIR is null or SHRP_INFO.LANES_NON_LTPP_DIR is null then:

- TRUCKS_LTPP_LN < 250,000

  Error Message: **TRF_MONITOR_LTPP_LN**-E-103, {STATE_CODE, SHRP_ID, YEAR, VEHICLE_CLASS} Estimate annual trucks in the LTPP lane excessive for {NUMBER_OF_LANES} - lane roadway

- If TRUCKS_COUNTED is > 0, TRUCKS_COUNTED < 250,000

  Error Message: **TRF_MONITOR_LTPP_LN**-E-104, {STATE_CODE, SHRP_ID, YEAR, VEHICLE_CLASS} Total trucks counted is large for {NUMBER_OF_LANES} - lane roadway

- If TRUCKS_WEIGHED is > 0, TRUCKS_WEIGHED < 250,000

  Error Message: **TRF_MONITOR_LTPP_LN**-E-105, {STATE_CODE, SHRP_ID, YEAR, VEHICLE_CLASS} Total trucks weighed is large for {NUMBER_OF_LANES} - lane roadway

If TRF_MONITOR_AADT.NUMBER_OF_LANES = 6 or 8 or SHRP_INFO.LANES_LTPP_DIR is non-null and SHRP_INFO.LANES_NON_LTPP_DIR is non-null and LANES_LTPP_DIR + LANES_NON_LTPP_DIR = 6 or 8 then:

- TRUCKS_LTPP_LN < 575,000

  Error Message: **TRF_MONITOR_LTPP_LN**-E-103, {STATE_CODE, SHRP_ID, YEAR, VEHICLE_CLASS} Estimate annual trucks in the LTPP lane excessive for {NUMBER_OF_LANES} - lane roadway

- If TRUCKS_COUNTED is > 0, TRUCKS_COUNTED < 575,000

  Error Message: **TRF_MONITOR_LTPP_LN**-E-104, {STATE_CODE, SHRP_ID, YEAR, VEHICLE_CLASS} Total trucks counted is large for {NUMBER_OF_LANES} - lane roadway

- If TRUCKS_WEIGHED is > 0, TRUCKS_WEIGHED < 575,000

  Error Message: **TRF_MONITOR_LTPP_LN**-E-105, {STATE_CODE, SHRP_ID, YEAR, VEHICLE_CLASS} Total trucks weighed is large for {NUMBER_OF_LANES} - lane roadway

All Records:

- If COUNT_DAYS is non-null and CT_DAYS_RECEIVED is non-null, then COUNT_DAYS <= CT_DAYS_RECEIVED

  Error Message: **TRF_MONITOR_LTPP_LN**-E-107, {STATE_CODE, SHRP_ID, YEAR, VEHICLE_CLASS} More days of class data in estimate than were provided by the agency.

- If WEIGHT_DAYS is non-null and WT_DAYS_RECEIVED is non-null, then WEIGHT_DAYS <= WT_DAYS_RECEIVED

  Error Message: **TRF_MONITOR_LTPP_LN**-E-108, {STATE_CODE, SHRP_ID, YEAR, VEHICLE_CLASS} More days of weight data in estimate than were provided by the agency.

11. 2 Manual Upgrade Guidelines

The QC for the tables holding data from Traffic Data Sheet 16 is based on the LTPP Weigh-in-Motion (WIM) and Classification validation protocols. The tables are TRF_CALIBRATION_AVC, TRF_CALIBRATION_WIM and TRF_EQUIPMENT_MASTER.

The data cannot be manually upgraded unless LTPP has a copy of the protocol by which the validation was done. If LTPP has a copy of the protocol and it is available for distribution on request, this is indicated by a non-null value for TRF_CALIBRATION_PROTOCOL.

The manual upgrades for statistics not provided as part of non-LTPP validations and for different ranges on the statistics must be consistent with the protocol values for a successfully validated site.

Sites that are validated by auto-calibration (TRF_CALIBRATION_PROTOCOL = 0) may not have these tables manually upgraded unless the validation is associated with checking the auto-calibration statistic(s) by use of trucks of known weights.

12.0 CLIMATIC QC PROGRAMS

12.1 Level 1

A. Initial Level

Records in the IMS are at Level A when they first enter the system and are set back to A when changes are made to a given record or to selected related records.

B. Dependency Checks

No dependency checks are performed.

C. Minimum Data Elements

Tables and accompanying fields that must be included in a data record are identified below. Explanations are provided for those fields having certain conditions as to when they are required (i.e., X = always; * = conditionally).

Table	Field	Condition
CLM_SITE_VWS_LINK	VWS_ID	X
CLM_OWS_HUMIDITY_DAILY	MAX_DAY_HUM	X
	MIN_DAY_HUM	X
CLM_OWS_LOCATION	ELEVATION	X
	END_YEAR	X
	LATITUDE_DEG	X
	LATITUDE_DIRECTION	X
	LATITUDE_MIN	X
	LATITUDE_SEC	X
	LONGITUDE_DEG	X
	LONGITUDE_DIRECTION	X
	LONGITUDE_MIN	X
	LONGITUDE_SEC	X
	START_YEAR	X
	WS_NAME	X
	WS_TYPE	X
CLM_OWS_PRECIP_DAILY	DAY_PRECIPITATION	X
CLM_OWS_TEMP_DAILY	No level C checks	
CLM_OWS_WIND_DAILY	MAX_DAY_WIND_SPD	*
	MEAN_DAY_WIND_SPD	*
	*Either max or mean is required	

CLM_VWS_HUMIDITY_DAILY	MAX_DAY_HUM	X
	MIN_DAY_HUM	X
CLM_VWS_PRECIP_DAILY	DAY_PRECIPITATION	X
CLM_VWS_TEMP_DAILY	No level C checks	
CLM_VWS_WIND_DAILY	No level C checks	
CLM_VWS_OWS_LINK	BEARING_TO_SITE	X
	DISTANCE	X
	ELEVATION_DIFF	X
	WEATHER_STATION_ID	X

D. Expanded Range Checks

Expanded range checks are applied to certain fields to identify data element values that fall outside an expected range. Field names are listed below the bolded table name.

Table	Units	Range
CLM_SITE_VWS_LINK		
No level D checks		
CLM_OWS_HUMIDITY_DAILY		
WS_DATE		>= January 1, 1930
MAX_DAY_HUM	%	null, 0 - 100
MIN_DAY_HUM	%	null, 0 - 100
CLM_OWS_LOCATION		
ELEVATION	m	-50 - 3000
END_YEAR		1925 - 1997
LATITUDE_DEG	deg	15 - 75
LATITUDE_DIRECTION	N	
LATITUDE_MIN	min	0 - 59
LATITUDE_SEC	sec	0 - 59
LONGITUDE_DEG	deg	45 - 180
LONGITUDE_DIRECTION	W	
LONGITUDE_MIN	min	0 - 59
LONGITUDE_SEC	sec	0 - 59
START_YEAR		1925 - 1997
WS_TYPE		F - C
CLM_OWS_PRECIP_DAILY		
WS_DATE		>= January 1, 1930
DAY_PRECIPITATION	mm	null, 0.0 - 300.0
CLM_OWS_TEMP_DAILY		
WS_DATE		>= January 1, 1930
CLM_OWS_WIND_DAILY		
WS_DATE		>= January 1, 1930
CONTRIBUTE_WS_NO		1 - 5

MEAN_DAY_WIND_SPD		0.0 - 40.0
MAX_DAY_WIND_SPD		0.0 - 50.0

CLM_VWS_HUMIDITY_ANNUAL

MAX_ANN_HUM_AVG	%	1 - 97
MAX_ANN_HUM_DAYS		300 - days in year
MAX_CONTRIBUTE_WS_NO		1 - 5
MIN_ANN_HUM_AVG	%	1 - 90
MIN_ANN_HUM_DAYS		300 - days in year

CLM_VWS_HUMIDITY_DAILY

WS_DATE		January 1, 1930 - Today's Date
CONTRIBUTE_WS_NO		1 - 5
MAX_DAY_HUM	%	null, 0 - 100
MIN_DAY_HUM	%	null, 0 - 100

CLM_VWS_HUMIDITY_MONTH

MAX_CONTRIBUTE_WS_NO		1 - 5
MAX_MON_HUM_AVG	%	0 - 100
MAX_MON_HUM_DAYS		24 - days in month
MIN_MON_HUM_AVG	%	1 - 100
MIN_MON_HUM_DAYS		24 - days in month
MONTH		1 - 12

CLM_VWS_OWS_LINK

BEARING_TO_SITE	deg	0 - 360
DISTANCE	m	0 - 200000
ELEVATION_DIFF	m	-1000 - 1000

CLM_VWS_PRECIP_ANNUAL

INTENSE_PRECIP_DAYS_YR		0 - days in year
MAX_CONTRIBUTE_WS_NO		1 - 5
NUM_ANN_PRECIP_DAYS		300 - days in year
NUM_SNOWFALL_DAYS_YR		0 - days in year
SNOW_COVERED_DAYS_YR		0 - 300
TOTAL_ANN_PRECIP	mm	0.0 - 4000.0
TOTAL_SNOWFALL_YR	mm	0 - 11000
WET_DAYS_YR		0 - days in year

CLM_VWS_PRECIP_DAILY

WS_DATE		January 1, 1930 - Today's Date
CONTRIBUTE_WS_NO		1 - 5
DAY_PRECIPITATION	mm	null, 0.0 - 300.0
DAY_SNOWFALL	mm	null, 0 - 1800

CLM_VWS_PRECIP_MONTH

INTENSE_PRECIP_DAYS_MONTH		0 - days in month
MAX_CONTRIBUTE_WS_NO		1 - 5
MONTH		1 - 12
NUM_MON_PRECIP_DAYS		24 - days in month
TOTAL_MON_PRECIP	mm	0.0 - 1000.0
TOTAL_SNOWFALL_MONTH	mm	0 - 5000
WET_DAYS_MONTH		0 - days in month

CLM_VWS_TEMP_ANNUAL

DAYS_ABOVE_32_C_YR		0 - days in year
DAYS_BELOW_0_C_YR		0 - days in year
FREEZE_INDEX_DAYS_YR		300 - days in year
FREEZE_INDEX_YR	deg C degree days	0 - 5000
FREEZE_THAW_DAYS_YR		300 - days in year
FREEZE_THAW_YR		0 - days in year
MAX_ANN_TEMP_AVG	deg C	-50.0 - 50.0
MAX_ANN_TEMP_DAYS		300 - days in year
MAX_CONTRIBUTE_WS_NO		1 - 5
MAX_ANN_TEMP	deg C	-50.0 - 50.0
MEAN_ANN_TEMP_AVG	deg C	-50.0 - 50.0
MEAN_ANN_TEMP_DAYS		300 - days in year
MIN_ANN_TEMP	deg C	-50.0 - 50.0
MIN_ANN_TEMP_AVG	deg C	-50.0 - 50.0
MIN_ANN_TEMP_DAYS		300 - days in year

CLM_VWS_TEMP_DAILY

WS_DATE		January 1, 1930 - Today's Date
CONTRIBUTE_WS_NO		1 - 5

CLM_VWS_TEMP_MONTH

DAYS_ABOVE_32_C_MONTH		0 - days in month
DAYS_BELOW_0_C_MONTH		0 - days in month
FREEZE_INDEX_DAYS_MONTH		0 - days in month
FREEZE_INDEX_MONTH	deg C degree days	0 - 900
FREEZE_THAW_DAYS_MONTH		0 - days in month
FREEZE_THAW_MONTH		0 - days in month
MAX_CONTRIBUTE_WS_NO		1 - 5
MAX_MON_TEMP_DAYS		24 - days in month
MEAN_MON_TEMP_DAYS		24 - days in month
MIN_MON_TEMP_DAYS		24 - days in month
MONTH		1 - 12

CLM_VWS_WIND_ANNUAL

MAX_ANN_WIND_DAYS		[1]300 - days in year
MAX_ANN_WIND_SPD	m/s	0.0 - 50.0
MAX_CONTRIBUTE_WS_NO		1 - 5
MEAN_ANN_WIND_AVG	m/s	0.0 - 20.0
MEAN_ANN_WIND_DAYS[1]		300 - days in year

CLM_VWS_WIND_DAILY

WS_DATE		January 1, 1930 - Today's Date
CONTRIBUTE_WS_NO		1 - 5
MEAN_DAY_WIND_SPD		0.0 - 20.0
MAX_DAY_WIND_SPD		0.0 - 50.0

CLM_VWS_WIND_MONTH

MAX_CONTRIBUTE_WS_NO		1 – 5
MAX_MON_WIND_DAYS[2]		24 - days in month

[1] Some weather stations did not collect one or the other of these values. Only one must be in range 300 - days in year.

MAX_MON_WIND_SPD	m/s	0.0 - 40.0
MEAN_MON_WIND_AVG	m/s	0.0 - 20.0
MEAN_MON_WIND_DAYS[2]		24 - days in month
MONTH		1 - 12

E. Intramodular Checks

Each E-type check is separated by a single line. In general, each bullet represents a procedure, action, etc.

Table: CLM_SITE_VWS_LINK

No level E checks

Table: CLM_OWS_HUMIDITY_DAILY

- MIN_DAY_HUM < MAX_DAY_HUM

  Error Message: **CLM_OWS_HUMIDITY_DAILY**-E-1, The maximum humidity {MAX_DAY_HUM} is less than the minimum humidity {MIN_DAY_HUM}.

- If both MIN_DAY_HUM and MAX_DAY_HUM are null, record should be deleted

  Error Message: **CLM_OWS_HUMIDITY_DAILY**-E-2, All data fields are null, delete record.

Tables: CLM_OWS_HUMIDITY_DAILY, CLM_OWS_HUMIDITY_MONTH

- For matching WEATHER_STATION_ID and CLM_OWS_HUMIDITY_MONTH.YEAR = TO_NUMBER(TO_CHAR(ws_date, 'YYYY')) and CLM_OWS_HUMIDITY_MONTH.MONTH = TO_NUMBER(TO_CHAR(ws_date, 'MM')), the CLM_OWS_HUMIDITY_MONTH.MAX_MON_HUM_STDEV cannot be zero

  Error Message: **CLM_OWS_HUMIDITY_DAILY**-E-3, The standard deviation for maximum month humidity in the OWS month table is zero.

- For matching WEATHER_STATION_ID and CLM_OWS_HUMIDITY_MONTH.YEAR = TO_NUMBER(TO_CHAR(ws_date, 'YYYY')) and CLM_OWS_HUMIDITY_MONTH.MONTH = TO_NUMBER(TO_CHAR(ws_date, 'MM')), the CLM_OWS_HUMIDITY_MONTH.MIN_MON_HUM_STDEV cannot be zero

  Error Message: **CLM_OWS_HUMIDITY_DAILY**-E-4, The standard deviation for minimum month humidity in the OWS month table is zero.

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[2] Some weather stations did not collect one or the other of these values. Only one must be in range 24 - days in month.

Table: CLM_OWS_LOCATION

No level E checks

Table: CLM_OWS_PRECIP_DAILY

- If both DAY_PRECIPITATION and DAY_SNOWFALL are null, record should be deleted

  Error Message: **CLM_OWS_PRECIP_DAILY**-E-1, All data fields are null, delete record.

Table: CLM_OWS_TEMP_DAILY

- MIN_DAY_TEMP <= MEAN_DAY_TEMP <= MAX_DAY_TEMP

  Error Message: **CLM_OWS_TEMP_DAILY**-E-1, The mean daily temperature {MEAN_DAY_TEMP} is not between maximum {MAX_DAY_TEMP} and minimum {MIN_DAY_TEMP} daily extremes.

- MIN_DAY_TEMP <= MAX_DAY_TEMP

  Error Message: **CLM_OWS_TEMP_DAILY**-E-2, The maximum temperature {MAX_DAY_TEMP} is less than the minimum temperature {MIN_DAY_TEMP}.

- If MIN_DAY_TEMP, MEAN_DAY_TEMP, and MAX_DAY_TEMP are null, record should be deleted

  Error Message: **CLM_OWS_TEMP_DAILY**-E-3, All data fields are null, delete record.

- For matching WEATHER_STATION_ID and CLM_OWS_TEMP_MONTH.YEAR = **CLM_OWS_TEMP_DAILY**.(ws_date, 'YYYY') and CLM_OWS_TEMP_MONTH.MONTH = **CLM_OWS_TEMP_DAILY**.(ws_date, 'MM'), the **CLM_OWS_TEMP_DAILY**.MEAN_MON_TEMP_STDEV cannot be zero

  Error Message: **CLM_OWS_TEMP_DAILY**-E-4, The standard deviation for mean month temperature in the OWS month table is zero.

- For matching WEATHER_STATION_ID and **CLM_OWS_TEMP_MONTH**.YEAR = **CLM_OWS_TEMP_DAILY**.(ws_date, 'YYYY')) and **CLM_OWS_TEMP_MONTH**.MONTH = **CLM_OWS_TEMP_DAILY**.(ws_date, 'MM')), the **CLM_OWS_TEMP_MONTH**.MAX_MON_TEMP_STDEV cannot be zero

  Error Message: **CLM_OWS_TEMP_DAILY**-E-5, The standard deviation for max month temperature in the OWS month table is zero.

- For matching WEATHER_STATION_ID and **CLM_OWS_TEMP_MONTH**.YEAR = **CLM_OWS_TEMP_DAILY**.(ws_date, 'YYYY') and **CLM_OWS_TEMP_MONTH**.MONTH = **CLM_OWS_TEMP_DAILY**.(ws_date, 'MM'), the **CLM_OWS_TEMP_MONTH**.MIN_MON_TEMP_STDEV cannot be zero

  Error Message: **CLM_OWS_TEMP_DAILY**-E-6, The standard deviation for min month temperature in the OWS month table is zero.

Table: CLM_OWS_WIND_DAILY

- MEAN_DAY_WIND_SPD <= MAX_DAY_WIND_SPD

  Error Message: **CLM_OWS_WIND_DAILY**-E-1, The mean day wind speed {MEAN_DAY_WIND_SPD} is greater than the max day wind speed {MAX_DAY_WIND_SPD}.

- If both MEAN_DAY_WIND_SPD and MAX_DAY_WIND_SPD are null, record should be deleted

  Error Message: **CLM_OWS_WIND_DAILY**-E-2, All data fields are null, delete record.

Table: CLM_VWS_HUMIDITY_ANNUAL

- If both MIN_ANN_HUM_AVG and MAX_ANN_HUM_AVG are null, record should be deleted

  Error Message: **CLM_VWS_HUMIDITY_ANNUAL**-E-1, Both max and min humidity values are null, record should be deleted.

- MIN_ANN_HUM_AVG <= MAX_ANN_HUM_AVG

  Error Message: **CLM_VWS_HUMIDITY_ANNUAL**-E-2, The maximum humidity {MAX_ANN_HUM_AVG} is less than the minimum humidity {MIN_ANN_HUM_AVG}.

Tables: CLM_VWS_HUMIDITY_ANNUAL, CLM_VWS_HUMIDITY_MONTH

- Matching records (VWS_ID, YEAR) in **CLM_VWS_HUMIDITY_MONTH** must be at level E

  Error Message: **CLM_VWS_HUMIDITY_ANNUAL**-E-3, All matching records in **CLM_VWS_HUMIDITY_MONTH** are not at level E.

Table: CLM_VWS_HUMIDITY_DAILY

- MIN_DAY_HUM < MAX_DAY_HUM

  Error Message: **CLM_VWS_HUMIDITY_DAILY**-E-1, The maximum humidity {MAX_DAY_HUM} is less than the minimum humidity {MIN_DAY_HUM}.

- If both MIN_DAY_HUM and MAX_DAY_HUM are null, record should be deleted

  Error Message: **CLM_VWS_HUMIDITY_DAILY**-E-2, All data fields are null, delete record.

Tables: CLM_VWS_HUMIDITY_DAILY, CLM_VWS_HUMIDITY_MONTH

- For matching WEATHER_STATION_ID and **CLM_VWS_HUMIDITY_MONTH**.YEAR = **CLM_VWS_HUMIDITY_DAILY**.(ws_date, 'YYYY') and **CLM_VWS_HUMIDITY_MONTH**.MONTH = **CLM_VWS_HUMIDITY_DAILY**.(ws_date, 'MM'), the **CLM_VWS_HUMIDITY_MONTH**.MAX_MON_HUM_STDEV cannot be zero

Error Message: **CLM_VWS_HUMIDITY_DAILY**-E-3, The standard deviation for maximum month humidity in the VWS month table is zero.

- For matching WEATHER_STATION_ID and **CLM_VWS_HUMIDITY_MONTH**.YEAR = **CLM_VWS_HUMIDITY_DAILY**.(ws_date, 'YYYY') and **CLM_VWS_HUMIDITY_MONTH**.MONTH = **CLM_VWS_HUMIDITY_DAILY**.(ws_date, 'MM'), the **CLM_VWS_HUMIDITY_MONTH**.MIN_MON_HUM_STDEV cannot be zero

  Error Message: **CLM_VWS_HUMIDITY_DAILY**-E-4, The standard deviation for minimum month humidity in the VWS month table is zero.

Tables: CLM_VWS_HUMIDITY_DAILY, CLM_OWS_HUMIDITY_DAILY

- Matching records (WEATHER_STATION_ID, VWS_ID, WS_DATE) in CLM_OWS_HUMIDITY_DAILY must exist and be at level E

  Error Message: **CLM_VWS_HUMIDITY_DAILY**-E-5, All matching records in CLM_OWS_HUMIDITY_DAILY are not at level E.

Table: CLM_VWS_HUMIDITY_MONTH

- If both MIN_MON_HUM_AVG and MAX_MON_HUM_AVG are null, record should be deleted

  Error Message: **CLM_VWS_HUMIDITY_MONTH**-E-1, Both max and min humidity values are null, record should be deleted.

- MIN_MON_HUM_AVG <= MAX_MON_HUM_AVG

  Error Message: **CLM_VWS_HUMIDITY_MONTH**-E-2, The maximum humidity {MAX_MON_HUM_AVG} is less than the minimum humidity {MIN_MON_HUM_AVG}.

Tables: CLM_VWS_HUMIDITY_MONTH, CLM_VWS_HUMIDITY_DAILY

- Matching records (VWS_ID, CLM_VWS_HUMIDITY_MONTH.YEAR = CLM_VWS_HUMIDITY_DAILY.(vws_date, 'YYYY'), and CLM_VWS_HUMIDITY_MONTH.MONTH = CLM_VWS_HUMIDITY_DAILY.(ws_date, 'MM')) in CLM_VWS_HUMIDITY_DAILY must be at level E

  Error Message: **CLM_VWS_HUMIDITY_MONTH**-E-3, All matching records in **CLM_VWS_HUMIDITY_DAILY** are not at level E.

Table: CLM_VWS_OWS_LINK

No level E checks

Tables: CLM_VWS_PRECIP_ANNUAL, CLM_VWS_PRECIP_MONTH

- Matching records (VWS_ID, YEAR) in **CLM_VWS_PRECIP_MONTH** must be at level E

Error Message: **CLM_VWS_PRECIP_ANNUAL**-E-1, All matching records in **CLM_VWS_PRECIP_MONTH** are not at level E.

Table: CLM_VWS_PRECIP_DAILY

- If both DAY_PRECIPITATION and DAY_SNOWFALL are null, record should be deleted

  Error Message: **CLM_VWS_PRECIP_DAILY**-E-1, All data fields are null, delete record.

Tables: CLM_VWS_PRECIP_DAILY, CLM_OWS_PRECIP_DAILY

- Matching records (WEATHER_STATION_ID, VWS_ID, WS_DATE) in CLM_OWS_PRECIP_DAILY must exist and be at level E

  Error Message: **CLM_VWS_PRECIP_DAILY**-E-2, All matching records in **CLM_OWS_PRECIP_DAILY** are not at level E.

Tables: CLM_VWS_PRECIP_MONTH, CLM_VWS_PRECIP_DAILY

- Matching records (VWS_ID, **CLM_VWS_PRECIP_MONTH**.YEAR = **CLM_VWS_PRECIP_DAILY**.(vws_date, 'YYYY'), and **CLM_VWS_PRECIP_MONTH**.MONTH = **CLM_VWS_PRECIP_DAILY**.(ws_date, 'MM')) in **CLM_VWS_PRECIP_DAILY** must be at level E

  Error Message: **CLM_VWS_PRECIP_MONTH**-E-1, All matching records in **CLM_VWS_PRECIP_DAILY** are not at level E.

Tables: CLM_VWS_TEMP_ANNUAL, CLM_VWS_TEMP_MONTH

- Matching records (VWS_ID, YEAR) in **CLM_VWS_TEMP_MONTH** must be at level E

  Error Message: **CLM_VWS_TEMP_ANNUAL**-E-1, All matching records in **CLM_VWS_TEMP_MONTH** are not at level E.

Table: CLM_VWS_TEMP_DAILY

- MIN_DAY_TEMP <= MEAN_DAY_TEMP <= MAX_DAY_TEMP

  Error Message: **CLM_VWS_TEMP_DAILY**-E-1, The mean daily temperature {MEAN_DAY_TEMP} is not between maximum {MAX_DAY_TEMP} and minimum {MIN_DAY_TEMP} daily extremes.

- MIN_DAY_TEMP <= MAX_DAY_TEMP

  Error Message: **CLM_VWS_TEMP_DAILY**-E-2, The maximum temperature {MAX_DAY_TEMP} is less than the minimum temperature {MIN_DAY_TEMP}.

- If MIN_DAY_TEMP, MEAN_DAY_TEMP, and MAX_DAY_TEMP are null, record should be deleted

Error Message: **CLM_VWS_TEMP_DAILY**-E-3, All data fields are null, delete record.

- For matching WEATHER_STATION_ID and CLM_VWS_TEMP_MONTH.YEAR = TO_NUMBER(TO_CHAR(ws_date, 'YYYY')) and CLM_VWS_TEMP_MONTH.MONTH = TO_NUMBER(TO_CHAR(ws_date, 'MM')), the CLM_VWS_TEMP_MONTH.MEAN_MON_TEMP_STDEV cannot be zero

  Error Message: **CLM_VWS_TEMP_DAILY**-E-4, The standard deviation for mean month temperature in the VWS month table is zero.

- For matching WEATHER_STATION_ID and CLM_VWS_TEMP_MONTH.YEAR = TO_NUMBER(TO_CHAR(ws_date, 'YYYY')) and CLM_VWS_TEMP_MONTH.MONTH = TO_NUMBER(TO_CHAR(ws_date, 'MM')), the CLM_VWS_TEMP_MONTH.MAX_MON_TEMP_STDEV cannot be zero

  Error Message: **CLM_VWS_TEMP_DAILY**-E-5, The standard deviation for max month temperature in the VWS month table is zero.

- For matching WEATHER_STATION_ID and CLM_VWS_TEMP_MONTH.YEAR = TO_NUMBER(TO_CHAR(ws_date, 'YYYY')) and CLM_VWS_TEMP_MONTH.MONTH = TO_NUMBER(TO_CHAR(ws_date, 'MM')), the CLM_VWS_TEMP_MONTH.MIN_MON_TEMP_STDEV cannot be zero

  Error Message: **CLM_VWS_TEMP_DAILY**-E-6, The standard deviation for min month temperature in the VWS month table is zero.

Tables: CLM_VWS_TEMP_DAILY, CLM_OWS_TEMP_DAILY

- Matching records (WEATHER_STATION_ID, VWS_ID, WS_DATE) in CLM_OWS_TEMP_DAILY must exist and be at level E

  Error Message: **CLM_VWS_TEMP_DAILY**-E-7, All matching records in CLM_OWS_TEMP_DAILY are not at level E.

Tables: CLM_VWS_TEMP_MONTH, CLM_VWS_TEMP_DAILY

- Matching records (VWS_ID, **CLM_VWS_TEMP_MONTH**.YEAR = **CLM_VWS_TEMP_DAILY**.(vws_date, 'YYYY'), and **CLM_VWS_TEMP_MONTH**.MONTH = **CLM_VWS_TEMP_DAILY**.(ws_date, 'MM')) in **CLM_VWS_TEMP_DAILY** must be at level E

  Error Message: **CLM_VWS_TEMP_MONTH**-E-1, All matching records in **CLM_VWS_TEMP_DAILY** are not at level E.

Tables: CLM_VWS_WIND_ANNUAL, CLM_VWS_WIND_MONTH

- Matching records (VWS_ID,YEAR) in **CLM_VWS_WIND_MONTH** must be at level E

  Error Message: **CLM_VWS_WIND_MONTH**-E-1, All matching records in **CLM_VWS_WIND_MONTH** are not at level E.

Table: CLM_VWS_WIND_DAILY

- MEAN_DAY_WIND_SPD <= MAX_DAY_WIND_SPD

  Error Message: **CLM_VWS_WIND_DAILY**-E-1, The mean day wind speed {MEAN_DAY_WIND_SPD} is greater than the max day wind speed {MAX_DAY_WIND_SPD}.

- If both MEAN_DAY_WIND_SPD and MAX_DAY_WIND_SPD are null, record should be deleted

  Error Message: **CLM_VWS_WIND_DAILY**-E-2, All data fields are null, delete record.

Tables: CLM_VWS_WIND_DAILY, CLM_OWS_WIND_DAILY

- Matching records (WEATHER_STATION_ID, VWS_ID, WS_DATE) in CLM_OWS_WIND_DAILY must exist and be at level E

  Error Message: **CLM_VWS_TEMP_DAILY**-E-3, All matching records in CLM_OWS_WIND_DAILY are not at level E.

Tables: CLM_VWS_WIND_MONTH, CLM_VWS_WIND_DAILY

- Matching records (VWS_ID, **CLM_VWS_WIND_MONTH**.YEAR = **CLM_VWS_WIND_DAILY**.(vws_date, 'YYYY'), and **CLM_VWS_WIND_MONTH**.MONTH = **CLM_VWS_WIND_DAILY**.(ws_date, 'MM')) in **CLM_VWS_WIND_DAILY** must be at level E

  Error Message: **CLM_VWS_WIND_MONTH**-E-1, All matching records in **CLM_VWS_WIND_DAILY** are not at level E.

13.0 SPS1 CONSTRUCTION

13.1 Level 1

A. Initial Level

Records in the IMS are at Level A when they first enter the system and are set back to A when changes are made to a given record or to selected related records.

B. Dependency Checks

Dependency checks (B) are performed on records at level A. These checks are performed to ensure that essential data (data which are required to properly reference all other data) are present and adequate. For SPS1 sections, the dependency checks are performed for specific SPS sections (SINIT).

Four types of checks are performed for the SINIT checks; INIT B - an experiment verification check, INIT C- a minimum data check, INIT D - an expanded range check, and INIT E - an intramodular check. Each of these checks are specified below. **A Project record must be at level E in SPS_PROJECT_STATIONS prior to a section passing the level B check for the remaining tables. (See SPS2 Construction Table Dependency Checks at the end of this section.)**

SINIT B Checks (Section Experiment Verification Checks)

Tables: SPS_ID, SPS_PROJECT_STATIONS, SPS1_LAYER

- For each SPS1 record in **SPS1_LAYER**, the corresponding Project Level record must be at level E in **SPS_ID** and **SPS_PROJECT_STATIONS**

SINIT C Checks (Section Minimum Data Checks)

Minimum data checks for the section data tables are listed below. Data fields with a Condition of "X" must always contain a non-null value, however, data fields with a Condition of "*" are only required to
contain a non-null value if a particular condition is met as specified in the accompanying field explanation.

Table	Field	Condition
SPS1_LAYER	DESCRIPTION	X
	LAYER_NO	X
	MATERIAL_TYPE	X
	MEAN_THICKNESS	X

SINIT D Checks (Section Minimum Data Checks)

SPS1_LAYER

DESCRIPTION	MEAN_THICKNESS
6	4.0 - 47.9
7	null
8	0.1 - 0.5
9	0.1 - 1.0
11	4.0 - 47.9

In addition, for each test section in the primary experiment, the following ranges apply for DESCRIPTION = 3, 4[1] and 5[2].

	THICKNESS[3]		
	DESCRIPTION = 3 + 4	DESCRIPTION = 5	DESCRIPTION = 5 + 5
?101	6.0 - 8.0	7.0 - 9.0	
?102	3.0 - 5.0	11.0 - 13.0	
?103	3.0 - 5.0	7.0 - 9.0	
?104	6.0 - 8.0	11.0 - 13.0	
?105	3.0 - 5.0		6.5 - 9.5
?106	6.0 - 8.0		10.5 - 13.5
?107	3.0 - 5.0		6.5 - 9.5
?108	6.0 - 8.0		10 5 - 13.5
?109	6.0 - 8.0		14.5 - 17.5

[1] If DESCRIPTION = 4 exists.

[2] Sections with a "5 + 5" DESCRIPTION must have two LAYER_NOs with a DESCRIPTION = 5. The thicknesses for these two layers should be summed.

[3] Thickness above includes the variables MEAN_THICKNESS, MAX_THICKNESS and MIN_THICKNESS. MEAN_THICKNESS is required, therefore if it is null it will not be raised above RECORD_STATUS = B. For the other two thicknesses, the check is valid only if the values exist.

	THICKNESS[3]		
	DESCRIPTION = 3 + 4	**DESCRIPTION = 5**	**DESCRIPTION = 5 + 5**
?110	6.0 - 8.0		6.5 - 9.5
?111	3.0 - 5.0		10.5 - 13.5
?112	3.0 - 5.0		14.5 - 17.5
?114	6.0 - 8.0	11.0 - 13.0	
?115	6.0 - 8.0	7.0 - 9.0	
?116	3.0 - 5.0	11.0 - 13.0	
?117	6.0 - 8.0		6.5 - 9.5
?118	3.0 - 5.0		10.5 - 13.5
?119	6.0 - 8.0		6.5 - 9.5
?120	3.0 - 5.0		10.5 - 13.5
?121	3.0 - 5.0		14.5 - 17.5
?122	3.0 - 5.0		6.5 - 9.5
?123	6.0 - 8.0		10.5 - 13.5
?124	6.0 - 8.0		14.5 - 17.5

In addition, for each test section, the following ranges apply for each DESCRIPTION (not supplementals):

DESCRIPTION	MATERIAL_TYPE
3	1
4	1
6	22 - 27, 37, 40 - 44
7	51 - 56, 57 - 65
8	74, 75
9	2

DESCRIPTION	MATERIAL_TYPE
11	51 - 56, 57 - 65

In addition, for each test section in the primary experiment, the following range applies for DESCRIPTION = 5:

SHRP_ID	MATERIAL_TYPE
?101	23
?102	23
?103	28
?104	28
?105	23, 28
?106	23, 28
?107	23, 31
?108	23, 31
?109	23, 31
?110	28, 31
?111	28, 31
?112	28, 31
?113	23
?114	23
?115	28
?116	28
?117	23, 28
?118	23, 28
?119	23, 31
?120	23, 31

SHRP_ID	MATERIAL_TYPE
?121	23, 31
?122	28, 31
?123	28, 31
?124	28, 31

SINIT E Checks (Section Intramodular Checks)

Intramodular checks for the Section tables are listed below:

Table: SPS1_LAYER

- Logical Layering Checks

  –The top layer must have a description of 3 or 9 (not supplementals)
  –A layer for DESCRIPTION = 3 cannot be below a layer for DESCRIPTION 4, 5, 6, 7, 8, 11
  –A layer for DESCRIPTION = 4 cannot be below a layer for DESCRIPTION 5, 6, 7, 11
  –A layer for DESCRIPTION = 5 cannot be below a layer for DESCRIPTION 6, 7, 11
  –A layer for DESCRIPTION = 6 cannot be below a layer for DESCRIPTION 7, 11
  –A layer for DESCRIPTION = 8 cannot be below a layer for DESCRIPTION 7, 11
  –A layer for DESCRIPTION = 9 cannot be below a layer for DESCRIPTION 3 - 8, 11
  –A layer for DESCRIPTION = 11 cannot be below a layer for DESCRIPTION = 7
  –For LAYER_NO = 1, the DESCRIPTION must always equal 7

- Layer Compatibility Checks

  –There must be a layer for DESCRIPTION of 3
  –There cannot be two layers with a DESCRIPTION of 3
  –There must be a layer with a DESCRIPTION = 4 or 5 directly beneath the layer with a DESCRIPTION = 3
  –There must be a layer for DESCRIPTION of 5
  –For SHRP_IDs like ?105-?112 and ?117-?124 there must be two layers with a DESCRIPTION = 5
  –There cannot be two layers with a DESCRIPTION = 7
  –For SHRP_IDs like ?101-?106 and ?113-?118, there cannot be a layer with a DESCRIPTION of 8
  –There cannot be two layers with a DESCRIPTION of 9

SPS1 Construction Table Dependency Checks

- All records in each Construction table are checked against **SPS_PROJECT_STATIONS** for matching project level ID. If the corresponding project level records are at level E in **SPS_PROJECT_STATIONS**, the records in the construction tables go to level B.

C. Minimum Data Checks

Minimum data checks for all SPS1 Construction data tables are identified below. Data fields with a Condition of X must always contain a non-null value, however, data fields with a Condition of * are only required to contain a non-null value if a particular condition is met as specified in the accompanying field explanation.

Table	Field	Condition
SPS1_LAYER_THICKNESS	DENSE_GRADE_AGG_BASE	*
	*Only for SHRP_ID = ?101, ?102, ?113, or ?114	
	DENSE_GRD_ASPH_TREAT_BASE	**
	**Only for SHRP_ID = ?103, ?106, ?110, ?112, ?115 - ?118, or ?122-?124	
	OFFSET	X
	PERM_ASPH_TREAT_BASE	***
	***Only for SHRP_ID = ?107 - ?112, or ?119 - ?124	
	STATION_NO	X
	SURFACE_AND_BINDER	X
SPS1_NOTES_AND_COMMENTS	No level C checks	
SPS1_PMA_AC_PROPERTIES	ASPHALT_GRADE	X
	LAYER_NO	X
	SOURCE	X
SPS1_PMA_AGGREGATE_PROP	AGGR_COMB_BULK_SPEC	X
	AGGR_COMP_PERCENT_C1	X
	AGGR_COMP_PERCENT_F1	X
	AGGR_COMP_TYPE_C1	X
	AGGR_COMP_TYPE_F1	X
	COARSE_AGGR_BULK_SPEC	X
	FINE_AGGR_BULK_SPEC	X
	LAYER_NO	X
SPS1_PMA_COMPACTION	COMPACTED_THICK	X
	LAYER_NO	X
	LIFT_NO	X
SPS1_PMA_CONSTRUCTION	LAYER_NO	X
	MEAN_MIXING_TEMP	X
SPS1_PMA_DENSITY_PROFILE	AVERAGE_ATB	*
	AVERAGE_BINDER	*
	AVERAGE_FRICTION	*
	AVERAGE_SURFACE	*
	LAYER_NO_ATB	*
	LAYER_NO_BINDER	*
	LAYER_NO_FRICTION	*
	*One combination of (AVERAGE_* and LAYER_NO_*) or (PROFILE_INDEX and PROFILOGRAPH_TYPE) is required	

	LAYER_NO_SURFACE	*
	PROFILE_INDEX	*
	PROFILOGRAPH_TYPE	*
SPS1_PMA_MIXTURE_PROP	ASPHALT_CONTENT_MEAN	X
	ASPHALT_PLANT_TYPE	X
	BULK_SPEC_GRAVITY_MEAN	X
	EFF_ASPHALT_CONTENT	X
	LAYER_NO	X
	MAX_SPEC_GRAVITY	X
	SAMPLE_TYPE	X
	PCT_AIR_VOIDS_MEAN	X
	VOIDS_MINERAL_AGGR	X
SPS1_PMA_PLACEMENT_DATA	AC_SURFACE_1ST_THICK	X
	ATB_1ST_THICK	*
	*only if SHRP_ID = ?103 - ?106, ?110 - ?112, ?115 - ?118, or ?122 - ?124	
	LAYDOWN_WIDTH	X
	LAYER_NO_AC_SURFACE	X
	LAYER_NO_ATB	*
	LAYER_NO_PATB	**
	PATB_1ST_THICK	**
	**only if SHRP_ID =?107 - ?112 or ?119 - ?124	
SPS1_PMA_ROLLER	LAYER_NO	X
	ROLLER_CODE	X
	ROLLER_CODE_DESC	X
	ROLLER_GROSS_WT	X
SPS1_SUBGRADE_PREP	COMPACTION_EQUIP_TYPE	X
	GROSS_WEIGHT	X
SPS1_UNBOUND_AGG_BASE	COMPACTION_TYPE	X
	FIRST_LIFT_THICKNESS	X
	GROSS_WEIGHT	X
	LAYER_NO	X

D. Expanded Range Checks

Expanded range checks are applied to certain fields to identify data element values that fall outside an expected range. Field names are listed below the bolded table name.

Table	Units	Range
SPS1_LAYER_THICKNESS		
DENSE_GRADE_AGG_BASE	in	0 - 13
DENSE_GRD_ASPH_TREAT_BASE	in	0 - 13
OFFSET	in	0 - 168
PERM_ASPH_TREAT_BASE	in	0 - 5
STATION_NO	ft	0 - 500
SURFACE_AND_BINDER	in	0 - 8
SURFACE_FRICTION	in	0 - 3
SPS1_NOTES_AND_COMMENTS		

No level D checks

SPS1_PMA_AC_PROPERTIES

ASPHALT_GRADE		1 - 40, 99
ASPHALT_SPECIFIC_GRAVITY		0.9 - 1.1
ASPHALT_VISCOSITY_140	poise	500 - 20000
ASPHALT_VISCOSITY_275	centistokes	100 - 1200
DUCTILITY_77	cm	8 - 150
LAYER_NO		> 1
MODIFIER_1		1 - 27
MODIFIER_2		1 - 27
PENETRATION_770	.1 mm	20 - 250
RING_BALL_SOFT_PT	deg F	50 - 200

SPS1_PMA_AGGREGATE_PROP

AGGR_COMB_BULK_SPEC		1 - 4
AGGR_COMP_PERCENT_C1	%	0 - 100
AGGR_COMP_PERCENT_C2	%	0 - 100
AGGR_COMP_PERCENT_C3	%	0 - 100
AGGR_COMP_PERCENT_F1	%	0 - 100
AGGR_COMP_PERCENT_F2	%	0 - 100
AGGR_COMP_PERCENT_F3	%	0 - 100
AGGR_COMP_TYPE_C1		1 - 6
AGGR_COMP_TYPE_C2		1 - 6
AGGR_COMP_TYPE_C3		1 - 6
AGGR_COMP_TYPE_F1		1 - 4
AGGR_COMP_TYPE_F2		1 - 4
AGGR_COMP_TYPE_F3		1 - 4
AGGR_DUR_TYPE_C1		1 - 11
AGGR_DUR_TYPE_C2		1 - 11
AGGR_DUR_TYPE_C3		1 - 11
AGGR_DUR_TYPE_M1		1 - 11
AGGR_DUR_RESULT_C1	%	0 - 90
AGGR_DUR_RESULT_C2	%	0 - 90
AGGR_DUR_RESULT_C3	%	0 - 90
AGGR_DUR_RESULT_M1	%	0 - 90
COARSE_AGGR_BULK_SPEC		1 - 4
EFFECTIVE_SPEC_GRAVITY		1 - 4
FINE_AGGR_BULK_SPEC		1 - 4
LAYER_NO		> 1
MINERAL_FILLER		1 - 5
MINERAL_FILLER_BULK_SPEC		1 - 4
POLISH_VALUE		0 - 50

SPS1_PMA_COMPACTION

BREAKDOWN_ROLLER_CODE		A - Q
COMPACTED_THICK	in	1 - 8
FINAL_ROLLER_CODE		A - Q
INTERMED_ROLLER_CODE		A - Q
LAYER_NO		> 1
MEAN_AIR_TEMP	deg F	40 - 120

SPS1_PMA_CONSTRUCTION

LAYDOWN_TEMP_MAX	deg F	150 - 400
LAYDOWN_TEMP_MEAN	deg F	150 - 400
LAYDOWN_TEMP_MIN	deg F	150 - 400

LAYDOWN_TEMP_STD_DEV		0 - 50
LAYER_NO		> 1
MEAN_MIXING_TEMP	deg F	150 - 400

SPS1_PMA_DENSITY_PROFILE

ATB_MEASURE		A, C
AVERAGE_ATB	pcf	100 - 160
AVERAGE_BINDER	pcf	100 - 160
AVERAGE_FRICTION	pcf	100 - 160
AVERAGE_SURFACE	pcf	100 - 160
BINDER_MEASURE		A, C
BLANK_BAND_HEIGHT	in	0 - 0.5
FRICTION_MEASURE		A, C
GAUGE_COUNT_RATE		0 - 9999
INTERP_METHOD		1 - 3
LAYER_NO_ATB		> 1
LAYER_NO_BINDER		> 1
LAYER_NO_FRICTION		> 1
LAYER_NO_SURFACE		> 1
MAXIMUM_ATB	pcf	100 - 160
MAXIMUM_BINDER	pcf	100 - 160
MAXIMUM_FRICTION	pcf	100 - 160
MAXIMUM_SURFACE	pcf	100 - 160
MINIMUM_ATB	pcf	100 - 160
MINIMUM_BINDER	pcf	100 - 160
MINIMUM_FRICTION	pcf	100 - 160
MINIMUM_SURFACE	pcf	100 - 160
SURFACE_MEASURE		A, C
PROFILE_INDEX	in/mi	0 - 20
PROFILOGRAPH_TYPE		1 - 2

SPS1_PMA_MIXTURE_PROP

ANTISTRIP_AGENT_AMOUNT	%	0 - 5
ANTISTRIP_AGENT_CODE		1 - 2
ANTISTRIP_AGENT_TYPE		0 - 70
ASPHALT_CONTENT_MAX	%	1 - 10
ASPHALT_CONTENT_MEAN	%	1 - 10
ASPHALT_CONTENT_MIN	%	1 - 10
ASPHALT_PLANT_TYPE		1 - 3
BULK_SPEC_GRAVITY_MAX		1 - 4
BULK_SPEC_GRAVITY_MEAN		1 - 4
BULK_SPEC_GRAVITY_MIN		1 - 4
EFF_ASPHALT_CONTENT	%	1 - 10
HVEEM_STABILITY		25 - 50
LAYER_NO		> 1
MARSHALL_FLOW	.01 in	0 - 25
MARSHALL_STABILITY	lb	1200 - 5000
MAX_SPEC_GRAVITY		1 - 4
NO_SAMP_PCT_AIR_VOIDS		>= 1
NUMBER_OF_BLOWS		50, 75
PCT_AIR_VOIDS_MAX	%	0 - 10
PCT_AIR_VOIDS_MEAN	%	0 - 10
PCT_AIR_VOIDS_MIN	%	0 - 10
PCT_AIR_VOIDS_STD_DEV	%	0 - 5
SAMPLE_TYPE		1 - 2
VOIDS_MINERAL_AGGR	%	10 - 20

SPS1_PMA_PLACEMENT_DATA

AC_BINDER_1ST_THICK	in	1 - 4
AC_BINDER_2ND_THICK	in	1 - 4
AC_BINDER_3RD_THICK	in	1 - 4
AC_SURFACE_1ST_THICK	in	1 - 4
AC_SURFACE_2ND_THICK	In	1 - 4
AC_SURFACE_3RD_THICK	In	1 - 4
ATB_1ST_THICK	in	1 - 8
ATB_2ND_THICK	in	1 - 4
ATB_3RD_THICK	in	1 - 4
ATB_4TH_THICK	in	1 - 4
ATB_5TH_THICK	in	1 - 4
BINDER_COURSE_STATION		null
LAYDOWN_WIDTH	ft	10 - 14
LAYER_NO_AC_BINDER		> 1
LAYER_NO_AC_SURFACE		> 1
LAYER_NO_ATB		> 1
LAYER_NO_PATB		> 1
LAYER_NO_SURFACE_FRICTION		> 1
LAYER_NO1_1		> 1
LAYER_NO1_2		> 1
LAYER_NO1_3		> 1
LAYER_NO2_1		> 1
LAYER_NO2_2		> 1
LAYER_NO2_3		> 1
LAYER_NO3_1		> 1
LAYER_NO3_2		> 1
LAYER_NO3_3		> 1
LONG_SURFACE_JOINT_LOC		1, 2
OFFSET	ft	10 - 14
PATB_1ST_THICK	in	1 - 5
PATB_2ND_THICK	in	1 - 4
PLANT_TYPE1		1 - 3
PLANT_TYPE2		1 - 3
PLANT_TYPE3		1 - 3
SURF_FRICTION_STATION		null
SURFACE_COURSE_STATION		null
SURFACE_FRICTION_THICK	in	0.75 - 4

SPS1_PMA_ROLLER

LAYER_NO		1- 20
ROLLER_CODE		A - Q
ROLLER_FREQ	vib/min	2000 - 3000 (I - P)
ROLLER_GROSS_WT	tons	0 - 20 (A - D, I - P) 0 - 50 (E - H)
ROLLER_SPEED	mph	0 - 10
ROLLER_TIRE_PRES	psi	50 - 100 (E - H)

SPS1_SUBGRADE_PREP

COMPACTION_EQUIP_TYPE		1 - 6
GROSS_WEIGHT	tons	5 - 20
STABIL_AGENT1		1 - 5
STABIL_AGENT1_PERCENT	%	1 - 10
STABIL_AGENT2		1 - 5
STABIL_AGENT2_PERCENT	%	1 - 10

SPS1_UNBOUND_AGG_BASE

COMPACTION_TYPE		1 - 5
FIRST_LIFT_THICKNESS	in	1 - 12
FOURTH_LIFT_THICKNESS	in	1 - 12
GROSS_WEIGHT	tons	5 - 50
LAYER_NO		> 1
SECOND_LIFT_THICKNESS	in	1 - 12
THIRD_LIFT_THICKNESS	in	1 - 12

E. Intramodular Checks

Intramodular checks for all SPS1 Construction data tables are specified below.

Table: SPS1_LAYER

- No level E checks

Table: SPS1_LAYER_THICKNESS

- No level E checks

Table: SPS1_NOTES_AND_COMMENTS

- No level E checks

Table: SPS1_PMA_AC_PROPERTIES

- DUCTILITY_77 >= DUCTILITY_39

  Error Message: SPS1_PMA_AC_PROPERTIES-E-1, DUCTILITY_77 must be >= DUCTILITY_39.

Tables: SPS1_PMA_AGGREGATE_PROP, SPS1_PMA_AC_PROPERTIES, SPS1_PMA_MIXTURE_PROP

- AGGR_COMB_BULK_SPEC = 100/(P1/G1 + P2/G2 + P3/G3) [+ or – 2%]
  where: P_1 = AGGR_COMP_TYPE_C1 + AGGR_COMP_TYPE_C2 + AGGR_COMP_TYPE_C3
  P_2 = AGGR_COMP_TYPE_F1 + AGGR_COMP_TYPE_F2 + AGGR_COMP_TYPE_F3
  P_3 = 100 - (P1 + P2)
  G_1 = COARSE_AGGR_BULK_SPEC
  G_2 = FINE_AGGR_BULK_SPEC
  G_3 = MINERAL_FILLER_BULK_SPEC

  Error Message: **SPS1_PMA_AGGREGATE_PROP**-E-1, AGGR_COMB_BULK_SPEC must be equal to the equation above. Check input of all appropriate values.

- EFFECTIVE_SPEC_GRAVITY = (100 -

SPS1_PMA_MIXTURE_PROP.ASPHALT_CONTENT_MEAN)/
[(100/**SPS1_PMA_MIXTURE_PROP**.MAX_SPEC_GRAVITY) -
(ASPHALT_CONTENT_MEAN/**SPS1_PMA_AC_PROPERTIES**.
ASPHALT_SPECIFIC_GRAVITY)]

Error Message: **SPS1_PMA_AGGREGATE_PROP**-E-9, EFFECTIVE_SPECIFIC_GRAVITY must be equal to the equation above. Check all appropriate values.

Tables: SPS1_PMA_COMPACTION and SPS1_PMA_ROLLER

- For a given BREAKDOWN_ROLLER_CODE in **SPS1_PMA_COMPACTION**, a matching ROLLER_CODE must exist in **SPS1_PMA_ROLLER**

  Error Message: **SPS1_PMA_COMPACTION**-E-1, for a given BREAKDOWN_ROLLER_CODE in **SPS1_PMA_COMPACTION**, a matching ROLLER_CODE must exist in **SPS1_PMA_ROLLER**.

- For a given INTERMED_ROLLER_CODE in **SPS1_PMA_COMPACTION**, a matching ROLLER_CODE must exist in **SPS1_PMA_ROLLER**

  Error Message: **SPS1_PMA_COMPACTION**-E-2, for a given INTERMED_ROLLER_CODE in **SPS1_PMA_COMPACTION**, a matching ROLLER_CODE must exist in **SPS1_PMA_ROLLER**.

- For a given FINAL_ROLLER_CODE in **SPS1_PMA_COMPACTION**, a matching ROLLER_CODE must exist in **SPS1_PMA_ROLLER**

  Error Message: **SPS1_PMA_COMPACTION**-E-3, for a given FINAL_ROLLER_CODE in **SPS1_PMA_COMPACTION**, a matching ROLLER_CODE must exist in **SPS1_PMA_ROLLER**.

Table: SPS1_PMA_CONSTRUCTION

- DATE_COMPLETE >= DATE_BEGAN

  Error Message: **SPS1_PMA_CONSTRUCTION**-E-1, DATE_COMPLETE must be >= DATE_BEGAN.

- LAYDOWN_TEMP_MIN <= LAYDOWN_TEMP_MEAN <= LAYDOWN_TEMP_MAX

  Error Message: **SPS1_PMA_CONSTRUCTION**-E-2, the following relationship must exist: LAYDOWN_TEMP_MIN <= LAYDOWN_TEMP_MEAN <= LAYDOWN_TEMP_MAX.

Table: SPS1_PMA_DENSITY_PROFILE

- MINIMUM_ATB <= AVERAGE_ATB <= MAXIMUM_ATB

  Error Message: **SPS1_PMA_DENSITY_PROFILE**-E-1, the following relationship must exist: MINIMUM_BINDER <= AVERAGE_BINDER <= MAXIMUM_BINDER.

- MINIMUM_BINDER <= AVERAGE_BINDER <= MAXIMUM_BINDER

Error Message: **SPS1_PMA_DENSITY_PROFILE**-E-2, the following relationship must exist: MINIMUM_BINDER <= AVERAGE_BINDER <= MAXIMUM_BINDER.

- MINIMUM_SURFACE <= AVERAGE_SURFACE <= MAXIMUM_SURFACE

  Error Message: **SPS1_PMA_DENSITY_PROFILE**-E-3, In **SPS1_PMA_DENSITY_PROFILE**, MINIMUM_SURFACE <= AVERAGE_SURFACE <= MAXIMUM_SURFACE.

- MINIMUM_FRICTION <= AVERAGE_FRICTION <= MAXIMUM_FRICTION

  Error Message: **SPS1_PMA_DENSITY_PROFILE**-E-4, In **SPS1_PMA_DENSITY_PROFILE**, MINIMUM_FRICTION <= AVERAGE_FRICTION <= MAXIMUM_FRICTION.

Table: SPS1_PMA_MIXTURE_PROP

- BULK_SPEC_GRAVITY_MIN <= BULK_SPEC_GRAVITY_MEAN <= BULK_SPEC_GRAVITY_MAX

  Error Message: **SPS1_PMA_MIXTURE_PROP**-E-1, the following relationship must exist: BULK_SPEC_GRAVITY_MIN <= BULK_SPEC_GRAVITY_MEAN <= BULK_SPEC_GRAVITY_MAX.

- ASPHALT_CONTENT_MIN <= ASPHALT_CONTENT_MEAN <= ASPHALT_CONTENT_MAX

  Error Message: **SPS1_PMA_MIXTURE_PROP**-E-2, the following relationship must exist: ASPHALT_CONTENT_MIN <= ASPHALT_CONTENT_MEAN <= ASPHALT_CONTENT_MAX.

- PCT_AIR_VOIDS_MIN <= PCT_AIR_VOIDS_MEAN <= PCT_AIR_VOIDS_MAX

  Error Message: **SPS1_PMA_MIXTURE_PROP**-E-3, the following relationship must exist: PCT_AIR_VOIDS_MIN <= PCT_AIR_VOIDS_MEAN <= PCT_AIR_VOIDS_MAX.

- If ASPHALT_PLANT_TYPE = 3, then ASPHALT_PLANT_TYPE_OTHER must be non-null

  Error Message: **SPS1_PMA_MIXTURE_PROP**-E-4, if asphalt_plant_type = 3, then asphalt_plant_type_other must be non-null.

- If ANTISTRIP_AGENT_TYPE = 70 then ANTISTRIP_AGENT_TYPE_OTHER must be non-null

  Error Message: **SPS1_PMA_MIXTURE_PROP**-E-5, if antistrip_agent_type = 70 then antistrip_agent_type_other must be non-null.

- Either HVEEM_COHESIOMETER and HVEEM STABILITY or MARSHALL_FLOW, MARSHALL_STABILITY, and NUMBER_OF_BLOWS must be non-null

  Error Message: **SPS1_PMA_MIXTURE_PROP**-E-6, either HVEEM_COHESIOMETER and HVEEM STABILITY or MARSHALL_FLOW, MARSHALL_STABILITY, and NUMBER_OF_BLOWS must be non-null.

Table: SPS1_PMA_PLACEMENT_DATA

- DATE_COMPLETE >= DATE_BEGAN

  Error Message: **SPS1_PMA_PLACEMENT_DATA**-E-1, DATE_COMPLETE must be >= DATE_BEGAN.

Table: SPS1_PMA_ROLLER

- If ROLLER_CODE = A, B, C, or D, then ROLLER_TIRE_PRES, ROLLER_FREQ, ROLLER_AMP, and ROLLER_SPEED must be null

  Error Message: **SPS1_PMA_ROLLER**-E-1, if ROLLER_CODE = A, B, C, or D, then ROLLER_TIRE_PRES, ROLLER_FREQ, ROLLER_AMP, and ROLLER_SPEED must be null.

- If ROLLER_CODE = E, F, G, or H, then ROLLER_FREQ, ROLLER_AMP, and ROLLER_SPEED must be null

  Error Message: **SPS1_PMA_ROLLER**-E-2, if ROLLER_CODE = E, F, G, or H, then ROLLER_FREQ, ROLLER_AMP, and ROLLER_SPEED must be null.

- If ROLLER_CODE = I, J, K, L, M, N, O, or P, then ROLLER_TIRE_PRES must be null

  Error Message: **SPS1_PMA_ROLLER**-E-3, if ROLLER_CODE = I, J, K, L, M, N, O, or P, then ROLLER_TIRE_PRES must be null.

Table: SPS1_SUBGRADE_PREP

- DATE_COMPLETE >= DATE_BEGAN

  Error Message: **SPS1_SUBGRADE_PREP**-E-1, DATE_COMPLETE must be >= DATE_BEGAN.

- If STABIL_AGENT1 <> 5
  then STABIL_AGENT1 = STABIL_AGENT2

  Error Message: **SPS1_SUBGRADE_PREP**-E-2, if STABIL_AGENT1 <> 5, then STABIL_AGENT1 must be equal STABIL_AGENT2.

Table: SPS1_UNBOUND_AGG_BASE

- DATE_COMPLETE >= DATE_BEGAN

  Error Message: **SPS1_UNBOUND_AGG_BASE**-E-1, DATE_COMPLETE must be >= DATE_BEGAN.

In addition, the checks listed in Table 13-1 are required for the identified tables and elements.

Table 13-1. Additional Level E Checks

Error Code	If the data element below	has a code of	then a non-null entry must exist in the data element below
	SPS1_PMA_AC_PROPERTIES		
E-2	ASPHALT_GRADE	17, 35, 99	ASPHALT_GRADE_OTHER
E-3	SOURCE	77	SOURCE_OTHER
E-4	MODIFIER_1	27	MODIFIER_1_OTHER
E-5	MODIFIER_2	27	MODIFIER_2_OTHER
	SPS1_PMA_AGGREGATE_PROP		
E-2	AGGR_COMP_TYPE_C1	6	AGGR_COMP_TYPE_C1_OTHER
E-3	AGGR_COMP_TYPE_C2	6	AGGR_COMP_TYPE_C2_OTHER
E-4	AGGR_COMP_TYPE_C3	6	AGGR_COMP_TYPE_C3_OTHER
E-5	AGGR_COMP_TYPE_F1	4	AGGR_COMP_TYPE_F1_OTHER
E-6	AGGR_COMP_TYPE_F2	4	AGGR_COMP_TYPE_F2_OTHER
E-7	AGGR_COMP_TYPE_F3	4	AGGR_COMP_TYPE_F3_OTHER
E-8	MINERAL_FILLER	5	MINERAL_FILLER_OTHER
	SPS1_PMA_PLACEMENT_DATA		
E-2	PLANT_TYPE1	3	PLANT_TYPE_OTHER1
E-3	PLANT_TYPE2	3	PLANT_TYPE_OTHER2
E-4	PLANT_TYPE3	3	PLANT_TYPE_OTHER2
	SPS1_SUBGRADE_PREP		
E-3	COMPACTION_EQUIP_TYPE	6	COMPACTION_EQUIP_TYPE_OTHER
E-4	STABIL_AGENT1	5	STABIL_AGENT1_OTHER
E-5	STABIL_AGENT2	5	STABIL_AGENT2_OTHER
	SPS1_UNBOUND_AGG_BASE		
E-2	COMPACTION_TYPE	5	COMPACTION_TYPE_OTHER

14.0 SPS2 CONSTRUCTION

14.1 Level 1

A. Initial Level

Records in the IMS are at Level A when they first enter the system and are set back to A when changes are made to a given record or to selected related records.

B. Dependency Checks

Dependency checks (B) are performed on records at level A. These checks are performed to ensure that essential data (data which are required to properly reference all other data) are present and adequate. For SPS2 sections, the dependency checks are performed for specific SPS sections (SINIT).
Four types of checks are performed for the SINIT checks; INIT B - an experiment verification check, INIT C - a minimum data check, INIT D - an expanded range check and INIT E - an intramodular check. Each of these checks are specified below. **A Project record must be at level E in SPS_PROJECT_STATIONS prior to a section passing the level B check for the remaining tables. (See SPS2 Construction Table Dependency Checks at the end of this section.)**

SINIT B Checks (Section Experiment Verification Checks)

- For each SPS2 record in **SPS2_LAYER** the corresponding SPS2 Project record in **SPS_ID** and **SPS_PROJECT_STATIONS** must be at Level E

SINIT C Checks (Section Minimum Data Checks)

Minimum data checks for the SPS2 Section data tables are listed below. Data fields with a Condition of X must always contain a non-null value, however, data fields with a Condition of * are only required to contain a non-null value if a particular condition is met as specified in the accompanying field explanation.

Table	Field	Condition
SPS2_LAYER	DESCRIPTION	X
	LAYER_NO	X
	MATERIAL_TYPE	X
	MEAN_THICKNESS	*
	*For LAYER_NO > 1	

SINIT D Checks (Section Expanded Range Checks)

Expanded range checks are applied to certain fields to identify data element values that fall outside an expected range. Field names are listed below the bolded table name. Expanded range checks for SPS2 Section data table is listed below:

SPS2_LAYER

DESCRIPTION can only equal: 3, 5, 6, 7, 8, or 11 (not supplementals).

The following ranges are valid for the given DESCRIPTION:

DESCRIPTION	THICKNESS[1]
6	4.0 - 47.9
7	null
8	0.1 - 0.5
11	4.0 - 47.9

The following ranges apply for DESCRIPTION = 3 and 5:

SHRP_ID	THICKNESS[1]		
	DESCRIPTION = 3	DESCRIPTION = 5	DESCRIPTION = 5 + 5[2]
?201, ?202, ?205, ?206, ?213, ?214, ?217, ?218, ?225, ?227, ?231, ?233, ?237, ?238, ?245, ?246	7.0 - 9.0	5.0 - 7.0	
?203, ?204, ?207, ?208, ?215, ?216, ?219, ?220, ?226, ?228, ?232, ?234, ?239, ?240, ?247, ?248	10.0 - 12.0	5.0 - 7.0	
?209, ?210, ?221, ?222, ?229, ?235, ?241, ?242, ?249, ?250	7.0 - 9.0		6.5 - 9.5
?211, ?212, ?223, ?224, *?230, ?236, ?243, ?244, ?251, ?252*	10.0 - 12.0		6.5 - 9.5

The following ranges apply for each DESCRIPTION:

---

[1] Thickness above includes the variables MEAN_THICKNESS, MAX_THICKNESS and MIN_THICKNESS. MEAN_THICKNESS is required, therefore if it is null it will not be raised above RECORD_STATUS = B. For the other two thicknesses, the check is valid only if the values exist.

[2] Sections with a "5+5" DESCRIPTION must have two LAYER_NOs with a DESCRIPTION = 5. The thicknesses for these two layers should be summed.

DESCRIPTION	MATERIAL_TYPE
6	22 - 27, 37, 40 - 44
7	51 - 65
8	74, 75
11	51 - 65

The following ranges apply for a DESCRIPTION = 3:

SHRP_ID	MATERIAL_TYPE
?201 - ?236	4
?237 - ?252	5

The following ranges apply for a DESCRIPTION = 5:

SHRP_ID	MATERIAL_TYPE
?201, ?202, ?203, ?204, ?213, ?214, ?215, ?216, ?225, ?226, ?231, ?232, ?237, ?238, ?239, ?240, ?245, ?246, ?247, ?248	2
?205, ?206, ?207, ?208, ?217, ?218, ?219, ?220, ?227, ?228, ?233, ?234	38
?209, ?210, ?211, ?212, ?221, ?222, ?223, ?224, ?229, ?230, ?235, ?236, ?241, ?242, ?243, ?244, ?249, ?250, ?251, ?252	23, 31

SINIT E Checks (Section Intramodular Checks)

SPS2_LAYER

- Logical Layering Checks

  – The top layer can only have a DESCRIPTION of 3 (not supplementals)
  – A DESCRIPTION = 3 must not be designated for a layer below a layer with a DESCRIPTION = 5, 6, 7, 8, or 11
  – A DESCRIPTION = 5 must not be designated for a layer below a layer with a DESCRIPTION = 6, 7, or 11
  – A DESCRIPTION = 6 must not be designated for a layer below a layer with a DESCRIPTION = 7 or 11
  – For LAYER_NO = 1, the DESCRIPTION must always equal 7
  – A DESCRIPTION = 8 must not be designated for a layer below a layer with a DESCRIPTION = 7 or 11
  – A DESCRIPTION = 11 must not be designated for a layer below a layer with a DESCRIPTION = 7

- Layer Compatibility Checks

  – There must be a layer with a DESCRIPTION of 3
  – There cannot be two layers with a DESCRIPTION of 3
  – There must be a layer with a DESCRIPTION of 5 directly below a layer with a DESCRIPTION of 3
  – There must be a layer with a DESCRIPTION of 5
  – For SHRP_IDs like ?209 - ?212, ?221 - ?224, ?229 - ?230, ?235 - ?236, ?241 - ?244 and ?249 - ?252, there must be two layers with a DESCRIPTION of 5
  – There cannot be two layers with a DESCRIPTION of 7
  – A layer with a DESCRIPTION of 8 is not allowed for sections with SHRP_ID like ?201 - ?208, ?213 - ?220, ?225 - ?228, ?231 - ?234, ?237 - ?240 and ?245 - ?248

SPS2 Construction Table Dependency Checks

- All records in each Construction table are checked against **SPS_PROJECT_STATIONS**, for matching project level ID. If the corresponding project level records are at level E in **SPS_PROJECT_STATIONS**, the records in the construction tables go to level B.

C. Minimum Data Checks

Minimum data checks for all SPS2 Construction data tables are identified below. Data fields with a Condition of X must always contain a non-null value, however, data fields with a Condition of * are only required to contain a non-null value if a particular condition is met as specified in the accompanying field explanation.

Table	Field	Condition
SPS2_LAYER_THICKNESS	DENSE_GRADE_AGG_BASE	*
	*only if SHRP_ID = ?201 - ?204, ?209 - ?212, ?213 - ?216, ?221 - ?224	
	LAYER_NO	X
	LEAN_CONCRETE	**
	**only if SHRP_ID = ?205 - ?208 or ?217 - ?220	
	OFFSET	X
	PCC_SURFACE	X
	PERM_ASPH_TREAT_BASE	***
	***only if SHRP_ID = ?209 - ?212 or ?221 - ?224	
	STATION_N0	X
SPS2_NOTES_AND_COMMENTS	No level C checks	
SPS2_PCC_FULL_DEPTH	NO_SLABS_REPLACED	X
	REASON	X
	PATCH_MATL	X
	PATCH_NO_SLAB	X
	PATCH_SF_SLAB	X
	SF_SLABS_REPLACED	X
SPS2_PCC_JOINT_DATA	AVG_CONTRACTION_SPACING	X
	JOINT_SKEWNESS	X
	LONG_TYPE	X
	SH_TRAFFIC_LANE_TYPE	X
	TRANS_METHOD	X

	TRANS_SEAL_TYPE	X
SPS2_PCC_MIXTURE_DATA	AGGR_COMP_PERCENT_F1	X
	AGGR_COMP_PERCENT_C1	X
	AGGR_COMP_TYPE_F1	X
	AGGR_COMP_TYPE_C1	X
	ALKALI_CONTENT_CEMENT	X
	CEMENT_TYPE	X
	GEOL_CLASS_COARSE_AGGR	X
	LAYER_NO	X
	MIX_DESIGN_CEMENT	X
	MIX_DESIGN_COARSE	X
	MIX_DESIGN_FINE	X
	MIX_DESIGN_WATER	X
SPS2_PCC_PLACEMENT_DATA	LAYER_NO	X
	PAVER_TYPE	X
SPS2_PCC_PROFILE_DATA	PROFILE_INDEX	*
	*****only required if state specifies smoothness	
	PROFILOGRAPH_TYPE	X
SPS2_PCC_STEEL	DEPTH_TO_REINFORCEMENT	X
	DESIGN_PERCENT_LONG_STEEL	X
	LAYER_NO	X
	LONG_BAR_DIAMETER	X
	REINFORCING_TYPE	X
	TRANSVERSE_BAR_DIAMETER	X
	TRANSVERSE_BAR_SPACING	X
SPS2_PMA_AC_PROPERTIES	ASPHALT_GRADE	X
	LAYER_NO	X
	SOURCE	X
SPS2_PMA_AGGREGATE_PROP	AGGR_COMP_PERCENT_C1	X
	AGGR_COMP_PERCENT_F1	X
	AGGR_COMP_TYPE_C1	X
	AGGR_COMP_TYPE_F1	X
	LAYER_NO	X
SPS2_PMA_COMPACTION	COMPACTED_THICK	X
	LAYER_NO	X
	LIFT_NO	X
SPS2_PMA_CONSTRUCTION	LAYER_NO	X
	MEAN_MIXING_TEMP	X
SPS2_PMA_MIXTURE_PROP	ASPHALT_CONTENT_MEAN	X
	BULK_SPEC_GRAVITY_MEAN	X
	EFF_ASPHALT_CONTENT	X
	LAYER_NO	X
	MAX_SPEC_GRAVITY	X
	PCT_AIR_VOIDS_MEAN	X
	SAMPLE_TYPE	X
	VOIDS_MINERAL_AGGR	X

SPS2_PMA_PLACEMENT_DATA	LAYER_NO_PATB	X
	PATB_1ST_THICK	X
SPS2_PMA_ROLLER	LAYER_NO	X
	ROLLER_CODE	X
	ROLLER_CODE_DESC	X
	ROLLER_GROSS_WT	X
SPS2_SUBGRADE_PREP	COMPACTION_EQUIP_TYPE	X
	GROSS_WEIGHT	X
SPS2_UNBOUND_AGG_BASE	COMPACTION_TYPE	
	FIRST_LIFT_THICKNESS	X
	GROSS_WEIGHT	X
	LAYER_NO	X

D. Expanded Range Checks

Expanded range checks are applied to certain fields to identify data element values that fall outside an expected range. Field names are listed below the bolded table name. Expanded range checks for all SPS2 Construction data tables are specified below.

Table	Units	Range
SPS2_LAYER_THICKNESS		
DENSE_GRADE_AGG_BASE	in	0, 5 - 7 (?201 - ?204, ?213 - ?216, ?225, ?226, ?231, ?232, ?237 - ?240, ?245 - ?248)
LEAN_CONCRETE	in	0, 3 - 5 (?209 - ?212, ?221 - ?224, ?229, ?230, ?235, ?236, ?241 - ?244, ?249 - ?252)
		0, 5 - 7
OFFSET	in	0 - 168
PCC_SURFACE	in	0, 7 - 9, 10 - 12
PERM_ASPH_TREAT_BASE	in	0, 3 - 5
STATION_NO	ft	0 - 500
SPS2_NOTES_AND_COMMENTS		
No Level D Checks		
SPS2_PCC_FULL_DEPTH		
ADMIXTURE_1		1 - 13
ADMIXTURE_2		1 - 13
AIR_CONTENT_MAX	%	4 - 10
AIR_CONTENT_MEAN	%	4 - 8
AIR_CONTENT_MIN	%	2 - 8
AIR_TEMP_LOW	deg F	40 - 120
AIR_TEMP_HIGH	deg F	40 - 120
BOND_BREAKER		1 - 2
BOUNDARY_METHOD		1 - 5
CAGG_MIX	lbs/cu yd	500 - 3000
CEMENT_MIX	lbs/cu yd	300 - 1000
CEMENT_TYPE		41 - 55
CONC_BREAK_METHOD		1 - 5

CONC_REMOVAL		1 - 3
CONSOLIDATE_METHOD		1 - 6
CURE_METHOD_1		1 - 10
CURE_METHOD_2		1 - 10
CUT_METHOD		1 - 5
DOWEL_COAT_TRANS		1 - 7
FAGG_MIX	lbs/cu yd	500 - 2000
FINISH_METHOD		1 - 4
FLEX_CURE_TIME	days	0 - 28
FLEX_STRENGTH	psi	400 - 900
JOINT_METHOD_LONG		1 - 7
JOINT_METHOD_SH		1 - 7
JOINT_METHOD_TRANS		1 - 7
JOINTS_MATCHED		1 - 2
MAX_AGG_SIZE	in	0.1 - 2
PATCH_MATL		1 - 4
PATCH_SF_BASE	sq ft	0 - 7000
PATCH_SF_SLAB	sq ft	0 - 7000
REASON		20 - 38
REBAR_DOWEL	size	1 - 10
REBAR_LONG	size	1 - 10
REBAR_TIE	size	1 - 10
REBAR_TRANS	size	1 - 10
REBAR_LENGTH_TIE	in	1 - 48
REBAR_LENGTH_DOWEL	in	1 - 36
REBAR_SPACE_DOWEL	in	2 - 24
REBAR_SPACE_LONG	in	2 - 24
SAW_CUTS		1 - 10
SAW_CUT_DEPTH	in	1 - 18
SECONDARY_REASON		20 - 38
SF_BASE_REPLACE	sq ft	0 - 7000
SF_SLABS_REPLACED	sq ft	0 - 7000
SLUMP_MAX	in	1 - 4
SLUMP_MEAN	in	1 - 3
SLUMP_MIN	in	1 - 3
STEEL		1 - 2
STEEL_PLACE_METHOD		1 - 2
SURFACE_MOISTURE		1 - 2
TRAFFIC_OPEN_TIME	hr	0 - 99
TRANS_JOINT_PATCH		1 - 4
TRANS_JOINT_SLAB		1 - 4
TRANSFER_DEVICE		1 - 4
WATER_MIX	gal/cu yd	10 - 60

SPS2_PCC_JOINT_DATA

AVG_CONTRACTION_SPACING	ft	15 - 30
CHK_DOWEL_AFTER_PLACE		Y, N
CHK_DOWEL_BEFORE_PLACE		Y, N
DEPTH_OF_SAWCUT	in	0.1 - 4
DOWEL_COATING		1 - 6
DOWEL_DISTANCE	in	4 - 12
DOWEL_SPACING	in	10 - 14
DOWEL_LENGTH	in	16 - 20
JOINT_SKEWNESS	ft	0.0 - 5.0
LAYER_NO		> 1
LONG_SEAL_RESVR_DEPTH	in	0.3 - 1.5

LONG_SEAL_RESVR_WIDTH	in	0.3 - 1.5
LONG_TYPE		1 - 4
MLTD_METHOD		1 - 3
ROUND_DOWEL_DIAMETER	in	1.25 - 1.5
SH_TRAFFIC_SEAL_RESVR_DEPTH	in	0.3 - 1.5
SH_TRAFFIC_SEAL_RESVR_WIDTH	in	0.3 - 1.5
SH_TRAFFIC_LANE_TYPE		1 - 4
TIE_BAR_DIAMETER	in	0.3 - 3.0
TIE_BAR_LENGTH	in	18 - 60
TIE_BAR_SPACING	in	12 - 60
TIME_BETWEEN_PLACE_SAWCUT	hr	0 - 24
TRANS_CONT_JLTS		1 - 3
TRANS_METHOD		1 - 4
TRANS_SEAL_RESVR_DEPTH	in	0.3 - 1.5
TRANS_SEAL_RESVR_WIDTH	in	0.3 - 1.5
TRANS_SEAL_TYPE		1 - 5

SPS2_PCC_MIXTURE_DATA

ADMIXTURE_AMT_1	%	0 - 100
ADMIXTURE_AMT_2	%	0 - 100
ADMIXTURE_AMT_3	%	0 - 100
ADMIXTURE_TYPE_1		1 - 13
ADMIXTURE_TYPE_2		1 - 13
ADMIXTURE_TYPE_3		1 - 13
AGGR_COMP_TYPE_C1		1 - 7
AGGR_COMP_TYPE_C2		1 - 7
AGGR_COMP_TYPE_C3		1 - 7
AGGR_COMP_TYPE_F1		1 - 4
AGGR_COMP_TYPE_F2		1 - 4
AGGR_COMP_TYPE_F3		1 - 4
AGGR_COMP_PERCENT_C1	%	0 - 100
AGGR_COMP_PERCENT_C2	%	0 - 100
AGGR_COMP_PERCENT_C3	%	0 - 100
AGGR_COMP_PERCENT_F1	%	0 - 100
AGGR_COMP_PERCENT_F2	%	0 - 100
AGGR_COMP_PERCENT_F3	%	0 - 100
AGGR_DUR_TYPE_C1		1 - 11
AGGR_DUR_TYPE_C2		1 - 11
AGGR_DUR_TYPE_C3		1 - 11
AGGR_DUR_TYPE_M1		1 - 11
ALKALI_CONTENT_CEMENT	%	0 - 1
CEMENT_TYPE		41 - 55
COARSE_AGGR_BULK_SPEC		1.5 - 4
FINE_AGGR_BULK_SPEC		1.5 - 4
FIVE_EIGHTHS_PASSING	%	35 - 100 or 65 – 100 (combined)
GEOL_CLASS_COARSE_AGGR		1 - 22
LAYER_NO		> 1
MIX_DESIGN_CEMENT	lbs/cu yd	0 - 700
MIX_DESIGN_COARSE	lbs/cu yd	500 - 3000
MIX_DESIGN_FINE	lbs/cu yd	500 - 2000
MIX_DESIGN_WATER	lbs/cu yd	100 - 500
NO_10_PASSING	%	45 - 90 or 15 - 50 (combined)
NO_100_PASSING	%	2 - 20 or 2 - 15 (combined)
NO_16_PASSING	%	40 - 90 or 10 - 45 (combined)
NO_200_PASSING	%	2 - 12
NO_30_PASSING	%	20 - 70 or 10 - 40 (combined)

NO_4_PASSING	%	0 - 15 or 45 - 90 (combined)
NO_40_PASSING	%	20 - 60 or 10 - 35 (combined)
NO_50_PASSING	%	10 - 40 or 5 - 30 (combined)
NO_8_PASSING	%	70 - 100 or 30 - 60 (combined)
NO_80_PASSING	%	5 - 25 or 4 - 25 (combined)
ONE_AND_HALF_PASSING	%	85 - 100
ONE_HALF_PASSING	%	10 - 70 or 60 - 100 (combined)
ONE_PASSING	%	70 - 100 or 80 - 100 (combined)
SEVEN_EIGHTHS_PASSING	%	65 - 100 or 75 - 100 (combined)
THREE_EIGHTHS_PASSING	%	2 - 25 or 50 - 95 (combined)
THREE_FOURTHS_PASSING	%	45 - 100 or 70 - 100 (combined)
TWO_PASSING	%	90 - 100

SPS2_PCC_PLACEMENT_DATA

CONSOLIDATION		1 - 6
CURING		1 - 8
DEPTH_OF_VIBRATORS	in	1 - 10
DOWEL_PLACE_METHOD		1 - 2
FINISHING		1 - 4
LAYDOWN_WIDTH	ft	10 - 40
LAYER_NO		> 1
NUMBER_OF_VIBRATORS		2 - 40
PAVER_TYPE		1 - 3
TEXTURING		1 - 7
VIBRATOR_SPACING	in	3 - 24

SPS2_PCC_PROFILE_DATA

AVG_BLADE_SPACING	in	0.1 - 0.2
AVG_CUT_DEPTH	in	0 - 0.8
AVG_GROOVE_WIDTH	in	0.1 - 0.2
CUTTING_HEAD_WIDTH	in	36 - 72
DIAMOND_GRIND_CORRECTED		Y, N
GRINDING_REASON		1 - 6
INTERPRETATION_METHOD		1 - 3
PROFILE_INDEX	in/mi	0 - 20
PROFILOGRAPH_TYPE		1 - 2
SURFACE_PROFILE_INCENTIVE		Y, N

SPS2_PCC_STEEL

DEPTH_TO_REINFORCEMENT	in	2.0 - 6.0
DESIGN_PERCENT_LONG_STEEL	%	0.1 - 0.2
LAYER_NO		> 1
LONG_BAR_DIAMETER	in	0.1 - 1.5
LONG_BAR_SPACING	in	6.0 - 60.0
REINFORCING_TYPE		1 - 3
REINFORCE_PLACE_METHOD		1 – 4
REINFORCE_YIELD_STRENGTH	ksi	40 - 60
TRANSVERSE_BAR_DIAMETER	in	0 - 2.0
TRANSVERSE_BAR_SPACING	in	6.0 - 48.0

SPS2_PMA_AC_PROPERTIES

ASPHALT_GRADE		1 - 40, 99
ASPHALT_SPECIFIC_GRAVITY		0.9 - 1.1
ASPHALT_VISCOSITY_140	poises	500 - 20000
ASPHALT_VISCOSITY_275	centistokes	100 - 200
DUCTILITY_77	cm	8 - 150

LAYER_NO		> 1
MODIFIER_1		1 - 27
MODIFIER_2		1 - 27
PENETRATION_77	0.1 mm	20 - 250
RING_BALL_SOFT_PT	deg F	50 - 200

SPS2_PMA_AGGREGATE_PROP

AGGR_COMB_BULK_SPEC		1 - 4
AGGR_COMP_PERCENT_C1	%	0 - 100
AGGR_COMP_PERCENT_C2	%	0 - 100
AGGR_COMP_PERCENT_C3	%	0 - 100
AGGR_COMP_PERCENT_F1	%	0 - 100
AGGR_COMP_PERCENT_F2	%	0 - 100
AGGR_COMP_PERCENT_F3	%	0 - 100
AGGR_COMP_TYPE_C1		1 - 6
AGGR_COMP_TYPE_C2		1 - 6
AGGR_COMP_TYPE_C3		1 - 6
AGGR_COMP_TYPE_F1		1 - 4
AGGR_COMP_TYPE_F2		1 - 4
AGGR_COMP_TYPE_F3		1 - 4
AGGR_DUR_RESULT_C1	%	0 - 90
AGGR_DUR_RESULT_C2	%	0 - 90
AGGR_DUR_RESULT_C3	%	0 - 90
AGGR_DUR_RESULT_M1	%	0 - 90
AGGR_DUR_TYPE_C1		1 - 11
AGGR_DUR_TYPE_C2		1 - 11
AGGR_DUR_TYPE_C3		1 - 11
AGGR_DUR_TYPE_M1		1 - 11
COARSE_AGGR_BULK_SPEC		1 - 4
EFFECTIVE_SPEC_GRAVITY		1 - 4
FINE_AGGR_BULK_SPEC		1 - 4
LAYER_NO		> 1
MINERAL_FILLER		1 - 5
MINERAL_FILLER_BULK_SPEC		1 - 4
POLISH_VALUE		0 - 50

SPS2_PMA_COMPACTION

BREAKDOWN_ROLLER_CODE		A - Q
COMPACTED_THICK	in	1 - 8
FINAL_ROLLER_CODE		A - Q
INTERMED_ROLLER_CODE		A - Q
LAYER_NO		> 1
MEAN_AIR_TEMP	deg F	40 - 120

SPS2_PMA_CONSTRUCTION

LAYDOWN_TEMP_MAX	deg F	150 - 400
LAYDOWN_TEMP_MEAN	deg F	150 - 400
LAYDOWN_TEMP_MIN	deg F	150 - 400
LAYDOWN_TEMP_STD_DEV		0 - 50
LAYER_NO		> 1
MEAN_MIXING_TEMP	deg F	150 - 400

SPS2_PMA_MIXTURE_PROP

ASPHALT_CONTENT_MEAN	%	1 - 10
ASPHALT_CONTENT_MIN	%	1 - 10
ASPHALT_CONTENT_MAX	%	1 - 10

ANTISTRIP_AGENT_AMOUNT	%	0 - 5
ANTISTRIP_AGENT_CODE		1 - 2
ANTISTRIP_AGENT_TYPE		0 - 70
BULK_SPEC_GRAVITY_MAX		1 - 4
BULK_SPEC_GRAVITY_MEAN		1 - 4
BULK_SPEC_GRAVITY_MIN		1 - 4
EFF_ASPHALT_CONTENT	%	1 - 10
HVEEM_STABILITY		25 - 50
LAYER_NO		> 1
MARSHALL_FLOW	.01 in	0 - 25
MARSHALL_STABILITY	lbs	1200 - 5000
MAX_SPEC_GRAVITY		1 - 4
NO_SAMP_PCT_AIR_VOIDS		>= 1
NUMBER_OF_BLOWS		50, 75
PCT_AIR_VOIDS_MAX	%	0 - 10
PCT_AIR_VOIDS_MEAN	%	0 - 10
PCT_AIR_VOIDS_MIN	%	0 - 10
PCT_AIR_VOIDS_STD_DEV		0 - 5
SAMPLE_TYPE		1 - 2
VOIDS_MINERAL_AGGR	%	10 - 20

SPS2_PMA_PLACEMENT_DATA

LAYDOWN_WIDTH	ft	10 - 15
LAYER_NO_PATB		> 1
LAYER_NO1		> 1
LAYER_NO2		> 1
PATB_1ST_THICK	in	1 - 5
PATB_2ND_THICK	in	1 - 5
PATB_3RD_THICK	in	1 - 5
PLANT_TYPE1		1 - 3
PLANT_TYPE2		1 - 3

SPS2_PMA_ROLLER

LAYER_NO		> 1
ROLLER_CODE		A - Q
ROLLER_FREQ	vib/min	2000 - 3000 (I - P)
ROLLER_GROSS_WT	tons	0 - 20 (A - D, I- P); 0 - 50 (E - H)
ROLLER_SPEED	mph	0 - 10
ROLLER_TIRE_PRES	psi	50 - 100 (E - H)

SPS2_SUBGRADE_PREP

COMPACTION_EQUIP_TYPE		1 - 6
GROSS_WEIGHT	tons	5 - 20
STABIL_AGENT1		1 - 5
STABIL_AGENT1_PERCENT	%	1 - 10
STABIL_AGENT2		1 - 5
STABIL_AGENT2_PERCENT	%	1 - 10

SPS2_UNBOUND_AGG_BASE

COMPACTION_TYPE		1 - 5
FIRST_LIFT_THICKNESS	in	1 - 8
FOURTH_LIFT_THICKNESS	in	1 - 8
GROSS_WEIGHT	tons	5 - 50
LAYER_NO		> 1
SECOND_LIFT_THICKNESS	in	1 - 8
THIRD_LIFT_THICKNESS	in	1 - 8

E. Intramodular Checks

Intramodular checks for all SPS2 Construction data tables are specified below.

Table: SPS2_*

- DATE_COMPLETE >= DATE_BEGAN

Table: SPS2_LAYER_THICKNESS

- No Level E Checks

Table: SPS2_NOTES_AND_COMMENTS

- No Level E Checks

Table: SPS2_PCC_FULL_DEPTH

- DATE_COMPLETE ≥ DATE_BEGAN

  Error Message: **SPS2_PCC_FULL_DEPTH**-E-1, DATE_COMPLETE must be >= DATE_BEGAN.

- If STEEL = 1, then REBAR_TRAN, REBAR_LONG, REBAR_LENGTH_TRANS, REBAR_LENGTH_LONG, REBAR_SPACE_TRANS, and REBAR_SPACE_LONG must be 0 or null

  Error Message: **SPS2_PCC_FULL_DEPTH**-E-2, If STEEL = 1, then REBAR_TRAN, _LONG, LENGTH_TRANS, _LENGTH_LONG, _SPACE_TRANS, _SPACE_LONG must be 0. Check all appropriate values.

- AIR_CONTENT_MIN ≤ AIR_CONTENT_MEAN ≤ AIR_CONTENT_MAX

  Error Message: **SPS2_PCC_FULL_DEPTH**-E-3, The following relationship must exist: AIR_CONTENT_MIN <= AIR_CONTENT_MEAN <= AIR_CONTENT_MAX

- SLUMP_MIN ≤ SLUMP_MEAN ≤ SLUMP_MAX

  Error Message: **SPS2_PCC_FULL_DEPTH**-E-4, The following relationship must exist: SLUMP_MIN <= SLUMP_MEAN <= SLUMP_MAX

- AIR_TEMP_LOW ≤ AIR_TEMP_HIGH

  Error Message: **SPS2_PCC_FULL_DEPTH**-E-5, The following relationship must exist: AIR_TEMP_LOW <= SLUMP_MEAN <= SLUMP_MAX

Table: SPS2_PCC_JOINT_DATA

- If AVG_CONTRACTION_SPACING ≥ 30, then JOINT_SKEWNESS must be 0

  Error Message: **SPS2_PCC_JOINT_DATA**-E-1, JOINT_SKEWNESS must = 0 for AVG_CONTRACTION_SPACING >= 30.

- If TRANS_CONT_JLTS <> 1, then ROUND_DOWEL_DIAMETER, DOWEL_SPACING, and DOWEL_DISTANCE must be 0 or null

  Error Message: **SPS2_PCC_JOINT_DATA**-E-2, If TRANS_CONT_JLTS <> 1, then ROUND_DOWEL_DIAMETER, DOWEL_SPACING, DOWEL_DISTANCE must be 0 or null.

- If CHK_DOWEL_AFTER_PLACE = Y, then a non-null entry must exist in DOWEL_CHK_METHOD

  Error Message: **SPS2_PCC_JOINT_DATA**-E-3, DOWEL_CHK_METHOD must be non-null for CHK_DOWEL_AFTER_PLACE = Y.

- TRANS_SEAL_RESVR_WIDTH <= TRANS_SEAL_RESVR_DEPTH

  Error Message: **SPS2_PCC_JOINT_DATA**-E-4, TRANS_SEAL_RESVR_WIDTH must be <= TRANS_SEAL_RESVR_DEPTH.

- LONG_SEAL_RESVR_WIDTH <= LONG_SEAL_RESVR_DEPTH

  Error Message: **SPS2_PCC_JOINT_DATA**-E-5, LONG_SEAL_RESVR_WIDTH must be <= LONG_SEAL_RESVR_DEPTH.

- SH_TRAFFIC_SEAL_RESVR_WIDTH <= SH_TRAFFIC_SEAL_RESVR_DEPTH

  Error Message: **SPS2_PCC_JOINT_DATA**-E-6, SH_TRAFFIC_SEAL_RESVR_WIDTH must be <= SH_TRAFIC_SEAL_RESVR_DEPTH.

Table: SPS2_PCC_MIXTURE_DATA

- ADMIXTURE_TYPE_1 <> ADMIXTURE_TYPE_2 <> ADMIXTURE_TYPE_3

  Error Message: **SPS2_PCC_MIXTURE_DATA**-E-1, Must have condition ADMIXTURE_TYPE_1 not equal ADMIXTURE_TYPE_2 not equal ADMIXTURE_TYPE_3

- AGG_COMP_TYPE_C1 <> AGG_COMP_TYPE_C2 <> AGG_COMP_TYPE_C3

  Error Message: **SPS2_PCC_MIXTURE_DATA**-E-2, Must have condition AGG_COMP_TYPE_C1 not equal AGG_COMP_TYPE_C2 not equal AGG_COMP_TYPE_C3

- (AGG_COMP_PERCENT_C1 + AGG_COMP_PERCENT_C2 + AGG_COMP_PERCENT_C3) = 100

  Error Message: **SPS2_PCC_MIXTURE_DATA**-E-3, AGG_COMP_PERCENT_C1 + AGG_COMP_PERCENT_C2 + AGG_COMP_PERCENT_C3 must equal 100

- AGG_COMP_TYPE_F1 <> AGG_COMP_TYPE_F2 <> AGG_COMP_TYPE_F3

Error Message: **SPS2_PCC_MIXTURE_DATA**-E-4, Must have condition AGG_COMP_TYPE_F1 not equal AGG_COMP_TYPE_F2 not equal AGG_COMP_TYPE_F3

- (AGG_COMP_PERCENT_F1 + AGG_COMP_PERCENT_F2 + AGG_COMP_PERCENT_F3) = 100

  Error Message: **SPS2_PCC_MIXTURE_DATA**-E-5, AGG_COMP_PERCENT_F1 + AGG_COMP_PERCENT_F2 + AGG_COMP_PERCENT_F3 must equal 100

- TWO_PASSING >= ONE_AND_HALF_PASSING >= ONE_PASSING >= SEVEN_EIGHTHS_PASSING >= THREE_FOURTHS_PASSING >= FIVE_EIGHTHS_PASSING >= ONE_HALF_PASSING >= THREE_EIGHTHS_PASSING >= NO_4_PASSING

  Error Message: **SPS2_PCC_MIXTURE_DATA**-E-6, Must have TWO_PASSING >= ONE_AND_HALF_PASSING >= ONE_PASSING >= SEVEN_EIGHTHS_PASSING >= THREE_FOURTHS_PASSING >= FIVE_EIGHTHS_PASSING >= ONE_HALF_PASSING >= THREE_EIGHTHS_PASSING >= NO_4_PASSING

- NO_8_PASSING >= NO_10_PASSING >= NO_16_PASSING >= NO_30_PASSING >= NO_40_PASSING >= NO_50_PASSING >= NO_80_PASSING >= NO_100_PASSING >= NO_200_PASSING

  Error Message: **SPS2_PCC_MIXTURE_DATA**-E-7, Must have condition NO_8_PASSING >= NO_10_PASSING >= NO_16_PASSING >= NO_30_PASSING >= NO_40_PASSING >= NO_50_PASSING >= NO_80_PASSING >= NO_100_PASSING >= NO_200_PASSING

Table: SPS2_PCC_PLACEMENT_DATA

- DATE_COMPLETE >= DATE_BEGAN

  Error Message: **SPS2_PCC_PLACEMENT_DATA**-E-1, DATE_COMPLETE must be >= DATE_BEGAN.

Table: SPS2_PCC_PROFILE_DATA

- If DIAMOND_GRIND_CORRECTED = N, then DATE_GRINDING_BEGAN must be null

  Error Message: **SPS2_PCC_PROFILE_DATA**-E-1, If DIAMOND_GRIND_CORRECTED = N then DATE_GRINDING_BEGAN must be null

- If DIAMOND_GRIND_CORRECTED = N, then DATE_GRINDING_COMPLETE must be null

  Error Message: **SPS2_PCC_PROFILE_DATA**-E-2, If DIAMOND_GRIND_CORRECTED = N then DATE_GRINDING_COMPLETE must be null

- If DIAMOND_GRIND_CORRECTED = N, then GRINDING_REASON must be null or 0

  Error Message: **SPS2_PCC_PROFILE_DATA**-E-3, If DIAMOND_GRIND_CORRECTED = N then GRINDING_REASON must be null or 0

- If DIAMOND_GRIND_CORRECTED = N, then AVG_CUT_DEPTH must be null or 0

Error Message: **SPS2_PCC_PROFILE_DATA**-E-4, If DIAMOND_GRIND_CORRECTED = N then AVG_CUT_DEPTH must be null or 0

- If DIAMOND_GRIND_CORRECTED = N, then CUTTING_HEAD_WIDTH must be null or 0

  Error Message: **SPS2_PCC_PROFILE_DATA**-E-5, If DIAMOND_GRIND_CORRECTED = N then CUTTING_HEAD_WIDTH must be null or 0

- If DIAMOND_GRIND_CORRECTED = N, then AVG_GROOVE_WIDTH must be null or 0

  Error Message: **SPS2_PCC_PROFILE_DATA**-E-6, If DIAMOND_GRIND_CORRECTED = N then AVG_GROOVE_WIDTH must be null or 0

- If DIAMOND_GRIND_CORRECTED = N, then AVG_BLADE_SPACING must be null or 0

  Error Message: **SPS2_PCC_PROFILE_DATA**-E-7, If DIAMOND_GRIND_CORRECTED = N then AVG_BLADE_SPACING must be null or 0

- DATE_GRINDING_COMPLETE >= DATE_GRINDING_BEGAN

  Error Message: **SPS2_PCC_PROFILE_DATA**-E-8, DATE_GRINDING_COMPLETE must be >= DATE_GRINDING_BEGAN

Table: SPS2_PMA_AC_PROPERTIES

- DUCTILITY_77 >= DUCTILITY_39

  Error Message: SPS2_PMA_AC_PROPERTIES-E-1, DUCTILITY_77 must be >= DUCTILITY_39.

Table: SPS2_PMA_AGGREGATE_PROP

- AGGR_COMB_BULK_SPEC = 100/(P1/G1 + P2/G2 + P3/G3)
  where: P_1 = AGGR_COMP_TYPE_C1 + AGGR_COMP_TYPE_C2 + AGGR_COMP_TYPE_C3
  P_2 = AGGR_COMP_TYPE_F1 + AGGR_COMP_TYPE_F2 + AGGR_COMP_TYPE_F3
  P_3 = 100 - (P1 + P2)
  G_1 = COARSE_AGGR_BULK_SPEC
  G_2 = FINE_AGGR_BULK_SPEC
  G_3 = MINERAL_FILLER_BULK_SPEC

  Error Message:**SPS2_PMA_AGGREGATE_PROP**-E-1, AGGR_COMB_BULK_SPEC must be equal to the equation above. Check input of all appropriate values.

- EFFECTIVE_SPEC_GRAVITY = (100-ASPHALT_CONTENT_MEAN)/ [(100/MAX_SPEC_GRAVITY) - (ASPHALT_CONTENT_MEAN/ ASPHALT_SPECIFIC_GRAVITY)]

  Error Message: **SPS2_PMA_AGGREGATE_PROP**-E-9, EFFECTIVE_SPEC_GRAVITY must be (100-ASPHALT_CONTENT_MEAN)/ [(100/MAX_SPEC_GRAVITY) - (ASPHALT_CONTENT_MEAN/ ASPHALT_SPECIFIC_GRAVITY)]

- AGGR_COMP_TYPE_C1 <> AGGR_COMP_TYPE_C2 <> AGGR_COMP_TYPE_C3

  Error Message: **SPS2_PMA_AGGREGATE_PROP**-E-10, Must have AGGR_COMP_TYPE_C1 <> AGGR_COMP_TYPE_C2 <> AGGR_COMP_TYPE_C3

- AGGR_COMP_TYPE_F1 <> AGGR_COMP_TYPE_F2 <> AGGR_COMP_TYPE_F3

  Error Message: **SPS2_PMA_AGGREGATE_PROP-E-11**, Must have AGGR_COMP_TYPE_F1 <> AGGR_COMP_TYPE_F2 <> AGGR_COMP_TYPE_F3

Table: SPS2_PMA_COMPACTION and SPS2_PMA_ROLLER

- For a given BREAKDOWN_ROLLER_CODE in **SPS2_PMA_COMPACTION**, a matching ROLLER_CODE must exist in **SPS2_PMA_ROLLER**

  Error Message: **SPS2_PMA_COMPACTION-E-1**, If BREAKDOWN_ROLLER_CODE is not null, then for a matching record in **SPS2_PMA_ROLLER**, **SPS2_PMA_COMPACTION**.BREAKDOWN_ROLLER_CODE must equal **SPS2_PMA_ROLLER**.ROLLER_CODE.

- For a given INTERMED_ROLLER_CODE in **SPS2_PMA_COMPACTION**, a matching ROLLER_CODE must exist in **SPS2_PMA_ROLLER**

  Error Message: **SPS2_PMA_COMPACTION-E-2**, If INTERMED_ROLLER_CODE is not null, then for a matching record in **SPS2_PMA_ROLLER**, **SPS2_PMA_COMPACTION**. INTERMED_ROLLER_CODE must equal **SPS2_PMA_ROLLER**.ROLLER_CODE.

- For a given FINAL_ROLLER_CODE in **SPS2_PMA_COMPACTION**, a matching ROLLER_CODE must exist in **SPS2_PMA_ROLLER**

  Error Message: **SPS2_PMA_COMPACTION-E-3**, If FINAL_ROLLER_CODE is not null, then for a matching record in **SPS2_PMA_ROLLER**, **SPS2_PMA_COMPACTION**.FINALROLLER_CODE must equal **SPS2_PMA_ROLLER**.ROLLER_CODE.

Table: SPS2_PMA_CONSTRUCTION

- DATE_COMPLETE >= DATE_BEGAN

  Error Message: **SPS2_PMA_CONSTRUCTION**-E-1, DATE_COMPLETE must be >= DATE_BEGAN.

- LAYDOWN_TEMP_MAX >= LAYDOWN_TEMP_MEAN >= LAYDOWN_TEMP_MIN

  Error Message: **SPS2_PMA_CONSTRUCTION**-E-2, The following condition must exist: LAYDOWN_TEMP_MAX >= LAYDOWN_TEMP_MEAN >= LAYDOWN_TEMP_MIN

Table: SPS2_PMA_MIXTURE_PROP

- BULK_SPEC_GRAVITY_MIN <= BULK_SPEC_GRAVITY_MEAN <= BULK_SPEC_GRAVITY_MAX

Error Message: **SPS2_PMA_MIXTURE_PROP**-E-1, the following relationship must exist: BULK_SPEC_GRAVITY_MIN <= BULK_SPEC_GRAVITY_MEAN <= BULK_SPEC_GRAVITY_MAX.

- ASPHALT_CONTENT_MIN <= ASPHALT_CONTENT_MEAN <= ASPHALT_CONTENT_MAX

  Error Message: **SPS2_PMA_MIXTURE_PROP**-E-2, the following relationship must exist: ASPHALT_CONTENT_MIN <= ASPHALT_CONTENT_MEAN <= ASPHALT_CONTENT_MAX.

- PCT_AIR_VOIDS_MIN <= PCT_AIR_VOIDS_MEAN <= PCT_AIR_VOIDS_MAX

  Error Message: **SPS2_PMA_MIXTURE_PROP**-E-3, the following relationship must exist: PCT_AIR_VOIDS_MIN <= PCT_AIR_VOIDS_MEAN <= PCT_AIR_VOIDS_MAX.

- Either HVEEM_COHESIOMETER and HVEEM STABILITY or MARSHALL_FLOW, MARSHALL_STABILITY, and NUMBER_OF_BLOWS must be non-null

  Error Message: **SPS2_PMA_MIXTURE_PROP**-E-6, either HVEEM_COHESIOMETER and HVEEM STABILITY or MARSHALL_FLOW, MARSHALL_STABILITY, and NUMBER_OF_BLOWS must be non-null.

Table: SPS2_PMA_PLACEMENT_DATA

- DATE_COMPLETE >= DATE_BEGAN

  Error Message: **SPS2_PMA_PLACEMENT_DATA**-E-1, DATE_COMPLETE must be >= DATE_BEGAN.

Table: SPS2_PMA_ROLLER

- If ROLLER_CODE = A, B, C, or D, then ROLLER_TIRE_PRES, ROLLER_FREQ, ROLLER_AMP, and ROLLER_SPEED must be null

  Error Message: **SPS2_PMA_ROLLER**-E-1, If ROLLER_CODE = A, B, C, or D, then ROLLER_TIRE_PRES, ROLLER_FREQ, ROLLER_AMP, and ROLLER_SPEED must be null

- If ROLLER_CODE = E, F, G, or H, then ROLLER_FREQ, ROLLER_AMP, and ROLLER_SPEED must be null

  Error Message: **SPS2_PMA_ROLLER**-E-2, If ROLLER_CODE = E, F, G, or H, then ROLLER_FREQ, ROLLER_AMP, and ROLLER_SPEED must be null

- If ROLLER_CODE = I, J, K, L, M, N, or P, then ROLLER_TIRE_PRES must be null

  Error Message: **SPS2_PMA_ROLLER**-E-3, If ROLLER_CODE = I, J, K, L, M, N, or P, then ROLLER_TIRE_PRES must be null

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Table: SPS2_SUBGRADE_PREP

- DATE_COMPLETE >= DATE_BEGAN

  Error Message: **SPS2_PMA_SUBGRADE_PREP**-E-1, DATE_COMPLETE must be >= DATE_BEGAN.

- If STABIL_AGENT1 <> 5
  then STABIL_AGENT1 <> STABIL_AGENT2

  Error Message: **SPS2_PMA_SUBGRADE_PREP**-E-2, If STABIL_AGENT1 <> 5 then STABIL_AGENT1 must not equal STABIL_AGENT2

Table: SPS2_UNBOUND_AGG_BASE

- DATE_COMPLETE >= DATE_BEGAN

  Error Message: **SPS2_UNBOUND_AGG_BASE**-E-1, DATE_COMPLETE must be >= DATE_BEGAN.

In addition, the checks listed in Table 14-1 are required for the identified tables and elements.

Table 14-1. Additional Level E Checks

Error Code	if the data element below	has a code of	then a non-null entry must exist in the data element below
	SPS2_PMA_AC_PROPERTIES		
E-2	ASPHALT_GRADE	17, 35, 99	ASPHALT_GRADE_OTHER
E-3	SOURCE	77	SOURCE_OTHER
E-4	MODIFIER_1	27	MODIFIER_1_OTHER
E-5	MODIFIER_2	27	MODIFIER_2_OTHER
	SPS2_PMA_AGGREGATE_PROP		
E-2	AGGR_COMP_TYPE_C1	6	AGGR_COMP_TYPE_C1_OTHER
E-3	AGGR_COMP_TYPE_C2	6	AGGR_COMP_TYPE_C2_OTHER
E-4	AGGR_COMP_TYPE_C3	6	AGGR_COMP_TYPE_C3_OTHER
E-5	AGGR_COMP_TYPE_F1	4	AGGR_COMP_TYPE_F1_OTHER
E-6	AGGR_COMP_TYPE_F2	4	AGGR_COMP_TYPE_F2_OTHER
E-7	AGGR_COMP_TYPE_F3	4	AGGR_COMP_TYPE_F3_OTHER
E-8	MINERAL_FILLER	5	MINERAL_FILLER_OTHER
	SPS2_PMA_PLACEMENT_DATA		
E-2	PLANT_TYPE1	3	PLANT_TYPE_OTHER1
E-3	PLANT_TYPE2	3	PLANT_TYPE_OTHER2
	SPS2_PMA_MIXTURE_PROP		
E-5	ANTISTRIP_AGENT_TYPE	70	ANTISTRIP_AGENT_TYPE_OTHER

Error Code	if the data element below	has a code of	then a non-null entry must exist in the data element below
	SPS2_SUBGRADE_PREP		
E-3	COMPACTION_EQUIP_TYPE	6	COMPACTION_EQUIP_TYPE_OTHER
E-4	STABIL_AGENT1	5	STABIL_AGENT1_OTHER
E-5	STABIL_AGENT2	5	STABIL_AGENT2_OTHER
	SPS2_UNBOUND_AGG_BASE		
E-2	COMPACTION_TYPE	5	COMPACTION_TYPE
	SPS2_PCC_FULL_DEPTH		
E-6	REASON	38	REASON_OTHER
E-7	SECONDARY_REASON	38	SECONDARY_REASON_OTHER
E-8	PATCH_MATL	5	PATCH_MATL_OTHER
E-9	BOUNDARY_METHOD	5	BOUNDARY_METHOD_OTHER
E-10	CUT_METHOD	5	CUT_METHOD_OTHER
E-11	TRANSFER_DEVICE	4	TRANSFER_DEVICE_OTHER
E-12	DOWEL_COAT_TRANS	7	DOWEL_COAT_TRANS_OTHER
E-13	CONCRETE_BREAK_METHOD	5	CONCRETE_BREAK_METHOD_OTHER
E-14	CONC_REMOVAL	3	CONC_REMOVAL_OTHER
E-15	JOINT_METHOD_SH	7	JOINT_METHOD_SH_OTHER
E-16	JOINT_METHOD_LONG	7	JOINT_METHOD_LONG_OTHER
E-17	JOINT_METHOD_TRANS	7	JOINT_METHOD_TRANS_OTHER
E-18	CURE_METHOD_1	10	CURE_METHOD_1_OTHER
E-19	CURE_METHOD_2	10	CURE_METHOD_2_OTHER
E-20	CONSOLIDATE_METHOD	6	CONSOLIDATE_METHOD_OTHER
E-21	FINISH_METHOD	4	FINISH_METHOD_OTHER
	SPS2_PCC_JOINT_DATA		
E-7	TRANS_CONT_JLTS	3	TRANS_CONT_JLTS_OTHER
E-8	DOWEL_COATING	6	DOWEL_COATING_OTHER
E-9	MLTD_METHOD	3	MLTD_METHOD_OTHER
E-10	TRANS_MEHTOD	4	TRANS_MEHTOD_OTHER
E-11	LONG_TYPE	4	LONG_TYPE_OTHER
E-12	SH_TRAFFIC_LANE_TYPE	4	SH_TRAFFIC_LANE_TYPE_OTHER
E-13	TRANS_SEAL_TYPE	5	TRANS_SEAL_TYPE_OTHER
	SPS2_PCC_MIXTURE_DATA		
E-9	CEMENT_TYPE	55	CEMENT_TYPE_OTHER
E-10	ADMIXTURE_TYPE_1	13	ADMIXTURE_TYPE_OTHER1
E-11	ADMIXTURE_TYPE_2	13	ADMIXTURE_TYPE_OTHER2
E-12	ADMIXTURE_TYPE_3	13	ADMIXTURE_TYPE_OTHER3
E-13	AGGR_COMP_TYPE_C1	7	AGGR_COMP_TYPE_C1_OTHER
E-14	AGGR_COMP_TYPE_C2	7	AGGR_COMP_TYPE_C2_OTHER
E-15	AGGR_COMP_TYPE_C3	7	AGGR_COMP_TYPE_C3_OTHER
E-16	AGGR_COMP_TYPE_F1	4	AGGR_COMP_TYPE_F1_OTHER
E-17	AGGR_COMP_TYPE_F2	4	AGGR_COMP_TYPE_F2_OTHER
E-18	AGGR_COMP_TYPE_F3	4	AGGR_COMP_TYPE_F3_OTHER

Error Code	if the data element below	has a code of	then a non-null entry must exist in the data element below
	SPS2_PCC_PLACEMENT_DATA		
E-2	PAVER_TYPE	3	PAVER_TYPE_OTHER
E-3	CONSOLIDATION	6	CONSOLIDATION_OTHER
E-4	FINISHING	4	FINISHING_OTHER
E-5	CURING	8	CURING_OTHER
E-6	TEXTURING	7	TEXTURING_OTHER
	SPS2_PCC_PROFILE_DATA		
E-9	GRINDING_REASON	6	GRINDING_REASON_OTHER
	SPS2_PCC_STEEL		
E-1	REINFORCING_TYPE	3	REINFORCING_TYPE_OTHER
E-2	REINFORCE_PLACE_ METHOD	4	REINFORCE_PLACE_METHOD_OTHER

15.0 SPS3 CONSTRUCTION

15.1 Level 1

A. Initial Level

Records in the IMS are at Level A when they first enter the system and are set back to A when changes are made to a given record or to selected related records.

B. Dependency Checks

Dependency checks (B) are performed on records at level A. These checks are performed to ensure that essential data (data which are required to properly reference all other data) are present and adequate.

Four types of checks are performed for INIT checks; INIT B - an experiment verification check, INIT C -a minimum data check, INIT D - an expanded range check and INIT E - an intramodular check. Each of these checks are specified below. **A Project record must be at level E in SPS_PROJECT_STATIONS prior to a section passing the level B check for the remaining tables. (See SPS3 Construction Table Dependency Checks at the end of this section.)**

INIT B Checks (Experiment Verification Checks)

All Project Level SPS3 records in **INV_AGE**, **INV_GENERAL**, **INV_ID** and **INV_LAYER** are set to B.

INIT C Checks (Project Minimum Data Checks)

Data fields below with the Condition of X must always contain a non-null value. The data fields with the Condition of * must contain a non-null field where applicable.

Table	Field	Condition
INV_AGE	CONSTRUCTION_DATE	X
	FINAL_NO_LANES	X
	ORIGINAL_NO_LANES	X
	TRAFFIC_OPEN_DATE	X
INV_GENERAL	LANE_NO	X
	LANE_WIDTH	X
	NO_OF_LANES	X
	PAVEMENT_TYPE	X
	SUB_DRAINAGE_TYPE	X
INV_ID	COUNTY	X

	ELEVATION	X
	FUNCTIONAL_CLASS	X
INV_LAYER	DESCRIPTION	X
	MATERIAL_TYPE	X
	MEAN_THICKNESS -if LAYER_NO > 1	*

INIT D Checks (Project Expanded Range Checks)

Expanded range checks are applied to certain fields to identify data element values that fall outside an expected range. Field names are listed below the bolded table name.

Table	Units	Range
INV_AGE		
CONSTRUCTION_DATE		Between 1970 and 1991
LANE_ADDED_NO		null
FINAL_NO_LANES		1 - 6
ORIGINAL_NO_LANES		1 - 6
TRAFFIC_OPEN_DATE		Between 1970 and 1991
YEAR_WIDENED		null
INV_GENERAL		
LANE_NO		1
LANE_WIDTH		11.0 - 99.0
NO_OF_LANES		1 - 6
PAVEMENT_TYPE		1, 2, 7 (not supplementals)
PAVEMENT_TYPE_OTHER		null (not supplementals)
SUB_DRAINAGE_TYPE		1 - 7
INV_ID		
ELEVATION	ft	-290 - 12000
FUNCTIONAL_CLASS		1, 2, 6 - 9,11,12,14,16,17,19
INV_LAYER		
DESCRIPTION		2 - 7, 10 (not supplementals)

DESCRIPTION	MEAN_THICKNESS	MATERIAL_TYPE (not supplementals)
2	0.1 - 1.5	71-73, 81-83
3	1.0 - 10.0	1
4	1.0 - 10.0	1
5	4.0 - 24.0	22 - 46

DESCRIPTION	MEAN_THICKNESS	MATERIAL_TYPE (not supplementals)
6	4.0 - 47.9	22 - 46
7	Must be null	51 - 65
9	0.3 - 2.5	2
10	0.1 - 1.5	11, 12, 71 - 73, 81 - 84

A DESCRIPTION = 1, 8, or 11 is not valid (not supplementals).

In addition, the following MEAN_THICKNESS range is valid for the given combination of DESCRIPTIONS:
(**Please note** that this applies to DESCRIPTION = 3 and all LAYER_NOs below a DESCRIPTION = 3 that have a DESCRIPTION = 4)

DESCRIPTION	MEAN_THICKNESS
3 + 4	1 - 14

INIT E Checks (Project Intramodular Checks)

Table: INV_AGE

- TRAFFIC_OPEN_DATE >= CONSTRUCTION_DATE

Table: INV_GENERAL

- For PAVEMENT_TYPE = 1, then a MATERIAL_TYPE of 1 for a DESCRIPTION of 3 and a MATERIAL_TYPE of 22 - 26 or 39 - 42 for a DESCRIPTION of 5 must exist within **INV_LAYER**
- For PAVEMENT_TYPE = 2, then a MATERIAL_TYPE of 1 for a DESCRIPTION of 3 and a MATERIAL_TYPE of 28 - 36 or 46 for a DESCRIPTION of 5 must exist within **INV_LAYER**
- For PAVEMENT_TYPE = 7, then a MATERIAL_TYPE of 1 for a DESCRIPTION of 3 and a MATERIAL_TYPE of 27, 37, 38, 39, 43 or 44 for a DESCRIPTION of 5 must exist within **INV_LAYER**
- If SUB_DRAINAGE_TYPE = 7, then SUB_DRAINAGE_TYPE_OTHER must be non null

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Table: INV_ID

No Checks Required

Table: INV_LAYER

- If not null, perform the following relational check

  – MIN_THICKNESS≤MEAN_THICKNESS≤MAX_THICKNESS

- Logical Layering Checks

  – For LAYER_NO = 1, the DESCRIPTION must always equal 7
  – The top layer can only have a DESCRIPTION of 2, 3, 9, or 10 (not supplementals)
  – A DESCRIPTION = 2, must not be designated for a layer below a layer with a DESCRIPTION = 3, 4, 5, 6, or 7
  – A DESCRIPTION = 3, must not be designated for a layer below a layer with a DESCRIPTION = 4, 5, 6, or 7
  – A DESCRIPTION = 4, must not be designated for a layer below a layer with a DESCRIPTION = 5, 6, or 7
  – A DESCRIPTION = 5, must not be designated for a layer below a layer with a DESCRIPTION = 6 or 7
  – A DESCRIPTION = 6, must not be designated for a layer below a layer with a DESCRIPTION = 7
  – A DESCRIPTION = 9 must not be designated for a layer below a layer with a DESCRIPTION = 3, 4, 5, 6, or 7
  – A DESCRIPTION = 10, must not be designated for a layer below a layer with a DESCRIPTION = 3, 4, 5, 6, or 7

- Layer Compatibility Checks

  – There must be a layer with a DESCRIPTION of 3
  – There cannot be two layers with a DESCRIPTION of 3
  – There cannot be two layers with a DESCRIPTION of 5
  – There cannot be two layers with a DESCRIPTION of 7
  – There cannot be two layers with a DESCRIPTION of 9 (not supplementals)

SPS3 Construction Table Dependency Checks

- All records in each Construction table are checked against **SPS_PROJECT_STATIONS**, for matching project level ID. If the corresponding project level records are at level E in **SPS_PROJECT_STATIONS**, the records in the construction tables go to level B.

C. Minimum Data Checks

Minimum data checks for all SPS3 Construction data tables are identified below. Data fields with a Condition of X must always contain a non-null value, however, data fields with a Condition of * are only required to contain a non-null value if a particular condition is met as specified in the accompanying field explanation.

Table	Field	Condition
SPS3_*	CONSTRUCTION_NO	* these values shall
	DATE_COMPLETE	* be non-null in the tables these variables

	SHRP_ID	X
	STATE_CODE	X
SPS3_CHIP	AGG_RATE_BET_WHEEL	X
	AGG_RATE_IN_WHEEL	X
	AGG_TARGET_RATE	X
	AGG_TYPE	X
	ASPHALT_GRADE	X
	DIST_READ_RATE	*
	DIST_TANK_RATE	*
	*either or both may be present but one value is mandatory	
	LENGTH_SEALED	X
	SEAL_TYPE	X
	SURFACE_COND	X
	TARGET_RATE	X
	WIDTH_SEALED	X
SPS3_CHIP_EQUIP	DIST_BRAND	X
	DIST_MODEL	X
	LAP	X
	POWER_BROOM	X
	SPREADER_BRAND	X
	SPREADER_MODEL	X
SPS3_CRACK	CRACK_TYPE	X
	LENGTH_SEALED	X
	SECTION_LENGTH	X
	SECTION_WIDTH	X
	SURFACE_COND	X
SPS3_ROLLER	ROLLER	X
SPS3_SLURRY	AGG_ACTUAL_RATE	X
	AGG_TYPE	X
	ASPHALT_GRADE	X
	BIT_ACTUAL_RATE	X
	CRACK_TYPE	X
	LENGTH_SEALED	X
	MINERAL_ACTUAL_RATE	X
	MINERAL_FILL_TYPE	X
	PAVE_COND	X
	SEAL_TYPE	X
	SLURRY_ACTUAL_RATE	X
	WIDTH_SEALED	X
SPS3_SLURRY_EQUIP	SLURRY_BRAND	X
	SLURRY_MODEL	X

D. Expanded Range Checks

Expanded range checks are applied to certain fields to identify data element values that fall outside an expected range. Field names are listed below the bolded table name. Expanded range checks for all SPS3 Construction data tables are specified below.

Table	Units	Range
SPS3_CHIP		
ACTUAL_TEMP	deg F	
1 <= ASPHALT_GRADE <= 17		100 - 400
18 <= ASPHALT_GRADE <= 35		50 - 200
36 <= ASPHALT_GRADE <= 40		50 - 300
AGG_COND		1 - 4
AGG_COND_MOIST		1 - 6
AGG_MOISTURE	%	0 - 10
AGG_RATE_BET_WHEEL	lbs/sq yd	10 - 50
AGG_RATE_IN_WHEEL	lbs/sq yd	10 - 50
AGG_TARGET_RATE	lbs/sq yd	10 - 50
AGG_TYPE		1 - 22, 30
AIR_TEMP	deg F	60 - 120
ASPHALT_GRADE		1 - 40, 99
COVERAGES		3 - 9
CRACK_SEVERITY		1 - 3
CRACK_TYPE		1 - 17
DIST_READ_RATE	gal/sq yd	0.1 - 1
DIST_TANK_RATE	gal/sq yd	0.100 - 0.999
MAX_SPEED_ALLOWED	mph	15 - 30
MAX_TARGET_TEMP	deg F	
1 <= ASPHALT_GRADE <= 17		150 - 400
18 <= ASPHALT_GRADE <= 35		100 - 200
36 <= ASPHALT_GRADE <= 40		150 - 300
MIN_TARGET_TEMP	deg F	
1 <= ASPHALT_GRADE <= 17		100 - 350
18 <= ASPHALT_GRADE <= 35		50 - 150
36 <= ASPHALT_GRADE <= 40		50 - 200
PAVE_COND		1 - 4
PAVE_TEMP	deg F	60 - 200
PERCENT_SEALED	%	0 - 100
RATE_ADJUSTED		1 - 2
RELATIVE_HUMIDITY	%	0 - 100
SEAL_TYPE		3
SURFACE_COND		1 - 7
SURFACE_MOISTURE		1 - 4
SURFACE_PREP		1 - 5
TARGET_RATE	gal/sq yd	0.100 - 0.999
TIME_BEFORE_BROOM	hr	0 - 30
TIME_BEFORE_FULL_SPEED	hr	0 - 30
TIME_BEFORE_OPEN	hr	0 - 30
TIME_BEFORE_ROLL	sec	0 - 60
TIME_BEFORE_SPREAD	sec	0 - 60
WIDTH_SEALED	ft	10 - 15
SPS3_CHIP_EQUIP		
ATOMIZATION		1 - 5
BAR_HEIGHT	in	6 - 24
BITUMETER_EQUIPPED		1 - 4
BITUMETER_USED		1 - 4
BITUMETER_VISIBLE		1 - 4
BROOM_PASSES		1 - 10
CIRCULATORY_EQUIPPED		1 - 4

CLEANED		1 - 4
END_NOZZLES_USED		1 - 5
EXCEEDS_5		1 - 4
FINAL_COVERAGES		3 - 9
HANDSPRAYER_USED		1 - 5
HEATERS-EQUIPPED		1 - 4
LAP		1 - 2
LOC_MISSED		1 - 5
MATL_REMAIN		1 - 4
MATL_REMOVED		1 - 4
NOZZLE_ANGLE	deg	15 - 30
NOZZLE_SPACING	in	2 - 6
PAPER_USED_BEGIN		1 - 5
PAPER_USED_END		1 - 5
POWER_BROOM		1 - 2
SELF_PROPELLED		1 - 2
STREAKING		1 - 5
TACHOMETER_EQUIPPED		1 - 4
TACHOMETER_USED		1 - 4
TACHOMETER_VISIBLE		1 - 4
THERMOMETER_CONTACT_FREE		1 - 4
THERMOMETER_VISIBLE		1 - 4
UNIFORM_AGG_SPREAD		1 - 5
UNIFORM_SPRAY		1 - 5

SPS3_CRACK

AIR_TEMP	deg F	60 - 120
AVG_WIDTH_CRACK	in	0.1 - 3
BLOT_MATL_USED		1 - 4
CHAMBER_HEATED		1 - 4
CHARRED		1 - 4
CRACK_CLEAN		1 - 4
CRACK_DRY		1 - 4
CRACK_SEVERITY		1 - 3
CRACK_TYPE		1 - 17
DEPTH_MAX	in	0.1 - 9
DEPTH_MEAN	in	0.1 - 9
DEPTH_MIN	in	0.1 - 9
DIAG_CRACKS_ROUTED		1 - 4
FINISH_SEAL		1 - 3
FLUSH_FILLER		1 - 4
FLUSH_HOSE		1 - 4
HOSE_HEATED		1 - 4
HOT_PLACED		1 - 4
LANCE_USED		1 - 4
LONG_CRACKS_ROUTED		1 - 4
MATL_AGITATION		1 - 4
MAX_SEAL_TEMP	deg F	150 - 350
ONE_PASS_ROUTING		1 - 4
PAVE_COND		1 - 4
PAVE_TEMP	deg F	60 - 200
PERCENT_SEALED	%	0 - 100
REHEATED		1 - 2
RELATIVE_HUMIDITY	%	0 - 100
SEAL_TEMP_BEGIN	deg F	100 - 350
SEAL_TEMP_END	deg F	100 - 350

SEAL_THICKNESS	in	0.01 - 0.99
SECTION_WIDTH	ft	10 - 15
SURFACE_COND		1 - 6
SURFACE_MOISTURE		1 - 4
SURFACE_PREP		1 - 5
THERMOMETER_VISIBLE		1 - 4
TIME_BEFORE_PLACE	min	0.0 - 99.9
TIME_SEAL_BEGAN	hr	0 - 24
TIME_SEAL_END	hr	0 - 24
TRANS_CRACKS_ROUTED		1 - 4
WAND_SQUEEGEE_DIST	ft	1 - 9
WIDTH_MAX	in	0.06 - 3
WIDTH_MEAN	in	0.06 - 3
WIDTH_MIN	in	0.06 - 3

SPS3_ROLLER

GROSS_WT	tons	6 - 15
SPEED	mph	1 - 20
TIRE_PRES	psi	40 - 199
WIDTH	in	40 - 99

SPS3_SLURRY

AGG_ACTUAL_RATE	lbs/sq yd	5 - 20
AGG_COND		1 - 4
AGG_COND_MOIST		1 - 6
AGG_MOISTURE	%	0 - 15
AGG_TARGET_RATE	lbs/sq yd	5 - 20
AGG_TYPE		1 - 22, 30
AIR_TEMP	deg F	60 - 120
ASPHALT_GRADE		18 - 35
BIT_ACTUAL_RATE	gal/sq yd	0.1 - 1
BIT_TARGET_RATE	gal/sq yd	0.1 - 1
CRACK_SEVERITY		1 - 3
CRACK_TYPE		1 - 17
MAX_SPEED_ALLOWED	mph	15 - 30
MINERAL_ACTUAL_RATE	lbs/sq yd	0.5 - 5
MINERAL_FILL_TYPE		1, 2, 3, 26, 27
MINERAL_TARGET_RATE	lbs/sq yd	0.5 - 5
PAVE_COND		1 - 4
PAVE_TEMP	deg F	60 - 200
PERCENT_SEALED	%	0 - 100
RATE_ADJUSTED		1 - 2
RELATIVE_HUMIDITY	%	0 - 100
SEAL_TYPE		2
SLURRY_ACTUAL_RATE	lbs/sq yd	5 - 30
SLURRY_TARGET_RATE	lbs/sq yd	5 - 30
SLURRY_TEMP	deg F	50 - 125
SURFACE_COND		1 - 7
SURFACE_MOISTURE		1 - 4
SURFACE_PREP		1 - 5
TIME_BEFORE_FULL_SPEED	hr	0 - 30
TIME_BEFORE_OPEN	hr	0 - 30
WATER_ADDED	gal/gal of emul	0.2 - 1
WIDTH_SEALED	ft	10 - 15

SPS3_SLURRY_EQUIP

APPORTION_MIX	1 - 4
BLENDED	1 - 4
BOX_EVEN_FILL	1 - 4
BOX_OVERLOAD	1 - 4
CLEAN_BOX	1 - 4
CONT_DISCHARGE	1 - 4
CONT_MIX	1 - 4
DRAG	1 - 3
EMULSION_BREAK	1 - 4
FINES_FEEDER	1 - 4
FOG_SPRAY	1 - 4
MATL_BUILDUP	1 - 4
METER_DEVICE	1 - 4
MINERAL_AGG_FED	1 - 4
PREWET_AGG	1 - 4
REAR_STRIKEOFF	1 - 4
SEGREGATION	1 - 4
SLURRY_REMAIN_MIXED	1 - 4
SQUEEGEE	1 - 4
STEERING	1 - 4
STRIKEOFF_CONTACT	1 - 4
SURFACE_TEXTURE	1 - 4
UNMIX_AGG	1 - 4

E. Intramodular Checks

Intramodular checks for all SPS3 Construction data tables are specified below.

Table: SPS3_CHIP

- DATE_COMPLETE >= DATE_BEGAN
- TIME_COMPLETE >= TIME_BEGAN
- (TARGET_RATE) * 0.8 <= DIST_READ_RATE <= (TARGET_RATE) * 1.2
- MIN_TARGET_TEMP <= ACTUAL_TEMP <= MAX_TARGET_TEMP
- (AGG_TARGET_RATE) * 0.8 <= AGG_RATE_IN_WHEEL <= (AGG_TARGET_RATE) * 1.2
- (AGG_TARGET_RATE) * 0.8 <= AGG_RATE_BET_WHEEL <= (AGG_TARGET_RATE) * 1.2
- TIME_BEFORE_FULL_SPEED >= TIME_BEFORE_OPEN >= TIME_BEFORE_BROOM

Table: SPS3_CHIP_EQUIP

- If LOC_MISSED = 4 or 5, then HANDSPRAYER_USED must be 4 or 5

Table: SPS3_CRACK

- DATE_COMPLETE >= DATE_BEGAN
- TIME_COMPLETE >= TIME_BEGAN
- WIDTH_MIN <= WIDTH_MEAN <= WIDTH_MAX
- DEPTH_MIN <= DEPTH_MEAN <= DEPTH_MAX
- If LANCE_USED = 4, then CHARRED and HOT_PLACED must be equal to 4

- SEAL_TEMP_BEGIN <= MAX_SEAL_TEMP
- SEAL_TEMP_END <= MAX_SEAL_TEMP
- If REHEATED = 2, then TIMES_REHEATED must be null or equal to 0

Table: SPS3_SLURRY

- TIME_COMPLETE >= TIME_BEGAN
- DATE_COMPLETE >= DATE_BEGAN
- REV_AFTER_APP >= REV_BEFORE_APP
- (BIT_TARGET_RATE) * 0.8 <= BIT_ACTUAL_RATE <= (BIT_TARGET_RATE) * 1.2
- (AGG_TARGET_RATE) * 0.8 <= AGG_ACTUAL_RATE <= (AGG_TARGET_RATE) * 1.2
- (MINERAL_TARGET_RATE) * 0.8 <= MINERAL_ACTUAL_RATE <= (MINERAL_TARGET_RATE) * 1.2
- (SLURRY_TARGET_RATE) * 0.8 <= SLURRY_ACTUAL_RATE <= (SLURRY_TARGET_RATE) * 1.2
- TIME_BEFORE_FULL_SPEED >= TIME_BEFORE_OPEN

Table: SPS3_SLURRY_EQUIP

- If REAR_STRIKEOFF = 4, then STRIKEOFF_CONTACT must be equal to 4

In addition, the checks listed in Table 15-1 are required for the identified tables and elements.

Table 15-1. Additional Level E Checks

If the data element below	has a code of	then a non-null entry must exist in the data element below
SPS3_CHIP		
ASPHALT_GRADE	17, 35, or 99	ASPHALT_GRADE_OTHER
AGG_TYPE	0, 27, or null	AGG_TYPE_OTHER
SURFACE_PREP	5	SURFACE_PREP_OTHER
SURFACE_COND	7	SURFACE_COND_OTHER
SPS3_CRACK		
SURFACE_PREP	5	SURFACE_PREP_OTHER
SURFACE_COND	7	SURFACE_COND_OTHER
SPS3_SLURRY		
ASPHALT_GRADE	17, 35, or 99	ASPHALT_GRADE_OTHER
AGG_TYPE	0, 27, or null	AGG_TYPE_OTHER
MINERAL_FILL_TYPE	27	MINERAL_FILL_TYPE_OTHER
SURFACE_PREP	5	SURFACE_PREP_OTHER
SURFACE_COND	7	SURFACE_COND_OTHER
SPS3_SLURRY_EQUIP		
DRAG	3	DRAG_OTHER
SURFACE_TEXTURE	0 or null	SURFACE_TEXTURE_OTHER

If the data element below	has a code of	then a non-null entry must exist in the data element below
SPS3_CHIP		
SURFACE_PREP	1 - 4	SURFACE_PREP_OTHER
SURFACE_COND	1 - 6	SURFACE_COND_OTHER
SPS3_CRACK		
SURFACE_PREP	1 - 4	SURFACE_PREP_OTHER
SURFACE_COND	1 - 6	SURFACE_COND_OTHER
SPS3_SLURRY		
SURFACE_PREP	1 - 4	SURFACE_PREP_OTHER
SURFACE_COND	1 - 6	SURFACE_COND_OTHER

16.0 SPS4 CONSTRUCTION

16.1 Level 1

A. Initial Level

Records in the IMS are at Level A when they first enter the system and are set back to A when changes are made to a given record or to selected related records.

B. Dependency Checks

SPS4 Construction Table Dependency Checks

- All records in each Construction table are checked against **SPS_PROJECT_STATIONS**, for matching project level ID. If the corresponding project level records are at level E in **SPS_PROJECT_STATIONS**, the records in the construction tables go to level B.

C. Minimum Data Checks

Minimum data checks for all SPS4 Construction data tables are identified below. Data fields with a Condition of X must always contain a non-null value, however, data fields with a Condition of * are only required to contain a non-null value if a particular condition is met as specified in the accompanying field explanation.

Table	Field	Condition
SPS4_BENKELMAN_GENERAL	PURPOSE_OF_TESTING	X
SPS4_BENKELMAN_MEASURE	BEFORE_AFTER_REGROUT	X
	DEFLECTION_APPROACH	X
	DEFLECTION_LEAVE	X
	JOINT_NO	X
	LOCATION_OF_AXLE	X
	STATION	X
	TESTING_AT	X
SPS4_CONTROL_GENERAL	DIAGONAL_CRACK	X
	JOINT_OPEN_PROCESS	*
	LANE_WIDTH	X
	LONG_CRACK	X
	LONG_JOINT	X
	OTHER_PROCESS	*
	*either JOINT_OPEN_PROCESS or OTHER_PROCESS or both	
	PATCHING	X
	SECTION_LENGTH	X
	SHOULDER_JOINT	X

	TRANS_CRACK	X
	TRANS_JOINT	X
SPS4_CONTROL_LONG	AVG_WIDTH	X
SPS4_CONTROL_RANDOM	AVG_WIDTH	X
SPS4_CONTROL_SHOULDER	AVG_WIDTH	X
SPS4_CONTROL_TRANS	AVG_WIDTH	X
SPS4_CRACK_SEAL_GENERAL	CONCRETE_SHOULDER_JOINT	X
	DIAGONAL_CRACK	X
	LANE_WIDTH	X
	LONGITUDINAL_CRACK	X
	LONGITUDINAL_JOINT	X
	TEST_SECTION_LENGTH	X
	TRANSVERSE_CRACK	X
	TRANSVERSE_JOINT	X
SPS4_CRACK_SEAL_PVMT	APPL_METHOD	X
	BACKER_TYPE	X
	JOINT_SAWED	X
	SEAL_REMOVAL_METHOD	X
	SEALANT_OTHER	*
	SEALANT_TYPE	*
	*either one or both, if applicable	
SPS4_CRACK_SEAL_PVMT_MEAS	AVG_DEPTH_TOP_SEAL	X
	L_AVG_BACKER_DEPTH	X
	L_AVG_RESERVOIR_DEPTH	X
	L_AVG_RESERVOIR_WIDTH	X
	L_TOT_LENGTH_PREP	X
	T_AVG_BACKER_DEPTH	X
	T_AVG_RESERVOIR_DEPTH	X
	T_AVG_RESERVOIR_WIDTH	X
	T_TOT_LENGTH_PREP	X
SPS4_CRACK_SEAL_RAND	APPL_METHOD	X
	BACKER_TYPE	X
	JOINT_SAWED	X
	SEAL_REMOVAL_METHOD	X
	SEALANT_OTHER	*
	SEALANT_TYPE	*
	*either one or both, if applicable	
SPS4_CRACK_SEAL_RAND_MEAS	AVG_DEPTH_TOP_SEAL	X
	AVG_BACKER_DEPTH	X
	AVG_RESERVOIR_DEPTH	X
	AVG_RESERVOIR_WIDTH	X
	TOT_LENGTH_PREP	X
SPS4_CRACK_SEAL_SH	APPL_METHOD	X
	BACKER_TYPE	X
	JOINT_SAWED	X
	SEAL_REMOVAL_METHOD	X

	SEALANT_OTHER	*
	SEALANT_TYPE	*
	*either one or both, if applicable	
SPS4_CRACK_SEAL_SH_MEAS	AVG_BACKER_DEPTH	X
	AVG_DEPTH_TOP_SEAL	X
	AVG_RESERVOIR_DEPTH	X
	AVG_RESERVOIR_WIDTH	X
	TOT_LENGTH_PREP	X
SPS4_DYNAFLECT_GENERAL	TEST_PURPOSE	X
SPS4_DYNAFLECT_MEASURE	DEFLECT1	X
	JOINT_NO	X
	LOCATION_AT	X
	SIDE_OF_JOINT_CRACK	X
	STATION	X
SPS4_FWD_MEASUREMENTS	FILE_ID	X
	TEST_PURPOSE	X
SPS4_TRANSIENT_GENERAL	TEST_PURPOSE	X
SPS4_TRANSIENT_MEASURE	AIR_TEMPERATURE	X
	LOCATION_AT	X
	LOCATION_DESC	X
	OFFSET	X
	PAVEMENT_TEMPERATURE	X
	SIDE_OF_JOINT_CRACK	X
	STATION	X
SPS4_UNDERSEAL_GENERAL	CEMENT_TYPE	X
	UPLIFT_MONITORED	X
SPS4_UNDERSEAL_INIT_GROUT	CEMENT_BAGS_PER_BATCH	X
	FLY_ASH_BAGS_PER_BATCH	X
	GALLONS_WATER_PER_BATCH	X
	GROUT_WELL_BLENDED	X
	STABILITY_CHECKED_AFTER	X
	UNSTABLE_SLABS_REGROUTED	*
	*only applicable if STABILITY_CHECKED_AFTER = 1	
SPS4_UNDERSEAL_PRES_GROUT	GROUT_PUMPED_PER_HOLE	X
	HOLE_DEPTH	X
	HOLE_NO	X
	INITIAL_OR_REGROUT	X
	JOINT_NO	X
	OFFSET	X
	STATION	X
SPS4_UNDERSEAL_REGROUT	CEMENT_BAGS_PER_BATCH	X
	FLY_ASH_BAGS_PER_BATCH	X
	GALLONS_WATER_PER_BATCH	X
	GROUT_WELL_BLENDED	X
	STABILITY_CHECKED_AFTER	X

UNSTABLE_SLABS_REGROUTED *
*only applicable if STABILITY_CHECKED_AFTER = 1

D. Expanded Range Checks

Expanded range checks are applied to certain fields to identify data element values that fall outside an expected range. Field names are listed below the bolded table name. Expanded range checks for all SPS4 Construction data tables are specified below.

Table	Units	Range
SPS4_BENKELMAN_GENERAL		
BEGIN_HUMIDITY	%	0 - 100
BEGIN_TEMPERATURE	deg F	40 - 80
END_HUMIDITY	%	0 - 100
END_TEMPERATURE	deg F	40 - 80
PURPOSE_OF_TESTING		1 - 4
SURFACE_MOISTURE		1 - 4
TESTING_DEVICE_SOURCE		1 - 4
TIME_BEGAN_UNDERSEAL	hr	0 - 2359
TIME_END_UNDERSEAL	hr	0 - 2359
SPS4_BENKELMAN_MEASUREMENTS		
DEFLECTION_APPROACH	mils	0 - 50
DEFLECTION_LEAVE	mils	0 - 50
JOINT_NO		1 - 50
LOCATION_OF_AXLE		1 - 2
STATION	ft	-100 - 600
TESTING_AT		1 - 2
SPS4_CONTROL_GENERAL		
AIR_TEMPERATURE	deg F	40 - 120
DIAGONAL_CRACK		1 - 5
HUMIDITY	%	0 - 100
JOINT_OPEN_PROCESS		1 - 5
LANE_WIDTH	ft	10 - 15
LONG_CRACK		1 - 5
LONG_JOINT		1 - 5
PATCHING		1 - 4
SECTION_LENGTH	ft	300 - 600
SHOULDER_JOINT		1 - 5
TIME	hr	0 - 2359
TRANS_CRACK		1 - 5
TRANS_JOINT		1 - 5
SPS4_CONTROL_LONG		
AVG_WIDTH	1/16 in	0 - 24
MAX_WIDTH	1/16 in	0 - 24
MIN_WIDTH	1/16 in	0 - 24
WIDTH1	1/16 in	0 - 24
WIDTH10	1/16 in	0 - 24
WIDTH2	1/16 in	0 - 24
WIDTH3	1/16 in	0 - 24
WIDTH4	1/16 in	0 - 24

WIDTH5	1/16 in	0 - 24
WIDTH6	1/16 in	0 - 24
WIDTH7	1/16 in	0 - 24
WIDTH8	1/16 in	0 - 24
WIDTH9	1/16 in	0 - 24

SPS4_CONTROL_RANDOM

WIDTH1	1/16 in	0 - 24
WIDTH10	1/16 in	0 - 24
WIDTH2	1/16 in	0 - 24
WIDTH3	1/16 in	0 - 24
WIDTH4	1/16 in	0 - 24
WIDTH5	1/16 in	0 - 24
WIDTH6	1/16 in	0 - 24
WIDTH7	1/16 in	0 - 24
WIDTH8	1/16 in	0 - 24
WIDTH9	1/16 in	0 - 24
AVG_WIDTH	1/16 in	0 - 24
MAX_WIDTH	1/16 in	0 - 24
MIN_WIDTH	1/16 in	0 - 24

SPS4_CONTROL_SHOULDER

AVG_WIDTH	1/16 in	0 - 24
MAX_WIDTH	1/16 in	0 - 24
WIDTH1	1/16 in	0 - 24
WIDTH10	1/16 in	0 - 24
WIDTH2	1/16 in	0 - 24
WIDTH3	1/16 in	0 - 24
WIDTH4	1/16 in	0 - 24
WIDTH5	1/16 in	0 - 24
WIDTH6	1/16 in	0 - 24
WIDTH7	1/16 in	0 - 24
WIDTH8	1/16 in	0 - 24
WIDTH9	1/16 in	0 - 24
MIN_WIDTH	1/16 in	0 - 24

SPS4_CONTROL_TRANS

AVG_WIDTH	1/16 in	0 - 24
MAX_WIDTH	1/16 in	0 - 24
MIN_WIDTH	1/16 in	0 - 24
WIDTH1	1/16 in	0 - 24
WIDTH10	1/16 in	0 - 24
WIDTH2	1/16 in	0 - 24
WIDTH3	1/16 in	0 - 24
WIDTH4	1/16 in	0 - 24
WIDTH5	1/16 in	0 - 24
WIDTH6	1/16 in	0 - 24
WIDTH7	1/16 in	0 - 24
WIDTH8	1/16 in	0 - 24
WIDTH9	1/16 in	0 - 24

SPS4_CRACK_SEAL_GENERAL

CONCRETE_PATCHING_COMPLETED		1 - 2
CONCRETE_SHOULDER_JOINT		1 - 5
DAY1_BEGIN_SEAL_HUMIDITY	%	0 - 100
DAY1_BEGIN_SEAL_TEMP	deg F	40 - 120

DAY1_END_SEAL_HUMIDITY	%	0 - 100
DAY1_END_SEAL_TEMP	deg F	40 - 120
DAY1_TIME_WORK_BEGAN	hr	0 - 2359
DAY1_TIME_WORK_ENDED	hr	0 - 2359
DAY2_BEGIN_SEAL_HUMIDITY	%	0 - 100
DAY2_BEGIN_SEAL_TEMP	deg F	40 - 120
DAY2_END_SEAL_HUMIDITY	%	0 - 100
DAY2_END_SEAL_TEMP	deg F	40 - 120
DAY2_TIME_WORK_BEGAN	hr	0 - 2359
DAY2_TIME_WORK_ENDED	hr	0 - 2359
DAY3_BEGIN_SEAL_HUMIDITY	%	0 - 100
DAY3_BEGIN_SEAL_TEMP	deg F	40 - 120
DAY3_END_SEAL_HUMIDITY	%	0 - 100
DAY3_END_SEAL_TEMP	deg F	40 - 120
DAY3_TIME_WORK_BEGAN	hr	0 - 2359
DAY3_TIME_WORK_ENDED	hr	0 - 2359
DIAGONAL_CRACK		1 - 5
FIELD_NOTES_AVAILABLE		1 - 2
LANE_WIDTH	ft	10 - 15
LONGITUDINAL_CRACK		1 - 5
LONGITUDINAL_JOINT		1 - 5
MATL_BURNED_BY_AIR_LANCE		1 - 4
SHOULDER_PATCHING_COMPLETED		1 - 2
TEST_SECTION_LENGTH	ft	300 - 600
TRANSVERSE_CRACK		1 - 5
TRANSVERSE_JOINT		1 - 5

SPS4_CRACK_SEAL_PVMT

AIR_CLEAN_DRY_RESERVOIR		1 - 2
AIR_LANCE		1 - 2
AGITATION		1 - 2
APPL_METHOD		1 - 2
BACKER_TYPE		1 - 4
DIAMETER	1/16 in	0, 6 - 32, null
HOSE_BACKFLUSHED		1 - 2
HOSE_CONNECT_WAND		1 - 2
INDIRECT_OIL_HEATING		1 - 2
JOINT_SAWED		1 - 4
L_BUBBLES_PRESENT		1 - 4
L_FILM_ON_SILICONE		1 - 3
L_HOURS_INSTALL_CLEAN	hr	0 - 24
L_RESERVOIR_CONDITION		1 - 4
L_RESERVOIR_MOISTURE		1 - 4
L_SEALANT_BONDED_TO_BOTH		1 - 3
L_SEALANT_TACKY		1 - 3
LIQUID_TIME	hr	0 - 2400
SANDBLAST_RESERVOIR		1 - 2
SAW_BLADE_DIAM	in	0 - 60
SAW_IN_ONE_PASS		1 - 2
SEAL_REMOVAL_METHOD		1 - 9
SEALANT_TOOLED		1 - 2
SEALANT_TYPE		1 - 3
SILICONE_TIME		1 - 2
SPALLING_CAUSED_BY_REMOVAL		1 - 4
SPALLING_CAUSED_BY_SAW		1 - 4
SUPPLY_UNIT		1 - 5

T_BUBBLES_PRESENT		1 - 3
T_FILM_ON_SILICONE		1 - 3
T_HOURS_INSTALL_CLEAN	hr	0 - 24
T_RESERVOIR_CONDITION		1 - 4
T_RESERVOIR_MOISTURE		1 - 4
T_SEALANT_BONDED_TO_BOTH	hr	0 - 2400
T_SEALANT_TACKY		1 - 4
WALL_SAWED_VERTICAL		1 - 4
WATER_BLAST_RESERVOIR		1 - 2
WATER_FLUSH_RESERVOIR		1 - 2
WATER_SAWING_REFACING		1 - 2
WATER_SAWING_SEAL		1 - 2

SPS4_CRACK_SEAL_PVMT_MEAS

AVG_DEPTH_TOP_SEAL	1/16 in	0 - 8
DEPTH_TOP_SEAL1	1/16 in	0 - 8
DEPTH_TOP_SEAL10	1/16 in	0 - 8
DEPTH_TOP_SEAL2	1/16 in	0 - 8
DEPTH_TOP_SEAL3	1/16 in	0 - 8
DEPTH_TOP_SEAL4	1/16 in	0 - 8
DEPTH_TOP_SEAL5	1/16 in	0 - 8
DEPTH_TOP_SEAL6	1/16 in	0 - 8
DEPTH_TOP_SEAL7	1/16 in	0 - 8
DEPTH_TOP_SEAL8	1/16 in	0 - 8
DEPTH_TOP_SEAL9	1/16 in	0 - 8
L_AVG_BACKER_DEPTH	1/16 in	5 - 40
L_AVG_RESERVOIR_DEPTH	1/16 in	5 - 36
L_AVG_RESERVOIR_WIDTH	1/16 in	5 - 24
L_BACKER_DEPTH1	1/16 in	5 - 40
L_BACKER_DEPTH10	1/16 in	5 - 40
L_BACKER_DEPTH2	1/16 in	5 - 40
L_BACKER_DEPTH3	1/16 in	5 - 40
L_BACKER_DEPTH4	1/16 in	5 - 40
L_BACKER_DEPTH5	1/16 in	5 - 40
L_BACKER_DEPTH6	1/16 in	5 - 40
L_BACKER_DEPTH7	1/16 in	5 - 40
L_BACKER_DEPTH8	1/16 in	5 - 40
L_BACKER_DEPTH9	1/16 in	5 - 40
L_MAX_BACKER_DEPTH	1/16 in	5 - 40
L_MAX_RESERVOIR_DEPTH	1/16 in	5 - 36
L_MAX_RESERVOIR_WIDTH	1/16 in	5 - 24
L_MIN_BACKER_DEPTH	1/16 in	5 - 40
L_MIN_RESERVOIR_DEPTH	1/16 in	5 - 36
L_MIN_RESERVOIR_WIDTH	1/16 in	5 - 24
L_RESERVOIR_DEPTH1	1/16 in	5 - 36
L_RESERVOIR_DEPTH10	1/16 in	5 - 36
L_RESERVOIR_DEPTH2	1/16 in	5 - 36
L_RESERVOIR_DEPTH3	1/16 in	5 - 36
L_RESERVOIR_DEPTH4	1/16 in	5 - 36
L_RESERVOIR_DEPTH5	1/16 in	5 - 36
L_RESERVOIR_DEPTH6	1/16 in	5 - 36
L_RESERVOIR_DEPTH7	1/16 In	5 - 36
L_RESERVOIR_DEPTH8	1/16 in	5 - 36
L_RESERVOIR_DEPTH9	1/16 in	5 - 36
L_RESERVOIR_WIDTH1	1/16 in	5 - 24
L_RESERVOIR_WIDTH10	1/16 in	5 - 24

L_RESERVOIR_WIDTH2	1/16 in	5 - 24
L_RESERVOIR_WIDTH3	1/16 in	5 - 24
L_RESERVOIR_WIDTH4	1/16 in	5 - 24
L_RESERVOIR_WIDTH5	1/16 in	5 - 24
L_RESERVOIR_WIDTH6	1/16 in	5 - 24
L_RESERVOIR_WIDTH7	1/16 in	5 - 24
L_RESERVOIR_WIDTH8	1/16 in	5 - 24
L_RESERVOIR_WIDTH9	1/16 in	5 - 24
MAX_DEPTH_TOP_SEAL	1/16 In	0 - 8
MIN_DEPTH_TOP_SEAL	1/16 in	0 - 8
T_AVG_BACKER_DEPTH	1/16 in	5 - 40
T_AVG_RESERVOIR_DEPTH	1/16 in	5 - 36
T_AVG_RESERVOIR_WIDTH	1/16 in	5 - 24
T_BACKER_DEPTH1	1/16 in	5 - 40
T_BACKER_DEPTH10	1/16 in	5 - 40
T_BACKER_DEPTH2	1/16 in	5 - 40
T_BACKER_DEPTH3	1/16 in	5 - 40
T_BACKER_DEPTH4	1/16 in	5 - 40
T_BACKER_DEPTH5	1/16 in	5 - 40
T_BACKER_DEPTH6	1/16 in	5 - 40
T_BACKER_DEPTH7	1/16 in	5 - 40
T_BACKER_DEPTH8	1/16 in	5 - 40
T_BACKER_DEPTH9	1/16 in	5 - 40
T_MAX_BACKER_DEPTH	1/16 in	5 - 40
T_MAX_RESERVOIR_DEPTH	1/16 in	5 - 36
T_MAX_RESERVOIR_WIDTH	1/16 in	5 - 24
T_MIN_BACKER_DEPTH	1/16 in	5 - 40
T_MIN_RESERVOIR_DEPTH	1/16 in	5 - 36
T_MIN_RESERVOIR_WIDTH	1/16 in	5 - 24
T_RESERVOIR_DEPTH1	1/16 in	5 - 36
T_RESERVOIR_DEPTH10	1/16 in	5 - 36
T_RESERVOIR_DEPTH2	1/16 in	5 - 36
T_RESERVOIR_DEPTH3	1/16 in	5 - 36
T_RESERVOIR_DEPTH4	1/16 in	5 - 36
T_RESERVOIR_DEPTH5	1/16 in	5 - 36
T_RESERVOIR_DEPTH6	1/16 in	5 - 36
T_RESERVOIR_DEPTH7	1/16 in	5 - 36
T_RESERVOIR_DEPTH8	1/16 in	5 - 36
T_RESERVOIR_DEPTH9	1/16 in	5 - 36
T_RESERVOIR_WIDTH1	1/16 in	5 - 24
T_RESERVOIR_WIDTH10	1/16 in	5 - 24
T_RESERVOIR_WIDTH2	1/16 in	5 - 24
T_RESERVOIR_WIDTH3	1/16 in	5 - 24
T_RESERVOIR_WIDTH4	1/16 in	5 - 24
T_RESERVOIR_WIDTH5	1/16 in	5 - 24
T_RESERVOIR_WIDTH6	1/16 in	5 - 24
T_RESERVOIR_WIDTH7	1/16 in	5 - 24
T_RESERVOIR_WIDTH8	1/16 in	5 - 24
T_RESERVOIR_WIDTH9	1/16 in	5 - 24

SPS4_CRACK_SEAL_RAND

AGITATION	1 - 2
AIR_CLEAN_DRY_RESERVOIR	1 - 2
AIR_LANCE	1 - 2
APPL_METHOD	1 - 2
BACKER_TYPE	1 - 4

BUBBLES_PRESENT		1 - 4
DIAMETER	1/16 in	0, 6 - 32
FILM_ON_SILICONE		1 - 3
HOSE_BACKFLUSHED		1 - 2
HOSE_CONNECT_WAND		1 - 2
HOURS_INSTALL_CLEAN	hr	0 - 24
INDIRECT_OIL_HEATING		1 - 2
JOINT_SAWED		1 - 4
LIQUID_TIME	hr	0 - 2400
RESERVOIR_CONDITION		1 - 4
RESERVOIR_MOISTURE		1 - 4
SANDBLAST_RESERVOIR		1 - 2
SAW_BLADE_DIAM	in	0 - 60
SAW_IN_ONE_PASS		1 - 2
SEAL_REMOVAL_METHOD		1 - 9
SEALANT_BONDED_TO_BOTH		1 - 3
SEALANT_TACKY		1 - 3
SEALANT_TOOLED		1 - 2
SEALANT_TYPE		1 - 3
SILICONE_TIME	hr	0 - 2400
SPALLING_CAUSED_BY_REMOVAL		1 - 4
SPALLING_CAUSED_BY_SAW		1 - 4
SUPPLY_UNIT		1 - 5
WALL_SAWED_VERTICAL		1 - 4
WATER_BLAST_RESERVOIR		1 - 2
WATER_FLUSH_RESERVOIR		1 - 2
WATER_SAWING_REFACING		1 - 2
WATER_SAWING_SEAL		1 - 2

SPS4_CRACK_SEAL_RAND_MEAS

AVG_BACKER_DEPTH	1/16 in	12 - 40
AVG_DEPTH_TOP_SEAL	1/16 in	0 - 8
AVG_RESERVOIR_DEPTH	1/16 in	12 - 36
AVG_RESERVOIR_WIDTH	1/16 in	6 - 24
BACKER_DEPTH1	1/16 in	12 - 40
BACKER_DEPTH10	1/16 in	12 - 40
BACKER_DEPTH2	1/16 in	12 - 40
BACKER_DEPTH3	1/16 in	12 - 40
BACKER_DEPTH4	1/16 in	12 - 40
BACKER_DEPTH5	1/16 in	12 - 40
BACKER_DEPTH6	1/16 in	12 - 40
BACKER_DEPTH7	1/16 in	12 - 40
BACKER_DEPTH8	1/16 in	12 - 40
BACKER_DEPTH9	1/16 in	12 - 40
DEPTH_TOP_SEAL1	1/16 in	0 - 8
DEPTH_TOP_SEAL10	1/16 in	0 - 8
DEPTH_TOP_SEAL2	1/16 in	0 - 8
DEPTH_TOP_SEAL3	1/16 in	0 - 8
DEPTH_TOP_SEAL4	1/16 in	0 - 8
DEPTH_TOP_SEAL5	1/16 in	0 - 8
DEPTH_TOP_SEAL6	1/16 in	0 - 8
DEPTH_TOP_SEAL7	1/16 in	0 - 8
DEPTH_TOP_SEAL8	1/16 in	0 - 8
DEPTH_TOP_SEAL9	1/16 in	0 - 8
MAX_BACKER_DEPTH	1/16 in	12 - 40
MAX_DEPTH_TOP_SEAL	1/16 in	0 - 8

MAX_RESERVOIR_DEPTH	1/16 in	12 - 36
MAX_RESERVOIR_WIDTH	1/16 in	6 - 24
MIN_BACKER_DEPTH	1/16 in	12 - 40
MIN_DEPTH_TOP_SEAL	1/16 in	0 - 8
MIN_RESERVOIR_DEPTH	1/16 in	12 - 36
MIN_RESERVOIR_WIDTH	1/16 in	6 - 24
RESERVOIR_DEPTH1	1/16 in	12 - 36
RESERVOIR_DEPTH10	1/16 in	12 - 36
RESERVOIR_DEPTH2	1/16 in	12 - 36
RESERVOIR_DEPTH3	1/16 in	12 - 36
RESERVOIR_DEPTH4	1/16 in	12 - 36
RESERVOIR_DEPTH5	1/16 in	12 - 36
RESERVOIR_DEPTH6	1/16 in	12 - 36
RESERVOIR_DEPTH7	1/16 in	12 - 36
RESERVOIR_DEPTH8	1/16 in	12 - 36
RESERVOIR_DEPTH9	1/16 in	12 - 36
RESERVOIR_WIDTH10	1/16 in	6 - 24
RESERVOIR_WIDTH1	1/16 in	6 - 24
RESERVOIR_WIDTH2	1/16 in	6 - 24
RESERVOIR_WIDTH3	1/16 in	6 - 24
RESERVOIR_WIDTH4	1/16 in	6 - 24
RESERVOIR_WIDTH5	1/16 in	6 - 24
RESERVOIR_WIDTH6	1/16 in	6 - 24
RESERVOIR_WIDTH7	1/16 in	6 - 24
RESERVOIR_WIDTH8	1/16 in	6 - 24
RESERVOIR_WIDTH9	1/16 in	6 - 24

SPS4_CRACK_SEAL_SH

AGITATION		1 - 2
AIR_CLEAN_DRY_RESERVOIR		1 - 2
AIR_LANCE		1 - 2
APPL_METHOD		1 - 2
BACKER_TYPE		1 - 4
BUBBLES_PRESENT		1 - 4
DIAMETER	1/16 in	0, 6 - 32
FILM_ON_SILICONE		1 – 3
HOSE_CONNECT_WAND		1 – 2
HOSE_BACKFLUSHED		1 - 2
HOURS_INSTALL_CLEAN	hr	0 - 24
INDIRECT_OIL_HEATING		1 - 2
JOINT_SAWED		1 - 4
LIQUID_TIME	hr	0 - 2400
RESERVOIR_CONDITION		1 - 4
RESERVOIR_MOISTURE		1 - 4
SANDBLAST_RESERVOIR		1 - 2
SAW_BLADE_DIAM	in	0 - 60
SAW_IN_ONE_PASS		1 – 2
SEAL_REMOVAL_METHOD		1 - 9
SEALANT_BONDED_TO_BOTH		1 - 3
SEALANT_TACKY		1 - 3
SEALANT_TOOLED		1 - 2
SEALANT_TYPE		1 - 3
SILICONE_TIME	hr	0 - 2400
SPALLING_CAUSED_BY_REMOVAL		1 - 4
SPALLING_CAUSED_BY_SAW		1 - 4
SUPPLY_UNIT		1 - 5

WALL_SAWED_VERTICAL		1 - 4
WATER_BLAST_RESERVOIR		1 - 2
WATER_FLUSH_RESERVOIR		1 - 2
WATER_SAWING_REFACING		1 - 2
WATER_SAWING_SEAL		1 - 2

SPS4_CRACK_SEAL_SH_MEAS

AVG_BACKER_DEPTH	1/16 in	5 - 40
AVG_DEPTH_TOP_SEAL	1/16 in	0 - 8
AVG_RESERVOIR_DEPTH	1/16 in	5 - 36
AVG_RESERVOIR_WIDTH	1/16 in	5 - 24
BACKER_DEPTH1	1/16 in	5 - 40
BACKER_DEPTH10	1/16 in	5 - 40
BACKER_DEPTH2	1/16 in	5 - 40
BACKER_DEPTH3	1/16 in	5 - 40
BACKER_DEPTH4	1/16 in	5 - 40
BACKER_DEPTH5	1/16 in	5 - 40
BACKER_DEPTH6	1/16 in	5 - 40
BACKER_DEPTH7	1/16 in	5 - 40
BACKER_DEPTH8	1/16 in	5 - 40
BACKER_DEPTH9	1/16 in	5 - 40
DEPTH_TOP_SEAL1	1/16 in	0 - 8
DEPTH_TOP_SEAL10	1/16 in	0 - 8
DEPTH_TOP_SEAL2	1/16 in	0 - 8
DEPTH_TOP_SEAL3	1/16 in	0 - 8
DEPTH_TOP_SEAL4	1/16 in	0 - 8
DEPTH_TOP_SEAL5	1/16 in	0 - 8
DEPTH_TOP_SEAL6	1/16 in	0 - 8
DEPTH_TOP_SEAL7	1/16 in	0 - 8
DEPTH_TOP_SEAL8	1/16 in	0 - 8
DEPTH_TOP_SEAL9	1/16 in	0 - 8
MAX_BACKER_DEPTH	1/16 in	5 - 40
MAX_DEPTH_TOP_SEAL	1/16 in	0 - 8
MAX_RESERVOIR_DEPTH	1/16 in	5 - 36
MAX_RESERVOIR_WIDTH	1/16 in	5 - 24
MIN_BACKER_DEPTH	1/16 in	5 - 40
MIN_DEPTH_TOP_SEAL	1/16 in	0 - 8
MIN_RESERVOIR_DEPTH	1/16 in	5 - 36
MIN_RESERVOIR_WIDTH	1/16 in	5 - 24
RESERVOIR_DEPTH1	1/16 in	5 - 36
RESERVOIR_DEPTH10	1/16 in	5 - 36
RESERVOIR_DEPTH2	1/16 in	5 - 36
RESERVOIR_DEPTH3	1/16 in	5 - 36
RESERVOIR_DEPTH4	1/16 in	5 - 36
RESERVOIR_DEPTH5	1/16 in	5 - 36
RESERVOIR_DEPTH6	1/16 in	5 - 36
RESERVOIR_DEPTH7	1/16 in	5 - 36
RESERVOIR_DEPTH8	1/16 in	5 - 36
RESERVOIR_DEPTH9	1/16 in	5 - 36
RESERVOIR_WIDTH1	1/16 in	5 - 24
RESERVOIR_WIDTH10	1/16 in	5 - 24
RESERVOIR_WIDTH2	1/16 in	5 - 24
RESERVOIR_WIDTH3	1/16 in	5 - 24
RESERVOIR_WIDTH4	1/16 in	5 - 24
RESERVOIR_WIDTH5	1/16 in	5 - 24
RESERVOIR_WIDTH6	1/16 in	5 - 24

RESERVOIR_WIDTH7	1/16 in	5 - 24
RESERVOIR_WIDTH8	1/16 in	5 - 24
RESERVOIR_WIDTH9	1/16 in	5 - 24

SPS4_DYNAFLECT_GENERAL

BEGIN_AIR_TEMP	deg F	40 - 80
BEGIN_HUMIDITY	%	0 - 100
DEVICE_SOURCE		1 - 4
END_AIR_TEMP	deg F	40 - 80
END_HUMIDITY	%	0 - 100
SURFACE_MOISTURE		1 - 4
TEST_PURPOSE		1 - 4
TIME_COMPLETE	hr	0 - 2359
TIME_BEGAN	hr	0 - 2359

SPS4_DYNAFLECT_MEASURE

DEFLECT1	mils	0 - 50
DEFLECT2	mils	0 - 50
DEFLECT3	mils	0 - 50
DEFLECT4	mils	0 - 50
DEFLECT5	mils	0 - 50
JOINT_NO		0 - 50
LOCATION_AT		1 - 2
SIDE_OF_JOINT_CRACK		1 - 2
STATION	ft	-100 - 600

SPS4_FWD_MEASUREMENTS

BEGIN_AIR_TEMP	deg F	40 - 80
BEGIN_HUMIDITY	%	0 - 100
END_AIR_TEMP	deg F	40 - 80
END_HUMIDITY	%	0 - 100
TEST_PURPOSE		1 - 4
TESTING_DEVICE_SOURCE		1 - 4
TIME_BEGAN	hr	0 - 2359
TIME_COMPLETE	hr	0 - 2359
SURFACE_MOISTURE		1 - 4

SPS4_TRANSIENT_GENERAL

BEGIN_AIR_TEMP	deg F	40 - 80
BEGIN_HUMIDITY	%	0 - 100
END_AIR_TEMP	deg F	40 - 80
END_HUMIDITY	%	0 - 100
SURFACE_MOISTURE		1 - 4
TEST_PURPOSE		1 - 4
TIME_BEGAN	hr	0 - 2359
TIME_COMPLETE	hr	0 - 2359

SPS4_TRANSIENT_MEASURE

AIR_TEMPERATURE	deg F	40 - 80
LOCATION_AT		1 - 3
LOCATION_DESC		1 - 7
OFFSET	ft	0 - 15
PAVEMENT_TEMPERATURE	deg F	40 - 80
SIDE_OF_JOINT_CRACK		1 - 3
STATION	ft	-100 - 600

SPS4_UNDERSEAL_GENERAL

CEMENT_TYPE		41 - 43
EST_EXCESS_GROUT		1 - 4
FIELD_NOTES_AVAILABLE		1 - 2
FLY_ASH_TYPE		9 - 11
HOLE_INSTALL_METHOD		1 - 3
HOLE_VOLUME_DETERMINED		1 - 4
HOLES_PLUGGED		1 - 2
LANE_WIDTH	ft	10 - 15
METHOD_SLAB_PANEL		1 - 4
METHOD_TRAFFIC_RESTRICTION		1 - 3
SAME_CONTROLS_USED		1 - 4
TEST_SECTION_LENGTH	ft	200 - 600
TOT_VOL_GROUT_DETERMINED		1 - 2
TRAFFIC_RESTRICTED		1 - 4
UPLIFT_MONITORED		1 - 4

SPS4_UNDERSEAL_INIT_GROUT

BEGIN_HUMIDITY	%	0 - 100
BEGIN_TEMPERATURE	deg F	40 - 120
CHAMBER_CLEANLINESS		1 - 4
END_HUMIDITY	%	0 - 100
END_TEMPERATURE	deg F	40 - 120
GROUT_MIX_SPEED	rpm	800 - 2000
GROUT_WELL_BLENDED		1 - 4
HOLES_RETAIN_DRILL_FLUSH		1 - 4
MAX_PUMP_PRESSURE	psi	250 - 300
SURFACE_MOISTURE		1 - 4
STABILITY_CHECKED_AFTER		1 - 2
TIME_BEGAN_HOLE_DRILL	hr	0 - 2359
TIME_BEGAN_UNDERSEAL	hr	0 - 2359
TIME_END_HOLE_DRILL	hr	0 - 2359
TIME_END_UNDERSEAL	hr	0 - 2359
UNSTABLE_SLABS_REGROUTED		1 - 2
WATER_FLUSH_HOLES		1 - 2

SPS4_UNDERSEAL_PRES_GROUT

CUTOFF_CRITERIA		1 - 4
HOLE_DEPTH	in	6 - 30
INITIAL_OR_REGROUT		1 - 2
JOINT_NO		1 - 50
OFFSET	ft	0 - 15
STATION	ft	-100 - 600

SPS4_UNDERSEAL_REGROUT

BEGIN_HUMIDITY	%	0 - 100
BEGIN_TEMPERATURE	deg F	40 - 120
CHAMBER_CLEANLINESS		1 - 4
END_HUMIDITY	%	0 - 100
END_TEMPERATURE	deg F	40 - 120
GROUT_MIX_SPEED	rpm	800 - 2000
GROUT_WELL_BLENDED		1 - 4
HOLES_RETAIN_DRILL_FLUSH		1 - 4
MAX_PUMP_PRESSURE	psi	250 - 300
STABILITY_CHECKED_AFTER		1 - 2
SURFACE_MOISTURE		1 - 4

TIME_BEGAN_HOLE_DRILL	hr	0 - 2359
TIME_BEGAN_UNDERSEAL	hr	0 - 2359
TIME_END_HOLE_DRILL	hr	0 - 2359
TIME_END_UNDERSEAL	hr	0 - 2359
UNSTABLE_SLABS_REGROUTED		1 - 2
WATER_FLUSH_HOLES		1 - 2

E. Intramodular Checks

Intramodular checks for all SPS4 Construction data tables are specified below.

Table: SPS4_BENKELMAN_GENERAL

- DATE_COMPLETE >= DATE_BEGAN

Table: SPS4_BENKELMAN_MEASURE

- If RECORD_STATUS = D, set to E

Tables: SPS4_CONTROL_RANDOM, SPS4_CONTROL_LONG, SPS4_CONTROL_SHOULDER, SPS4_CONTROL_TRANS

- AVG_WIDTH = ROUND TO INTEGER ((WIDTH1 + WIDTH2 + ... WIDTH10)/10)
- MIN_WIDTH = MIN (WIDTH1 , WIDTH2 , ... WIDTH10)
- MAX_WIDTH = MAX (WIDTH1 , WIDTH2 , ... WIDTH10)

Table: SPS4_CRACK_SEAL_GENERAL

- DATE_COMPLETE >= DATE_BEGAN
- DAY1_TIME_WORK_ENDED >= DAY1_TIME_WORK_BEGAN
- If DAY2_TIME_WORK_ENDED is non-null then DAY2_TIME_WORK_ENDED $\geq$ DAY2_TIME_WORK_BEGAN
- If DAY3_TIME_WORK_ENDED is non-null then DAY3_TIME_WORK_ENDED $\geq$ DAY3_TIME_WORK_BEGAN

Tables: SPS4_CRACK_SEAL_PVMT, SPS4_CRACK_SEAL_RAND, SPS4_CRACK_SEAL_SH

- MIN_OIL_TEMP <= MAX_OIL_TEMP
- MIN_SEALANT_TEMP <= MAX_SEALANT_TEMP
- MIN_HEAT_TIME <= MAX_HEAT_TIME
- If APPL_METHOD = 1 then APPL_PRESSURE = 0

- If BACKER_TYPE = 1 then DIAMETER must be 0 for tables SPS4_CRACK_SEAL_RAND and SPS_CRACK_SEAL_SH. DIAMETER must be null or 0 for table SPS_CRACK_SEAL_PVMT.

- If SEAL_REMOVAL_METHOD = 1 then SPALLING_CAUSED_BY_REMOVAL must be null or 0

- If JOINT_SAWED = 1 then the following must hold true: SAW_BLADE_DIAM = 0, WATER_SAWING_REFACING must be null or 2, SAW_IN_ONE_PASS must be null or 2 and SPALLING_CAUSED_BY_SAW must be null or 1

- If WATER_BLAST_RESERVOIR = 2 then the following must hold true:

  a) WATER_PRESSURE = 0
  b) WATER_VOLUME = 0

- If AIR_CLEAN_DRY_RESERVOIR = 2 then AIR_PRESSURE must be 0

- If AIR_LANCE = 2 then AIR_LANCE_PRESSURE must be 0

Table: SPS4_CRACK_SEAL_PVMT_MEAS

- T_AVG_RESERVOIR_WIDTH = ROUND TO INTEGER ((T_RESERVOIR_WIDTH1 + T_RESERVOIR_WIDTH2 + ... T_RESERVOIR_WIDTH10)/10)

- T_MIN_RESERVOIR_WIDTH = MIN (T_RESERVOIR_WIDTH1 , T_RESERVOIR_WIDTH2 , ... T_RESERVOIR_WIDTH10)

- T_MAX_RESERVOIR_WIDTH = MAX (T_RESERVOIR_WIDTH1 , T_RESERVOIR_WIDTH2 , ... T_RESERVOIR_WIDTH10)

- T_AVG_RESERVOIR_DEPTH = ROUND TO INTEGER ((T_RESERVOIR_DEPTH1 + T_RESERVOIR_DEPTH2 + ... T_RESERVOIR_DEPTH10)/10)

- T_MIN_RESERVOIR_DEPTH = MIN (T_RESERVOIR_DEPTH1 , T_RESERVOIR_DEPTH2 , ... T_RESERVOIR_DEPTH10)

- T_MAX_RESERVOIR_DEPTH = MAX (T_RESERVOIR_DEPTH1 , T_RESERVOIR_DEPTH2 , ... T_RESERVOIR_DEPTH10)

- L_AVG_RESERVOIR_WIDTH = ROUND TO INTEGER ((L_RESERVOIR_WIDTH1 + L_RESERVOIR_WIDTH2 + ... L_RESERVOIR_WIDTH10)/10)

- L_MIN_RESERVOIR_WIDTH = MIN (L_RESERVOIR_WIDTH1 , L_RESERVOIR_WIDTH2 , ... L_RESERVOIR_WIDTH10)

- L_MAX_RESERVOIR_WIDTH = MAX (L_RESERVOIR_WIDTH1 , L_RESERVOIR_WIDTH2 , ... L_RESERVOIR_WIDTH10)

- L_AVG_RESERVOIR_DEPTH = ROUND TO INTEGER ((L_RESERVOIR_DEPTH1 + L_RESERVOIR_DEPTH2 + ... L_RESERVOIR_DEPTH10)/10)

- L_MIN_RESERVOIR_DEPTH = MIN (L_RESERVOIR_DEPTH1 , L_RESERVOIR_DEPTH2 ,

... L_RESERVOIR_DEPTH10)

- L_MAX_RESERVOIR_DEPTH = MAX (L_RESERVOIR_DEPTH1 , L_RESERVOIR_DEPTH2 , ... L_RESERVOIR_DEPTH10)
- T_AVG_BACKER_DEPTH = ROUND TO INTEGER ((T_BACKER_DEPTH1 + T_BACKER_DEPTH2 + ... T_BACKER_DEPTH10)/10)
- T_MIN_BACKER_DEPTH = MIN (T_BACKER_DEPTH1 , T_BACKER_DEPTH2 , ... T_BACKER_DEPTH10)
- T_MAX_BACKER_DEPTH = MAX (T_BACKER_DEPTH1 , T_BACKER_DEPTH2 , ... T_BACKER_DEPTH10)
- L_AVG_BACKER_DEPTH = ROUND TO INTEGER ((L_BACKER_DEPTH1 + L_BACKER_DEPTH2 + ... L_BACKER_DEPTH10)/10)
- L_MIN_BACKER_DEPTH = MIN (L_BACKER_DEPTH1 , L_BACKER_DEPTH2 , ... L_BACKER_DEPTH10)
- L_MAX_BACKER_DEPTH = MAX (L_BACKER_DEPTH1 , L_BACKER_DEPTH2 , ... L_BACKER_DEPTH10)
- AVG_DEPTH_TOP_SEAL = ROUND TO INTEGER ((DEPTH1_TOP_SEAL + DEPTH2_TOP_SEAL + ... DEPTH10_TOP_SEAL)/10)
- MIN_DEPTH_TOP_SEAL = MIN (DEPTH1_TOP_SEAL , DEPTH2_TOP_SEAL , ... DEPTH10_TOP_SEAL)
- MAX_DEPTH_TOP_SEAL = MAX (DEPTH1_TOP_SEAL , DEPTH2_TOP_SEAL , ... DEPTH10_TOP_SEAL)

Tables: SPS4_CRACK_SEAL_RAND_MEAS, SPS4_CRACK_SEAL_SH_MEAS

- AVG_RESERVOIR_WIDTH = ROUND TO INTEGER ((RESERVOIR_WIDTH1 + RESERVOIR_WIDTH2 + ... RESERVOIR_WIDTH10)/10)
- MIN_RESERVOIR_WIDTH = MIN (RESERVOIR_WIDTH1 , RESERVOIR_WIDTH2 , ... RESERVOIR_WIDTH10)
- MAX_RESERVOIR_WIDTH = MAX (RESERVOIR_WIDTH1 , RESERVOIR_WIDTH2 , ... RESERVOIR_WIDTH10)
- AVG_RESERVOIR_DEPTH = ROUND TO INTEGER ((RESERVOIR_DEPTH1 + RESERVOIR_DEPTH2 + ... RESERVOIR_DEPTH10)/10)
- MIN_RESERVOIR_DEPTH = MIN (RESERVOIR_DEPTH1 , RESERVOIR_DEPTH2 , ... RESERVOIR_DEPTH10)
- MAX_RESERVOIR_DEPTH = MAX (RESERVOIR_DEPTH1 , RESERVOIR_DEPTH2 , ... RESERVOIR_DEPTH10)
- AVG_BACKER_DEPTH = ROUND TO INTEGER ((BACKER_DEPTH1 + BACKER_DEPTH2 + ... BACKER_DEPTH10)/10)

- MIN_BACKER_DEPTH = MIN (BACKER_DEPTH1 , BACKER_DEPTH2 , ... BACKER_DEPTH10)
- MAX_BACKER_DEPTH = MAX (BACKER_DEPTH1 , BACKER_DEPTH2 , ... BACKER_DEPTH10)
- AVG_DEPTH_TOP_SEAL = ROUND TO INTEGER ((DEPTH1_TOP_SEAL + DEPTH2_TOP_SEAL + ... DEPTH10_TOP_SEAL)/10)
- MIN_DEPTH_TOP_SEAL = MIN (DEPTH1_TOP_SEAL , DEPTH2_TOP_SEAL , ... DEPTH10_TOP_SEAL)
- MAX_DEPTH_TOP_SEAL = MAX (DEPTH1_TOP_SEAL , DEPTH2_TOP_SEAL , ... DEPTH10_TOP_SEAL)

Table: SPS4_DYNAFLECT_GENERAL

- DATE_COMPLETE >= DATE_BEGAN

Table: SPS4_FWD_MEASUREMENTS

- DATE_COMPLETE >= DATE_BEGAN

Table: SPS4_TRANSIENT_GENERAL

- DATE_COMPLETE >= DATE_BEGAN

Table: SPS4_UNDERSEAL_GENERAL

- DATE_COMPLETE >= DATE_BEGAN

Tables: SPS4_UNDERSEAL_INIT_GROUT, SPS4_UNDERSEAL_REGROUT

- TIME_END_HOLE_DRILL >= TIME_BEGAN_HOLE_DRILL
- If STABILITY_CHECKED_AFTER = 2 then UNSTABLE_SLABS_REGROUTED should be null or 2

In addition, the checks listed in Table 16-1 are required for the identified tables and elements.

Table 16.1. Additional Level E Checks

If the data element below	has a code of	then a non-null entry must exist in the data element below
SPS4_CRACK_SEAL_PVMT		
SEALANT_TYPE	3	SEALANT_TYPE_OTHER
REMOVAL_METHOD	9	REMOVAL_METHOD_OTHER
SPS4_CRACK_SEAL_RAND		
SEALANT_TYPE	3	SEALANT_TYPE_OTHER
REMOVAL_METHOD	9	REMOVAL_METHOD_OTHER
SPS4_CRACK_SEAL_SH		
SEALANT_TYPE	3	SEALANT_TYPE_OTHER
REMOVAL_METHOD	9	REMOVAL_METHOD_OTHER
SPS4_UNDERSEAL_GENERAL		
METHOD_SLAB_PANEL	4	METHOD_SLAB_PANEL_OTHER
METHOD_TRAFFIC_RESTRICTION	3	METHOD_TRAFFIC_RESTRICTION_OTHER

17.0 SPS5 CONSTRUCTION

17.1 Level 1

A. Initial Level

Records in the IMS are at Level A when they first enter the system and are set back to A when changes are made to a given record or to selected related records.

B. Dependency Checks

Dependency checks (B) are performed on records at level A. These checks are performed to ensure that essential data (data which are required to properly reference all other data) are present and adequate. For SPS5 sections, the dependency checks are performed for the specific SPS section (SINIT).

Four types of checks are performed for the SINIT checks; INIT B - an experiment verification check, INIT C - a minimum data check, INIT D - an expanded range check and INIT E - an intramodular check. Each of these checks are specified below. **A Project record must be at level E in SPS_PROJECT_STATIONS prior to a section passing the level B check for the remaining tables. (See SPS5 Construction Table Dependency Checks at the end of this section.)**

SINIT B Checks (Section Experiment Verification)

Table: SPS5_LAYER

- All records for the project level (PINIT) must have RECORD_STATUS = E

SINIT C Checks (Section Minimum Data Checks)

Table	Field	Condition
SPS5_LAYER	DESCRIPTION	X
	MATERIAL_TYPE	X
	MEAN_THICKNESS	*
	*For LAYER_NO >1	

SINIT D Checks (Section Expanded Range Checks)

SPS5_LAYER

DESCRIPTION	MAX_ THICKNESS (in)	MEAN_ THICKNESS (in)	MIN_ THICKNESS (in)	MATERIAL_TYPE (not supplementals)
2	0.1 -1.5	0.1 - 1.5	0.1 - 1.5	71 - 73, 81 - 83
3	0.0 - 10.0	0.0 - 10.0	0.0 - 10.0	1
4 (below 3)	1.0 – 10	1.0 - 10	1.0 - 10.0	1
5	4.0 - 24.0	4.0 - 24.0	4.0 - 24.0	22 - 46
6	4.0 - 47.9	4.0 - 47.9	4.0 - 47.9	22 - 46
7	null	null	null	51 - 65
8	0.1- 6.0	0.1 - 6.0	0.1 - 6.0	74 - 84
9	0.0 - 2.5	0.0 - 2.5	0.0 - 2.5	2
10	0.0 - 1.5	0.0 - 1.5	0.0 - 1.5	11, 12, 71 - 73, 81 - 84

- Overlay verification

Section	Description[1]	Material_Type[2]	Thickness[3]
?502	1 + 4	13	1 - 3
?503	1 + 4	13	4 – 6
?504	1 + 4	14	4 – 6

[1] DESCRIPTION above includes the LAYER_NO with a DESCRIPTION = 1 and all LAYER_NOs above the LAYER_NO with a DESCRIPTION = 3 that have a DESCRIPTION = 4 (if a LAYER_NO with a DESCRIPTION = 4 exists). It is not mandatory that a LAYER_NO with a DESCRIPTION = 4 exist above a LAYER_NO with a DESCRIPTION = 3. The *_THICKNESS values should be summed for all LAYER_NOs corresponding to the above criteria and compared with the values listed for THICKNESS above.

[2] Similar to note 1 above, the MATERIAL_TYPE should be checked for all LAYER_NOs with a DESCRIPTION = 1 and all LAYER_NOs above the LAYER_NO with a DESCRIPTION = 3 that have a DESCRIPTION = 4 (if a LAYER_NO with a DESCRIPTION = 4 exists). It is not mandatory that a LAYER_NO with a DESCRIPTION = 4 exist above a LAYER_NO with a DESCRIPTION = 3.

[3] THICKNESS above includes the variables MEAN_THICKNESS, MAX_THICKNESS and MIN_THICKNESS. MEAN_THICKNESS is a required data element. For the other two thicknesses, the check is valid only if the appropriate field is not null.

Section	Description[1]	Material_Type[2]	Thickness[3]
?505	1 + 4	11	1 – 3
?506	1 + 4	12	2 - 5[4]
?507	1 + 4	15	5 - 8[4]
?508	1 + 4	13	5 – 8[4]
?509	1 + 4	13	2 - 5[4]

SINIT E Checks (Section Intramodular Checks)

Table: SPS5_LAYER

- If not null, perform the following relational checks.
  - MIN_THICKNESS <= MEAN_THICKNESS <= MAX_THICKNESS
- Logical Layering Checks
  - For SHRP_ID = ?501, the top layer can only have a DESCRIPTION = 2, 3, 9, 10
  - For SHRP_ID = ?502 - ?509, the top layer can only have a DESCRIPTION = 1, 2, 9, 10
  - A DESCRIPTION = 2 must not be designated for a layer below a layer with a DESCRIPTION = 3, 5, 6, 7, or 8
  - A DESCRIPTION = 9 must not be designated for a layer below a layer with a DESCRIPTION = 3, 5, 6, 7, 8, or 11
  - A DESCRIPTION = 10 must not be designated for a layer below a layer with a DESCRIPTION = 3, 5, 6, 7, or 8
  - A DESCRIPTION = 3 must not be designated for a layer below a layer with a DESCRIPTION = 5, 6, or 7
  - A DESCRIPTION = 4 must not be designated for a layer below a layer with a DESCRIPTION = 5, 6, or 7
  - A DESCRIPTION = 5 must not be designated for a layer below a layer with a DESCRIPTION = 6 or 7
  - A DESCRIPTION = 6 must not be designated for a layer below a layer with a DESCRIPTION = 7
  - For SHRP_IDs like ?506 - ?509, a DESCRIPTION = 10 must not be designated for a layer below a layer with a DESCRIPTION = 3, 5, 6, 7, or 8
  - For LAYER_NO = 1, the DESCRIPTION must always equal 7
- Layer Compatibility Checks
  - For SHRP_ID = ?501, there cannot be a layer with a DESCRIPTION = 1
  - For SHRP_ID = ?502 - ?509, there must be a layer with a DESCRIPTION = 1
  - There must be a layer with a DESCRIPTION of 3
  - There must be a layer with a DESCRIPTION of 5

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[4] These thicknesses include the experimental design overlay thickness and an additional allowance (over and above the experimental design overlay thickness) of 2 inches for the mill-replacement layer. If milling in excess of 2 inches occurs, the data may fail QC checks. Therefore, this data is to be flagged and commented upon by the RCOC prior to manual upgrading of RECORD_STATUS.

- There cannot be two layers with a DESCRIPTION of 3
- There cannot be two layers with a DESCRIPTION of 5
- There cannot be two layers with a DESCRIPTION of 7
- There cannot be two or more layers with a DESCRIPTION of 9 that have MEAN_THICKNESS > 0 for SHRP_IDs like ?506 - ?509
- For sections ?506 - ?509, if a layer with a DESCRIPTION = 9 exists in INV_LAYER, then a layer with DESCRIPTION = 9 and a MEAN_THICKNESS = 0 must exist in **SPS5_LAYER** beneath a layer with DESCRIPTION = 1

SPS5 Construction Table Dependency Checks

- All records in each Construction table are checked against **SPS_PROJECT_STATIONS**, for matching project level ID. If the corresponding project level records are at level E in **SPS_PROJECT_STATIONS**, the records in the Construction table go to level B.

C. Minimum Data Checks

Minimum data checks for all SPS5 Construction data tables are identified below. Data fields with a Condition of X must always contain a non-null value, however, data fields with a Condition of * are only required to contain a non-null value if a particular condition is met as specified in the accompanying field explanation.

Table	Field	Condition
SPS5_AC_PATCHES	FULL_DEPTH_NO	X
	FULL_DEPTH_SF	X
	PARTIAL_BASE_NO	X
	PARTIAL_BASE_SF	X
	PATCH_MATERIAL	X
	PRIMARY_DISTRESS	X
	SURFACE_PATCHES_NO	X
	SURFACE_PATCHES_SF	X
SPS5_LAYER_THICKNESS	MILL_REPLACE	*
	*****only required if SHRP_ID = ?506, ?507, ?508, or ?509 (Not required for SHRP_ID = ?501)	
	OFFSET	X
	STATION_NO	X
	SURFACE_COURSE	X
SPS5_MILLED_SECTIONS	AVG_INSIDE	*
	AVG_OUTSIDE	*
	LAYER_THICKER_MILL_DEPTH	*
	MILLED_THE_SAME	*
	*Check only for SHRP_ID equal to ?506, ?507, ?508, or ?509	
SPS5_NOTES_AND_COMMENTS	No level C checks	
SPS5_OVERLAY (Not required for SHRP_ID = ?501)	LAYER_NO1_1	X
SPS5_OVERLAY_LAYERS	LAYER_NO	X
	LIFT_PLACEMENT1	X

	MATERIAL_TYPE	X
SPS5_PMA_COMPACTION	COMPACTED_THICK	X
(Not required for SHRP_ID = ?501)	LAYER_NO	X
	LIFT_NO	X
SPS5_PMA_CONSTRUCTION	LAYER_NO	X
(Not required for SHRP_ID = ?501)	MEAN_MIXING_TEMP	X
SPS5_PMA_ROLLER	LAYER_NO	X
(Not required for SHRP_ID = ?501)	ROLLER_CODE	X
	ROLLER_CODE_DESC	X
	ROLLER_GROSS_WT	X
SPS5_QC_MEASUREMENTS	AVERAGE_BINDER	*
	*(Not required for SHRP_ID = ?501)	
	AVERAGE_FRICTION	**
	AVERAGE_MILL	**
	AVERAGE_RUT	**
	AVERAGE_SURFACE	**
	LAYER_NO_BINDER	*
	LAYER_NO_FRICTION	*
	LAYER_NO_MILL	*
	LAYER_NO_RUT	*
	LAYER_NO_SURFACE	*
	PROFILE_INDEX	*
	PROFILOGRAPH_TYPE	**
	**at least one of the (AVERAGE_INDEX and GRAPH_TYPE) pairs must be NON-NULL	
SPS5_RUT_LEVEL_UP	IW_RUT_DEPTH	*
(This table may not be required)	LEVEL_UP_LAYER_LOC	X
	LEVEL_UP_MATL	X
	MAX_TOP_SIZE_AGGR	X
	OW_RUT_DEPTH	*
	*either IW_RUT_DEPTH, or OW_RUT_DEPTH, or both are required	

D. Expanded Range Checks

Expanded range checks are applied to certain fields to identify data element values that fall outside an expected range. Field names are listed below the bolded table name. Expanded range checks for all SPS5 Construction data tables are specified below.

Table	Units	Range
SPS5_AC_PATCHES		
AIR_TEMP_HIGH	deg F	40 - 120
AIR_TEMP_LOW	deg F	40 - 120
COMPACTION		1 - 8
FULL_DEPTH_SF	sq ft	0 - 6000
LOC_SIZE_METHOD		1 - 4

MAX_MATL_TEMP	deg F	0 - 300
PARTIAL_BASE_SF	sq ft	0 - 6000
PATCH_BOUNDARY_METHOD		1 - 5
PATCH_MATERIAL		1 - 7
PRIMARY_DISTRESS		1 - 17
SECONDARY_DISTRESS		1 - 17
SURFACE_PATCHES_SF	sq ft	0 - 6000

SPS5_LAYER_THICKNESS

BINDER_COURSE	in	0 - 6
MILL_REPLACE	in	1 - 3
OFFSET	in	0 - 180
RUT_LEVEL_UP	in	0 - 5
STATION_NO	ft	0 - 500
SURFACE_COURSE	in	0 - 6
SURFACE_FRICTION	in	0 - 3

SPS5_MILLED_SECTIONS

AVG_INSIDE	in	0 - 10
AVG_OUTSIDE	in	0 - 10
CUT_HEAD_WIDTH	in	12 - 180
MACRO_TEXTURE		1 - 2
MAX_INSIDE	in	0 - 10
MAX_OUTSIDE	in	0 - 10
MILL_LAYER_MATL		1 - 3
MIN_INSIDE	in	0 - 10
MIN_OUTSIDE	in	0 - 10
NOMINAL_THICKNESS	in	0 - 10
STD_INSIDE		0 - 2
STD_OUTSIDE		0 - 2

SPS5_NOTES_AND_COMMENTS

No Level D Checks

SPS5_OVERLAY

APPL_RATE	gal/sq yd	0 - 0.50
LAYDOWN_WIDTH	ft	5 - 24
LAYER_NO1_1		1 - 20
LAYER_NO1_2		1 - 20
LAYER_NO1_3		1 - 20
LAYER_NO2_1		1 - 20
LAYER_NO2_2		1 - 20
LAYER_NO2_3		1 - 20
LAYER_NO3_1		1 - 20
LAYER_NO3_2		1 - 20
LAYER_NO3_3		1 - 20
LONG_SURFACE_JOINT_LOC		1 - 2
OFFSET	ft	0 - 20
PLANT_TYPE1		1 - 3
PLANT_TYPE2		1 - 3
PLANT_TYPE3		1 - 3
SURFACE_PREP		1 - 4
TACK_COAT_MATL		1 - 10
TACK_COAT_PERCENT	%	20 - 70

SPS5_OVERLAY_LAYERS

LAYER_NO		1 - 20
LIFT_PLACEMENT1		0 - 5
LIFT_PLACEMENT2		0 - 5
LIFT_PLACEMENT3		0 - 5
LIFT_PLACEMENT4		0 - 5
MATERIAL_TYPE		1, 13
TACK_COAT_BETWEEN_LIFTS		Y, N
TRANS_JOINT_STATION	ft	0 - 500

SPS5_PMA_COMPACTION

BREAKDOWN_ROLLER_CODE		A - Q
COMPACTED_THICK	in	0 - 3
FINAL_ROLLER_CODE		A - Q
INTERMED_ROLLER_CODE		A - Q
LAYER_NO		> 1
MEAN_AIR_TEMP	deg F	40 - 120

SPS5_PMA_ROLLER

LAYER_NO		> 1
ROLLER_CODE		A - Q
ROLLER_FREQ	vib/min	2000 - 3000 (I - P)
ROLLER_GROSS_WT	tons	0 - 20 (A - D, I - P) 0 - 50 (E - H)
ROLLER_SPEED	mph	0 - 10
ROLLER_TIRE_PRES	psi	50 - 100 (E - H)

SPS5_QC_MEASUREMENTS

AVERAGE_BINDER	pcf	100 - 160
AVERAGE_FRICTION	pcf	100 - 160
AVERAGE_MILL	pcf	100 - 160
AVERAGE_RUT	pcf	100 - 160
AVERAGE_SURFACE	pcf	100 - 160
BINDER_MEASURE		A, C
BLANK_BAND_HEIGHT	in	0 - 0.5
FRICTION_MEASURE		A, C
GAUGE_COUNT_RATE		0 - 9999
INTERP_METHOD		1 - 3
LAYER_NO_BINDER		0 - 20
LAYER_NO_FRICTION		0 - 20
LAYER_NO_MILL		0 - 20
LAYER_NO_RUT		0 - 20
LAYER_NO_SURFACE		0 - 20
MAXIMUM_BINDER	pcf	100 - 160
MAXIMUM_FRICTION	pcf	100 - 160
MAXIMUM_MILL	pcf	100 - 160
MAXIMUM_RUT	pcf	100 - 160
MAXIMUM_SURFACE	pcf	100 - 160
MILL_MEASURE		A, C
MINIMUM_BINDER	pcf	100 - 160
MINIMUM_FRICTION	pcf	100 - 160
MINIMUM_MILL	pcf	100 - 160
MINIMUM_RUT	pcf	100 - 160
MINIMUM_SURFACE	pcf	100 - 160
PROFILE_INDEX	in/mi	0 - 20
PROFILOGRAPH_TYPE		1 - 2

RUT_MEASURE		A, C
SURFACE_MEASURE		A, C

SPS5_RUT_LEVEL_UP

AIR_TEMP_HIGH	deg F	40 - 120
AIR_TEMP_LOW	deg F	40 - 120
COMPACTION_EQUIP		1 - 8
IW_END_STA	ft	0 - 500
IW_RUT_DEPTH	in	0 - 3
IW_RUT_WIDTH	in	0 - 72
IW_START_STA	ft	0 - 500
LENGTH_SECTION_COVERED		1 - 2
LEVEL_UP_LAYER_LOC		1 - 4
LEVEL_UP_MATL		1 - 6
MAX_MATL_TEMP	deg F	100 - 150
MAX_TOP_SIZE_AGGR	in	0.1 - 2
OW_END_STA	ft	0 - 500
OW_RUT_DEPTH	in	0 - 3
OW_RUT_WIDTH	in	0 - 72
OW_START_STA	ft	0 - 500
ROAD_MOISTURE		1 - 3
RUT_PREP		1 - 6
RUT_PREP_DEPTH	in	0 - 5
RUT_PREP_WIDTH	in	0 - 72

E. Intramodular Checks

Intramodular checks for all SPS5 Construction data tables are specified below.

Table: SPS5_AC_PATCHES

- DATE_BEGAN <= DATE_COMPLETE
- AIR_TEMP_HIGH >= AIR_TEMP_LOW

Table: SPS5_MILLED_SECTIONS

- MIN_INSIDE <= AVG_INSIDE <= MAX_INSIDE
- MIN_OUTSIDE <= AVG_OUTSIDE <= MAX_OUTSIDE

FOR SECTIONS ?506 - ?509

- LAYER_NO_OF_REPLACEMENT = LAYER_NO_MILL of **SPS5_QC_MEASUREMENTS** table
- LAYER_NO_OF_REPLACEMENT = MAX(LAYER_NO of INV_LAYER table) + 1
- If LAYER_THICKER_MILL_DEPTH = “Yes,” then NOMINAL_THICKNESS >= AVG_INSIDE and NOMINAL_THICKNESS >= AVG_OUTSIDE
- If MILLED_THE_SAME = “No,” then WIDTH_MILL_SAME_TEST must be non null

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Table: SPS5_NOTES_AND_COMMENTS

- No Level E Checks

Table: SPS5_OVERLAY

- DATE_COMPLETE >= DATE_BEGAN
- If SURFACE_PREP = 3 or 4 then (TACK_COAT_MATL and APPL_RATE) and (TACK_COAT_PERCENT or (PARTS_DILUENT and PARTS_ASPHALT) must be non null

---

Table: SPS5_PMA_COMPACTION and SPS5_PMA_ROLLER

- For a given BREAKDOWN_ROLLER_CODE in **SPS5_PMA_COMPACTION**, a matching ROLLER_CODE must exist in **SPS5_PMA_ROLLER**
- For a given INTERMED_ROLLER_CODE in **SPS5_PMA_COMPACTION**, a matching ROLLER_CODE must exist in **SPS5_PMA_ROLLER**
- For a given FINAL_ROLLER_CODE in **SPS5_PMA_COMPACTION,** a matching ROLLER_CODE must exist in **SPS5_PMA_ROLLER**

Table: SPS5_PMA_CONSTRUCTION

- DATE_COMPLETE >= DATE_BEGAN
- LAYDOWN_TEMP_MAX >= LAYDOWN_TEMP_MEAN >= LAYDOWN_TEMP_MIN

Table: SPS5_PMA_ROLLER

- If ROLLER_CODE = A, B, C, or D, then ROLLER_TIRE_PRES, ROLLER_FREQ, ROLLER_AMP and ROLLER_SPEED must be null
- If ROLLER_CODE = E, F, G, or H, then ROLLER_FREQ, ROLLER_AMP or ROLLER_SPEED must be null
- If ROLLER_CODE = I, J, K, L, M, N, or P, then ROLLER_TIRE_PRES must be null

---

Table: SPS5_QC_MEASUREMENTS

- MINIMUM_RUT <= AVERAGE_RUT <= MAXIMUM_RUT
- MINIMUM_MILL <= AVERAGE_MILL <= MAXIMUM_MILL
- MINIMUM_BINDER <= AVERAGE_BINDER <= MAXIMUM_BINDER
- MINIMUM_SURFACE <= AVERAGE_SURFACE <= MAXIMUM_SURFACE
- MINIMUM_FRICTION <= AVERAGE_FRICTION <= MAXIMUM_FRICTION

Table: SPS5_RUT_LEVEL_UP

- If LENGTH_SECTION_COVERED = 1, then OW_START_STA, OW_END_STA, IW_START_STA and IW_END_STA must be null
- If LENGTH_SECTION_COVERED = 2, then
    - OW_START_STA, OW_END_STA, IW_START_STA, and IW_END_STA must be non null
    - OW_START_STA <= OW_END_STA
      IW_START_STA <= IW_END_STA
    - AIR_TEMP_LOW must be <= AIR_TEMP_HIGH

In addition, the checks listed in Table 17-1 are required for the identified tables and elements.

Table 17-1. Additional Level E Checks

If the data element below	has a code of	then a non-null entry must exist in the data element below
SPS5_AC_PATCHES		
PRIMARY_DISTRESS	17	PRIMARY_DISTRESS_OTHER
SECONDARY_DISTRESS	17	SECONDARY_DISTRESS_OTHER
LOC_SIZE_METHOD	4	LOC_SIZE_METHOD_OTHER
PATCH_BOUNDARY_METHOD	5	PATCH_BOUNDARY_METHOD_OTHER
COMPACTION	8	COMPACTION_OTHER
PATCH_MATERIAL	7	PATCH_MATERIAL_OTHER
SPS5_OVERLAY		
TACK_COAT_MATL	1	MATL_TYPE_OTHER
PLANT_TYPE1	3	PLANT_TYPE_OTHER1
PLANT_TYPE2	3	PLANT_TYPE_OTHER2
PLANT_TYPE3	3	PLANT_TYPE_OTHER3
SPS5_RUT_LEVEL_UP		
COMPACTION_EQUIP	8	COMPACTION_EQUIP_OTHER
LEVEL_UP_MATL	6	LEVEL_UP_MATL_OTHER

18.0 SPS6 CONSTRUCTION

18.1 Level 1

A. Initial Level

Records in the IMS are at Level A when they first enter the system and are set back to A when changes are made to a given record or to selected related records.

B. Dependency Checks

Dependency checks (B) are performed on records at level A. These checks are performed to ensure that essential data (data which are required to properly reference all other data) are present and adequate. For SPS6 sections, the dependency checks are performed for the specific SPS section (SINIT).

Four types of checks are performed for the SINIT checks; INIT B - an experiment verification check, INIT C - a minimum data check, INIT D - an expanded range check and INIT E - an intramodular check. Each of these checks are specified below. **A Project record must be at level E in SPS_PROJECT_STATIONS prior to a section passing the level B check for the remaining tables. (See SPS6 Construction Table Dependency Checks at the end of this section.)**

SINIT B Checks (Section Experiment Verification Checks)

Table: SPS6_LAYER

- All records for the Project level (PINIT*) must have a RECORD_STATUS = E. If this is true, set all records for this section to RECORD_STATUS = B

SINIT C Check (Section Minimum Data Checks)

Table	Field	Condition
SPS6_LAYER	DESCRIPTION	X
	MATERIAL_TYPE	X
	MEAN_THICKNESS	*
	*for LAYER_NO > 1	

SINIT D Check (Section Expanded Range Checks)

SPS6_LAYER

DESCRIPTION	*THICKNESS[1]	MATERIAL_TYPE
2	0.0 - 1.5	71 - 73, 81 - 83
3	7.0 - 11.0	4, 5
4	0.0 - 6.0	1
5	3.0 - 24.0	22 - 46
6	4.0 - 47.9	22 - 46
7	Must be Null	51 - 65
8	0.1 - 6.0	74 - 84
9	0.0 - 2.0	2
10	0.0 - 2.0	11, 12, 71 - 73, 81 - 84

A DESCRIPTION = 11 is not valid.

Also, the following ranges are valid:

SECTION	DESCRIPTION[2]	MATERIAL_TYPE[3]	*_THICKNESS[1]
?603	1 + 4	1	0, 3 - 5
?604	1 + 4	1	0, 3 - 5
?606	1 + 4	1	0, 3 - 5
?607	1 + 4	1	0, 3 - 5

[1] THICKNESS above includes the variables MEAN_THICKNESS, MAX_THICKNESS and MIN_THICKNESS. MEAN_THICKNESS is a required data element. For the other two thicknesses, the check is valid only if the appropriate thickness **field is not null.**

[2] DESCRIPTION above includes the LAYER_NO with a DESCRIPTION = 1 and all LAYER_NOs above the LAYER_NO with a DESCRIPTION = 3 that have a DESCRIPTION = 4 (if a LAYER_NO with a DESCRIPTION = 4 exists). It is not madatory that a LAYER_NO with a DESCRIPTION = 4 exist above a LAYER_NO with a DESCRIPTION = 3. The *_THICKNESS values shoud be summed for all LAYER_NOs corresponding to the above criteria and compared with the values listed for THICKNESS above.

[3] Similar to note 1 above, the MATERIAL_TYPE should be checked for all LAYER_NOs with a DESCRIPTION = 1 and all LAYER_NOs above the LAYER_NO with a DESCRIPTION = 3 that have a DESCRIPTION = 4 (if a LAYER_NO with a DESCRIPTION = 4 exists). It is not manatory that a LAYER_NO with a DESCRIPTION = 4 exist above a LAYER_NO with a DESCRIPTION = 3.

SECTION	DESCRIPTION[2]	MATERIAL_TYPE[3]	*_THICKNESS[1]
?608	1 + 4	1	0, 7 - 9

SINIT E Checks (Section Intramodular Checks)

Table: SPS6_LAYER

- If not null, perform the following relational checks:

  _ MIN_THICKNESS <= MEAN_THICKNESS <= MAX_THICKNESS
  _ STD_DEV_THICKNESS <= MEAN_THICKNESS

- Logical Layering Checks

  – For SHRP_ID = ?601, ?602, or ?605 the top layer must have DESCRIPTION of 2, 3, 10 or a DESCRIPTION = 1 or 9 with a MEAN_THICKNESS = 0
  – For SHRP_ID = ?603, ?604, or ?606-?608, the top layer can only have a DESCRIPTION of 1, 2, 9, or 10
  – A DESCRIPTION = 1 with a MEAN_THICKNESS greater than 0 must not be designated for a layer below a layer with a DESCRIPTION = 1 (not supplementals)
  – A layer for DESCRIPTION = 1 cannot be below a layer for DESCRIPTION = 3, 5, 6, 7, or 8
  – A DESCRIPTION = 2 must not be designated for a layer below a layer with a DESCRIPTION = 1, 3, 5, 6, 7, or 8 (not supplementals)
  – A DESCRIPTION = 9 with a MEAN_THICKNESS greater than 0 must not be designated for a layer below a layer with a DESCRIPTION = 1or 4 (not supplementals)
  – A DESCRIPTION = 10 must not be designated for a layer below a layer with a DESCRIPTION = 3, 5, 6, 7, or 8
  – A DESCRIPTION = 3 must not be designated for a layer below a layer with a DESCRIPTION = 5, 6, or 7
  – A DESCRIPTION = 4 must not be designated for a layer below a layer with a DESCRIPTION = 3
  – A DESCRIPTION = 5 must not be designated for a layer below a layer with a DESCRIPTION = 6 or 7
  – A layer for DESCRIPTION = 6 cannot be below layer for DESCRIPTION = 7
  – For SHRP_ID = ?603, ?604, ?606, ?607, or ?608, there must be a layer with DESCRIPTION = 1
  – For LAYER_NO = 1, the DESCRIPTION must always equal 7

- Layer Compatibility Checks

  – A layer with a DESCRIPTION of 3 must exist
  – A layer with a DESCRIPTION of 5 must exist
  – There cannot be two layers with a DESCRIPTION of 3
  – There cannot be two layers with a DESCRIPTION of 5
  – There cannot be two layers with a DESCRIPTION of 7
  – There cannot be two layers with a DESCRIPTION of 9 that have a MEAN_THICKNESS > 0

- For sections ?601, ?602 and ?605, if a layer with a DESCRIPTION = 1 exists in **INV_LAYER**, then a layer with a DESCRIPTION = 1 and a MEAN_THICKNESS = 0 must exist in

SPS6_LAYER

- For sections ?601, ?602 and ?605, if a layer with a DESCRIPTION = 4 exists in **INV_LAYER**, then a layer with a DESCRIPTION = 4 and a MEAN_THICKNESS = 0 must exist in **SPS6_LAYER**

- For section ?601, ?602 and ?605, if a layer with a DESCRIPTION = 9 exists in **INV_LAYER**, then a layer with a DESCRIPTION = 9 and a MEAN_THICKNESS = 0 must exist in **SPS6_LAYER**

- For section ?603, ?604, ?606 - ?608, if a layer with a DESCRIPTION = 1 exists in **INV_LAYER**, then a layer with a DESCRIPTION = 1 and a MEAN_THICKNESS = 0 must exist in **SPS6_LAYER** beneath a layer that has a DESCRIPTION = 1

- For section ?603, ?604, ?606 - ?608, if a layer with a DESCRIPTION = 4 exists in **INV_LAYER**, then a layer with a DESCRIPTION = 4 and a MEAN_THICKNESS = 0 must exist in **SPS6_LAYER** beneath a layer that has a DESCRIPTION = 1

- For section ?603, ?604, ?606 - ?608, if a layer with a DESCRIPTION = 9 exists in **INV_LAYER**, then a layer with a DESCRIPTION = 9 and a MEAN_THICKNESS = 0 must exist in **SPS6_LAYER** beneath a layer that has a DESCRIPTION = 1

SPS6 Construction Table Dependency Checks

- All records in each Construction table are checked against **SPS_PROJECT_STATIONS**, for matching project level ID. If the corresponding project level records are at level E in **SPS_PROJECT_STATIONS**, the records in the Construction table go to level B.

C. Minimum Data Checks

Minimum data checks for all SPS6 Construction data tables are identified below. Data fields with a Condition of X must always contain a non-null value, however, data fields with a Condition of * are only required to contain a non-null value if a particular condition is met as specified in the accompanying field explanation.

Table	Field	Condition
SPS6_CRACK_SEAT_PCC	BREAKER_TYPE	X
	PCC_BREAKAGE_LENGTH	X
	PCC_BREAKAGE WIDTH	X
SPS6_DIAMOND_GRIND	AVG_DEPTH	X
	GRINDING_REASON	X
SPS6_LAYER_THICKNESS	OFFSET	X
	STATION_NO	X
	SURFACE_COURSE	X
SPS6_LOAD_TRANSFER	NO_JOINT_RESTORE_LOCATIONS	X
	NO_JOINTS_IN_SECTION	X
SPS6_NOTES_AND_COMMENTS	No Level C Checks	

SPS6_OVERLAY	LAYER_NO1_1	*
	*not required for SHRP_ID = ?601, 2, 5	
SPS6_OVERLAY_LAYERS	LAYER_NO	X
	LIFT_PLACEMENT1	X
	MATERIAL_TYPE	X
SPS6_PCC_CRACK_SEAL	CRACK_SEAL_TYPE	X
	SEAL_RES_DEPTH	X
	SEAL_RES_WIDTH	X
	TOTAL_FEET_CRACKS_SEALED	X
SPS6_PCC_FULL_DEPTH	NO_SLABS_REPLACED	X
	PATCH_MATL	X
	PATCH_NO_SLAB	X
	PATCH_SF_SLAB	X
	REASON	X
	SF_SLABS_REPLACED	X
SPS6_PCC_JOINT_RESEAL	LONG_SEAL_LENGTH	X
	SEAL_RES_DEPTH	X
	SEAL_RES_WIDTH	X
	TRANS_SEAL_LENGTH	X
SPS6_PCC_PART_DEPTH	PATCH_AVG_DEPTH	X
	PATCH_MATL	X
	PATCH_NO	X
	PATCH_SF	X
SPS6_PMA_COMPACTION	COMPACTED_THICK	X
	LAYER_NO	X
	LIFT_NO	X
SPS6_PMA_CONSTRUCTION	LAYER_NO	X
	MEAN_MIXING_TEMP	X
SPS6_PMA_ROLLER	LAYER_NO	*
	ROLLER_CODE	*
	ROLLER_CODE_DESC	*
	ROLLER_GROSS_WT	*
	* not required for SHRP_ID =?601, ?602, ?605	
SPS6_QC_MEASUREMENTS	AVERAGE_ BINDER	*
	AVERAGE_ FRICTION	*
	AVERAGE_MILL	*
	AVERAGE_RUT	*
	AVERAGE_SURFACE	*
	*at least one of the (AVERAGE and LAYER_NO) or (PROFILE_INDEX and PROFILO_GRAPH _TYPE) pairs must be non_null	
	LAYER_NO_BINDER	*
	LAYER_NO_FRICTION	*
	LAYER_NO_MILL	*
	LAYER_NO_RUT	*
	LAYER_NO_SURFACE	*
	PROFILE_INDEX	*

	PROFILOGRAPH_TYPE	*
SPS6_SAW_AND_SEAL	DEPTH_OF_SAW_CUT	X
	JOINTS_SAWED	X
	WIDTH_OF_SAW_CUT	X
SPS6_SUBDRAINAGE	DRAINAGE_PIPE_TYPE	X
	HORIZ_PIPE_PLACEMENT	X
	PIPE_DEPTH	X
SPS6_TRANSFER_EFFICIENCY	EFFICIENCY_AFTER_APPROACH	X
	EFFICIENCY_AFTER_LEAVE	X
	EFFICIENCY_BEFORE_APPROACH	X
	EFFICIENCY_BEFORE_LEAVE	X
	POINT_DISTANCE	X
SPS6_UNDERSEALING	MONITORING_OF_LIFT	X
	SUBSEAL_MIX_TYPE	X

D. Expanded Range Checks

Expanded range checks are applied to certain fields to identify data element values that fall outside an expected range. Field names are listed below the bolded table name. Expanded range checks for all SPS6 Construction data tables are specified below.

Table	Units	Range
SPS6_CRACK_SEAT_PCC		
AFTER_BREAKING		1 - 2
AFTER_OVERLAY		1 - 2
BEFORE_BREAKING		1 - 2
BREAKER_PASSES		1 - 20
BREAKER_TYPE		2, 4, 7
PCC_BREAKAGE_LENGTH	in	1 - 36
PCC_BREAKAGE_WIDTH	in	1 - 36
ROLLER_PASSES_LANE		1 - 9
ROLLER_WEIGHT	tons	30 - 60
SURFACE_PREP		1 - 6
SPS6_DIAMOND_GRIND		
AVG_DEPTH	in	0 - 0.8
BLADE_SPACING	in	0.1 - 0.2
GRINDING_REASON		1 - 5
GROOVE_WIDTH	in	0.1 - 0.2
HEAD_WIDTH	in	36 - 72
SPS6_LAYER_THICKNESS		
BINDER_COURSE	in	0 - 9
LAYER_NO_BINDER		> 0
LAYER_NO_FRICTION		> 0
LAYER_NO_MILL		> 0
LAYER_NO_RUT		> 0
LAYER_NO_SURFACE		> 0
MILL_REPLACE	in	0

OFFSET	in	0 - 180
RUT_LEVEL_UP	in	0 - 3
STATION_NO	ft	0 - 1000
SURFACE_COURSE	in	0 - 9
SURFACE_FRICTION	in	0 - 3

SPS6_LOAD_TRANSFER

BACKFILL_MATERIAL		1 - 4
BOND_AGENT		1 - 4
DEVICES_PER_JOINT		6 - 14
DOWEL_1	in	0 - 168
DOWEL_10	in	0 - 168
DOWEL_11	in	0 - 168
DOWEL_12	in	0 - 168
DOWEL_2	in	0 - 168
DOWEL_3	in	0 - 168
DOWEL_4	in	0 - 168
DOWEL_5	in	0 - 168
DOWEL_6	in	0 - 168
DOWEL_7	in	0 - 168
DOWEL_8	in	0 - 168
DOWEL_9	in	0 - 168
DOWEL_DIAMETER	in	0.75 - 2
NO_JOINTS_RESTORE_LOCATION		0 - 100
NO_JOINTS_IN_SECTION		5 - 100

SPS6_NOTES_AND_COMMENTS

No Level D Checks

SPS6_OVERLAY

APPL_RATE	gal/sq yd	0 - 0.5
LAYDOWN_WIDTH	ft	5 - 24
LAYER_NO1_1		1 - 20
LAYER_NO1_2		1 - 20
LAYER_NO1_3		1 - 20
LAYER_NO2_1		1 - 20
LAYER_NO2_2		1 - 20
LAYER_NO2_3		1 - 20
LAYER_NO3_1		1 - 20
LAYER_NO3_2		1 - 20
LAYER_NO3_3		1 - 20
LONG_SURFACE_JOINT_LOC		1 - 2
OFFSET	ft	0 - 20
PLANT_TYPE1		1 - 3
PLANT_TYPE2		1 - 3
PLANT_TYPE3		1 - 3
SURFACE_PREP		1 - 4
TACK_COAT_MATL		1 - 10
TACK_COAT_PERCENT	%	20 - 70

SPS6_OVERLAY_LAYERS

LAYER_NO	1 - 20
LIFT_PLACEMENT1	0 - 5
LIFT_PLACEMENT2	0 - 5
LIFT_PLACEMENT3	0 - 5
LIFT_PLACEMENT4	0 - 5

MATERIAL_TYPE		1
TACK_COAT_BETWEEN_LIFTS		Y, N
TRANS_JOINT_STATION	ft	0 - 500

SPS6_PCC_CRACK_SEAL

BOND_BREAK		1 - 4
CRACK_SEAL_TYPE		1 - 7
CRACK_CLEAN		1 - 6
SEAL_DEPTH	in	0 - 0.5
SEAL_RES_DEPTH	in	0.1 - 2
SEAL_RES_WIDTH	in	0.1 - 2

SPS6_PCC_FULL_DEPTH

ADMIXTURE_1		1 - 13
ADMIXTURE_2		1 - 13
AIR_CONTENT_MAX	%	4 - 10
AIR_CONTENT_MEAN	%	4 - 8
AIR_CONTENT_MIN	%	2 - 8
AIR_TEMP_HIGH	deg F	40 - 120
AIR_TEMP_LOW	deg F	40 - 120
BOND_BREAKER		1 - 2
BOUNDARY_METHOD		1 - 5
CAGG_MIX	lbs/cu yd	500 - 3000
CEMENT_MIX	lbs/cu yd	300 - 1000
CEMENT_TYPE		41 - 55
CONC_BREAK_METHOD		1 - 5
CONC_REMOVAL		1 - 3
CONSOLIDATE_METHOD		1 - 6
CURE_METHOD_1		1 - 10
CURE_METHOD_2		1 - 10
CUT_METHOD		1 - 5
DOWEL_COAT_TRANS		1 - 7
FAGG_MIX	lbs/cu yd	500 - 2000
FINISH_METHOD		1 - 4
FLEX_CURE_TIME	days	0 - 28
FLEX_STRENGTH	psi	400 - 900
JOINT_METHOD_LONG		1 - 7
JOINT_METHOD_SH		1 - 7
JOINT_METHOD_TRANS		1 - 7
JOINTS_MATCHED		1 - 2
MAX_AGG_SIZE	in	0.1 - 2
PATCH_MATL		1 - 5
PATCH_SF_BASE	sq ft	0 - 7000
PATCH_SF_SLAB	sq ft	0 - 7000
REASON		20 - 38
REBAR_DOWEL		1 - 10
REBAR_LENGTH_DOWEL	in	1 - 36
REBAR_LENGTH_TIE	in	1 - 48
REBAR_LONG		1 - 10
REBAR_SPACE_DOWEL	in	2 - 24
REBAR_SPACE_LONG	in	2 - 24
REBAR_SPACE_TIE	in	12 - 60
REBAR_TIE		1 - 10
REBAR_TRANS		1 - 10
SAW_CUT_DEPTH	in	1 - 36
SAW_CUTS		1 - 10

SECONDARY_REASON		20 - 38
SF_BASE_REPLACE	sq ft	0 - 7000
SF_SLABS_REPLACED	sq ft	0 - 7000
SLUMP_MAX	in	1 - 4
SLUMP_MEAN	in	1 - 3
SLUMP_MIN	in	1 - 3
STEEL		1 - 2
STEEL_PLACE_METHOD		1 - 2
SURFACE_MOISTURE		1 - 2
TRAFFIC_OPEN_TIME	hr	0 - 9999
TRANS_JOINT_PATCH		1 - 4
TRANS_JOINT_SLAB		1 - 4
TRANSFER_DEVICE		1 - 4
WATER_MIX	gal/cu yd	10 - 60

SPS6_PCC_JOINT_RESEAL

BOND_BREAK		1 - 4
CONTRACTION_SEAL_TYPE		1 - 7
JOINT_SEAL_TYPE		1 - 7
LONG_SEAL_LENGTH	ft	0 - 2000
REFACED		1 - 4
REMOVAL_METHOD		1 - 9
SEAL_RES_DEPTH	in	0.3 - 1.5
SEAL_RES_WIDTH	in	0.3 - 1.5
SIDEWALL_CLEAN		1 - 5
SEAL_DEPTH	in	0 - 0.3
SEALS_DIFFERENT		1 - 2
TRANS_SEAL_LENGTH	ft	0 - 1500

SPS6_PCC_PART_DEPTH

ADMIXTURE_1		1 - 13
ADMIXTURE_2		1 - 13
AIR_CONTENT_MAX	%	4 - 10
AIR_CONTENT_MEAN	%	4 - 8
AIR_CONTENT_MIN	%	2 - 8
AIR_TEMP_HIGH	deg F	40 - 120
AIR_TEMP_LOW	deg F	40 - 120
BOND_AGENT		1 - 5
BOUNDARY_METHOD		1 - 4
BREAK_METHOD		1 - 3
CAGG_MIX	lbs/cu yd	500 - 3000
CEMENT_MIX	lbs/cu yd	300 - 1000
CEMENT_TYPE		41 - 55
CLEAN_METHOD		1 - 4
CONSOLIDATE_METHOD		1 - 6
CURE_METHOD_1		1 - 10
CURE_METHOD_2		1 - 10
CUT_METHOD		1 - 6
FAGG_MIX	lbs/cu yd	500 - 2000
FINISH_METHOD		1 - 4
JOINT_METHOD_LONG		1 - 7
JOINT_METHOD_SH		1 - 7
JOINT_METHOD_TRANS		1 - 7
MAX_AGG_SIZE	in	0.1 - 2
PATCH_AVG_DEPTH	in	1 - 15
PATCH_COMP_STRENGTH	psi	1000 - 5000

PATCH_CURE_TIME	days	0 - 28
PATCH_MATL		1 - 5
PATCH_SF	sq ft	0 - 7000
REASON		20 - 38
SECONDARY_REASON		20 - 38
SLUMP_MAX	in	1 - 4
SLUMP_MEAN	in	1 - 3
SLUMP_MIN	in	1 - 3
SURFACE_MOISTURE		1 - 2
TRAFFIC_OPEN_TIME	hr	0 - 9999
WATER_MIX	gal/cu yd	10 - 60

SPS6_PMA_COMPACTION

BREAKDOWN_ROLLER_CODE		A -Q
COMPACTED_THICK	in	0 - 5
FINAL_ROLLER_CODE		A - Q
INTERMED_ROLLER_CODE		A - Q
MEAN_AIR_TEMP	deg F	40 - 120

SPS6_PMA_CONSTRUCTION

LAYDOWN_TEMP_MAX	deg F	150 - 400
LAYDOWN_TEMP_MEAN	deg F	150 - 400
LAYDOWN_TEMP_MIN	deg F	150 - 400
LAYDOWN_TEMP_STD_DEV		0 - 50
LAYER_NO		1 - 20
MEAN_MIXING_TEMP	deg F	150 - 400

SPS6_PMA_ROLLER

ROLLER_CODE		A - Q
ROLLER_FREQ	vib/min	2000 - 3000 (I - P)
ROLLER_GROSS_WT	tons	0 - 20 (A - D, I - P); 0 - 50 (E - H)
ROLLER_SPEED	mph	0 - 10
ROLLER_TIRE_PRES	psi	50 - 100 (E - H)

SPS6_QC_MEASUREMENTS

AVERAGE_BINDER	pcf	100 - 160
AVERAGE_FRICTION	pcf	100 - 160
AVERAGE_MILL	pcf	100 - 160
AVERAGE_RUT	pcf	100 - 160
AVERAGE_SURFACE	pcf	100 - 600
BINDER_MEASURE		A, C
FRICTION_MEASURE		A, C
GAUGE_COUNT_RATE		0 - 9999
INTERP_METHOD		1 - 3
LAYER_NO_BINDER		0 - 20
LAYER_NO_FRICTION		0 - 20
LAYER_NO_MILL		null
LAYER_NO_RUT		null
LAYER_NO_SURFACE		0 - 20
MAXIMUM_BINDER	pcf	100 - 160
MAXIMUM_FRICTION	pcf	100 - 160
MAXIMUM_MILL	pcf	100 - 160
MAXIMUM_RUT	pcf	100 - 160
MAXIMUM_SURFACE	pcf	100 - 160
MILL_MEASURE		null

MINIMUM_BINDER	pcf	100 - 160
MINIMUM_FRICTION	pcf	100 - 160
MINIMUM_MILL	pcf	100 - 160
MINIMUM_RUT	pcf	100 - 160
MINIMUM_SURFACE	pcf	100 - 160
PROFILE_INDEX	in/mi	0 - 20
PROFILOGRAPH_TYPE		1 - 2
RUT_MEASURE		null
SURFACE_MEASURE		A, C

SPS6_SAW_AND_SEAL

DAYS_BEFORE_SAW_AND_SEAL	days	3 - 7
DEPTH_OF_SAW_CUT	in	1.5 - 4
EXTENT_OF_SAW_CUT	in	36 - 99
JOINTS_SAWED		5 - 50
SHAPE_FACTOR		0.6 - 1
WIDTH_OF_SAW_CUT	in	0.3 - 2

SPS6_SUBDRAINAGE

DRAINAGE_PIPE_TYPE		1 - 9
FILTER_TYPE		1 - 7
HORIZ_PIPE_PLACEMENT	in	0 - 120
MAX_PARTICLE_SIZE	in	0.1 - 2
NO_10_PASSING	%	0 - 100
NO_100_PASSING	%	0 - 100
NO_4_PASSING	%	0 - 100
NO_40_PASSING	%	0 - 100
OUTLET_INTERVAL	ft	5 - 500
PIPE_DEPTH	in	1 - 48
PIPE_DIAMETER	in	1 - 24
SUBDRAIN_PURPOSE		1 - 4
TYPE_LOC_FILTER		1 - 3

SPS6_TRANSFER_EFFICIENCY

EFFICIENCY_AFTER_APPROACH	%	0 - 100
EFFICIENCY_AFTER_LEAVE	%	0 - 100
EFFICIENCY_BEFORE_APPROACH	%	0 - 100
EFFICIENCY_BEFORE_LEAVE	%	0 - 100
POINT_DISTANCE	ft	0 - 1000

SPS6_UNDERSEALING

ADDITIVE_AMOUNT	%	0 - 10
ADDITIVE_TYPE		1 - 13
CEMENT_TYPE		41 - 55
CUBE_STRENGTH_PC_STRENGTH	psi	600 - 2000
DETERMINE_UNDERSEAL_AREA		1 - 4
END_TIME_AFTER	hr	0 - 2400
END_TIME_BEFORE	hr	0 - 2400
FLUIDITY_PC_GROUT	sec	8 - 25
HOLES_NEAR_JOINT_OR_CRACK		1 - 10
HOLES_PER_SLAB		1 - 10
MAX_PUMP_PRESSURE	psi	100 - 300
MAX_SURGE_PRESSURE	psi	100 - 300
MEASURE_AFTER_UNDERSEAL		1 - 2
MEASURE_BEFORE_UNDERSEAL		1 - 2
MONITORING_OF_LIFT		1 - 4

PC_GROUT_CURING_PERIOD	days	1 - 7
SLABS_UNDERSEALED		0 - 100
START_TIME_AFTER	hr	0 - 2359
START_TIME_BEFORE	hr	0 - 2359
SUBSEAL_MIX_TYPE		1 - 6
TIME_UNDERSEAL_TO_REOPEN	hr	0 - 48
TOTAL_SLABS		0 - 100
UNDERSEAL_HOLE_DEPTH	in	8 - 30
WATER_CEMENT_RATIO		0.1 - 1.0

E. Intramodular Checks

Intramodular checks for all SPS6 Construction data tables are specified below.

Tables: SPS6_CRACK_SEAT_PCC, SPS6_SAW_AND_SEAL

- DATE_COMPLETE >= DATE_BEGAN

Table: SPS6_DIAMOND_GRIND

- DATE_COMPLETE >= DATE_BEGAN

Table: SPS6_LOAD_TRANSFER

- DATE_COMPLETE >= DATE_BEGAN
- NO_JOINT_IN_SECTION >= NO_JOINT_RESTORE_LOCATIONS
- A value > 0 must exist for DOWEL_1, DOWEL_2, . . . DOWEL_n where n = DEVICES_PER_JOINT
- DOWEL_1 < DOWEL_2, < . . . DOWEL_n where n = DEVICES_PER_JOINT

Table: SPS6_NOTES_AND_COMMENTS

- No Level E Checks

Table: SPS6_OVERLAY

- DATE_COMPLETE >= DATE_BEGAN
- If: SURFACE_PREP = 3 or 4
  Then: LAYER_NO1, TACK_COAT_MATL, [TACK_COAT_PERCENT or (PARTS_DILUENT and PARTS_ASPHALT)], and APPL_RATE must be non-null

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Table: SPS6_PCC_CRACK_SEAL

- DATE_COMPLETE >= DATE_BEGAN
- SEAL_RES_WIDTH <= SEAL_RES_DEPTH

Table: SPS6_PCC_FULL_DEPTH

- DATE_COMPLETE >= DATE_BEGAN
- If STEEL = 1, then REBAR_TRANS, REBAR_LONG, REBAR_LENGTH_TRANS, REBAR_LENGTH_LONG, REBAR_SPACE_TRANS, and REBAR_SPACE_LONG must be 0 or null
- AIR_CONTENT_MIN <= AIR_CONTENT_MEAN <= AIR_CONTENT_MAX
- SLUMP_MIN <= SLUMP_MEAN <= SLUMP_MAX
- AIR_TEMP_LOW <= AIR_TEMP_HIGH

Table: SPS6_PCC_JOINT_RESEAL

- DATE_COMPLETE >= DATE_BEGAN
- SEAL_RES_WIDTH <= SEAL_RES_DEPTH
- If SEALS_DIFFERENT = 1, then CONTRACTION_SEAL_TYPE must be non-null

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Table: SPS6_PCC_PART_DEPTH

- DATE_COMPLETE >= DATE_BEGAN
- AIR_CONTENT <= AIR_CONTENT_MEAN <= AIR_CONTENT_MAX
- SLUMP_MIN <= SLUMP_MEAN <= SLUMP_MAX
- CURE_METHOD_1 not equal to CURE_METHOD_2
- AIR_TEMP_LOW <= AIR_TEMP_HIGH

Tables: SPS6_PMA_COMPACTION and SPS6_PMA_ROLLER

- For a given BREAKDOWN_ROLLER_CODE in **SPS6_PMA_COMPACTION**, a matching ROLLER_CODE must exist in **SPS6_PMA_ROLLER**
- For a given INTERMED_ROLLER_CODE in **SPS6_PMA_COMPACTION**, a matching ROLLER_CODE must exist in **SPS6_PMA_ROLLER**
- For a given FINAL_ROLLER_CODE in **SPS6_PMA_COMPACTION**, a matching ROLLER_CODE must exist in **SPS6_PMA_ROLLER**

Table: SPS6_PMA_CONSTRUCTION

- DATE_COMPLETE >= DATE_BEGAN
- LAYDOWN_TEMP_MAX >= LAYDOWN_TEMP_MEAN >= LAYDOWN_TEMP_MIN

Table: SPS6_PMA_ROLLER

- If ROLLER_CODE = A, B, C, or D, then ROLLER_TIRE_PRES, ROLLER_FREQ, ROLLER_AMP, and ROLLER_SPEED must be null
- If ROLLER_CODE = E, F, G, or H, then ROLLER_FREQ, ROLLER_AMP, or ROLLER_SPEED must be null
- If ROLLER_CODE = I, J, K, L, M, N, O, or P, then ROLLER_TIRE_PRES must be null

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Table: SPS6_QC_MEASUREMENTS

- MINIMUM_BINDER <= AVERAGE_BINDER <= MAXIMUM_BINDER
- MINIMUM_SURFACE <= AVERAGE_SURFACE <= MAXIMUM_SURFACE
- MINIMUM_FRICTION <= AVERAGE_FRICTION <= MAXIMUM_FRICTION

Table: SPS6_SUBDRAINAGE

- DATE_COMPLETE >= DATE_BEGAN
- If DRAINAGE_PIPE_TYPE = 7, then PIPE_DIAMETER must be 0 or null
- If FILTER_TYPE = 3, then MAX_PARTICLE_SIZE, NO_4_PASSING, NO_40_PASSING, and NO_100_PASSING must be 0 or null
- NO_4_PASSING >= NO_10_PASSING >= NO_40_PASSING >= NO_100_PASSING

Table: SPS6_UNDERSEALING

- DATE_COMPLETE >= DATE_BEGAN
- TOTAL_SLABS >= SLABS_UNDERSEALED
- If MONITORING_OF_LIFT = 2 or 3, then MEASURE_BEFORE_UNDERSEAL, MEASURE_AFTER_UNDERSEAL must be 2 or null and START_TIME_BEFORE, START_TIME_AFTER, END_TIME_BEFORE, and END_TIME_AFTER must be 0 or null
- START_TIME_BEFORE <= END_TIME_BEFORE
- START_TIME_AFTER <= END_TIME_AFTER
- START_TIME_BEFORE <= START_TIME_AFTER
- END_TIME_BEFORE <= END_TIME_AFTER

In addition, the checks listed in Table 18-1 are required for the identified tables and elements.

Table 18-1. Additional Level E Checks

If the data element below	has a code of	then a non-null entry must exist in the data element below
SPS6_CRACK_SEAT_PCC		
SURFACE_PREP	6	SURFACE_PREP_OTHER
SPS6_DIAMOND_GRIND		
GRINDING_REASON	5	GRINDING_REASON_OTHER
SPS6_LOAD_TRANSFER		
BACKFILL_MATERIAL	4	BACKFILL_MATERIAL_OTHER
BOND_AGENT	4	BOND_AGENT_OTHER
SPS6_OVERLAY		
TACK_COAT_MATL	10	MATL_TYPE_OTHER
PLANT_TYPE1	3	PLANT_TYPE_OTHER1
PLANT_TYPE2	3	PLANT_TYPE_OTHER2
PLANT_TYPE3	3	PLANT_TYPE_OTHER3

If the data element below	has a code of	then a non-null entry must exist in the data element below
SPS6_PCC_CRACK_SEAL		
BOND_BREAK	4	BOND_BREAK_OTHER
CRACK_CLEAN	6	CRACK_CLEAN_OTHER
CRACK_SEAL_TYPE	7	CRACK_SEAL_TYPE_OTHER
SPS6_PCC_FULL_DEPTH		
REASON	38	REASON_OTHER
SECONDARY_REASON	38	SECONDARY_REASON_OTHER
PATCH_MATL	5	PATCH_MATL_OTHER
BOUNDARY_METHOD	5	BOUNDARY_METHOD_OTHER
CUT_METHOD	5	CUT_METHOD_OTHER
TRANSFER_DEVICE	4	TRANSFER_DEVICE_OTHER
DOWEL_COAT_TRANS	7	DOWEL_COAT_TRANS_OTHER
CONCRETE_BREAK_METHOD	5	CONCRETE_BREAK_METHOD_OTHER
CONC_REMOVAL	3	CONC_REMOVAL_OTHER
JOINT_METHOD_SH	7	JOINT_METHOD_SH_OTHER
JOINT_METHOD_LONG	7	JOINT_METHOD_LONG_OTHER
JOINT_METHOD_TRANS	7	JOINT_METHOD_TRANS_OTHER
CURE_METHOD_1	10	CURE_METHOD_1_OTHER
CURE_METHOD_2	10	CURE_METHOD_2_OTHER
CONSOLIDATE_METHOD	6	CONSOLIDATE_METHOD_OTHER
FINISH_METHOD	4	FINISH_METHOD_OTHER
SPS6_PCC_JOINT_RESEAL		
REMOVAL_METHOD	9	REMOVAL_METHOD_OTHER
BOND_BREAK	4	BOND_BREAK_OTHER
REFACED	4	REFACED_OTHER
SIDEWALK_CLEAN	5	SIDEWALK_CLEAN_OTHER
CONTRACTION_SEAL_TYPE	7	CONTRACTION_SEAL_TYPE_OTHER
EXPANSION_SEAL_TYPE	7	EXPANSION_SEAL_TYPE_OTHER
SPS6_PCC_PART_DEPTH		
REASON	38	REASON_OTHER
SECONDARY_REASON	38	SECONDARY_REASON_OTHER
BOUNDARY_METHOD	4	BOUNDARY_METHOD_OTHER
CUT_METHOD	6	CUT_METHOD_OTHER
BREAK_METHOD	3	BREAK_METHOD_OTHER
CLEAN_METHOD	4	CLEAN_METHOD_OTHER
PATCH_MATL	5	PATCH_MATL_OTHER
BOND_AGENT	5	BOND_AGENT_OTHER
CURE_METHOD_1	10	CURE_METHOD_1_OTHER
CURE_METHOD_2	10	CURE_METHOD_2_OTHER
CONSOLIDATE_MEHTOD	6	CONSOLIDATE_MEHTOD_OTHER
FINISH_METHOD	4	FINISH_METHOD_OTHER
JOINT_METHOD_SH	7	JOINT_METHOD_SH_OTHER
JOINT_METHOD_TRANS	7	JOINT_METHOD_TRANS_OTHER
JOINT_METHOD_LONG	7	JOINT_METHOD_LONG_OTHER

If the data element below	has a code of	then a non-null entry must exist in the data element below
SPS6_SUBDRAINAGE		
DRAINAGE_PIPE_TYPE	8	DRAINAGE_PIPE_TYPE_OTHER
FILTER_TYPE	7	FILTER_TYPE_OTHER
TYPE_LOC_FILTER	3	TYPE_LOC_FILTER_OTHER
SUBDRAIN_PURPOSE	4	SUBDRAIN_PURPOSE_OTHER
SPS6_UNDERSEALING		
SUBSEAL_MIX_TYPE	6	SUBSEAL_MIX_TYPE_OTHER
DETERMINE_UNDERSEAL_AREA	4	DETERMINE_UNDERSEAL_AREA_OTHER

19.0 SPS7 CONSTRUCTION

19.1 Level 1

A. Initial Level

Records in the IMS are at Level A when they first enter the system and are set back to A when changes are made to a given record or to selected related records.

B. Dependency Checks

Dependency checks (B) are performed on records at level A. These checks are performed to ensure that essential data (data which are required to properly reference all other data) are present and adequate. For SPS7 sections, the dependency checks are performed for the specific SPS section (SINIT).

Four types of checks are performed for the SINIT checks; INIT B - an experiment verification check, INIT C - a minimum data check, INIT D - an expanded range check and INIT E - an intramodular check. Each of these checks are specified below. **A Project record must be at level E in SPS_PROJECT_STATIONS prior to a section passing the level B check for the remaining tables. (See SPS7 Construction Table Dependency Checks at the end of this section.)**

SINIT B Checks (Section Experiment Verification Checks)

Table: SPS7_LAYER

- All records for the present level (SINIT_*) must have a DESCRIPTION = 5
- If this is true, set all records for this section to RECORD_STATUS = B

SINIT C Checks (Section Minimum Data Checks)

Table	Field	Condition
SPS7_LAYER	DESCRIPTION	X
	MATERIAL_TYPE	X
	MEAN_THICKNESS	*
	*If LAYER_NO > 1	

SINIT D Check (Section Expanded Range Checks)

SPS7_LAYER

DESCRIPTION	*_THICKNESS[1]	MATERIAL_TYPE
2	0.0 - 1.5	71 - 73, 81 - 83
3	7.0 - 13.0	4, 5, 6
4	0.0 (not supplementals)	1
5	3.0 - 24.0	22 - 46
6	4.0 - 47.9	22 - 46
7	Must be null	51 - 65
8	0.1 - 6.0	74 - 84
9	0.0 - 2.5	2 (not supplementals)
10	0.0 - 1.5	11, 12, 71 - 73, 81 - 84

A DESCRIPTION = 11 is not valid.

Also, the following ranges are valid:

SECTION	DESCRIPTION[2]	MATERIAL_TYPE	*_THICKNESS[3]
?702 - ?705	1	4, 90	2 - 4
?706 - ?709	1	4, 90	4 - 6

[1] THICKNESS above includes the variables MEAN_THICKNESS, MAX_THICKNESS, and MIN_THICKNESS. MEAN_THICKNESS is a required data element. For the other two thicknesses, the check is valid only if the appropriate thickness field is not null.

[2] These checks are valid only for those layers with a DESCRIPTION = 1 that have a MEAN_THICKNESS > 0.

[3] THICKNESS above includes the variables MEAN_THICKNESS, MAX_THICKNESS, and MIN_THICKNESS. MEAN_THICKNESS is a required data element. For the other two thicknesses, the check is valid only if the appropriate thickness field **is not null.** For example, for the above table, if SECTION = ?702 and DESCRIPTION = 1, then MATL_TYPE = 4 or 90 and *_THICKNESS must be between 2 and 4 inches.

Table: SPS7_LAYER

- If not null, perform the following relational check
  - MIN_THICKNESS <= MEAN_THICKNESS <= MAX_THICKNESS
- Logical Layering Checks
  - A DESCRIPTION = 1 must not be designated for a layer below a layer with a DESCRIPTION = 3, 4, 5, 6, 7, or 8
  - A DESCRIPTION = 2 must not be designated for a layer below a layer with a DESCRIPTION = 1, 3, 4, 5, 6, 7, or 8 (not supplementals)
  - A DESCRIPTION = 9 must not be designated for a layer below a layer with a DESCRIPTION = 3, 5, 6, 7, or 8 (not supplementals)
  - A DESCRIPTION = 10 must not be designated for a layer below a layer with a DESCRIPTION = 3, 5, 6, 7, or 8 (not supplementals)
  - A DESCRIPTION = 3 must not be designated for a layer below a layer with a DESCRIPTION = 5, 6, or 7
  - A DESCRIPTION = 4 must not be designated for a layer below a layer with a DESCRIPTION = 3
  - A DESCRIPTION = 5 must not be designated for a layer below a layer with a DESCRIPTION = 6 or 7
  - A DESCRIPTION = 6 must not be designated for a layer below a layer with a DESCRIPTION = 7
  - There must be a layer with a DESCRIPTION = 5 directly beneath the layer with a DESCRIPTION = 3
  - For SHRP_ID = ?701 the top layer must have a DESCRIPTION of 2, 3, 10 or a DESCRIPTION = 1 or 9 with a MEAN_THICKNESS = 0
  - For SHRP_ID = ?702 - ?709 the top layer must have a DESCRIPTION of 1
  - A DESCRIPTION = 1 with a MEAN_THICKNESS > 0, must not be designated for a layer with a DESCRIPTION = 1
  - A layer with a DESCRIPTION = 9 with a MEAN_THICKNESS > 0, cannot be below a layer for DESCRIPTION = 1
  - For LAYER_NO = 1, the DESCRIPTION must always equal 7
- Layer Compatibility Checks
  - For SHRP_ID = ?702 - ?709, there must be a layer with a DESCRIPTION = 1 with a MEAN_THICKNESS > 0
  - A layer with a DESCRIPTION of 3 must exist
  - A layer with a DESCRIPTION of 5 must exist
  - There cannot be two layers with a DESCRIPTION of 3
  - There cannot be two layers with a DESCRIPTION of 5
  - There cannot be two layers with a DESCRIPTION of 7
  - There cannot be two layers with a DESCRIPTION of 9 with a MEAN_THICKNESS > 0
- For section ?701, if a layer with a DESCRIPTION = 1 exists in **INV_LAYER,** then a layer with a DESCRIPTION = 1 and a MEAN_THICKNESS = 0 must exist in **SPS7_LAYER**
- For section ?701, if a layer with a DESCRIPTION = 4 exists in **INV_LAYER,** then a layer with a DESCRIPTION = 4 and a MEAN_THICKNESS = 0 must exist in **SPS7_LAYER**

- For section ?701, if a layer with a DESCRIPTION = 9 exists in **INV_LAYER,** then a layer with a DESCRIPTION = 9 and a MEAN_THICKNESS = 0 must exist in **SPS7_LAYER**

- For section ?702-?709, if a layer with a DESCRIPTION = 1 exists in **INV_LAYER,** then a layer with a DESCRIPTION = 1 and a MEAN_THICKNESS = 0 must exist in **SPS7_LAYER** beneath a layer that has a DESCRIPTION = 1 and a MEAN_THICKNESS > 0

- For section ?702-?709, if a layer with a DESCRIPTION = 4 exists in **INV_LAYER,** then a layer with a DESCRIPTION = 4 and a MEAN_THICKNESS = 0 must exist in **SPS7_LAYER** beneath a layer that has a DESCRIPTION = 1 and a MEAN_THICKNESS > 0

- For section ?702-?709, if a layer with a DESCRIPTION = 9 exists in **INV_LAYER,** then a layer with a DESCRIPTION = 9 and a MEAN_THICKNESS = 0 must exist in **SPS7_LAYER** beneath a layer that has a DESCRIPTION = 1 and a MEAN_THICKNESS > 0

- For sections ?702-?709, for the layer with a DESCRIPTION = 3 with a MATERIAL_TYPE = 4 or 5, there must be a layer with a DESCRIPTION = 1 and a MATERIAL_TYPE = 4

- For sections ?702-?709, for the layer with a DESCRIPTION = 3 with a MATERIAL_TYPE = 6, there must be a layer with a DESCRIPTION = 1 and a MATERIAL_TYPE = 90

SPS7 Construction Table Dependency Checks

- All records in each Construction table are checked against **SPS_PROJECT_STATIONS**, for matching project level ID. If the corresponding project level records are at level E in **SPS_PROJECT_STATIONS**, the records in the Construction table go to level B.

C. Minimum Data Checks

Minimum data checks for all SPS7 Construction data tables are identified below. Data fields with a Condition of X must always contain a non-null value, however, data fields with a Condition of * are only required to contain a non-null value if a particular condition is met as specified in the accompanying field explanation.

Table	Field	Condition
SPS7_*	CONSTRUCTION_NO	*
	DATE_COMPLETE	*
	* if applicable	
	SHRP_ID	X
	STATE_CODE	X
SPS7_DELAMINATION	DELAM_DETECTION_METHOD	X
	TOTAL_AREA_DELAMINATED	X
	TOTAL_DELAMINATED_SLABS	X
SPS7_LAYER_THICKNESS	OFFSET	X
	STATION_NO	X
	SURFACE_COURSE	X
SPS7_LOAD_TRANSFER	NO_JOINTS_IN_SECTION	X
	NO_JOINT_RESTORE_LOCATIONS	X

SPS7_MILLING	AVG_CUT_DEPTH	X
SPS7_PCCO_JOINT_DATA	LONG_TYPE	X
	SH_TRAFFIC_LANE_TYPE	X
SPS7_PCC_CRACK_SEAL	SEAL_RES_DEPTH	X
	SEAL_RES_WIDTH	X
	TOTAL_FEET_CRACKS_SEALED	X
SPS7_PCC_FULL_DEPTH	NO_SLABS_REPLACED	X
	PATCH_MATL	X
	PATCH_NO_SLAB	X
	PATCH_SF_SLAB	X
	REASON	X
	SF_SLABS_REPLACED	X
SPS7_PCC_JOINT_RESEAL	LONG_SEAL_LENGTH	X
	REMOVAL_METHOD	
	SEAL_RES_DEPTH	X
	SEAL_RES_WIDTH	X
	TRANS_SEAL_LENGTH	X
SPS7_PCC_OVERLAY	CONCRETE_CURE_METHOD	X
	CONCRETE_TEXTURE_METHOD	X
	MEAN_AIR_TEMP	X
SPS7_PCC_PART_DEPTH	PATCH_AVG_DEPTH	X
	PATCH_MATL	X
	PATCH_NO	X
	PATCH_SF	X
	REASON	X
SPS7_QC_MEASUREMENTS	PROFILE_INDEX	X
	PROFILOGRAPH_TYPE	X
SPS7_REFLECTIVE_CRACK	BAR_LENGTH	X
	BAR_SIZE	X
	TOTAL_CRACKS_TIED	X
SPS7_REMOVAL_CLEANING	REMOVAL_CLEAN_METHOD	X
	REMOVAL_CLEAN_REASON	X
SPS7_SUBDRAINAGE	DRAINAGE_PIPE_TYPE	X
	FILTER_PERMEABILITY	X
	HORIZ_PIPE_PLACEMENT	X
	PIPE_DEPTH	X
	SUBDRAIN_PURPOSE	X
SPS7_TRANSFER_EFFICIENCY	EFFICIENCY_AFTER_APPROACH	X
	EFFICIENCY_AFTER_LEAVE	X
	EFFICIENCY_BEFORE_APPROACH	X
	EFFICIENCY_BEFORE_LEAVE	X
	POINT_DISTANCE	X
SPS7_UNDERSEALING	DETERMINE_UNDERSEAL_AREA	X

MONITORING_OF_LIFT	X
SUBSEAL_MIX_TYPE	X

D. Expanded Range Checks

Expanded range checks are applied to certain fields to identify data element values that fall outside an expected range. Field names are listed below the bolded table name. Expanded range checks for all SPS7 Construction data tables are specified below.

Table	Units	Range
SPS7_DELAMINATION		
DELAM_DETECTION_METHOD		1 - 2
TOTAL_AREA_DELAMINATED	sq ft	0 - 7000
TOTAL_DELAMINATED_SLABS		0 - 50
SPS7_LAYER_THICKNESS		
OFFSET	in	0 - 180
STATION_NO	ft	0 - 500
SURFACE_COURSE	in	0 - 6
SPS7_LOAD_TRANSFER		
BACKFILL_MATERIAL		1 - 4
BOND_AGENT		1 - 4
DEVICES_PER_JOINT		6 - 14
DOWEL_1	in	0 - 24
DOWEL_10	in	0 - 168
DOWEL_11	in	0 - 168
DOWEL_12	in	0 - 168
DOWEL_2	in	0 - 168
DOWEL_3	in	0 - 168
DOWEL_4	in	0 - 168
DOWEL_5	in	0 - 168
DOWEL_6	in	0 - 168
DOWEL_7	in	0 - 168
DOWEL_8	in	0 - 168
DOWEL_9	in	0 - 168
DOWEL_DIAMETER	in	0.75 - 2
NO_JOINTS_IN_SECTION		5 - 50
NO_JOINT_RESTORE_LOCATION		0 - 50
SPS7_MILLING		
AVG_CUT_DEPTH	in	0.3 - 2
CUTTING_HEAD_WIDTH	in	12 - 180
SPS7_PCCO_JOINT_DATA		
AVG_CONTRACTION_SPACING	ft	15 - 100
AVG_SAWED_SPACING	ft	15.0 - 99.9
BUILT_IN_EXPANSION_SPACING	ft	15 - 100
JOINT_SEAL_BACKER		1 - 5
JOINT_SEAL_BACKER_DIAM	in	0.4 - 2
JOINT_SKEWNESS	ft/lane	0-0 - 5.0
LONG_TYPE		1 - 5
LONG_SEAL_RESVR_DEPTH	in	0.3 - 1.5
LONG_SEAL_RESVR_WIDTH	in	0.3 - 1.5

SH_TRAFFIC_LANE_TYPE		1 - 6
SH_TRAFFIC_SEAL_RESVR_DEPTH	in	0.3 - 1.5
SH_TRAFFIC_SEAL_RESVR_WIDTH	in	0.3 - 1.5
TRANS_METHOD		1 - 4
TRANS_SEAL_RESVR_DEPTH	in	0.3 - 1.5
TRANS_SEAL_RESVR_WIDTH	in	0.3 - 1.5
TRANS_SEAL_TYPE		1 - 5

SPS7_PCC_CRACK_SEAL

BOND_BREAK		1 - 4
CRACK_CLEAN		1 - 6
CRACK_SEAL_TYPE		1 - 7
SEAL_DEPTH	in	0 - 0.5
SEAL_RES_DEPTH	in	0.1 - 2
SEAL_RES_WIDTH	in	0.1 - 2

SPS7_PCC_FULL_DEPTH

ADMIXTURE_1		1 - 13
ADMIXTURE_2		1 - 13
AIR_CONTENT_MAX	%	4 - 10
AIR_CONTENT_MEAN	%	4 - 8
AIR_CONTENT_MIN	%	2 - 8
AIR_TEMP_HIGH	deg F	40 - 120
AIR_TEMP_LOW	deg F	40 - 120
BOND_BREAKER		1 - 2
BOUNDARY_METHOD		1 - 5
CAGG_MIX	lbs/cu yd	500 - 3000
CEMENT_MIX	lbs/cu yd	300 - 1000
CEMENT_TYPE		41 - 55
CONC_BREAK_METHOD		1 - 5
CONC_REMOVAL		1 - 3
CONSOLIDATE_METHOD		1 - 6
CURE_METHOD_1		1 - 10
CURE_METHOD_2		1 - 10
CUT_METHOD		1 - 5
DOWEL_COAT_TRANS		1 - 7
FAGG_MIX	lbs/cu yd	500 - 2000
FINISH_METHOD		1 - 4
FLEX_CURE_TIME	days	0 - 28
FLEX_STRENGTH	psi	400 - 900
JOINT_METHOD_LONG		1 - 7
JOINT_METHOD_SH		1 - 7
JOINT_METHOD_TRANS		1 - 7
JOINTS_MATCHED		1 - 2
MAX_AGG_SIZE0		.1 - 2
PATCH_MATL		1 - 5
PATCH_SF_BASE	sq ft	0 - 7000
PATCH_SF_SLAB	sq ft	0 - 7000
REASON		20 - 38
REBAR_DOWEL		1 - 10
REBAR_LENGTH_DOWEL	in	1 - 18
REBAR_LENGTH_LONG	in	12 - 36
REBAR_LENGTH_TIE	in	1 - 48
REBAR_LENGTH_TRANS	in	12 - 36
REBAR_LONG		1 - 10
REBAR_SPACE_DOWEL	in	2 - 24

REBAR_SPACE_LONG	in	6 - 24
REBAR_SPACE_TRANS		9 - 36
REBAR_TIE		1 - 10
REBAR_TRANS		1 - 10
SAW_CUT_DEPTH	in	1 - 36
SAW_CUTS		1 - 10
SECONDARY_REASON		20 - 38
SF_BASE_REPLACE	sq ft	0 - 7000
SF_SLABS_REPLACED	sq ft	0 - 7000
SLUMP_MAX	in	1 - 4
SLUMP_MEAN	in	1 - 3
SLUMP_MIN	in	1 - 3
STEEL		1 - 2
STEEL_PLACE_METHOD		1 - 2
SURFACE_MOISTURE		1 - 2
TRAFFIC_OPEN_TIME	hr	0 - 99
TRANS_JOINT_PATCH		1 - 4
TRANS_JOINT_SLAB		1 - 4
TRANSFER_DEVICE		1 - 4
WATER_MIX	gal/cu yd	10 - 60

SPS7_PCC_JOINT_RESEAL

BOND_BREAK		1 - 4
CONTRACTION_SEAL_TYPE		1 - 7
EXPANSION_SEAL_TYPE		1 - 7
LONG_SEAL_LENGTH	ft	0 - 1000
REFACED		1 - 4
REMOVAL_METHOD		1 - 9
SEAL_DEPTH	in	0 - 0.5
SEAL_RES_DEPTH	in	0.3 - 1.5
SEAL_RES_WIDTH	in	0.3 - 1.5
SEALS_DIFFERENT		1 - 2
SIDEWALL_CLEAN		1, 4, 5, 6
TRANS_SEAL_LENGTH	lf	0 - 750

SPS7_PCC_OVERLAY

ADDITIVE_TYPE		1 - 13
CEMENT_TYPE		41 - 42
CONCRETE_CURE_METHOD		1 - 8
CONCRETE_TEXTURE_METHOD		1 - 6
CURE_PERIOD	days	0 - 28
GROUT_TYPE		1 - 5
MAX_AIR_TEMP	deg F	40 - 120
MEAN_AIR_TEMP	deg F	40 - 120
MIN_AIR_TEMP	deg F	40 - 120
TIME_BEFORE_SAWING	hr	0 - 8
WATER_CEMENT_RATIO		0.5 - 2

SPS7_PCC_PART_DEPTH

ADMIXTURE_1		1 - 13
ADMIXTURE_2		1 - 13
AIR_CONTENT_MAX	%	4 - 10
AIR_CONTENT_MEAN	%	4 - 8
AIR_CONTENT_MIN	%	2 - 8
AIR_TEMP_HIGH	deg F	40 - 120
AIR_TEMP_LOW	deg F	40 - 120

BOND_AGENT		1 - 5
BOUNDARY_METHOD		1 - 4
BREAK_METHOD		1 - 3
CAGG_MIX	lbs/cu yd	500 - 3000
CEMENT_MIX	lbs/cu yd	300 - 1000
CEMENT_TYPE		41 - 55
CLEAN_METHOD		1 - 4
CONSOLIDATE_METHOD		1 - 6
CURE_METHOD_1		1 - 10
CURE_METHOD_2		1 - 10
CUT_METHOD		1 - 6
FAGG_MIX	lbs/cu yd	500 - 2000
FINISH_METHOD		1 - 4
JOINT_METHOD_LONG		1 - 7
JOINT_METHOD_SH		1 - 7
JOINT_METHOD_TRANS		1 - 7
MAX_AGG_SIZE	in	0.1 - 2
PATCH_AVG_DEPTH	in	1 - 15
PATCH_COMP_STRENGTH	psi	1000 - 7000
PATCH_CURE_TIME	days	0 - 28
PATCH_MATL		1 - 5
PATCH_SF	sq ft	0 - 7000
REASON		20 - 38
SECONDARY_REASON		20 - 38
SLUMP_MAX	in	1 - 4
SLUMP_MEAN	in	1 - 3
SLUMP_MIN	in	1 - 3
SURFACE_MOISTURE		1 - 2
TRAFFIC_OPEN_TIME	hrs	0 - 99
WATER_MIX	gal/cu yd	10 - 60

SPS7_QC_MEASUREMENTS

INTERP_METHOD		1 - 3
PROFILE_INDEX	in/mi	0 - 20
PROFILOGRAPH_TYPE		1 - 2

SPS7_REFLECTIVE_CRACK

BAR_LENGTH	in	1 - 36
BAR_SIZE		1 - 16
LONG_BAR_PLACE_METHOD		1 - 4
RECESSED_SLOT_METHOD		1 - 3
TOTAL_CRACKS_TIED	ft	0 - 7000
TRANS_BAR_PLACE_METHOD		1 - 3

SPS7_REMOVAL_CLEANING

REMOVAL_CLEAN_METHOD		1 - 6
REMOVAL_CLEAN_REASON		1 - 5

SPS7_SUBDRAINAGE

DRAINAGE_PIPE_TYPE		1 - 8
FILTER_TYPE		1 - 7
HORIZ_PIPE_PLACEMENT	in	0 - 120
MAX_PARTICLE_SIZE	in	0.1 - 2.0
NO_10_PASSING	%	0 - 100
NO_100_PASSING	%	0 - 100
NO_4_PASSING	%	0 - 100

NO_40_PASSING	%	0 - 100
OUTLET_INTERVAL	ft	5 - 500
PIPE_DEPTH	in	1 - 48
PIPE_DIAMETER	in	1 - 24
SUBDRAIN_PURPOSE		1 - 4
TYPE_LOC_FILTER		1 - 3

SPS7_TRANSFER_EFFICIENCY

EFFICIENCY_AFTER_APPROACH	%	0 - 100
EFFICIENCY_AFTER_LEAVE	%	0 - 100
EFFICIENCY_BEFORE_APPROACH	%	0 - 100
EFFICIENCY_BEFORE_LEAVE	%	0 - 100
POINT_DISTANCE	ft	0 - 500

SPS7_UNDERSEALING

ADDITIVE_AMOUNT	%	0 - 10
ADDITIVE_TYPE		1 - 13
CEMENT_TYPE		41 - 55
CUBE_STRENGTH_PC_STRENGTH	psi	600 - 2000
DETERMINE_UNDERSEAL_AREA		1 - 4
END_TIME_AFTER	hr	0 - 2359
END_TIME_BEFORE	hr	0 - 2359
FLUIDITY_PC_GROUT	sec	8 - 25
HOLES_NEAR_JOINT_OR_CRACK		1 - 10
HOLES_PER_SLAB		1 - 50
MATL_PUMPED_PER_HOLE	cu ft	0 - 5
MAX_PUMP_PRESSURE	psi	100 - 300
MAX_SURGE_PRESSURE	psi	100 - 300
MEASURE_AFTER_UNDERSEAL		1 - 2
MEASURE_BEFORE_UNDERSEAL		1 - 2
MONITORING_OF_LIFT		1 - 4
PC_GROUT_CURING_PERIOD	days	1 - 7
SLABS_UNDERSEALED		0 - 50
START_TIME_AFTER	hr	0 - 2359
START_TIME_BEFORE	hr	0 - 2359
SUBSEAL_MIX_TYPE		1 - 6
TIME_UNDERSEAL_TO_REOPEN	hr	0 - 48
TOTAL_SLABS		0 - 50
UNDERSEAL_HOLE_DEPTH	in	8 - 30
WATER_CEMENT_RATIO		0.5 - 2

E. Intramodular Checks

Intramodular checks for all SPS7 Construction data tables are specified below.

Table: SPS7_DELAMINATION

- DATE_COMPLETE >= DATE_BEGAN
- If PAVEMENT_TYPE = 6, 13, 16, 19, 22, 25, 38, or 39 of **INV_GENERAL,** then TOTAL_DELAMINATED_SLABS must be 0 or null

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Table: SPS7_LOAD_TRANSFER

- DATE_COMPLETE >= DATE_BEGAN
- NO_JOINTS_IN_SECTION >= NO_JOINT_RESTORE_LOCATIONS
- A value must exist for DOWEL_1, DOWEL_2, . . . DOWEL_n, where n = DEVICES_PER_JOINT
- DOWEL_1 < DOWEL_2 < . . . DOWEL _n where n = DEVICES_PER_JOINT

Table: SPS7_PCC_CRACK_SEAL

- DATE_COMPLETE >= DATE_BEGAN
- SEAL_RES_WIDTH <= SEAL_RES_DEPTH

Table: SPS7_PCC_FULL_DEPTH

- DATE_COMPLETE >= DATE_BEGAN
- If STEEL = 1, then REBAR_TRAN, REBAR_LONG, REBAR_LENGTH_TRANS, REBAR_LENGTH_LONG, REBAR_SPACE_TRANS, and REBAR_SPACE_LONG must be 0 or null
- AIR_CONTENT_MIN <= AIR_CONTENT_MEAN <= AIR_CONTENT_MAX
- SLUMP_MIN <= SLUMP_MEAN <= SLUMP_MAX
- AIR_TEMP_LOW <= AIR_TEMP_HIGH

Table: SPS7_PCC_JOINT_RESEAL

- DATE_COMPLETE >= DATE_BEGAN
- SEAL_RES_WIDTH <= SEAL_RES_DEPTH
- If SEALS_DIFFERENT = 1, then CONTRACTION_SEAL_TYPE must be non-null

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Table: SPS7_PCC_OVERLAY

- DATE_COMPLETE >= DATE_BEGAN
- MIN_AIR_TEMP <= MEAN_AIR_TEMP <= MAX_AIR_TEMP

Table: SPS7_PCC_PART_DEPTH

- DATE_COMPLETE >= DATE_BEGAN
- AIR_CONTENT_MIN <= AIR_CONTENT_MEAN <= AIR_CONTENT_MAX
- SLUMP_MIN <= SLUMP_MEAN <= SLUMP_MAX
- CURE_METHOD_1 not equal to CURE_METHOD_2
- AIR_TEMP_LOW <= AIR_TEMP_HIGH

Table: SPS7_PCCO_JOINT_DATA

- DATE_COMPLETE ≥ DATE_BEGAN
- If JOINT_SKEWNESS is non-null, then JOINT_SKEWNESS in **INV_PCC_JOINT** for project level SHRP_ID must be non-null and ABS(**SPS7_PCCO_JOINT_DATA**.JOINT_SKEWNESS - **INV_PCC_JOINT**.JOINT_SKEWNESS) < 0.1 ft
  OR

JOINT_SKEWNESS in **INV_PCC_JOINT** for the LINKED_GPS_ID (found in **SPS_GPS_LINK** with project level SHRP_ID) must be non-null and ABS(**SPS7_PCCO_JOINT_DATA**.JOINT_SKEWNESS - **INV_PCC_JOINT**.JOINT_SKEWNESS) < 0.1 ft

- *_SEAL_RESVR_WIDTH ≤ *_SEAL_RESVR_DEPTH
- If TRANS_METHOD = 4, then TRANS_METHOD_OTHER must be non_null
- If TRANS_METHOD is non_null, then TRANS_SEAL_TYPE, TRANS_SEAL_RESVR_WIDTH, TRANS_SEAL_RESVR_DEPTH, JOINT_SEAL_BACKER and JOINT_SEAL_BACKER_DIAM must be non-NULL
- If LONG_TYPE = 5, then LONG_TYPE_OTHER must be non-NULL
- If LONG_TYPE is non-null, then LONG_SEAL_RESVR_WIDTH, LONG_SEAL_RESVR_DEPTH, JOINT_SEAL_BACKER and JOINT_SEAL_BACKER_DIAM must be non-null

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Table: SPS7_QC_MEASUREMENTS, SPS7_LAYER_THICKNESS, SPS7_MILLING, SPS7_REMOVAL_CLEANING

- DATE_COMPLETE >= DATE_BEGAN

Table: SPS7_REFLECTIVE_CRACK_CONTROL

- DATE_COMPLETE ≥ DATE_BEGAN
- If TRANS_BAR_PLACE_METHOD = 1, then RECESSES_SLOT_METHOD must be 0 or null

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Table: SPS7_SUBDRAINAGE

- DATE_COMPLETE ≥ DATE_BEGAN
- If DRAINAGE_PIPE_TYPE = 7, then PIPE_DIAMETER must be 0 or null
- If FILTER_TYPE = 3 or 4, then MAX_PARTICLE_SIZE, NO_4_PASSING, NO_10_PASSING, NO_40_PASSING, and NO_100_PASSING must be 0 or null
- NO_4_PASSING ≥ NO_10_PASSING ≥ NO_40_PASSING ≥ NO_100_PASSING

Table: SPS7_UNDERSEALING

- DATE_COMPLETE ≥ DATE_BEGAN
- TOTAL_SLABS ≥ SLABS_UNDERSEALED
- If PAVEMENT_TYPE = 6, 13, 19, 22, 25, 38, or 39 of INV_GENERAL, then: TOTAL_SLABS, SLABS_UNDERSEALED, HOLES_PER_SLAB, and HOLE_NEAR_JOINT_OR_CRACK must be 0 or null
- If MONITORING_OF_LIFT = 2 or 3, then MEASURE_BEFORE_UNDERSEAL, MEASURE_AFTER_UNDERSEAL must be 2 or null and START_TIME_BEFORE, START_TIME_AFTER, END_TIME_BEFORE, and END_TIME_AFTER must be 0 or null
- START_TIME_BEFORE < END_TIME_BEFORE
- START_TIME_AFTER < END_TIME_AFTER
- START_TIME_BEFORE < START_TIME_AFTER
- END_TIME_BEFORE < END_TIME_AFTER

In addition, the checks listed in Table 19-1 are required for the identified tables and elements.

Table 19-1. Additional Level E Checks

If the data element below	has a code of	then a non-null entry must exist in the data element below
SPS7_LOAD_TRANSFER		
BACKFILL_MATERIAL	4	BACKFILL_MATERIAL_OTHER
BOND_AGENT	4	BOND_AGENT_OTHER
SPS7_PCC_CRACK_SEAL		
BOND_BREAK	4	BOND_BREAK_OTHER
CRACK_CLEAN	6	CRACK_CLEAN_OTHER
CRACK_SEAL_TYPE	7	CRACK_SEAL_TYPE_OTHER
SPS7_PCC_FULL_DEPTH		
REASON	38	REASON_OTHER
SECONDARY_REASON	38	SECONDARY_REASON_OTHER
PATCH_MATL	5	PATCH_MATL_OTHER
BOUNDARY_METHOD	5	BOUNDARY_METHOD_OTHER
CUT_METHOD	5	CUT_METHOD_OTHER
TRANSFER_DEVICE	4	TRANSFER_DEVICE_OTHER
DOWEL_COAT_TRANS	7	DOWEL_COAT_OTHER
CONCRETE_BREAK_METHOD	5	CONCRETE_BREAK_METHOD_OTHER
CONC_REMOVAL	3	CONC_REMOVAL_OTHER
JOINT_METHOD_SH	7	JOINT_METHOD_SH_OTHER
JOINT_METHOD_LONG	7	JOINT_METHOD_LONG_OTHER
JOINT_METHOD_TRANS	7	JOINT_METHOD_TRANS_OTHER
CURE_METHOD_1	10	CURE_METHOD_1_OTHER
CURE_METHOD_2	10	CURE_METHOD_2_OTHER
CONSOLIDATE_METHOD	6	CONSOLIDATE_METHOD_OTHER
FINISH_METHOD	4	FINISH_METHOD_OTHER
SPS7_PCC_JOINT_RESEAL		
REMOVAL_METHOD	9	REMOVAL_METHOD_OTHER
BOND_BREAK	4	BOND_BREAK_OTHER
REFACED	4	REFACED_OTHER
SIDEWALL_CLEAN	5	SIDEWALL_CLEAN_OTHER
CONTRACTION_SEAL_TYPE	7	CONTRACTION_SEAL_TYPE_OTHER
EXPANSION_SEAL_TYPE	7	EXPANSION_SEAL_TYPE_OTHER
SPS7_PCCO_JOINT_DATA		
TRANS_METHOD	4	TRANS_METHOD_OTHER
LONG_TYPE	5	LONG_TYPE_OTHER
SH_TRAFFIC_LANE_TYPE	6	SH_TRAFFIC_LANE_TYPE_OTHER
TRANS_SEAL_TYPE	5	TRANS_SEAL_TYPE_OTHER
JOINT_SEAL_BACKER	5	JOINT_SEAL_BACKER_OTHER

If the data element below	has a code of	then a non-null entry must exist in the data element below
SPS7_PCC_OVERLAY		
CONCRETE_CURE_METHOD	8	CONCRETE_CURE_METHOD_OTHER
CONCRETE_TEXTURE_METHOD	6	CONCRETE_TEXTURE_METHOD_OTHER
GROUT_TYPE	5	GROUT_TYPE_OTHER
SPS7_REFLECTIVE_CRACK		
TRANS_BAR_PLACE_METHOD	3	TRANS_BAR_PLACE_METHOD_OTHER
RECESSED_SLOT_METHOD	3	RECESSED_SLOT_METHOD_OTHER
LONG_BAR_PLACE_METHOD	4	LONG_BAR_PLACE_METHOD_OTHER
SPS7_REMOVAL_CLEANING		
REMOVAL_CLEAN_METHOD	6	REMOVAL_CLEAN_METHOD_OTHER
REMOVAL_CLEAN_REASON	5	REMOVAL_CLEAN_REASON_OTHER
SPS7_SUBDRAINAGE		
DRAINAGE_PIPE_TYPE	8	DRAINAGE_PIPE_TYPE_OTHER
FILTER_TYPE	7	FILTER_TYPE_OTHER
TYPE_LOC_FILTER	3	TYPE_LOC_FILTER_OTHER
SUBDRAIN_PURPOSE	4	SUBDRAIN_PURPOSE_OTHER
SPS7_UNDERSEALING		
SUBSEAL_MIX_TYPE	6	SUBSEAL_MIX_TYPE_OTHER
DETERMINE_UNDERSEAL_AREA	4	DETERMINE_UNDERSEAL_AREA_OTHER

20.0 SPS8 CONSTRUCTION

20.1 Level 1

A. Initial Level

Records in the IMS are at Level A when they first enter the system and are set back to A when changes are made to a given record or to selected related records.

B. Dependency Checks

Dependency checks (B) are performed on records at level A. These checks are performed to ensure that essential data (data which are required to properly reference all other data) are present and adequate. For SPS8 sections, the dependency checks are performed for the specific SPS section (SINIT).

Four types of checks are performed on each of the four above listed data tables as part of the dependency checks, which include INIT B - an experiment verification check, INIT C - a minimum data check, INIT D - an expanded range check, and INIT E - an intramodular check. Each of these checks are specified below for the data records existing in each of the above four tables. **A Project record must be at level E in SPS_PROJECT_STATIONS prior to a section passing the level B check for the remaining tables. (See SPS8 Construction Table Dependency Checks at the end of this section.)**

SINIT B Checks (Section Experimental Verification Checks)

Set PROJ_ID(6 characters) to the current STATE_CODE(2 characters) | with the 1st 2 characters of SHRP_ID | with the 2 characters)) (zero, zero).

Table: SPS8_LAYER

- If the MIN(**SPS_ID**.RECORD_STATUS(PROJ_ID), **SPS_PROJECT_STATIONS**.RECORD_STATUS(PROJ_ID) >D then raise the layers to RECORD_STATUS =B for this STATE_CODE and SHRP_ID

SINIT C (Section Minimum Data Elements Checks)

Data fields with the Condition X must always contain a non-null value. The data fields with the Condition of * must contain a non-null field where applicable.

Table	Field	Condition
SPS8_LAYER	DESCRIPTION	X
	MATERIAL_TYPE	X
	MEAN_THICKNESS *(only for LAYER_NO > 1)	*

SINIT D (Section Expanded Range Checks)

In the following table, range checks are presented for the various data elements in each referenced table. To perform the check, a value must exist in the data field. Therefore, **if not null**, the following range checks apply.

SPS8_LAYER

Flexible Sections

- DESCRIPTION can only equal 3 - 9 and 11 (not supplementals)

For sections like ?801-?806, the following ranges are valid for the given DESCRIPTION:

DESCRIPTION	THICKNESS[1]	MATERIAL_TYPE
6	4.0 - 47.9	22 - 26, 40 - 43
7	24.0 - 240.0, null	51 - 56 where SHRP_ID in ?801 - ?804 57 - 65 where SHRP_ID in ?805, ?806
8	0.1 - 0.5	74, 75
9	0.1 - 1.0	2
11	4.0 - 47.9	51 - 56, 57 - 65

[1] THICKNESS above includes the variables MEAN_THICKNESS, MAX_THICKNESS and MIN_THICKNESS. MEAN_THICKNESS is a required data element. For the other two thicknesses, the check is valid only if the appropriate thickness field **is not null**.

In addition, for each test section, the following ranges apply for DESCRIPTION = 3, 4[2], AND 5:

SHRP_ID	THICKNESS[1]		MATERIAL_TYPE	
	DESCRIPTION = 3 + 4	DESCRIPTION = 5	DESCRIPTION = 3 + 4	DESCRIPTION = 5
?801, ?803, ?805	3.5 - 4.5	7 - 9	1	23
?802, ?804, ?806	6.5 - 7.5	11 - 13	1	23

Rigid Sections

- DESCRIPTION can only equal 3, 5, 6, 7, and 11 (not supplementals)

For sections like ?807-?812, the following ranges are valid for the given DESCRIPTION:

DESCRIPTION	THICKNESS[3]	MATERIAL_TYPE
5	5.0 - 7.0	23
6	4.0 - 47.9	22 - 26, 40 - 43
7	24.0 - 240.0, null	51 - 56 where SHRP_ID in ?807 - ?810 57 - 65 where SHRP_ID in ?811 - ?812
11	4.0 - 47.9	51 - 56, 57 - 65

In addition, for each test section, the following ranges (if not null) apply for DESCRIPTION = 3:

SHRP_ID	THICKNESS[3]	MATERIAL_TYPE
?807-?809, ?811	7.5 - 8.5	4
?808, ?810, ?812	11.5 - 12.5	4

[2] If DESCRIPTION = 4 exists.

[3] THICKNESS above includes the variables MEAN_THICKNESS, MAX_THICKNESS, and MIN_THICKNESS. MEAN_THICKNESS is a required data element. For the other two thicknesses, the check is valid only if the appropriate thickness field **is not null.**

SINIT E (Section Intramodular Checks)

To perform the check, values must exist in the data fields. Therefore, if not null, the following checks apply.

Table: SPS8_LAYER

- Logical Layering Checks
  - The top layer can only have a DESCRIPTION of 3 for SHRP_ID = ?801-812 or 9 for SHRP_ID = ?801-?806 (not supplementals)
  - A DESCRIPTION = 3 must not be designated for a layer below a layer with a DESCRIPTION = 4, 5, 6, 7, 8, or 11
  - A DESCRIPTION = 4 must not be designated for a layer below a layer with a DESCRIPTION = 5, 6, 7, or 11
  - A DESCRIPTION = 5 must not be designated for a layer below a layer with a DESCRIPTION = 6, 7, or 11
  - A DESCRIPTION = 6 must not be designated for a layer below a layer with a DESCRIPTION = 7 or 11
  - For LAYER_NO = 1, the DESCRIPTION must always equal 7
  - A DESCRIPTION = 8 must not be designated for a layer below a layer with a DESCRIPTION = 7 or 11
  - A DESCRIPTION = 9 must not be designated for a layer below a layer with a DESCRIPTION = 3, 4, 5, 6, 7, 8, or 11
  - A DESCRIPTION = 11 must not be designated for a layer below a layer with a DESCRIPTION = 7

- Layer Compatibility Checks
  - A layer with a DESCRIPTION of 3 must exist
  - There cannot be two layers with a DESCRIPTION of 3
  - There must be a layer with a DESCRIPTION of 4 or 5 directly below a layer with a DESCRIPTION of 3
  - A layer with a DESCRIPTION of 5 must exist
  - There cannot be two layers with a DESCRIPTION of 7
  - There cannot be two layers with a DESCRIPTION of 9

SPS8 Construction Table Dependency Checks

- All records in each Construction table are checked against **SPS8_PROJECT_STATIONS**, for matching project level ID. If the corresponding project level records are at level E in PROJECT_STATIONS, the records in the Construction table go to level B.

C. Minimum Data Checks

Minimum data checks for all SPS8 Construction data tables are identified below. Data fields with a Condition of X must always contain a non-null value, however, data fields with a Condition of * are only required to contain a non-null value if a particular condition is met as specified in the accompanying
field explanation.

Table	Field	Condition
SPS8_*	CONSTRUCTION_NO	*
	DATE_COMPLETE	*
	* if applicable	
	SHRP_ID	X
	STATE_CODE	X
SPS8_LAYER_THICKNESS	ASPH_SURFACE_AND_BINDER	*
	*only for SHRP_ID = ?801 - ?806	
	DENSE_GRADE_AGG_BASE	X
	OFFSET	X
	PORT_CEMENT_CONCRETE_ SURFACE	*
	*only for SHRP_ID = ?807 - ?812	
	STATION_NO	X
SPS8_NOTES_AND_COMMENTS	No Level C Checks	
SPS8_PCC_FULL_DEPTH	NO_SLABS_REPLACED	X
	PATCH_MATL	X
	PATCH_NO_SLAB	X
	PATCH_SF_SLAB	X
	REASON	X
	SF_SLABS_REPLACED	X
SPS8_PCC_JOINT_DATA	AVG_CONTRACTION_SPACING	X
	JOINT_SKEWNESS	X
	LONG_TYPE	X
	SH_TRAFFIC_LANE_TYPE	X
	TRANS_METHOD	X
	TRANS_SEAL_TYPE	X
SPS8_PCC_MIXTURE_DATA	AGGR_COMP_PERCENT_C1	X
	AGGR_COMP_PERCENT_F1	X
	AGGR_COMP_TYPE_C1	X
	AGGR_COMP_TYPE_F1	X
	ALKALI_CONTENT_CEMENT	X
	CEMENT_TYPE	X
	GEOL_CLASS_COARSE_AGGR	X
	LAYER_NO	X
	MIX_DESIGN_CEMENT	X
	MIX_DESIGN_COARSE	X
	MIX_DESIGN_FINE	X
	MIX_DESIGN_WATER	X
SPS8_PCC_PLACEMENT_DATA	LAYER_NO	X
	PAVER_TYPE	X
SPS8_PCC_PROFILE_DATA	PROFILE_INDEX	X
	PROFILOGRAPH_TYPE	X
SPS8_PMA_AC_PROPERTIES	ASPHALT_GRADE	X
	LAYER_NO	X
	SOURCE	X

SPS8_PMA_AGGREGATE_PROP	AGGR_COMB_BULK_SPEC	X
	AGGR_COMP_PERCENT_C1	X
	AGGR_COMP_PERCENT_F1	X
	AGGR_COMP_TYPE_C1	X
	AGGR_COMP_TYPE_F1	X
	COARSE_AGGR_BULK_SPEC	X
	FINE_AGGR_BULK_SPEC	X
	LAYER_NO	X
SPS8_PMA_COMPACTION	COMPACTED_THICK	X
	LAYER_NO	X
	LIFT_NO	X
SPS8_PMA_CONSTRUCTION	LAYER_NO	X
	MEAN_MIXING_TEMP	X
SPS8_PMA_DENSITY_PROFILE	AVERAGE_ATB	*
	AVERAGE_ BINDER	*
	AVERAGE_ FRICTION	*
	AVERAGE_SURFACE	*
	LAYER_NO_ATB	*
	LAYER_NO_BINDER	*
	LAYER_NO_FRICTION	*
	LAYER_NO_SURFACE	*
	PROFILE_INDEX	*
	PROFILOGRAPH_TYPE	*
	* One combination of (AVERAGE_* and LAYER_NO_*) or (PROFILE_INDEX and PROFILOGRAPH_TYPE) is required	
SPS8_PMA_MIXTURE_PROP	ASPHALT_CONTENT_MEAN	X
	ASPHALT_PLANT_TYPE	X
	BULK_SPEC_GRAVITY_MEAN	X
	EFF_ASPHALT_CONTENT	X
	LAYER_NO	X
	MAX_SPEC_GRAVITY	X
	PCT_AIR_VOIDS_MEAN	X
	SAMPLE_TYPE	X
	VOIDS_MINERAL_AGGR	X
SPS8_PMA_PLACEMENT_DATA	AC_SURFACE_1ST_THICK	X
	LAYDOWN_WIDTH	X
	LAYER_NO_AC_SURFACE	X
SPS8_PMA_ROLLER	LAYER_NO	*
	ROLLER_CODE	*
	ROLLER_CODE_DESC	*
	ROLLER_GROSS_WT	*
	*required only for ?801-06	
SPS8_SUBGRADE_PREP	COMPACTION_EQUIP_TYPE	X
	GROSS_WEIGHT	X
SPS8_UNBOUND_AGG_BASE	COMPACTION_TYPE	X
	FIRST_LIFT_THICKNESS	X

GROSS_WEIGHT	X
LAYER_NO	X

D. Expanded Range Checks

Expanded range checks are applied to certain fields to identify data element values that fall outside an expected range. Field names are listed below the bolded table name. Expanded range checks for all SPS8 Construction data tables are specified below.

Table	Units	Range
SPS8_LAYER_THICKNESS		
ASPH_SURFACE_AND_BINDER	in	0 - 8
DENSE_GRADE_AGG_BASE	in	5 - 13
OFFSET	ft	0 - 168
PORT_CEMENT_CONCRETE_SURFACE	in	0 - 13
STATION_NO	ft	0 - 500
SURFACE_FRICTION	in	0 - 3
SPS8_NOTES_AND_COMMENTS		
No Level D Checks		
SPS8_PCC_FULL_DEPTH		
ADMIXTURE_1		1 - 13
ADMIXTURE_2		1 - 13
AIR_CONTENT_MAX	%	4 - 10
AIR_CONTENT_MEAN	%	4 - 8
AIR_CONTENT_MIN	%	2 - 8
AIR_TEMP_HIGH	deg F	40 - 120
AIR_TEMP_LOW	deg F	40 - 120
BOND_BREAKER		1 - 2
BOUNDARY_METHOD		1 - 5
CAGG_MIX	lbs/cu yd	500 - 3000
CEMENT_MIX	lbs/cu yd	300 - 1000
CEMENT_TYPE		41 - 55
CONC_BREAK_METHOD		1 - 5
CONC_REMOVAL		1 - 3
CONSOLIDATE_METHOD		1 - 6
CURE_METHOD_1		1 - 10
CURE_METHOD_2		1 - 10
CUT_METHOD		1 - 5
DOWEL_COAT_TRANS		1 - 7
FAGG_MIX	lbs/cu yd	500 - 3000
FINISH_METHOD		1 - 4
FLEX_CURE_TIME	days	0 - 28
FLEX_STRENGTH	psi	400 - 900
JOINT_METHOD_LONG		1 - 7
JOINT_METHOD_SH		1 - 7
JOINT_METHOD_TRANS		1 - 7
JOINTS_MATCHED		1 - 2
MAX_AGG_SIZE	in	0.1 - 2
PATCH_MATL		1 - 4
PATCH_SF_BASE	sq ft	0 - 7000
PATCH_SF_SLAB	sq ft	0 - 7000

REASON		20 - 38
REBAR_DOWEL		1 - 10
REBAR_LENGTH_DOWEL	in	1 - 36
REBAR_LENGTH_TIE	in	1 - 48
REBAR_LONG		1 - 10
REBAR_SPACE_DOWEL	in	2 - 24
REBAR_SPACE_LONG	in	2 - 24
REBAR_TIE		1 - 10
REBAR_TRANS		1 - 10
SAW_CUT_DEPTH	in	1 - 18
SAW_CUTS		1 - 10
SECONDARY_REASON		20 - 38
SF_BASE_REPLACED	sq ft	0 - 7000
SF_SLABS_REPLACED	sq ft	0 - 7000
SLUMP_MAX	in	1 - 4
SLUMP_MEAN	in	1 - 3
SLUMP_MIN	in	1 - 3
STEEL		1 - 2
STEEL_PLACE_METHOD		1 - 2
SURFACE_MOISTURE		1 - 2
TRAFFIC_OPEN_TIME	hr	0 - 99
TRANS_JOINT_PATCH		1 - 4
TRANS_JOINT_SLAB		1 - 4
TRANSFER_DEVICE		1 - 4
WATER_MIX	gal/cu yd	10 - 60

SPS8_PCC_JOINT_DATA

AVG_CONTRACTION_SPACING	ft	15 - 30
CHK_DOWEL_AFTER_PLACE		Y, N
CHK_DOWEL_BEFORE_PLACE		Y, N
DEPTH_OF_SAWCUT	in	0.1 - 4
DOWEL_COATING		1 - 6
DOWEL_DISTANCE	in	4 - 12
DOWEL_LENGTH	in	16 - 20
DOWEL_SPACING	in	10 - 14
JOINT_SKEWNESS	ft	0.0 - 5.0
LAYER_NO		> 1
LONG_SEAL_RESVR_DEPTH	in	0.3 - 1.5
LONG_SEAL_RESVR_WIDTH	in	0.3 - 1.5
LONG_TYPE		1 - 4
MLTD_METHOD		1 - 3
ROUND_DOWEL_DIAMETER	in	1.25 - 1.5
SH_TRAFFIC_LANE_TYPE		1 - 4
SH_TRAFFIC_SEAL_RESVR_DEPTH	in	0.3 - 1.5
SH_TRAFFIC_SEAL_RESVR_WIDTH	in	0.3 - 1.5
TIE_BAR_DIAMETER	in	0.3 - 3.0
TIE_BAR_LENGTH	in	18 - 60
TIE_BAR_SPACING	in	12 - 60
TIME_BETWEEN_PLACE_SAWCUT	hr	0 - 24
TRANS_CONT_JLTS		1 - 3
TRANS_METHOD		1 - 4
TRANS_SEAL_RESVR_DEPTH	in	0.3 - 1.5
TRANS_SEAL_RESVR_WIDTH	in	0.3 - 1.5
TRANS_SEAL_TYPE		1 - 5

SPS8_PCC_MIXTURE_DATA

ADMIXTURE_AMT_1	%	0 - 100
ADMIXTURE_AMT_2	%	0 - 100
ADMIXTURE_AMT_3	%	0 - 100
ADMIXTURE_TYPE_1		1 - 13
ADMIXTURE_TYPE_2		1 - 13
ADMIXTURE_TYPE_3		1 - 13
AGGR_COMP_PERCENT_C1	%	0 - 100
AGGR_COMP_PERCENT_F1	%	0 - 100
AGGR_COMP_PERCENT_C2	%	0 - 100
AGGR_COMP_PERCENT_F2	%	0 - 100
AGGR_COMP_PERCENT_C3	%	0 - 100
AGGR_COMP_PERCENT_F3	%	0 - 100
AGGR_COMP_TYPE_C1		1 - 7
AGGR_COMP_TYPE_F1		1 - 4
AGGR_COMP_TYPE_C2		1 - 7
AGGR_COMP_TYPE_F2		1 - 4
AGGR_COMP_TYPE_C3		1 - 7
AGGR_COMP_TYPE_F3		1 - 4
AGGR_DUR_TYPE_C1		1 - 11
AGGR_DUR_TYPE_C2		1 - 11
AGGR_DUR_TYPE_C3		1 - 11
AGGR_DUR_TYPE_M1		1 - 11
ALKALI_CONTENT_CEMENT	%	0 - 1
CEMENT_TYPE		41 - 55
COARSE_AGGR_BULK_SPEC		1.5 - 4
FINE_AGGR_BULK_SPEC		1.5 - 4
FIVE_EIGHTHS_PASSING	%	35 - 100 or 65 - 100 (combined)
GEOL_CLASS_COARSE_AGGR		1 - 22
LAYER_NO		> 1
MIX_DESIGN_CEMENT	lbs/cu yd	0 - 700
MIX_DESIGN_COARSE	lbs/cu yd	500 - 3000
MIX_DESIGN_FINE	lbs/cu yd	500 - 2000
MIX_DESIGN_WATER	lbs/cu yd	100 - 500
NO_10_PASSING	%	45 - 90 or 15 - 50 (combined)
NO_100_PASSING	%	2 - 20 or 2 - 15 (combined)
NO_16_PASSING	%	40 - 90 or 10 - 45 (combined)
NO_200_PASSING	%	2-12
NO_30_PASSING	%	20 - 70 or 10 - 40 (combined)
NO_4_PASSING	%	0 - 15 or 45 - 90 (combined)
NO_40_PASSING	%	20 - 60 or 10 - 35 (combined)
NO_50_PASSING	%	10 - 40 or 5 - 30 (combined)
NO_8_PASSING	%	70 - 100 or 30 - 60 (combined)
NO_80_PASSING	%	5 - 25 or 4 - 25 (combined)
ONE_AND_HALF_PASSING	%	85 - 100
ONE_HALF_PASSING	%	10 - 70 or 60 - 100 (combined)
ONE_PASSING	%	70 - 100 or 80 - 100 (combined)
SEVEN_EIGHTHS_PASSING	%	65 - 100 or 75 - 100 (combined)
THREE-EIGHTHS_PASSING	%	2 - 25 or 50 - 95 (combined)
THREE_FOURTHS_PASSING	%	45 - 100 or 70 - 100 (combined)
TWO_PASSING	%	90 - 100

SPS8_PCC_PLACEMENT_DATA

CONSOLIDATION		1 - 6
CURING		1 - 8
DEPTH_OF_VIBRATORS	in	1 - 10
DOWEL_PLACE_METHOD		1 - 2

FINISHING		1 - 4
LAYER_NO		> 1
LAYDOWN_WIDTH	ft	1 - 14
NUMBER_OF_VIBRATORS		2 - 40
PAVER_TYPE		1 - 3
TEXTURING		1 - 7
VIBRATOR_SPACING	in	3 - 24

SPS8_PCC_PROFILE_DATA

AVG_BLADE_SPACING	in	0.1 - 0.2
AVG_CUT_DEPTH	in	0 - 0.8
AVG_GROOVE_WIDTH	in	0.1 - 0.2
CUTTING_HEAD_WIDTH	in	36 - 72
DIAMOND_GRIND_CORRECTED		Y, N
GRINDING_REASON		1 - 6
INTERPRETATION_METHOD		1 - 3
PROFILE_INDEX	in/mi	0 - 20
PROFILOGRAPH_TYPE		1 - 2
SURFACE_PROFILE_INCENTIVE		Y, N

SPS8_PMA_AC_PROPERTIES

ASPHALT_GRADE		1 - 40, 99
ASPHALT_SPECIFIC_GRAVITY		0.9 - 1.1
ASPHALT_VISCOSITY_140	poise	500 - 20000
ASPHALT_VISCOSITY_275	centistokes	100 - 1200
DUCTILITY_77	cm	8 - 150
LAYER_NO		> 1
MODIFIER_1		1 - 27
MODIFIER_2		1 - 27
PENETRATION_77	0.1 mm	20 - 250
RING_BALL_SOFT_PT	deg F	50 - 200

SPS8_PMA_AGGREGATE_PROP

AGGR_COMB_BULK_SPEC		1 - 4
AGGR_COMP_PERCENT_C1	%	0 - 100
AGGR_COMP_PERCENT_F1	%	0 - 100
AGGR_COMP_PERCENT_C2	%	0 - 100
AGGR_COMP_PERCENT_F2	%	0 - 100
AGGR_COMP_PERCENT_C3	%	0 - 100
AGGR_COMP_PERCENT_F3	%	0 - 100
AGGR_COMP_TYPE_C1		1 - 6
AGGR_COMP_TYPE_F1		1 - 4
AGGR_COMP_TYPE_C2		1 - 6
AGGR_COMP_TYPE_F2		1 - 4
AGGR_COMP_TYPE_C3		1 - 6
AGGR_COMP_TYPE_F3		1 - 4
AGGR_DUR_RESULT_C1	%	0 - 90
AGGR_DUR_RESULT_C2	%	0 - 90
AGGR_DUR_RESULT_C3	%	0 - 90
AGGR_DUR_RESULT_M1	%	0 - 90
AGGR_DUR_TYPE_C1		1 - 11
AGGR_DUR_TYPE_C2		1 - 11
AGGR_DUR_TYPE_C3		1 - 11
AGGR_DUR_TYPE_M1		1 - 11
COARSE_AGGR_BULK_SPEC		1 - 4
EFFECTIVE_SPEC_GRAVITY		1 - 4

FINE_AGGR_BULK_SPEC		1 - 4
LAYER_NO		> 1
MINERAL_FILLER		1 - 5
MINERAL_FILLER_BULK_SPEC		1 - 4
POLISH_VALUE		0 - 150

SPS8_PMA_COMPACTION

BREAKDOWN_ROLLER_CODE		A - Q
COMPACTED_THICK	in	1 - 8
FINAL_ROLLER_CODE		A - Q
INTERMED_ROLLER_CODE		A - Q
LAYER_NO		> 1
MEAN_AIR_TEMP	deg F	40 - 120

SPS8_PMA_CONSTRUCTION

LAYDOWN_TEMP_MAX	deg F	150 - 400
LAYDOWN_TEMP_MEAN	deg F	150 - 400
LAYDOWN_TEMP_MIN	deg F	150 - 400
LAYDOWN_TEMP_STD_DEV		0 - 50
LAYER_NO		> 1
MEAN_MIXING_TEMP	deg F	150 - 400

SPS8_PMA_DENSITY_PROFILE

AVERAGE_BINDER	pcf	100 - 160
AVERAGE_FRICTION	pcf	100 - 160
AVERAGE_SURFACE	pcf	100 - 160
BINDER_MEASURE		A, C
BLANK_BAND_HEIGHT	in	0 - 0.5
FRICTION_MEASURE		A, C
GAUGE_COUNT_RATE		0 - 9999
INTERP_METHOD		1 - 3
LAYER_NO_BINDER		> 1
LAYER_NO_FRICTION		> 1
LAYER_NO_SURFACE		> 1
MAXIMUM_BINDER	pcf	100 - 160
MAXIMUM_FRICTION	pcf	100 - 160
MAXIMUM_SURFACE	pcf	100 - 160
MINIMUM_BINDER	pcf	100 - 160
MINIMUM_FRICTION	pcf	100 - 160
MINIMUM_SURFACE	pcf	100 - 160
PROFILE_INDEX	in/mi	0 - 20
PROFILOGRAPH_TYPE		1 - 2
SURFACE_MEASURE		A, C

SPS8_PMA_MIXTURE_PROP

ANTISTRIP_AGENT_AMOUNT	%	0 - 5
ANTISTRIP_AGENT_CODE		1 - 2
ANTISTRIP_AGENT_TYPE		0 - 70
ASPHALT_CONTENT_MAX	%	1 - 10
ASPHALT_CONTENT_MEAN	%	1 - 10
ASPHALT_CONTENT_MIN	%	1 - 10
ASPHALT_PLANT_TYPE		1 - 3
BULK_SPEC_GRAVITY_MAX		1 - 4
BULK_SPEC_GRAVITY_MEAN		1 - 4
BULK_SPEC_GRAVITY_MIN		1 - 4
EFF_ASPHALT_CONTENT	%	1 - 10

HVEEM_STABILITY		25 - 50
LAYER_NO		> 1
MARSHALL_FLOW	.01 in	0 - 25
MARSHALL_STABILITY	lbs	1200 - 5000
MAX_SPEC_GRAVITY		1 - 4
NO_SAMP_PCT_AIR_VOIDS		≥ 1
NUMBER_OF_BLOWS		50, 75
PCT_AIR_VOIDS_MAX	%	0 - 10
PCT_AIR_VOIDS_MEAN	%	0 - 10
PCT_AIR_VOIDS_MIN	%	0 - 10
PCT_AIR_VOIDS_STD_DEV		0 - 5
SAMPLE_TYPE		1 - 2
VOIDS_MINERAL_AGGR	%	1 - 20

SPS8_PMA_PLACEMENT_DATA

AC_BINDER_1ST_THICK	in	1 - 4
AC_BINDER_2ND_THICK	in	1 - 4
AC_SURFACE_1ST_THICK	in	1 - 4
AC_SURFACE_2ND_THICK	in	1 - 4
BINDER_COURSE_STATION		null
LAYDOWN_WIDTH	ft	10 - 14
LAYER_NO_AC_BINDER		> 1
LAYER_NO_AC_SURFACE		> 1
LAYER_NO_SURFACE_FRICTION		> 1
LAYER_NO1_1		> 1
LAYER_NO1_2		> 1
LAYER_NO1_3		> 1
LAYER_NO2_1		> 1
LAYER_NO2_2		> 1
LAYER_NO2_3		> 1
LAYER_NO3_1		> 1
LAYER_NO3_2		> 1
LAYER_NO3_3		> 1
LONG_SURFACE_JOINT_LOC		1 - 2
OFFSET	ft	8 - 14
PLANT_TYPE1		1 - 3
PLANT_TYPE2		1 - 3
PLANT_TYPE3		1 - 3
SURF_FRICTION_STATION		null
SURFACE_COURSE_STATION		null
SURFACE_FRICTION_THICK	in	0.75 - 4

SPS8_PMA_ROLLER

LAYER_NO		> 1
ROLLER_CODE		A - Q
ROLLER_FREQ	vib/min	2000 - 3000 (I - P)
ROLLER_GROSS_WT	tons	0 - 20 (A - D, I - P); 0 - 50 (E - H)
ROLLER_SPEED	mph	0 - 10
ROLLER_TIRE_PRES	psi	50 - 100 (E - H)

SPS8_SUBGRADE_PREP

COMPACTION_EQUIP_TYPE		1 - 6
GROSS_WEIGHT	tons	5 - 20
STABIL_AGENT1		1 - 5
STABIL_AGENT1_PERCENT	%	1 - 10

STABIL_AGENT2		1 - 5
STABIL_AGENT2_PERCENT	%	1 - 10

SPS8_UNBOUND_AGG_BASE

COMPACTION_TYPE		1 - 5
FIRST_LIFT_THICKNESS	in	1 - 12
FOURTH_LIFT_THICKNESS	in	1 - 12
GROSS_WEIGHT	tons	5 - 50
LAYER_NO		> 1
SECOND_LIFT_THICKNESS	in	1 - 12
THIRD_LIFT_THICKNESS	in	1 - 12

E. Intramodular Checks

Intramodular checks for all SPS8 Construction data tables are specified below.

Table: SPS8_LAYER_THICKNESS

No level E checks

Table: SPS8_NOTES_AND_COMMENTS

No level E checks

Table: SPS8_PCC_FULL_DEPTH

- DATE_COMPLETE >= DATE_BEGAN

  Error Message: **SPS8_PCC_FULL_DEPTH**-E-1, DATE_COMPLETE must be >= DATE_BEGAN.

- If STEEL = 1, then REBAR_TRAN, REBAR_LONG, REBAR_LENGTH_TRANS, REBAR_LENGTH_LONG, REBAR_SPACE_TRANS, and REBAR_SPACE_LONG must be 0 or null

  Error Message: **SPS8_PCC_FULL_DEPTH**-E-2, If STEEL = 1, then REBAR_TRAN, _LONG, LENGTH_TRANS, _LENGTH_LONG, _SPACE_TRANS, _SPACE_LONG must be 0. Check all appropriate values.

- AIR_CONTENT_MIN <= AIR_CONTENT_MEAN <= AIR_CONTENT_MAX

  Error Message: **SPS8_PCC_FULL_DEPTH**-E-3, The following relationship must exist: AIR_CONTENT_MIN ≤ AIR_CONTENT_MEAN ≤ AIR_CONTENT_MAX.

- SLUMP_MIN <= SLUMP_MEAN <= SLUMP_MAX

  Error Message: **SPS8_PCC_FULL_DEPTH**-E-4, The following relationship must exist: SLUMP_MIN <= SLUMP_MEAN <= SLUMP_MAX

- AIR_TEMP_LOW <= AIR_TEMP_HIGH

Error Message: **SPS8_PCC_FULL_DEPTH**-E-5, The following relationship must exist: AIR_TEMP_LOW <= AIR_TEMP_HIGH

Table: SPS8_PCC_JOINT_DATA

- If AVG_CONTRACTION_SPACING = 30 then JOINT_SKEWNESS must be 0

  Error Message: **SPS8_PCC_JOINT_DATA**-E-1, JOINT_SKEWNESS must = 0 for AVG_CONTRACTION_SPACING >= 30.

- If TRANS_CONT_JLTS <> 1 then ROUND_DOWEL_DIAMETER, DOWEL_SPACING, and DOWEL_DISTANCE must be 0 or null

  Error Message: **SPS8_PCC_JOINT_DATA**-E-2, If TRANS_CONT_JLTS <> 1, then ROUND_DOWEL_DIAMETER, DOWEL_SPACING, DOWEL_DISTANCE must be 0 or null.

- If CHK_DOWEL_AFTER_PLACE = Y then a non-null entry must exist in DOWEL_CHK_METHOD

  Error Message: **SPS8_PCC_JOINT_DATA**-E-3, DOWEL_CHK_METHOD must be non-null for CHK_DOWEL_AFTER_PLACE = Y.

- TRANS_SEAL_RESVR_WIDTH <= TRANS_SEAL_RESVR_DEPTH

  Error Message: **SPS8_PCC_JOINT_DATA**-E-4, TRANS_SEAL_RESVR_WIDTH must be <= TRANS_SEAL_RESVR_DEPTH.

- LONG_SEAL_RESVR_WIDTH <= LONG_SEAL_RESVR_DEPTH

  Error Message: **SPS8_PCC_JOINT_DATA**-E-5, LONG_SEAL_RESVR_WIDTH must be <= LONG_SEAL_RESVR_DEPTH.

- SH_TRAFFIC_SEAL_RESVR_WIDTH <= SH_TRAFFIC_SEAL_RESVR_DEPTH

  Error Message: **SPS8_PCC_JOINT_DATA**-E-6, SH_TRAFFIC_SEAL_RESVR_WIDTH must be <= SH_TRAFIC_SEAL_RESVR_DEPTH.

Table: SPS8_PCC_MIXTURE_DATA

- ADMIXTURE_TYPE_1 <> ADMIXTURE_TYPE_2 <> ADMIXTURE_TYPE_3

  Error Message: **SPS8_PCC_MIXTURE_DATA**-E-1, Must have condition ADMIXTURE_TYPE_1 not equal ADMIXTURE_TYPE_2 not equal ADMIXTURE_TYPE_3

- AGG_COMP_TYPE_C1 <> AGG_COMP_TYPE_C2 <> AGG_COMP_TYPE_C3

  Error Message: **SPS8_PCC_MIXTURE_DATA**-E-2, Must have condition AGG_COMP_TYPE_C1 not equal AGG_COMP_TYPE_C2 not equal AGG_COMP_TYPE_C3

- (AGG_COMP_PERCENT_C1 + AGG_COMP_PERCENT_C2 + AGG_COMP_PERCENT_C3) = 100

Error Message: **SPS8_PCC_MIXTURE_DATA**-E-3, AGG_COMP_PERCENT_C1 + AGG_COMP_PERCENT_C2 + AGG_COMP_PERCENT_C3 must equal 100

- AGG_COMP_TYPE_F1 <> AGG_COMP_TYPE_F2 <> AGG_COMP_TYPE_F3

  Error Message: **SPS8_PCC_MIXTURE_DATA**-E-4, Must have condition AGG_COMP_TYPE_F1 not equal AGG_COMP_TYPE_F2 not equal AGG_COMP_TYPE_F3

- (AGG_COMP_PERCENT_F1 + AGG_COMP_PERCENT_F2 + AGG_COMP_PERCENT_F3) = 100

  Error Message: **SPS8_PCC_MIXTURE_DATA**-E-5, AGG_COMP_PERCENT_F1 + AGG_COMP_PERCENT_F2 + AGG_COMP_PERCENT_F3 must equal 100

- TWO_PASSING >= ONE_AND_HALF_PASSING >= ONE_PASSING >= SEVEN_EIGHTHS_PASSING >= THREE_FOURTHS_PASSING >= FIVE_EIGHTHS_PASSING >= ONE_HALF_PASSING >= THREE_EIGHTHS_PASSING >= NO_4_PASSING

  Error Message: **SPS8_PCC_MIXTURE_DATA**-E-6, Must have TWO_PASSING >= ONE_AND_HALF_PASSING >= ONE_PASSING >= SEVEN_EIGHTHS_PASSING >= THREE_FOURTHS_PASSING >= FIVE_EIGHTHS_PASSING >= ONE_HALF_PASSING >= THREE_EIGHTHS_PASSING >= NO_4_PASSING

- NO_8_PASSING >= NO_10_PASSING >= NO_16_PASSING >= NO_30_PASSING >= NO_40_PASSING >= NO_50_PASSING >= NO_80_PASSING >= NO_100_PASSING >= NO_200_PASSING

  Error Message: **SPS8_PCC_MIXTURE_DATA**-E-7, Must have condition NO_8_PASSING >= NO_10_PASSING >= NO_16_PASSING >= NO_30_PASSING >= NO_40_PASSING >= NO_50_PASSING >= NO_80_PASSING >= NO_100_PASSING >= NO_200_PASSING

Table: SPS8_PCC_PLACEMENT_DATA

- DATE_COMPLETE >= DATE_BEGAN

  Error Message: **SPS8_PCC_PLACEMENT_DATA**-E-1, DATE_COMPLETE must be >= DATE_BEGAN.

Table: SPS8_PCC_PROFILE_DATA

- If DIAMOND_GRIND_CORRECTED = N then DATE_GRINDING_BEGAN must be null

  Error Message: **SPS8_PCC_PROFILE_DATA**-E-1, If DIAMOND_GRIND_CORRECTED = N then DATE_GRINDING_BEGAN must be null

- If DIAMOND_GRIND_CORRECTED = N then DATE_GRINDING_COMPLETE must be null

  Error Message: **SPS8_PCC_PROFILE_DATA**-E-2, If DIAMOND_GRIND_CORRECTED = N then DATE_GRINDING_COMPLETE must be null

- If DIAMOND_GRIND_CORRECTED = N then GRINDING_REASON must be null or 0

Error Message: **SPS8_PCC_PROFILE_DATA**-E-3, If DIAMOND_GRIND_CORRECTED = N then GRINDING_REASON must be null or 0

- If DIAMOND_GRIND_CORRECTED = N then AVG_CUT_DEPTH must be null or 0

  Error Message: **SPS8_PCC_PROFILE_DATA**-E-4, If DIAMOND_GRIND_CORRECTED = N then AVG_CUT_DEPTH must be null or 0

- If DIAMOND_GRIND_CORRECTED = N then CUTTING_HEAD_WIDTH must be null or 0

  Error Message: **SPS8_PCC_PROFILE_DATA**-E-5, If DIAMOND_GRIND_CORRECTED = N then CUTTING_HEAD_WIDTH must be null or 0

- If DIAMOND_GRIND_CORRECTED = N then AVG_GROOVE_WIDTH must be null or 0

  Error Message: **SPS8_PCC_PROFILE_DATA**-E-6, If DIAMOND_GRIND_CORRECTED = N then

- If DIAMOND_GRIND_CORRECTED = N then AVG_BLADE_SPACING must be null or 0

  Error Message: **SPS8_PCC_PROFILE_DATA**-E-7, If DIAMOND_GRIND_CORRECTED = N then AVG_BLADE_SPACING must be null or 0

- DATE_GRINDING_COMPLETE >= DATE_GRINDING_BEGAN

Error Message: **SPS8_PCC_PROFILE_DATA**-E-8, DATE_GRINDING_COMPLETE must be >= DATE_GRINDING_BEGAN

Table: SPS8_PMA_AC_PROPERTIES

- DUCTILITY_77 >= DUCTILITY_39

  Error Message: SPS8_PMA_AC_PROPERTIES-E-1, DUCTILITY_77 must be >= DUCTILITY_39.

Table: SPS8_PMA_AGGREGATE_PROP

- AGGR_COMB_BULK_SPEC = 100/(P1/G1 + P2/G2 + P3/G3)
  Where P1 = AGGR_COMP_TYPE_C1 + AGGR_COMP_TYPE_C2 + AGGR_COMP_TYPE_C3
  P2 = AGGR_COMP_TYPE_F1 + AGGR_COMP_TYPE_F2 + AGGR_COMP_TYPE_F3
  P3 = 100 - (P1 + P2)
  G1 = COARSE_AGGR_BULK_SPEC
  G2 = FINE_AGGR_BULK_SPEC
  G3 = MINERAL_FILLER_BULK_SPEC

  Error Message: **SPS8_PMA_AGGREGATE_PROP**-E-1, AGGR_COMB_BULK_SPEC must be equal to the equation above. Check input of all appropriate values.

- EFFECTIVE_SPEC_GRAVITY = (100-ASPHALT_CONTENT_MEAN/ [(100/MAX_SPEC_GRAVITY) - (ASPHALT_CONTENT_MEAN)/

ASPHALT_SPECIFIC_GRAVITY)]

Error Message: **SPS8_PMA_AGGREGATE_PROP**-E-9, EFFECTIVE_SPEC_GRAVITY must be (100-ASPHALT_CONTENT_MEAN)/ [(100/MAX_SPEC_GRAVITY) - (ASPHALT_CONTENT_MEAN/ ASPHALT_SPECIFIC_GRAVITY)]

Table: SPS8_PMA_CONSTRUCTION

- DATE_COMPLETE >= DATE_BEGAN

  Error Message: **SPS8_PMA_CONSTRUCTION**-E-1, DATE_COMPLETE must be >= DATE_BEGAN.

- LAYDOWN_TEMP_MAX >= LAYDOWN_TEMP_MEAN >= LAYDOWN_TEMP_MIN

  Error Message: **SPS8_PMA_CONSTRUCTION**-E-2, The following condition must exist: LAYDOWN_TEMP_MAX >= LAYDOWN_TEMP_MEAN >= LAYDOWN_TEMP_MIN

Table: SPS8_PMA_DENSITY_PROFILE

- MINIMUM_ATB <= AVERAGE_ATB <= MAXIMUM_ATB

  Error Message: **SPS8_PMA_DENSITY_PROFILE**-E-1, The following condition must exist: MINIMUM_ATB <= AVERAGE_ATB <= MAXIMUM_ATB

- MINIMUM_BINDER <= AVERAGE_BINDER <= MAXIMUM_BINDER

  Error Message: **SPS8_PMA_DENSITY_PROFILE**-E-2, The following condition must exist: MINIMUM_BINDER <= AVERAGE_BINDER <= MAXIMUM_BINDER

- MINIMUM_SURFACE <= AVERAGE_SURFACE <= MAXIMUM_SURFACE

  Error Message: **SPS8_PMA_DENSITY_PROFILE**-E-3, The following condition must exist: MINIMUM_SURFACE <= AVERAGE_SURFACE <= MAXIMUM_SURFACE

- MINIMUM_FRICTION <= AVERAGE_FRICTION <= MAXIMUM_FRICTION

  Error Message: **SPS8_PMA_DENSITY_PROFILE**-E-4, The following condition must exist: MINIMUM_FRICTION <= AVERAGE_FRICTION <= MAXIMUM_FRICTION

Table: SPS8_PMA_MIXTURE_PROP

- BULK_SPEC_GRAVITY_MIN <= BULK_SPEC_GRAVITY_MEAN <= BULK_SPEC_GRAVITY_MAX

  Error Message: **SPS8_PMA_MIXTURE_PROP**-E-1, the following relationship must exist: BULK_SPEC_GRAVITY_MIN <= BULK_SPEC_GRAVITY_MEAN <= BULK_SPEC_GRAVITY_MAX.

- ASPHALT_CONTENT_MIN <= ASPHALT_CONTENT_MEAN <= ASPHALT_CONTENT_MAX

Error Message: **SPS8_PMA_MIXTURE_PROP**-E-2, the following relationship must exist: ASPHALT_CONTENT_MIN <= ASPHALT_CONTENT_MEAN <= ASPHALT_CONTENT_MAX.

- PCT_AIR_VOIDS_MIN <= PCT_AIR_VOIDS_MEAN <= PCT_AIR_VOIDS_MAX

  Error Message: **SPS8_PMA_MIXTURE_PROP**-E-3, the following relationship must exist: PCT_AIR_VOIDS_MIN <= PCT_AIR_VOIDS_MEAN <= PCT_AIR_VOIDS_MAX.

- Either HVEEM_COHESIOMETER and HVEEM STABILITY or MARSHALL_FLOW, MARSHALL_STABILITY, and NUMBER_OF_BLOWS must be non-null

  Error Message: **SPS8_PMA_MIXTURE_PROP**-E-6, either HVEEM_COHESIOMETER and HVEEM STABILITY or MARSHALL_FLOW, MARSHALL_STABILITY, and NUMBER_OF_BLOWS must be non-null.

Table: SPS8_PMA_ROLLER

- If ROLLER_CODE = A, B, C, or D, then ROLLER_TIRE_PRES, ROLLER_FREQ, ROLLER_AMP, and ROLLER_SPEED must be null

  Error Message: **SPS8_PMA_ROLLER**-E-1, If ROLLER_CODE = A, B, C, or D, then ROLLER_TIRE_PRES, ROLLER_FREQ, ROLLER_AMP, and ROLLER_SPEED must be null

- If ROLLER_CODE = E, F, G, or H, then ROLLER_FREQ, ROLLER_AMP, and ROLLER_SPEED must be null

  Error Message: **SPS8_PMA_ROLLER**-E-2, If ROLLER_CODE = E, F, G, or H, then ROLLER_FREQ, ROLLER_AMP, and ROLLER_SPEED must be null

- If ROLLER_CODE = I, J, K, L, M, N, or P, then ROLLER_TIRE_PRES must be null

  Error Message: **SPS8_PMA_ROLLER**-E-3, If ROLLER_CODE = I, J, K, L, M, N, or P then ROLLER_TIRE_PRES must be null

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Table: SPS8_SUBGRADE_PREP

- DATE_COMPLETE >= DATE_BEGAN

  Error Message: **SPS8_PMA_SUBGRADE_PREP**-E-1, DATE_COMPLETE must be >= DATE_BEGAN.

- If STABIL_AGENT1 <> 5, then STABIL_AGENT1 <> STABIL_AGENT2

  Error Message: **SPS8_PMA_SUBGRADE_PREP**-E-2, If STABIL_AGENT1 <> 5 then

---

Table: SPS8_UNBOUND_AGG_BASE

- DATE_COMPLETE >= DATE_BEGAN

Error Message: **SPS2_UNBOUND_AGG_BASE**-E-1, DATE_COMPLETE must be >= DATE_BEGAN.

In addition, the checks listed in Table 20-1 are required for the identified tables and elements.

Table 20-1. Additional Level E Checks

Error Code	If the data element below	has a code of	then a non-null entry must exist in the data element below
	SPS8_PCC_FULL_DEPTH		
E-6	REASON	38	REASON_OTHER
E-7	SECONDARY_REASON	38	SECONDARY_REASON_OTHER
E-8	PATCH_MATL	5	PATCH_MATL_OTHER
E-9	BOUNDARY_METHOD	5	BOUNDARY_METHOD_OTHER
E-10	CUT_METHOD	5	CUT_METHOD_OTHER
E-11	TRANSFER_DEVICE	4	TRANSFER_DEVICE_OTHER
E-12	DOWEL_COAT_TRANS	7	DOWEL_COAT_TRANS_OTHER
E-13	CONCRETE_BREAK_METHOD	5	CONCRETE_BREAK_METHOD_ OTHER
E-14	CONC_REMOVAL	3	CONC_REMOVAL_OTHER
E-15	JOINT_METHOD_SH	7	JOINT_METHOD_SH_OTHER
E-16	JOINT_METHOD_LONG	7	JOINT_METHOD_LONG_OTHER
E-17	JOINT_METHOD_TRANS	7	JOINT_METHOD_TRANS_OTHER
E-18	CURE_METHOD_1	10	CURE_METHOD_1_OTHER
E-19	CURE_METHOD_2	10	CURE_METHOD_2_OTHER
E-20	CONSOLIDATE_METHOD	6	CONSOLIDATE_METHOD_OTHER
E-21	FINISH_METHOD	4	FINISH_METHOD_OTHER
	SPS8_PCC_JOINT_DATA		
E-7	TRANS_CONT_JLTS	3	TRANS_CONT_JLTS_OTHER
E-8	DOWEL_COATING	6	DOWEL_COATING_OTHER
E-9	MLTD_METHOD	3	MLTD_METHOD_OTHER
E-10	TRANS_METHOD	4	TRANS_METHOD_OTHER
E-11	LONG_TYPE	4	LONG_TYPE_OTHER
E-12	SH_TRAFFIC_LANE_TYPE	4	SH_TRAFFIC_LANE_TYPE_OTHER
E-13	TRANS_SEAL_TYPE	5	TRANS_SEAL_TYPE_OTHER
	SPS8_PCC_MIXTURE_DATA		
E-9	CEMENT_TYPE	55	CEMENT_TYPE_OTHER
E-10	ADMIXTURE_TYPE_1	13	ADMIXTURE_TYPE_1_OTHER
E-11	ADMIXTURE_TYPE_2	13	ADMIXTURE_TYPE_2_OTHER
E-12	ADMIXTURE_TYPE_3	13	ADMIXTURE_TYPE_3_OTHER
E-13	AGGR_COMP_TYPE_C1	7	AGGR_COMP_TYPE_C1_OTHER
E-14	AGGR_COMP_TYPE_C2	7	AGGR_COMP_TYPE_C2_OTHER
E-15	AGGR_COMP_TYPE_C3	7	AGGR_COMP_TYPE_C3_OTHER
E-16	AGGR_COMP_TYPE_F1	4	AGGR_COMP_TYPE_F1_OTHER
E-17	AGGR_COMP_TYPE_F2	4	AGGR_COMP_TYPE_F2_OTHER
E-18	AGGR_COMP_TYPE_F3	4	AGGR_COMP_TYPE_F3_OTHER

Error Code	If the data element below	has a code of	then a non-null entry must exist in the data element below
	SPS8_PCC_PLACEMENT		
E-2	PAVER_TYPE	3	PAVER_TYPE_OTHER
E-3	CONSOLIDATION	6	CONSOLIDATION_OTHER
E-4	FINISHING	4	FINISHING_OTHER
E-5	CURING	8	CURING_OTHER
E-6	TEXTURING	7	TEXTURING_OTHER
	SPS8_PMA_AC_PROPERTIES		
E-2	ASPHALT_GRADE	17,35,99	ASPHALT_GRADE_OTHER
E-3	SOURCE	77	SOURCE_OTHER
E-4	MODIFIER_1	27	MODIFIER_1_OTHER
E-5	MODIFIER_2	27	MODIFIER_2_OTHER
	SPS8_PMA_AGGREGATE_PROP		
E-2	AGGR_COMP_TYPE_C1	6	AGGR_COMP_TYPE_C1_OTHER
E-3	AGGR_COMP_TYPE_C2	6	AGGR_COMP_TYPE_C2_OTHER
E-4	AGGR_COMP_TYPE_C3	66	AGGR_COMP_TYPE_C3_OTHER
E-5	AGGR_COMP_TYPE_F1	4	AGGR_COMP_TYPE_F1_OTHER
E-6	AGGR_COMP_TYPE_F2	4	AGGR_COMP_TYPE_F2_OTHER
E-7	AGGR_COMP_TYPE_F3	4	AGGR_COMP_TYPE_F3_OTHER
E-8	MINERAL_FILLER	5	MINERAL_FILLER_OTHER
	SPS8_PMA_MIXTURE_PROP		
E-4	ASPHALT_PLANT_TYPE	3	ASPHALT_PLANT_TYPE_OTHER
E-5	ANTISTRIP_AGENT_TYPE	70	ANTISTRIP_AGENT_TYPE_OTHER
	SPS8_PMA_PLACEMENT_DATA		
E-2	PLANT_TYPE1	3	PLANT_TYPE_OTHER1
E-3	PLANT_TYPE2	3	PLANT_TYPE_OTHER2
E-4	PLANT_TYPE3	3	PLANT_TYPE_OTHER
	SPS8_PROFILE_DATA		
E-9	GRINDING_REASON	6	GRINDING_REASON_OTHER
	SPS_SUBGRADE_PREP		
E-3	COMPACTION_EQUIP_TYPE	6	COMPACTION_EQUIP_TYPE_ OTHER
E-4	STABIL_AGENT1	5	STABIL_AGENT1_OTHER
E-5	STABIL_AGENT2	5	STABIL_AGENT2_OTHER
	SPS8_UNBOUND_AGG_BASE		
E-2	COMPACTION_TYPE	5	COMPACTION_TYPE_OTHER

21.0 SPS9 CONSTRUCTION

21.1 Level 1

A. Initial Level

Records in the IMS are at Level A when that first enter the system and are set back to A when changes are made to a given record or to selected related records.

B. Dependancy Checks

All records in these tables are set to RECORD_STATUS = B if a matching record (STATE_CODE, SHRP_ID) exists in **EXPERIMENT_SECTION** as SPS9 and CONSTRUCTION_NO = 1.

C. Minimum Data Checks

Minimum data checks for all other SPS9 tables are identified below. Data fields with a condition of X must always contain a non-null value, however, data fields with a condition of * are only required to contain a non-null value if a particular condition is met as specified in the accompanying field explanation.

Table	Field	Condition
SPS9_AC_PATCHES	FULL_DEPTH_AREA	X
	FULL_DEPTH_NO	X
	PARTIAL_BASE_NO	X
	PARTIAL_BASE_AREA	X
	PATCH_MATERIAL	X
	PRIMARY_DISTRESS	X
	SURFACE_PATCHES_NO	X
	SURFACE_PATCHES_AREA	X
SPS9_DIAMOND_GRIND	AVERAGE_DEPTH	X
SPS9_LAYER	DESCRIPTION	X
	MATERIAL_TYPE	X
	MEAN_THICKNESS *if LAYER_NO > 1	*
SPS9_LAYER_THICKNESS	LAYER_THICKNESS	X
SPS9_LOAD_TRANSFER	DEVICES_PER_JOINT	X
	DOWEL_1	X
	DOWEL_2	X
	DOWEL_3	X
	NO_JOINTS_IN_SECTION	X

	NO_JOINTS_RESTORE_LOCATIONS	X
SPS9_LOAD_TRANS_EFFICIENCY	DATE_BEFORE_RESTOREX	
	DATE_AFTER_RESTORE	X
SPS9_MILLED_SECTIONS	AVG_INSIDE	X
	AVG_OUTSIDE	X
	MILLED_THE_SAME	X
SPS9_PCC_CRACK_SEAL	CRACK_SEAL_TYPE	X
	SEAL_RES_DEPTH	X
	SEAL_RES_WIDTH	X
	TOTAL_LENGTH_CRACKS_SEALED	X
SPS9_PCC_FULL_DEPTH	AREA_SLABS_REPLACED	X
	NO_SLABS_REPLACED	X
	PATCH_AREA_SLAB	X
	PATCH_MATL	X
	PATCH_NO_SLAB	X
	REASON	X
SPS9_PCC_JOINT_RESEAL	LONG_SEAL_LENGTH	X
	REMOVAL_METHOD	X
	SEAL_RES_DEPTH	X
	SEAL_RES_WIDTH	X
	TRANS_SEAL_LENGTH	X
SPS9_PCC_PART_DEPTH	PATCH_AREA	X
	PATCH_AVG_DEPTH	X
	PATCH_MATL	X
	PATCH_NO	X
SPS9_PMA_AC_PROPERTIES	ASPHALT_GRADE	X
	LAYER_NO	X
	SOURCE	X
SPS9_PMA_AGGREGATE_PROP	AGGR_COMB_BULK_SPECX	
	AGGR_COMP_PERCENT_C1	X
	AGGR_COMP_PERCENT_F1	X
	AGGR_COMP_TYPE_C1	X
	AGGR_COMP_TYPE_F1	X
	COARSE_AGGR_BULK_SPEC	X
	FINE_AGGR_BULK_SPEC	X
	LAYER_NO	X
SPS9_PMA_COMPACTION	No level C checks	
SPS9_PMA_CONSTRUCTION	LAYER_NO	X
	MEAN_MIXING_TEMP	X
SPS9_PMA_DENSITY	DENSITY_MEAN	X
	LAYER_NO	X
SPS9_PMA_MIX_DES_PROP	MIX_DESIGN_TYPE	X
SPS9_PMA_MIXTURE_PROP	ASPHALT_CONTENT_MEAN	X

	BULK_SPEC_GRAVITY_MEAN	X
	EFF_ASPHALT_CONTENT	X
	MAX_SPEC_GRAVITY	X
	SAMPLE_TYPE	X
	PCT_AIR_VOIDS_MEAN	X
	VOIDS_MINERAL_AGGR	X
SPS9_PMA_PLACEMENT_INFO	No level C checks	
SPS9_PMA_PLACEMENT_LAYER	No level C checks	
SPS9_PMA_PROFILE	PROFILE_INDEX	X
SPS9_PMA_ROLLER	ROLLER_CODE_DESC	X
	ROLLER_GROSS_WT	X
SPS9_RUT_LEVEL_UP	IW_RUT_DEPTH	*
	OW_RUT_DEPTH	*
	*either one or both *_RUT_DEPTH value is required	
SPS9_SP_PMA_AC_PROPERTIES	LAYER_NOX	
	PG_HIGH_TEMP	X
	PG_LOW_TEMP	X
	SOURCE	X
SPS9_SP_PMA_AGGREGATE_PROP	AGGR_COMB_BULK_SPECX	
	AGGR_COMP_PERCENT_C1	X
	AGGR_COMP_PERCENT_F1	X
	AGGR_COMP_TYPE_C1	X
	AGGR_COMP_TYPE_F1	X
	COARSE_AGGR_BULK_SPEC	X
	FINE_AGGR_BULK_SPEC	X
	LAYER_NO	X
SPS9_SP_PMA_MIXTURE_PROP	ASPHALT_CONTENT_MEANX	
	BULK_SPEC_GRAVITY_MEAN	X
	EFF_ASPHALT_CONTENT	X
	MAX_SPEC_GRAVITY	X
	PCT_AIR_VOIDS_MEAN	X
	SAMPLE_TYPE	X
	VOIDS_MINERAL_AGGR	X
SPS9_SUBDRAINAGE	DRAINAGE_PIPE_TYPE	X
	FILTER_PERMEABILITY	X
	HORIZ_PIPE_PLACEMENT	X
	PIPE_DEPTH	X
	SUBDRAIN_PURPOSE	X
SPS9_SUBGRADE_PREP	COMPACTION_EQUIP_TYPE	X
	GROSS_WEIGHT	X
SPS9_UNBOUND_AGGR_BASE	COMPACTION_TYPE	X
	FIRST_LIFT_THICKNESS	X
	GROSS_WEIGHT	X
SPS9_UNDERSEALING	DETERMINE_UNDERSEAL_AREA	X

MONITORING_OF_LIFT	X
SUBSEAL_MIX_TYPE	X

D. Expanded Range Checks

Expanded range checks are applied to certain fields to identify data element values that fall outside an expected range. Field names are listed below the bolded table name. Expanded range checks for the SPS9 data tables are specified below. The Orange colored S.I. units are provided to aid in future metrification efforts.

Table	Units	Range
SPS9_AC_PATCHES		
AIR_TEMP_HIGH	deg F deg C	40 - 120 4.0 - 49.0
AIR_TEMP_LOW	deg F deg C	40 - 120 4.0 - 49.0
COMPACTION		1 - 8
COMPACTION_2		null, 1 - 8
FULL_DEPTH_NO		>= 0
FULL_DEPTH_AREA	sq ft m^2	0 - 4000 0.0 - 372.0
LOC_SIZE_METHOD		1 - 4
MAX_MATL_TEMP	deg F deg C	null, 0 - 300 null, 0.0 - 149.0
MIN_TIME_TO_OPEN		> 0
PARTIAL_BASE_NO		>= 0
PARTIAL_BASE_AREA	sq ft m^2	0 - 4000 0.0 - 372.0
PATCH_BOUNDARY_METHOD		1 - 5
PATCH_MATERIAL		1 - 7
PRIMARY_DISTRESS		1 - 17
ROAD_MOISTURE		1 - 3
SECONDARY_DISTRESS		1 - 17
SURFACE_PATCHES_NO		>= 0
SURFACE_PATCHES_AREA	sq ft m^2	0 - 4000 0.0 - 372.0
SPS9_DIAMOND_GRIND		
AVERAGE_DEPTH	in mm	0.00 - 0.80 0 - 21
BLADE_SPACING	in mm	0.1 - 0.2 2 - 6
GRINDING_REASON		1 - 5
GROOVE_WIDTH	in mm	0.1 - 0.2 2 – 6
HEAD_WIDTH	in mm	36 - 72 910 – 1830

SPS9_LAYER

DESCRIPTION	MEAN_THICKNESS	MATERIAL_TYPE
1	0.8 - 8.0 20 - 204	1, 13
2	0.1 - 1.5 2 - 39	71 - 73, 81 - 83
3	1.0 - 13.0 25 - 331	1, 4, 5, 6
4	1.0 - 10.0 25 - 254	1
5	3.0 - 24.0 77 - 607	22 – 46
6	4.0 - 47.9 101 - 1217	22 – 46
7	must be null	51 – 65
8	0.1 - 6.0 2 - 153	74 – 84
9	0.3 - 2.5 7 - 64	2
10	0.1 - 1.5 2 - 39	11, 12, 71 - 73, 81 – 84
11	4.0 - 47.9 101 - 1217	51 – 65

SPS9_LAYER_THICKNESS

LAYER_NO		null, 2 - 30
LAYER_THICKNESS	in mm	null, 0 - 13 null, 0 - 331
OFFSET	in mm	0 - 168 0 - 4270
STATION_NO	ft m	0 - 500 0.0 - 152.4

SPS9_LOAD_TRANSFER

BACK_FILL_MATERIAL		1 - 4
BOND_AGENT_BACKFILL		1 - 4
DEVICES_PER_JOINT		6 - 14
DOWEL_1	in mm	0 - 168 0 - 4270
DOWEL_10	in mm	null, 0 - 168 null, 0 - 4270
DOWEL_11	in mm	null, 0 - 168 null, 0 - 4270

DOWEL_12	in mm	null, 0 - 168 null, 0 - 4270
DOWEL_13	in mm	null, 0 - 168 null, 0 - 4270
DOWEL_14	in mm	null, 0 - 168 null, 0 - 4270
DOWEL_2	in mm	0 - 168 0 - 4270
DOWEL_3	in mm	0 - 168 0 - 4270
DOWEL_4	in mm	0 - 168 0 - 4270
DOWEL_5	in mm	null, 0 - 168 null, 0 - 4270
DOWEL_6	in mm	null, 0 - 168 null, 0 - 4270
DOWEL_7	in mm	null, 0 - 168 null, 0 - 4270
DOWEL_8	in mm	null, 0 - 168 null, 0 - 4270
DOWEL_9	in mm	null, 0 - 168 null, 0 - 4270
DOWEL_DIAMETER	in mm	0.75 - 2 19 - 51
NO_JOINTS_IN_SECTION		0 - 100
NO_JOINTS_RESTORE_LOCATIONS		5 - 100
SPS9_LOAD_TRANS_EFFICIENCY		
EFFICIENCY_BEFORE_APPROACH	%	0 - 70
EFFICIENCY_AFTER_APPROACH	%	50 - 100
EFFICIENCY_BEFORE_LEAVE	%	0 - 70
EFFICIENCY_AFTER_LEAVE	%	50 - 100
SPS9_MILLED_SECTIONS		
AVG_INSIDE	in mm	0.0 - 10.0 0 - 254
AVG_OUTSIDE	in mm	0.0 - 10.0 0 - 254
CUT_HEAD_WIDTH	in mm	12.0 - 180.0 300 - 4575
INSIDE_NO_MEASUREMENTS		> 0
LAYER_NO_OF_REPLACEMENT		2 - 20
LAYER_THICKER_MILL_DEPTH		Y, N
MACRO_TEXTURE		1 - 2
MAX_INSIDE	in mm	null, 0.0 - 10.0 null, 0 - 254
MAX_OUTSIDE	in mm	null, 0.0 - 10.0 null, 0 - 254

MILL_LAYER_MATL		1 - 3
MILLED_THE_SAME		Y, N
MIN_INSIDE	in	null, 0.0 - 10.0
	mm	null, 0 - 254
MIN_OUTSIDE	in	null, 0.0 - 10.0
	mm	null, 0 - 254
NOMINAL_THICKNESS	in	null, 0.0 - 10.0
	mm	null, 0 - 254
OUTSIDE_NO_MEASUREMENTS		> 0
PATCH_AFTER_MILLING		Y, N
RIDGE_HEIGHT	in	>= 0.0
	mm	0 - 255
SECTION_AREA_DELAMINATION	%	0 - 100
STD_INSIDE	in	null, 0.0 - 2.0
	mm	null, 0 - 51
STD_OUTSIDE	in	null, 0.0 - 2.0
	mm	null, 0 - 51
TIME_MILL_SURFACE_OPEN		>= 0
WIDTH_MILL_SAME_TEST	ft	null, 5.0 - 28.0
	m	null, 1.5 - 9.0

SPS9_PCC_CRACK_SEAL

BOND_BREAK		1 - 4
CRACK_SEAL_TYPE		1 - 7
CRACK_CLEAN		1 - 6
SEAL_DEPTH	in	0.0 - 0.5
	mm	0 - 13
SEAL_RES_DEPTH	in	0.1 - 2.0
	mm	0 - 51
SEAL_RES_WIDTH	in	0.1 - 2.0
	mm	0 - 51

SPS9_PCC_FULL_DEPTH

ADMIXTURE_1		null, 1 - 13
ADMIXTURE_2		null, 1 - 13
AIR_CONTENT_MAX	%	null, 4 - 10
AIR_CONTENT_MEAN	%	4 - 8
AIR_CONTENT_MIN	%	null, 2 - 8
AIR_TEMP_HIGH	deg (F)	40 - 120
	deg C	4.0 - 49.0
AIR_TEMP_LOW	deg (F)	40 - 120
	deg C	4.0 - 49.0
ALT_TEST_AGE		null, 1 - 48
ALT_TEST_STRENGTH	psi	null, 400 - 1200
	kPa	null, 2755 - 8275
AREA_BASE_REPLACE	sq ft	null, 0 - 7000
	m^2	null, 0.0 - 655.0
AREA_SLABS_REPLACED	sq ft	0 - 7000

	m^2	0.0 -655.0
BOND_BREAKER		Y, N
BOUNDARY_METHOD		1 - 5
CAGG_MIX	lbs/cu yd kg/m^3	500 - 3000 295.0 - 1780.0
CEMENT_MIX	lbs/cu yd kg/m^3	300 - 1000 177.0 - 595.0
CEMENT_TYPE		41 - 55
CONC_BREAK_METHOD		1 - 5
CONC_REMOVAL		1 - 3
CONSOLIDATE_METHOD		1 - 6
CURE_METHOD_1		1 - 10
CURE_METHOD_2		null, 1 - 10
CUT_METHOD		1 - 5
DOWEL_COAT_TRANS		null, 1 - 7
FAGG_MIX	lbs/cu yd kg/m^3	500 - 2000 295.0 - 1190.0
FINISH_METHOD		1 - 4
FLEX_CURE_TIME	days	0 - 28
FLEX_STRENGTH	psi kPa	400 - 900 2755 - 6210
JOINT_METHOD_LONG		1 - 7
JOINT_METHOD_SH		1 - 7
JOINT_METHOD_TRANS		1 - 7
JOINTS_MATCHED		Y, N
MAX_AGG_SIZE	in mm	0.1 - 2.0 2 - 51
NO_BASE_REPLACED		null, 1 - 65
NO_SLABS_REPLACED		1 - 65
PATCH_MATL_PCC		1 - 5
PATCH_NO_BASE		1 - 65
PATCH_NO_SLAB		1 - 65
PATCH_AREA_BASE	sq ft m^2	null, 0 - 7000 null, 0.0 -655.0
PATCH_AREA_SLAB	sq ft m^2	null, 0 - 7000 null, 0.0 - 651.0
REASON		20 - 38
REBAR_DOWEL		1 - 10
REBAR_LENGTH_DOWEL	in mm	1 - 36 25 - 915
REBAR_LENGTH_LONG	in mm	null, 12 - 36 null, 304 - 915
REBAR_LENGTH_TIE	in mm	null, 1 - 48 null, 25 - 1220
REBAR_LENGTH_TRANS	in mm	null, 12 - 36 null, 304 - 915

REBAR_LONG		null, 1 - 10
REBAR_SPACE_DOWEL	in mm	2 - 24 50 - 610
REBAR_SPACE_LONG	in mm	null, 6 - 24 null, 152 - 610
REBAR_SPACE_TIE	in mm	6 - 60 152 - 1525
REBAR_SPACE_TRANS	in mm	null, 9 - 36 null, 225 - 915
REBAR_TIE	in mm	1 - 10 25 - 255
REBAR_TRANS		null, 1 - 10
SAW_CUT_DEPTH	in mm	1 - 36 25 - 915
SAW_CUTS		1 - 10
SECONDARY_REASON		null, 20 - 38
SLUMP_MAX	in mm	null, 1 - 4 null, 25 - 102
SLUMP_MEAN	in mm	1 - 3 25 - 80
SLUMP_MIN	in mm	null, 1 - 3 null, 25 - 80
STEEL		Y, N
STEEL_PLACE_METHOD		1 - 2
SURFACE_MOISTURE		1 - 2
TRANS_JOINT_PATCH		1 - 4
TRANS_JOINT_SLAB		1 - 4
TRANSFER_DEVICE		1 - 4
WATER_MIX	gal/cu yd L/m^3	10 - 60 49 - 297

SPS9_PCC_JOINT_RESEAL

BOND_BREAK		1 - 4
CONTRACTION_SEAL_TYPE		1 - 7
EXPANSION_SEAL_TYPE		1 - 7
JOINT_SEAL_TYPE		1 - 7
LONG_SEAL_LENGTH	ft m	0 - 2000 0.0 - 610.0
REFACED		1 - 4
REMOVAL_METHOD		1 - 9
SEAL_RES_DEPTH	in mm	0.3 - 1.5 7 - 39
SEAL_RES_WIDTH	in mm	0.3 - 1.5 7 - 39
SIDEWALL_CLEAN		10 - 14
SEAL_DEPTH	in mm	0 - 0.5 0.0 - 13.0

SEALS_DIFFERENT		Y/N
TRANS_SEAL_LENGTH	ft m	0 - 1500 0.0 - 458.0
SPS9_PCC_PART_DEPTH		
ADMIXTURE_1		Null, 1 - 13
ADMIXTURE_2		Null, 1 - 13
AIR_CONTENT_MAX	%	Null, 4 - 10
AIR_CONTENT_MEAN	%	4 - 8
AIR_CONTENT_MIN	%	Null, 2 - 8
AIR_TEMP_HIGH	deg F deg C	40 - 120 4.0 - 49.0
AIR_TEMP_LOW	deg F deg C	40 - 120 4.0 - 49.0
ALT_TEST_AGE	days	Null, 0 - 60
ALT_TEST_STRENGTH	psi kPa	null, 1000 - 7000 null, 6895 - 48265
BOND_AGENT		1 - 3, 5
BOUNDARY_METHOD_PART		1 - 4
BREAK_METHOD		1 - 3
CAGG_MIX	lbs/cu yd kg/m^3	500 - 3000 290.0 - 1778.0
CEMENT_MIX	lbs/cu yd kg/m^3	300 - 1000 175.0 - 595.0
CEMENT_TYPE		41 - 55, 61 - 63
CLEAN_METHOD_PATCH		1 - 4
CONSOLIDATE_METHOD_PART		1 - 6
CURE_METHOD_1		1 - 10
CURE_METHOD_2		Null, 1 - 10
CUT_METHOD_PART		1 - 6
FAGG_MIX	lbs/cu yd kg/m^3	500 - 2000 295.0 - 1190.0
FINISH_METHOD		1 - 4
JOINT_METHOD_LONG		1 - 7
JOINT_METHOD_SH		1 - 7
JOINT_METHOD_TRANS		1 - 7
MAX_AGG_SIZE	in mm	0.1 - 2.0 2 - 51
PATCH_AVG_DEPTH	in mm	1 - 15 25 - 381
PATCH_COMP_STRENGTH	psi kPa	1000 - 7000 593 - 4151
PATCH_CURE_TIME	days	0 - 28
PATCH_MATL_PCC		1 - 3, 5
PATCH_NO		1 - 65
PATCH_AREA	sq ft m^2	0 - 7000 0.00 - 650.30

REASON		20 - 38
SECONDARY_REASON		Null, 20 - 38
SLUMP_MAX	in mm	null, 1 - 4 null, 25 - 102
SLUMP_MEAN	in mm	1 - 3 25 – 77
SLUMP_MIN	in mm	null, 1 - 3 null, 25 - 77
SURFACE_MOISTURE		1 – 2
TRAFFIC_OPEN_TIME	hrs	0 – 99
WATER_MIX	gal/cu yd L/m^3	10 - 60 40 – 300

SPS9_PMA_AC_PROPERTIES

ASPHALT_GRADE		1 - 40, 99
ASPHALT_SPECIFIC_GRAVITY		0.9 - 1.1
ASPHALT_VISCOSITY_140	poise	500 - 20000
ASPHALT_VISCOSITY_275	centistokes	100 - 1200
DUCTILITY_77	cm	8 – 150
LAYER_NO		>1
MODIFIER_1		1 – 27
MODIFIER_2		1 – 27
PENETRATION_77	0.1 mm	20 – 250
RING_BALL_SOFT_PT	deg F	50 – 200

SPS9_PMA_AGGREGATE_PROP

AGGR_COMB_BULK_SPEC		1 – 4
AGGR_COMP_PERCENT_C1	%	0 – 100
AGGR_COMP_PERCENT_F1	%	0 – 100
AGGR_COMP_PERCENT_C2	%	null, 1 - 99
AGGR_COMP_PERCENT_F2	%	null, 1 - 99
AGGR_COMP_PERCENT_C3	%	null, 1 - 98
AGGR_COMP_PERCENT_F3	%	null, 1 - 98
AGGR_COMP_TYPE_C1		1 – 6
AGGR_COMP_TYPE_F1		1 – 4
AGGR_COMP_TYPE_C2		null, 1 - 6
AGGR_COMP_TYPE_F2		null, 1 - 4
AGGR_COMP_TYPE_C3		null, 1 - 6
AGGR_COMP_TYPE_F3		null, 1 - 4
AGGR_DUR_RESULT_C1	%	0.0 – 90.0
AGGR_DUR_RESULT_C2	%	null, 0.0 - 90.0
AGGR_DUR_RESULT_C3	%	null, 0.0 - 90.0
AGGR_DUR_RESULT_M1	%	0.0 – 90.0
AGGR_DUR_TYPE_C1		1 – 11
AGGR_DUR_TYPE_C2		null, 1 - 11

AGGR_DUR_TYPE_C3		null, 1 - 11
AGGR_DUR_TYPE_M1		1 – 11
COARSE_AGGR_BULK_SPEC		1 – 4
EFFECTIVE_SPEC_GRAVITY		1 – 4
FINE_AGGR_BULK_SPEC		1 – 4
LAYER_NO		> 1
MINERAL_FILLER		1 – 6
MINERAL_FILLER_BULK_SPEC		1 – 4
POLISH_VALUE		0 – 150

SPS9_PMA_COMPACTION

BREAKDOWN_ROLLER_CODE		A – Q
COMPACTED_THICK	in mm	1 - 8 25 – 204
FINAL_ROLLER_CODE		A – Q
INTERMED_ROLLER_CODE		A – Q
LAYER_NO		> 1
MEAN_AIR_TEMP	deg F deg C	40 - 120 5 – 49

SPS9_PMA_CONSTRUCTION

LAYDOWN_TEMP_MAX	deg F deg C	150 - 400 65 – 205
LAYDOWN_TEMP_MEAN	deg F deg C	150 - 400 65 – 205
LAYDOWN_TEMP_MIN	deg F deg C	150 - 400 65 – 205
LAYDOWN_TEMP_STD_DEV	deg F deg C	0 - 50 0 – 10
LAYER_NO		> 1
MEAN_MIXING_TEMP	deg F deg C	150 - 400 65 - 205

SPS9_PMA_DENSITY

DENSITY_MAX	pcf kg/m^3	100.0 - 160.0 1600 - 2570
DENSITY_MEAN	pcf kg/m^3	100.0 - 160.0 1600 - 2570
DENSITY_MIN	pcf kg/m^3	100.0 - 160.0 1600 - 2570
DENSITY_STD	pcf kg/m^3	0.0 - 30.0 0 - 485
GAUGE_COUNT_RATE		0 - 9999
LAYER_NO		> 1
MEASURE_METHOD		A - C
NO_MEASUREMENTS		> 0

SPS9_PMA_MIX_DES_PROP

ASPHALT_CONTENT_DESIGN	%	1 - 10
ASPHALT_GRADE		1 - 40, 99
BULK_SPEC_GRAVITY_DESIGN		1 - 4
EFF_ASPHALT_CONTENT_DESIGN	%	1 - 10
PG_HIGH_TEMP		null, 46 - 82
LAYER_NO		> 1
PG_LOW_TEMP		null, 10 - 40
MARSHALL_FLOW_DESIGN	.01 in (or .25mm)	null, 0 - 25
MARSHALL_STABILITY_DESIGN	lb N	null, 1200 - 5000 null, 5300 - 22500
MAX_SPEC_GRAVITY_DESIGN		1 - 4
MIX_DESIGN_TYPE		1 - 4
NUMBER_OF_BLOWS		null, 50, 75
HVEEM_STABILITY_DESIGN		null, 25 - 60
PCT_AIR_VOIDS_DESIGN	%	1 - 10
SUPERPAVE_N_DESIGN		null, 80 - 150
VOIDS_MINERAL_AGGR_DESIGN		null, 10 - 20

SPS9_PMA_MIXTURE_PROP

ANTISTRIP_AGENT_AMOUNT	%	null, 0 - 5
ANTISTRIP_AGENT_CODE		null, 1 - 2
ANTISTRIP_AGENT_TYPE		null, 0 - 70
ASPHALT_CONTENT_MAX	%	null, 1.0 - 10.0
ASPHALT_CONTENT_MEAN	%	1.0 - 10.0
ASPHALT_CONTENT_MIN	%	null, 1.0 - 10.0
ASPHALT_CONTENT_STD_DEV	%	null, 0.0 - 5.0
BULK_SPEC_GRAVITY_MAX		null, 1.000 - 4.000
BULK_SPEC_GRAVITY_MEAN		1.000 - 4.000
BULK_SPEC_GRAVITY_MIN		null, 1.000 - 4.000
BULK_SPEC_GRAVITY_STD_DEV		null, 0.000 - 2.000
EFF_ASPHALT_CONTENT	%	1.0 - 10.0
HVEEM_COHESIOMETER	g/25mm	null, 5 - 5000
HVEEM_STABILITY		null, 25 - 50
LAYER_NO		> 1
MARSHALL_FLOW	.01 in 0.25mm	null, 0 - 25 null, 0 - 25
MARSHALL_STABILITY	lbs kg	null, 1200 - 5000 null, 540 - 2270
MAX_SPEC_GRAVITY		null, 1 - 4
NO_BULK_SPEC_GRAVITY		> 0
NO_SAMP_PCT_AIR_VOIDS		>= 1
NO_SAMP_ASPH_CONTENT		> 0
NUMBER_OF_BLOWS		null, 50, 75
PCT_AIR_VOIDS_MAX	%	null, 0.0 - 10.0

PCT_AIR_VOIDS_MEAN	%	0.0 - 10.0
PCT_AIR_VOIDS_MIN	%	null, 0.0 - 10.0
PCT_AIR_VOIDS_STD_DEV		null, 0.0 - 5.0
PLANT_TYPE		1 - 4
SAMPLE_TYPE		1 - 2
VOIDS_MINERAL_AGGR	%	1.0 - 20.0

SPS9_PMA_PLACEMENT_INFO

LAYDOWN_WIDTH	ft	10 - 15
	m	3.0 - 5.0
LAYER_NO1_1		> 1
LAYER_NO1_2		null, > 1
LAYER_NO1_3		null, > 1
LAYER_NO2_1		null, > 1
LAYER_NO2_2		null, > 1
LAYER_NO2_3		null, > 1
LAYER_NO3_1		null, > 1
LAYER_NO3_2		null, > 1
LAYER_NO3_3		null, > 1
LONG_SURFACE_JOINT_LOC		1, 2
LONG_JOINT_OFFSET	ft	null, 10 - 14
	m	null, 3.0 - 4.2
PMA_PLANT_TYPE_1		1 - 3
PMA_PLANT_TYPE_2		null, 1 - 3
PMA_PLANT_TYPE_3		null, 1 - 3
SURFACE_PREP		1 - 4

SPS9_PMA_PLACEMENT_LAYER

LIFT_1_THICKNESS	in	0.5 - 5.0
	mm	0 - 125
LIFT_2_THICKNESS	in	null, 0.5 - 5.0
	mm	null, 0 - 125
LIFT_3_THICKNESS	in	null, 0.5 - 5.0
	mm	null, 0 - 125
LIFT_4_THICKNESS	in	null, 0.5 - 5.0
	mm	null, 0 - 125
LAYDOWN_WIDTH	ft	10 - 15
	m	3.0 - 5.0
LIFT_TACK_COAT		Y, N

SPS9_PMA_PROFILE

BLANK_BAND_HEIGHT	in	null, 0.0 - 0.5
	mm	null, 0 - 13
CUTOFF_HEIGHT	in	null, > 0
	mm	null, 0 - 25
INCENTIVE_PAYMENT		null, Y, N
INTERPRETATION_METHOD		null, 1 - 3

PROFILE_INDEX	in/mi mm/km	0 - 20 0 - 316
PROFILOGRAPH_TYPE		1 - 3

SPS9_PMA_ROLLER

LAYER_NO		1 - 20
ROLLER_CODE		A - Q
ROLLER_FREQ	vib/min hz	2000 - 3000 (I - P) 34 - 51 (I - P)
ROLLER_GROSS_WT	tons kg	0 - 20 (A - D, I - P) 0 - 50 (E - H) 0 - 18140 (A - D, I - P) 0 - 45350 (E - H)
ROLLER_SPEED	mph km/h	0 - 10 0 - 16
ROLLER_TIRE_PRES	psi kPa	50 - 100 (E - H) 344 - 690

SPS9_RUT_LEVEL_UP

AIR_TEMP_HIGH	deg F deg C	40 - 120 4.0 - 49.0
AIR_TEMP_LOW	deg F deg C	40 - 120 4.0 - 49.0
COMPACTION_EQUIP		1 - 8
IW_END_STA	ft m	null, 0 - 500 null, 0.0 - 153.0
IW_RUT_DEPTH	in mm	null, 0.0 - 3.0 null, 0 - 77
IW_RUT_WIDTH	in mm	null, 0.0 - 72.0 null, 0 - 1830
IW_START_STA	ft m	null, 0 - 500 null, 0.0 - 153.0
LENGTH_SECTION_COVERED		1 - 2
LEVEL_UP_LAYER_LOC		1 - 4
LEVEL_UP_MATL		1 - 6
MAX_MATL_TEMP	deg F deg C	null, 100 - 150 null, 37.0 - 66.0
MAX_TOP_SIZE_AGGR	in mm	0.1 - 2.0 2 - 51
MIN_TIME_TO_OPEN	hr	> 0
OW_END_STA	ft m	null, 0 - 500 null, 0.0 - 153.0
OW_RUT_DEPTH	in mm	null, 0.0 - 3.0 null, 0 - 77
OW_RUT_WIDTH	in mm	null, 0.0 - 72.0 null, 0 - 1830
OW_START_STA	ft m	null, 0 - 500 null, 0.0 - 153.0
ROAD_MOISTURE		1 - 3

RUT_PREP		1 - 6
RUT_PREP_DEPTH	in	null, 0.0 - 5.0
	mm	null, 0 - 127
RUT_PREP_WIDTH	in	null, 0.0 - 72.0
	mm	null, 0 - 1830

SPS9_SP_PMA_AC_PROPERTIES

PG_HIGH_TEMP		46 - 82
PG_LOW_TEMP		(-46) - (-10)
ASPHALT_SPECIFIC_GRAVITY		1.000 - 4.000
ASPHALT_VISCOSITY_140	poise	500 - 20000
ASPHALT_VISCOSITY_275	centistokes	100 - 1200
BBR_SLOPE_PAV		null, 0 - 1
BBR_STIFFNESS_MODULUS_PAV	MPa	null, 100 - 400
LAYER_NO		> 1
DSR_COMPLEX_MODULUS_PAV	kPa	null, 1000 - 6000
DSR_COMPLEX_PHASE_ANGLE_PAV	deg	null, 0 - 90
DSR_COMPLEX_MODULUS_RTFO	kPa	null, 1 - 5
DSR_COMPLEX_PHASE_ANGLE_RTFO	deg	null, 0 - 90
DSR_COMPLEX_MODULUS_TANK	kPa	null, 1 - 5
DSR_COMPLEX_PHASE_ANGLE_TANK	deg	null, 0 - 90
DT_PECENT_TENSILE_STRAIN_PAV	kPa	null, 0.5 - 1.5
DT_TENSILE_STRENGTH_PAV	%	null, 1000 - 2500

SPS9_SP_PMA_AGGREGATE_PROP

AGGR_COMB_BULK_SPEC		1 - 4
AGGR_COMP_PERCENT_C1	%	0 - 100
AGGR_COMP_PERCENT_F1	%	0 - 100
AGGR_COMP_PERCENT_C2	%	null, 1 - 99
AGGR_COMP_PERCENT_F2	%	null, 1 - 99
AGGR_COMP_PERCENT_C3	%	null, 1 - 98
AGGR_COMP_PERCENT_F3	%	null, 1 - 98
AGGR_COMP_TYPE_C1		1 - 6
AGGR_COMP_TYPE_F1		1 - 4
AGGR_COMP_TYPE_C2		null, 1 - 6
AGGR_COMP_TYPE_F2		null, 1 - 4
AGGR_COMP_TYPE_C3		null, 1 - 6
AGGR_COMP_TYPE_F3		null, 1 - 4
ANGULARITY_COARSE_ONE_FACE	%	null, 0 - 100
ANGULARITY_COARSE_TWO_FACE	%	null, 0 - 100
ANGULARITY_FINE	%	null, 0 - 100
CLAY_CONTENT		null, 35 - 99.9
COARSE_AGGR_BULK_SPEC		1 - 4
COARSE_AGGREGATE_TOUGHNESS	%	null, 10 - 40
DELETERIOUS_MATERIALS	%	null, 0 - 10

EFFECTIVE_SPEC_GRAVITY		1 - 4
FINE_AGGR_BULK_SPEC		1 - 4
LAYER_NO		> 1
MINERAL_FILLER		1 - 6
MINERAL_FILLER_BULK_SPEC		1 - 4
SOUNDNESS_COARSE	%	null, 0 - 20
SOUNDNESS_FINE	%	null, 0 - 20
THIN_ELONGATED_PARTICLES	%	null, 0 - 20

SPS9_SP_PMA_MIXTURE_PROP

ANTISTRIP_AGENT_AMOUNT	%	null, 0 - 5
ANTISTRIP_AGENT_CODE		null, 1 - 2
ANTISTRIP_AGENT_TYPE		null, 0 - 70
ASPHALT_CONTENT_MAX	%	null, 1.0 - 10.0
ASPHALT_CONTENT_MEAN	%	1.0 - 10.0
ASPHALT_CONTENT_MIN	%	null, 1.0 - 10.0
ASPHALT_CONTENT_STD_DEV	%	null, 0.0 - 5.0
BULK_SPEC_GRAVITY_MAX		null, 1.000 - 4.000
BULK_SPEC_GRAVITY_MEAN		1.000 - 4.000
BULK_SPEC_GRAVITY_MIN		null, 1.000 - 4.000
BULK_SPEC_GRAVITY_STD_DEV		null, 0.000 - 2.000
CONFINING_PRESSURE_4C	kPa	750 - 950
CONFINING_PRESSURE_20C	kPa	600 - 800
CONFINING_PRESSURE_40C	kPa	450 - 650
EFF_ASPHALT_CONTENT	%	1.0 - 10.0
FREQ_SWP_PHASE_ANGLE_4C	deg	0 - 90
FREQ_SWP_PHASE_ANGLE_20C	deg	0 - 90
FREQ_SWP_PHASE_ANGLE_40C	deg	0 - 90
LAYER_NO		> 1
MAX_SPEC_GRAVITY		null, 1 - 4
NO_BULK_SPEC_GRAVITY		> 0
NO_SAMP_PCT_AIR_VOIDS		>= 1
NO_SAMP_ASPH_CONTENT		> 0
NUMBER_OF_BLOWS		null, 50, 75
PCT_AIR_VOIDS_MAX	%	null, 0.0 - 10.0
PCT_AIR_VOIDS_MEAN	%	0.0 - 10.0
PCT_AIR_VOIDS_MIN	%	null, 0.0 - 10.0
PCT_AIR_VOIDS_STD_DEV		null, 0.0 - 5.0
SIMPLE_SHEAR_SHEAR_STRESS_4C	kPa	300 - 400
SIMPLE_SHEAR_SHEAR_STRESS_20C	kPa	90 - 120
SIMPLE_SHEAR_SHEAR_STRESS_40C	kPa	30 - 40
UNIAXIAL_STRESS_4C	kPa	550 - 750
UNIAXIAL_STRESS_20C	kPa	400 - 600
UNIAXIAL_STRESS_40C	kPa	300 - 400

VOIDS_MINERAL_AGGR	%	1.0 - 20.0
SPS9_SUBDRAINAGE		
DRAINAGE_PIPE_TYPE		1 - 8
FILTER_PERMEABILITY	ft/day m/day	> 0 > 0.00
FILTER_TYPE		1 - 7
HORIZ_PIPE_PLACEMENT	in mm	null, 0.0 - 120.0 null, 0.0 - 3050
MAX_PARTICLE_SIZE	in mm	null, 0.1 - 2.0 null, 2 - 51
NO_10_PASSING	%	null, 0 - 100
NO_100_PASSING	%	null, 0 - 100
NO_4_PASSING	%	null, 0 - 100
NO_40_PASSING	%	null, 0 - 100
OUTLET_INTERVAL	ft m	5 - 500 1.0 - 153.0
PIPE_DEPTH	in mm	null, 1.0 - 48.0 null, 25 - 1220
PIPE_DIAMETER	in mm	null, 1.0 - 24.0 null, 25 - 610
SUBDRAIN_PURPOSE		1 - 4
TYPE_LOC_FILTER		1 - 3
SPS9_SUBGRADE_PREP		
COMPACTION_EQUIP_TYPE		1 - 6
GROSS_WEIGHT	tons kg	5 - 20 4500 - 18200
LIFT_THICKNESS	in mm	2 - 36 50 - 915
STABIL_AGENT1		null, 1 - 5
STABIL_AGENT1_PERCENT	%	null, 1.0 - 10.0
STABIL_AGENT2		null, 1 - 5
STABIL_AGENT2_PERCENT	%	null, 1.0 - 10.0
SPS9_UNBOUND_AGGR_BASE		
COMPACTION_TYPE		1 - 5
FIRST_LIFT_THICKNESS	in mm	1 - 12 25 - 305
FOURTH_LIFT_THICKNESS	in mm	null, 1 - 12 null, 25 - 305
GROSS_WEIGHT	tons kg	5.0 - 50.0 4500 - 45400
LAYER_NO		> 1
SECOND_LIFT_THICKNESS	in mm	null, 1 - 12 null, 25 - 305
THIRD_LIFT_THICKNESS	in mm	null, 1 - 12, null null, 25 - 305

SPS9_UNDERSEALING

ADDITIVE_AMOUNT	%	null, 0 - 10
ADDITIVE_TYPE		null, 1 – 13
CEMENT_SAND_RATIO		0.1 - 2.0
CEMENT_TYPE		41 – 55
CUBE_STRENGTH_PC_GROUT	psi kPa	600 - 2000 4137 – 13790
DETERMINE_UNDERSEAL_AREA		1 – 4
FLUIDITY_PC_GROUT	sec	8 – 25
HOLES_NEAR_JOINT_OR_CRACK		null, 1 – 10
HOLES_PER_LINEAL_FOOT HOLES_PER_METER		null, 0.1 - 3.0 null, 0.3 - 10.0
HOLES_PER_SLAB		null, 1 – 10
MATL_PUMPED_PER_HOLE	cu ft m^3	0.0 - 5.0 0 - 0.002
MAX_PUMP_PRESSURE	psi kPa	100 - 300 689 – 2070
MAX_SURGE_PRESSURE	psi kPa	100 - 300 689 – 2070
MEASURE_AFTER_UNDERSEAL		Y, N
MEASURE_BEFORE_UNDERSEAL		Y, N
MONITORING_OF_LIFT		1 – 4
PC_GROUT_CURING_PERIOD	days	1 – 7
SLABS_UNDERSEALED		null, 0 – 50
SUBSEAL_MIX_TYPE		1 – 5
TIME_UNDERSEAL_TO_REOPEN	hr	0 – 48
TOTAL_SLABS		null, 0 – 50
UNDERSEAL_HOLE_DEPTH	in mm	8 - 30 203 – 765
WATER_CEMENT_RATIO		0.1 - 1.0

E. Intramodular Checks

Intramodular checks for the SPS9 tables are specified below.

Table: SPS9_AC PATCHES

- DATE_BEGAN <= DATE_COMPLETE

  Error message **SPS9_AC_PATCHES**-E-101: {STATE_CODE, SHRP_ID, DATE_COMPLETE} Patching complete {DATE_COMPLETE} before it began {DATE_BEGAN}.

- AIR_TEMP_HIGH >= AIR_TEMP_LOW

Error message **SPS9_AC_PATCHES**-E-102: {STATE_CODE, SHRP_ID, DATE_COMPLETE} AIR_TEMP_HIGH {AIR_TEMP_HIGH} < AIR_TEMP_LOW {AIR_TEMP_LOW}

- If PRIMARY_DISTRESS = 17, then PRIMARY_DISTRESS_OTHER must be non-null

  Error message **SPS9_AC_PATCHES**-E-103: {STATE_CODE, SHRP_ID, DATE_COMPLETE} PRIMARY_DISTRESS = 17 Requires a non-null entry in PRIMARY_DISTRESS_OTHER

- If SECONDARY_DISTRESS = 17, then SECONDARY_DISTRESS_OTHER must be non-null

  Error message **SPS9_AC_PATCHES**-E-104: {STATE_CODE, SHRP_ID, DATE_COMPLETE] SECONDARY_DISTRESS = 17 Requires a non-null entry in SECONDARY_DISTRESS_OTHER

- If LOC_SIZE_METHOD = 4, then LOC_SIZE_METHOD_OTHER must be non-null

  Error message **SPS9_AC_PATCHES**-E-105: {STATE_CODE, SHRP_ID, DATE_COMPLETE} LOC_SIZE_METHOD = 4 Requires a non-null entry in LOC_SIZE_OTHER

- If PATCH_BOUNDARY_METHOD = 5, then PATCH_BOUNDARY_METHOD_OTHER must be non-null

  Error message **SPS9_AC_PATCHES**-E-106: {STATE_CODE, SHRP_ID, DATE_COMPLETE} PATCH_BOUNDARY_METHOD = 5 Requires a non-null entry in PATCH_BOUNDARY_METHOD_OTHER

- If COMPACTION = 8, then COMPACTION_OTHER must be non-null

  Error message **SPS9_AC_PATCHES**-E-107: {STATE_CODE, SHRP_ID, DATE_COMPLETE} COMPACTION = 8 Requires a non-null entry in COMPACTION_OTHER

- If COMPACTION_2 = 8, then COMPACTION_2_OTHER must be non-null

  Error message **SPS9_AC_PATCHES**-E-108: {STATE_CODE, SHRP_ID, DATE_COMPLETE} COMPACTION_2 = 8 Requires a non-null entry in COMPACTION_2_OTHER

- If PATCH_MATERIAL = 7, then PATCH_MATERIAL_OTHER must be non-null

  Error message **SPS9_AC_PATCHES**-E-109: {STATE_CODE, SHRP_ID, DATE_COMPLETE} PATCH_MATERIAL =7 Requires a non-null entry in PATCH_MATERIAL_OTHER

- SURFACE_PATCHES_NO > 0 if and only if SURFACE_PATCHES_AREA > 0

  Error message **SPS9_AC_PATCHES**-E-110: {STATE_CODE, SHRP_ID, DATE_COMPLETE} SURFACE_PATCHES_NO and SURFACE_PATCHES_AREA should both be zero or both be > 0.

- PARTIAL_BASE_NO > 0 if and only if PARTIAL_BASE_AREA > 0

Error message **SPS9_AC_PATCHES**-E-111: {STATE_CODE, SHRP_ID, DATE_COMPLETE} PARTIAL_BASE_NO and PARTIAL_BASE_AREA should both be zero or both be > 0.

- FULL_DEPTH_NO > 0 if and only if FULL_DEPTH_AREA > 0

  Error message **SPS9_AC_PATCHES**-E-112: {STATE_CODE, SHRP_ID, DATE_COMPLETE} FULL_DEPTH_NO and FULL_DEPTH_AREA should both be zero or both be > 0.

- At least one of the following fields must be greater than zero: SURFACE_PATCHES_AREA, PARTIAL_BASE_AREA, FULL_DEPTH_AREA

  Error message **SPS9_AC_PATCHES**-E-113: {STATE_CODE, SHRP_ID, DATE_COMPLETE} Invalid value SURFACE_PATCHES_AREA and/or PARTIAL_BASE_AREA, FULL_DEPTH_AREA

- SURFACE_PATCHES_AREA + PARTIAL_BASE_AREA + FULL_DEPTH_AREA < 6000 sq.ft. (550 m^2)

  Error message **SPS9_AC_PATCHES**-E-114: {STATE_CODE, SHRP_ID, DATE_COMPLETE} Invalid value SURFACE_PATCHES_AREA and/or PARTIAL_BASE_AREA, FULL_DEPTH_AREA

- At least one of the following must be greater than zero: SURFACE_PATCHES_NO, PARTIAL_BASE_NO, FULL_DEPTH_NO

  Error message **SPS9_AC_PATCHES**-E-115: {STATE_CODE, SHRP_ID, DATE_COMPLETE} Invalid value SURFACE_PATCHES_NO and/or PARTIAL_BASE_NO, FULL_DEPTH_NO

Table: SPS9_DIAMOND_GRIND

- If GRINDING_REASON = 5, then GRINDING_REASON_OTHER must be non-null

  Error message **SPS9_DIAMOND_GRIND**-E-101: {STATE_CODE, SHRP_ID} GRINDING_REASON = 5 requires a non-null entry in GRINDING_REASON_OTHER

Table: SPS9_LAYER

- Logical Layering Checks

  - A layer for DESCRIPTION = 3 cannot be below a layer for DESCRIPTION 6, 7, 11
  - A layer for DESCRIPTION = 4 cannot be below a layer for DESCRIPTION 5, 6, 7, 11
  - A layer for DESCRIPTION = 5 cannot be below a layer for DESCRIPTION 6, 7, 11
  - A layer for DESCRIPTION = 6 cannot be below a layer for DESCRIPTION 7, 11
  - A layer for DESCRIPTION = 8 cannot be below a layer for DESCRIPTION 7, 11
  - A layer for DESCRIPTION = 9 cannot be below a layer for DESCRIPTION 3 - 8, 11
  - A layer for DESCRIPTION = 11 cannot be below a layer for DESCRIPTION = 7
  - For LAYER_NO = 1, the DESCRIPTION must always equal 7

- Layer Compatibility Checks

- The top layer must have a description of 1, 3 or 9
- There must be a layer with a DESCRIPTION of 3
- There cannot be two layers with a DESCRIPTION of 3
- There must be a layer with a DESCRIPTION of 4 or 5 directly beneath the layer with a DESCRIPTION of 3
- There must be a layer with a DESCRIPTION of 5
- There cannot be two layers with a DESCRIPTION of 5
- There cannot be two layers with a DESCRIPTION of 7
- There cannot be two layers with a DESCRIPTION of 9

Tables: SPS9_LAYER_THICKNESS, SPS9_LAYER

- For matching SHRP_ID, STATE_CODE, each **SPS9_LAYER_THICKNESS**.LAYER_NO must have a matching **SPS9_LAYER**.LAYER_NO

  Error message **SPS9_LAYER_THICKNESS-**E-101: {STATE_CODE, SHRP_ID} LAYER_NO {**SPS9_LAYER_THICKNESS**.LAYER_NO} does not have a matching layer number in **SPS9_LAYER**

- For matching SHRP_ID, STATE_CODE, LAYER_NO, **SPS9_LAYER**.MIN_THICKNESS -3.0 < **SPS9_LAYER_THICKNESS**.LAYER_THICKNESS < **SPS9_LAYER**.MAX_THICKNESS +3.0

- For matching SHRP_ID, STATE_CODE, LAYER_NO, **SPS9_LAYER**.MIN_THICKNESS - 76 < **SPS9_LAYER_THICKNESS**.LAYER_THICKNESS < **SPS9_LAYER**.MAX_THICKNESS + 76

  Error message **SPS9_LAYER_THICKNESS-**E-102: {STATE_CODE, SHRP_ID, LAYER_NO} depth for layer number {LAYER_NO} inconsistent between **SPS9_LAYER_THICKNESS** and **SPS9_LAYER**.

Table: SPS9_LOAD_TRANSFER

- DATE_COMPLETE >= DATE_BEGAN

  Error message **SPS9_LOAD_TRANSFER**-E-101: {STATE_CODE, SHRP_ID, DATE_COMPLETE} Operation complete {DATE_COMPLETE} before it began {DATE_BEGAN}

- NO_JOINT_IN_SECTION >= NO_JOINT_RESTORE_LOCATIONS

  Error message **SPS9_LOAD_TRANSFER**-E-102: {STATE_CODE, SHRP_ID, DATE_COMPLETE} NO_JOINT_IN_SECTION {NO_JOINT_IN_SECTION} < NO_JOINT_RESTORE_LOCATIONS {NO_JOINT_RESTORE_LOCATIONS}

- A value > 0 must exist for DOWEL_1, DOWEL_2, … DOWEL_n where n = DEVICES_PER_JOINT

  Error message **SPS9_LOAD_TRANSFER**-E-103: {STATE_CODE, SHRP_ID, DATE_COMPLETE} A non-null value must exist for all DOWEL devices up to DOWEL_{DEVICES_PER_JOINT}

- DOWEL_1 < DOWEL_2 < . . . DOWEL_n where n = DEVICES_PER_JOINT

Error message **SPS9_LOAD_TRANSFER**-E-104: {STATE_CODE, SHRP_ID, DATE_COMPLETE} Invalid DOWEL distance relation

- If BACKFILL_MATERIAL = 4, then BACKFILL_MATERIAL_OTHER must be non-null

  Error message **SPS9_LOAD_TRANSFER**-E-105: {STATE_CODE, SHRP_ID, DATE_COMPLETE} BACKFILL_MATERIAL = {BACKFILL_MATERIAL} Requires non-null entry in BACKFILL_MATERIAL_OTHER

- If BOND_AGENT_BACKFILL = 4, then BOND_AGENT_OTHER must be non-null

  Error message **SPS9_LOAD_TRANSFER**-E-106: {STATE_CODE, SHRP_ID, DATE_COMPLETE} BOND_AGENT = {BOND_AGENT} Requires non-null entry in BOND_AGENT_OTHER

- DATE_BEFORE_RESTORE < DATE_AFTER_RESTORE

  Error message **SPS9_LOAD_TRANSFER**-E-107: {STATE_CODE, SHRP_ID, DATE_COMPLETE} DATE_BEFORE_RESTORE {DATE_BEFORE_RESTORE} > DATE_AFTER_RESTORE {DATE_AFTER_RESTORE}

- DATE_COMPLETE + 180 >= DATE_AFTER_RESTORE

  Error message **SPS9_LOAD_TRANSFER**-E-108: {STATE_CODE, SHRP_ID, DATE_COMPLETE, DATE_AFTER_RESTORE} Recommended interval between restoration completion and load transfer efficiency testing exceeded.

Table: SPS9_LOAD_TRANS_EFFICIENCY

- DATE_BEFORE_RESTORE < DATE_AFTER_RESTORE

  Error message **SPS9_LOAD_TRANS_EFFICIENCY**-E-101: {STATE_CODE, SHRP_ID, DATE_COMPLETE} Operation complete {DATE_AFTER_RESTORE} before it began {DATE_BEFORE_RESTORE}.

- EFFICIENCY_BEFORE_APPROACH > EFFICIENCY_AFTER_APPROACH

  Error message **SPS9_LOAD_TRANS_EFFICIENCY**-E-102: {STATE_CODE, SHRP_ID, DATE_COMPLETE, POINT_DISTANCE} Load transfer efficiency on the approach side before restoration {EFFICIENCY_BEFORE_APPROACH} > efficiency on approach side after restoration {EFFICIENCY_AFTER_APPROACH}.

- EFFICIENCY_BEFORE_LEAVE > EFFICIENCY_AFTER_LEAVE

  Error message **SPS9_LOAD_TRANS_EFFICIENCY**-E-103: {STATE_CODE, SHRP_ID, DATE_COMPLETE, POINT_DISTANCE} Load transfer efficiency on the leave side before restoration {EFFICIENCY_BEFORE_LEAVE} > efficiency on leave side after restoration {EFFICIENCY_AFTER_LEAVE}.

Tables: SPS9_LOAD_TRANS_EFFICIENCY, SPS9_LOAD_TRANSFER

- For matching STATE_CODE, SHRP_ID, DATE_COMPLETE a record must exist in

SPS9_LOAD_TRANSFER

Error message **SPS9_LOAD_TRANS_EFFICIENCY**-E-104: {STATE_CODE, SHRP_ID, DATE_COMPLETE} Load transfer efficiency improvement has no record of joint reconstruction.

Table: SPS9_MILLED_SECTIONS

- For non-null values of *_INSIDE, MIN_INSIDE <= AVG_INSIDE <= MAX_INSIDE

  Error message **SPS9_MILLED_SECTIONS**-E-101: {STATE_CODE, SHRP_ID, DATE_COMPLETE} Invalid MIN {MIN_INSIDE}, MEAN {AVG_INSIDE}, MAX {MAX_INSIDE} INSIDE relation

- For non-null values of *_OUTSIDE MIN_OUTSIDE <= AVG_OUTSIDE <= MAX_OUTSIDE

  Error message **SPS9_MILLED_SECTIONS**-E-102: {STATE_CODE, SHRP_ID, DATE_COMPLETE} Invalid MIN {MIN_OUTSIDE}, MEAN {AVG_OUTSIDE}, MAX {MAX_OUTSIDE} relation

- If LAYER_THICKER_MILL_DEPTH = “Y” then NOMINAL_THICKNESS >= AVG_INSIDE and NOMINAL_THICKNESS >= AVG_OUTSIDE

  Error message **SPS9_MILLED_SECTIONS**-E-103: {STATE_CODE, SHRP_ID, DATE_COMPLETE} For LAYER_THICKER_MILL_DEPTH = {LAYER_THICKER_MILL_DEPTH} Invalid NOMINAL_THICKNESS.

- If MILLED_THE_SAME = “N” then WIDTH_MILL_SAME_TEST must be non null

  Error message **SPS9_MILLED_SECTIONS**-E-104: {STATE_CODE, SHRP_ID_DATE_COMPLETE} For MILLED_THE_SAME = {MILLED_THE_SAME} WIDTH_MILL_SAME_TEST value is null.

- STD_INSIDE is non-null if and only if INSIDE_NO_MEASUREMENTS > 1

  Error message **SPS9_MILLED_SECTIONS**-E-105: {STATE_CODE, SHRP_ID, DATE_COMPLETE} Invalid STD_INSIDE value for INSIDE_NO_MEASUREMENTS = {INSIDE_NO_MEASUREMENTS}

- STD_OUTSIDE is non-null if and only if OUTSIDE_NO_MEASUREMENTS > 1

  Error message **SPS9_MILLED_SECTIONS**-E-106: {STATE_CODE, SHRP_ID, DATE_COMPLETE} Invalid STD_OUTSIDE value for OUTSIDE_NO_MEASUREMENTS = {OUTSIDE_NO_MEASUREMENTS}

- If MILL_LAYER_MATL = 3, then MILL_LAYER_MATL_OTHER must be non-null

  Error message **SPS9_MILLED_SECTIONS**-E-107: {STATE_CODE, SHRP_ID, DATE_COMPLETE} MILL_LAYER_MATL = {MILL_LAYER_MATL} Requires a non-null value in MILL_LAYER_MATL_OTHER.

Tables: SPS9_MILLED_SECTIONS, **INV_LAYER**

- For matching STATE_CODE, SHRP_ID of project level SPS section, **SPS9_MILLED_SECTIONS**.LAYER_NO_OF_REPLACEMENT = MAX(INV_LAYER.LAYER_NO) +1

  Error message **SPS9_MILLED_SECTIONS**-E-109: LAYER_NO_OF_REPLACEMENT {LAYER_NO_OF_REPLACEMENT} not above original surface layer {INV_LAYER.LAYER_NO}

Note: If project_id not found in INV_LAYER, check for linked GPS section in SPS_GPS_LINK table.

Table: SPS9_PCC_CRACK_SEAL

- DATE_COMPLETE >= DATE_BEGAN

  Error message **SPS9_PCC_CRACK_SEAL**-E-101: {STATE_CODE, SHRP_ID, DATE_COMPLETE} Operation complete {DATE_COMPLETE} before it began {DATE_BEGAN}

- SEAL_RES_WIDTH <= SEAL_RES_DEPTH

  Error message **SPS9_PCC_CRACK_SEAL**-E-102: {STATE_CODE, SHRP_ID, DATE_COMPLETE} SEAL_RES_WIDTH {SEAL_RES_WIDTH} > SEAL_RES_DEPTH {SEAL_RES_DEPTH}

- If BOND_BREAK = 4, then a non-null entry must exist in BOND_BREAK_OTHER

  Error message **SPS9_PCC_CRACK_SEAL**-E-103: {STATE_CODE, SHRP_ID, DATE_COMPLETE} BOND_BREAK = {BOND_BREAK} Requires a non-null entry in BOND_BREAK_OTHER

- If CRACK_CLEAN = 6, then a non-null entry must exist in CRACK_CLEAN_OTHER

  Error message **SPS9_PCC_CRACK_SEAL**-E-104: {STATE_CODE, SHRP_ID, DATE_COMPLETE} CRACK_CLEAN = {CRACK_CLEAN} Requires a non-null entry in CRACK_CLEAN_OTHER

Table: SPS9_PCC_FULL_DEPTH

- DATE_COMPLETE >= DATE_BEGAN

  Error message **SPS9_PCC_FULL_DEPTH**-E-101: {STATE_CODE, SHRP_ID} Operation complete {DATE_COMPLETE} before it began {DATE_BEGAN}

- If STEEL = N, then REBAR_TRANS, REBAR_LONG, REBAR_LENGTH_TRANS, REBAR_LENGTH_LONG, REBAR_SPACE_TRANS, and REBAR_SPACE_LONG must be 0 or null

  Error message **SPS9_PCC_FULL_DEPTH**-E-102: {STATE_CODE, SHRP_ID, DATE_COMPLETE} For STEEL = {STEEL} Invalid value for one or more of REBAR_TRANS, REBAR_LONG REBAR_LENGTH_TRANS, REBAR_LENGTH_LONG, REBAR_SPACE_TRANS, REBAR_SPACE_LONG

- For non-null values, AIR_CONTENT_MIN <= AIR_CONTENT_MEAN <= AIR_CONTENT_MAX

  Error message **SPS9_PCC_FULL_DEPTH**-E-103: {STATE_CODE, SHRP_ID, DATE_COMPLETE} Air Content Relation Min {AIR_CONTENT_MIN}, Mean {AIR_CONTENT_MEAN}, Max {AIR_CONTENT_MAX} invalid

- For non-null values, SLUMP_MIN <= SLUMP_MEAN <= SLUMP_MAX

  Error message **SPS9_PCC_FULL_DEPTH**-E-104: {STATE_CODE, SHRP_ID, DATE_COMPLETE} Slump Relation Min {SLUMP_MIN}, Mean {SLUMP_MEAN}, Max {SLUMP_MAX} invalid

- AIR_TEMP_LOW <= AIR_TEMP_HIGH

  Error message **SPS9_PCC_FULL_DEPTH**-E-105: {STATE_CODE, SHRP_ID, DATE_COMPLETE} Low air temperature {AIR_TEMP_LOW} > High air temperature {AIR_TEMP_HIGH}

- If REASON = 38, then REASON_OTHER must be non-null

  Error message **SPS9_PCC_FULL_DEPTH**-E-106: {STATE_CODE, SHRP_ID, DATE_COMPLETE} REASON = {REASON} Requires non-null entry in REASON_OTHER

- If SECONDARY_REASON = 38, then SECONDARY_REASON_OTHER must be non-null

  Error message **SPS9_PCC_FULL_DEPTH**-E-107: {STATE_CODE, SHRP_ID, DATE_COMPLETE} SECONDARY_REASON = {SECONDARY_REASON} Requires non-null entry in SECONDARY_REASON_OTHER

- If PATCH_MATL = 5, then PATCH_MATL_OTHER must be non-null

  Error message **SPS9_PCC_FULL_DEPTH**-E-108: {STATE_CODE, SHRP_ID, DATE_COMPLETE} PATCH_MATL = {PATCH_MATL} Requires non-null entry in PATCH_MATL_OTHER

- If BOUNDARY_METHOD = 5, then BOUNDARY_METHOD_OTHER must be non-null

  Error message **SPS9_PCC_FULL_DEPTH**-E-109: {STATE_CODE, SHRP_ID, DATE_COMPLETE} BOUNDARY_METHOD = {BOUNDARY_METHOD} Requires non-null entry in BOUNDARY_METHOD_OTHER

- If CUT_METHOD = 5, then CUT_METHOD_OTHER must be non-null

  Error message **SPS9_PCC_FULL_DEPTH**-E-110: {STATE_CODE, SHRP_ID, DATE_COMPLETE} CUT_METHOD = {CUT_METHOD} Requires non-null entry in CUT_METHOD_OTHER

- If TRANSFER_DEVICE = 4, then TRANSFER_DEVICE_OTHER must be non-null

  Error message **SPS9_PCC_FULL_DEPTH**-E-111: {STATE_CODE, SHRP_ID, DATE_COMPLETE} TRANSFER_DEVICE = {TRANSFER_DEVICE} Requires non-null entry in TRANSFER_DEVICE_OTHER

- If DOWEL_COAT_TRANS = 7, then DOWEL_COAT_OTHER must be non-null

Error message **SPS9_PCC_FULL_DEPTH**-E-112: {STATE_CODE, SHRP_ID, DATE_COMPLETE} DOWEL_COAT_TRANS = {DOWEL_COAT_TRANS} Requires non-null entry in DOWEL_COAT_TRANS_OTHER

- If CONC_BREAK_METHOD = 5, then CONC_BREAK_METHOD_OTHER must be non-null

  Error message **SPS9_PCC_FULL_DEPTH**-E-113: {STATE_CODE, SHRP_ID, DATE_COMPLETE} CONC_BREAK_METHOD = {CONC_BREAK_METHOD} Requires non-null entry in CONC_BREAK_METHOD_OTHER

- If CONC_REMOVAL = 3, then CONC_REMOVAL_OTHER must be non-null

  Error message **SPS9_PCC_FULL_DEPTH**-E-114: {STATE_CODE, SHRP_ID, DATE_COMPLETE} CONC_REMOVAL = {CONC_REMOVAL} Requires non-null entry in CONC_REMOVAL_OTHER

- If JOINT_METHOD_SH = 7, then JOINT_METHOD_SH_OTHER must be non-null

  Error message **SPS9_PCC_FULL_DEPTH**-E-115: {STATE_CODE, SHRP_ID, DATE_COMPLETE} JOINT_METHOD_SH = {JOINT_METHOD_SH} Requires non-null entry in JOINT_METHOD_SH_OTHER

- If JOINT_METHOD_LONG = 7, then JOINT_METHOD_LONG_OTHER must be non-null

  Error message **SPS9_PCC_FULL_DEPTH**-E-116: {STATE_CODE, SHRP_ID, DATE_COMPLETE} JOINT_METHOD_LONG = {JOINT_METHOD_LONG} Requires non-null entry in JOINT_METHOD_LONG_OTHER

- If JOINT_METHOD_TRANS = 7, then JOINT_METHOD_TRANS_OTHER must be non-null

  Error message **SPS9_PCC_FULL_DEPTH**-E-117: {STATE_CODE, SHRP_ID, DATE_COMPLETE} JOINT_METHOD_TRANS = {JOINT_METHOD_TRANS} Requires non-null entry in JOINT_METHOD_TRANS_OTHER

- If CURE_METHOD_1 = 10, then CURE_METHOD_1_OTHER must be non-null

  Error message **SPS9_PCC_FULL_DEPTH**-E-118: {STATE_CODE, SHRP_ID, DATE_COMPLETE} CURE_METHOD_1 = {CURE_METHOD_1} Requires non-null entry in CURE_METHOD_1_OTHER

- If CURE_METHOD_2 = 10, then CURE_METHOD_2_OTHER must be non-null

  Error message **SPS9_PCC_FULL_DEPTH**-E-119: {STATE_CODE, SHRP_ID, DATE_COMPLETE} CURE_METHOD_2 = {CURE_METHOD_2} Requires non-null entry in CURE_METHOD_2_OTHER

- If CONSOLIDATE_METHOD = 6, then CONSOLIDATE_METHOD_OTHER must be non-null

  Error message **SPS9_PCC_FULL_DEPTH**-E-120: {STATE_CODE, SHRP_ID, DATE_COMPLETE} CONSOLIDATE_METHOD = {CONSOLIDATE_METHOD} Requires non-null entry in CONSOLIDATE_METHOD_OTHER

- If FINISH_METHOD = 4, then FINISH_METHOD_OTHER must be non-null

Error message **SPS9_PCC_FULL_DEPTH**-E-121: {STATE_CODE, SHRP_ID, DATE_COMPLETE} FINISH_METHOD = {FINISH_METHOD} Requires non-null entry in FINISH_METHOD_OTHER

- If REASON = 38, then REASON_OTHER must be non-null

  Error message **SPS9_PCC_FULL_DEPTH**-E-106: {STATE_CODE, SHRP_ID, DATE_COMPLETE} REASON = {REASON} Requires non-null entry in REASON_OTHER

- If SECONDARY_ REASON = 38, then SECONDARY_REASON_OTHER must be non-null

  Error message **SPS9_PCC_FULL_DEPTH**-E-107: {STATE_CODE, SHRP_ID, DATE_COMPLETE} SECONDARY_REASON = {SECONDARY_REASON} Requires non-null entry in SECONDARY_ REASON_OTHER

Table: SPS9_PCC_JOINT_RESEAL

- DATE_COMPLETE >= DATE_BEGAN

  Error message **SPS9_PCC_JOINT_RESEAL**-E-101: {STATE_CODE, SHRP_ID} Operation complete {DATE_COMPLETE} before it began {DATE_BEGAN}

- SEAL_RES_WIDTH <= SEAL_RES_DEPTH

  Error message **SPS9_PCC_JOINT_RESEAL**-E-102: {STATE_CODE, SHRP_ID, DATE_COMPLETE} SEAL_RES_WIDTH {SEAL_RES_WIDTH} > SEAL_RES_DEPTH {SEAL_RES_DEPTH}

- If SEALS_DIFFERENT = Y, then: CONTRACTION_SEAL_TYPE must be non-null

  Error message **SPS9_PCC_JOINT_RESEAL**-E-103: {STATE_CODE, SHRP_ID, DATE_COMPLETE} For SEALS_DIFFERENT = {SEALS_DIFFERENT} Invalid value CONTRACTION_SEAL_TYPE

- If REMOVAL_METHOD = 9, then REMOVAL_METHOD_OTHER must be non-null

  Error message **SPS9_PCC_JOINT_RESEAL**-E-104: {STATE_CODE, SHRP_ID, DATE_COMPLETE} REMOVAL_METHOD = {REMOVAL_METHOD} Requires a non-null entry in REMOVAL_METHOD_OTHER

- If BOND_BREAK = 4, then BOND_BREAK_OTHER must be non-null

  Error message **SPS9_PCC_JOINT_RESEAL**-E-105: {STATE_CODE, SHRP_ID, DATE_COMPLETE} BOND_BREAK = {BOND_BREAK} Requires a non-null entry in BOND_BREAK_OTHER

- If REFACED = 4, then REFACED_OTHER must be non-null

  Error message **SPS9_PCC_JOINT_RESEAL**-E-106: {STATE_CODE, SHRP_ID, DATE_COMPLETE} REFACED = {REFACED} Requires a non-null entry in REFACED_OTHER

- If SIDEWALL_CLEAN = 14, then SIDEWALL_CLEAN_OTHER must be non-null

Error message **SPS9_PCC_JOINT_RESEAL**-E-107: {STATE_CODE, SHRP_ID, DATE_COMPLETE} SIDEWALL_CLEAN = {SIDEWALL_CLEAN} Requires a non-null entry in SIDEWALL_CLEAN_OTHER

- If CONTRACTION_SEAL_TYPE = 7, then CONTRACTION_SEAL_TYPE_OTHER must be non-null

  Error message **SPS9_PCC_JOINT_RESEAL**-E-108: {STATE_CODE, SHRP_ID, DATE_COMPLETE} CONTRACTION_SEAL_TYPE = {CONTRACTION_SEAL_TYPE} Requires a non-null entry in CONTRACTION_SEAL_TYPE_OTHER

- If EXPANSION_SEAL_TYPE = 7, then EXPANSION_SEAL_TYPE_OTHER must be non-null

  Error message **SPS9_PCC_JOINT_RESEAL**-E-109: {STATE_CODE, SHRP_ID, DATE_COMPLETE} EXPANSION_SEAL_TYPE = {EXPANSION_SEAL_TYPE} Requires a non-null entry in EXPANSION_SEAL_TYPE_OTHER

Table: SPS9_PCC_PART_DEPTH

- DATE_COMPLETE >= DATE_BEGAN

  Error message **SPS9_PCC_PART_DEPTH**-E-101: { STATE_CODE, SHRP_ID} Operation complete {DATE_COMPLETE} before it began {DATE_BEGAN}

- For non-null values of AIR_CONTENT_* , AIR_CONTENT_MIN <= AIR_CONTENT_MEAN <= AIR_CONTENT_MAX

  Error message **SPS9_PCC_PART_DEPTH**-E-102: { STATE_CODE, SHRP_ID, DATE_COMPLETE} Air Content Relation Min {AIR_CONTENT_MIN}, Mean {AIR_CONTENT_MEAN}, Max {AIR_CONTENT_MAX} invalid.

- For non-null values of SLUMP_* , SLUMP_MIN <= SLUMP_MEAN <= SLUMP_MAX

  Error message **SPS9_PCC_PART_DEPTH**-E-103: { STATE_CODE, SHRP_ID, DATE_COMPLETE} Slump Relation Min {SLUMP_MIN}, Mean SLUMP_MEAN}, Max SLUMP_MAX} invalid.

- CURE_METHOD_1 must not = CURE_METHOD_2

  Error message **SPS9_PCC_PART_DEPTH**-E-104: { STATE_CODE, SHRP_ID, DATE_COMPLETE} CURE_METHOD_1 {CURE_METHOD_1} = CURE_METHOD_2 {CURE_METHOD_2}.

- AIR_TEMP_LOW <= AIR_TEMP_HIGH

  Error message **SPS9_PCC_PART_DEPTH**-E-105: { STATE_CODE, SHRP_ID, DATE_COMPLETE} Low air temperature {AIR_TEMP_LOW} > high air temperature {AIR_TEMP_HIGH}

- If REASON = 38, then REASON_OTHER must be non-null

  Error message **SPS9_PCC_PART_DEPTH**-E-106: {STATE_CODE, SHRP_ID, DATE_COMPLETE} REASON = {REASON} Requires non-null entry in REASON_OTHER

- If SECONDARY_REASON = 38, then SECONDARY_REASON_OTHER must be non-null

  Error message **SPS9_PCC_PART_DEPTH**-E-107: {STATE_CODE, SHRP_ID, DATE_COMPLETE} SECONDARY_REASON = {SECONDARY_REASON} Requires non-null entry in SECONDARY_REASON_OTHER

- If PATCH_MATL_PCC = 5, then PATCH_MATL_OTHER must be non-null

  Error message **SPS9_PCC_PART_DEPTH**-E-108: {STATE_CODE, SHRP_ID, DATE_COMPLETE} PATCH_MATL_PCC = {PATCH_MATL_PCC} Requires non-null entry in PATCH_MATL_OTHER

- If BOND_AGENT = 5, then BOND_AGENT_OTHER must be non-null

  Error message **SPS9_PCC_PART_DEPTH**-E-109: {STATE_CODE, SHRP_ID, DATE_COMPLETE} BOND_AGENT = {BOND_AGENT} Requires non-null entry in BOND_AGENT_OTHER

- If BOUNDARY_METHOD_PART = 4, then BOUNDARY_METHOD_OTHER must be non-null

  Error message **SPS9_PCC_PART_DEPTH**-E-110: {STATE_CODE, SHRP_ID, DATE_COMPLETE} BOUNDARY_METHOD_PART = {BOUNDARY_METHOD_PART} Requires non-null entry in BOUNDARY_METHOD_OTHER

- If BREAK_METHOD = 3, then BREAK_METHOD_OTHER must be non-null

  Error message SPS9_PCC_PART_DEPTH-E-111: {STATE_CODE, SHRP_ID, DATE_COMPLETE} BREAK_METHOD = {BREAK_METHOD} Requires non-null entry in BREAK_METHOD_OTHER

- If CLEAN_METHOD_PATCH = 4, then CLEAN_METHOD_PATCH_OTHER must be non-null

  Error message **SPS9_PCC_PART_DEPTH**-E-112: {STATE_CODE, SHRP_ID, DATE_COMPLETE} CLEAN_METHOD_PATCH = {CLEAN_METHOD_PATCH} Requires non-null entry in CLEAN_METHOD_PATCH_OTHER

- If CUT_METHOD_PART = 6, then CUT_METHOD_OTHER must be non-null

  Error message **SPS9_PCC_PART_DEPTH**-E-113: {STATE_CODE, SHRP_ID, DATE_COMPLETE} CUT_METHOD_PART = {CUT_METHOD_PART} Requires non-null entry in CUT_METHOD_OTHER

- If JOINT_METHOD_SH = 7, then JOINT_METHOD_SH_OTHER must be non-null

  Error message **SPS9_PCC_PART_DEPTH**-E-114: {STATE_CODE, SHRP_ID, DATE_COMPLETE} JOINT_METHOD_SH = {JOINT_METHOD_SH} Requires non-null entry in JOINT_METHOD_SH_OTHER

- If JOINT_METHOD_LONG = 7, then JOINT_METHOD_LONG_OTHER must be non-null

  Error message **SPS9_PCC_PART_DEPTH**-E-115: {STATE_CODE, SHRP_ID, DATE_COMPLETE} JOINT_METHOD_LONG = {JOINT_METHOD_LONG} Requires non-null entry in JOINT_METHOD_LONG_OTHER

- If JOINT_METHOD_TRANS = 7, then JOINT_METHOD_TRANS_OTHER must be non-null

Error message **SPS9_PCC_PART_DEPTH**-E-116: {STATE_CODE, SHRP_ID, DATE_COMPLETE} JOINT_METHOD_TRANS = {JOINT_METHOD_TRANS} Requires non-null entry in JOINT_METHOD_TRANS_OTHER

- If CURE_METHOD_1 = 10, then CURE_METHOD_1_OTHER must be non-null

  Error message **SPS9_PCC_PART_DEPTH**-E-117: {STATE_CODE, SHRP_ID, DATE_COMPLETE} CURE_METHOD_1 = {CURE_METHOD_1} Requires non-null entry in CURE_METHOD_1_OTHER

- If CURE_METHOD_2 = 10, then CURE_METHOD_2_OTHER must be non-null

  Error message **SPS9_PCC_PART_DEPTH**-E-118: {STATE_CODE, SHRP_ID, DATE_COMPLETE} CURE_METHOD_2 = {CURE_METHOD_2} Requires non-null entry in CURE_METHOD_2_OTHER

- If CONSOLIDATE_METHOD_PART = 6, then CONSOLIDATE_METHOD_OTHER must be non-null

  Error message **SPS9_PCC_PART_DEPTH**-E-119: {STATE_CODE, SHRP_ID, DATE_COMPLETE} CONSOLIDATE_METHOD_PART = {CONSOLIDATE_METHOD_PART} Requires non-null entry in CONSOLIDATE_METHOD_OTHER

- If FINISH_METHOD = 4, then FINISH_METHOD_OTHER must be non-null

  Error message **SPS9_PCC_PART_DEPTH**-E-120: {STATE_CODE, SHRP_ID, DATE_COMPLETE} FINISH_METHOD = {FINISH_METHOD} Requires non-null entry in FINISH_METHOD_OTHER

- ADMIXTURE_1 must not = ADMIXTURE_2

  Error message **SPS9_PCC_PART_DEPTH**-E-121: {STATE_CODE, SHRP_ID, DATE_COMPLETE} ADMIXTURE_1 {ADMIXTURE_1} equal to ADMIXTURE_2 {ADMIXTURE_2}

Table: SPS9_PMA_AC_PROPERTIES

- DUCTILITY_77 >= DUCTILITY_39

  Error message **SPS9_PMA_AC_PROPERTIES**-E-101: {STATE_CODE, SHRP_ID, LAYER_NO} DUCTILITY relation invalid

- If ASPHALT_GRADE = 17, 35, or 99, then ASPHALT_GRADE_OTHER must be non-null

  Error message **SPS9_PMA_AC_PROPERTIES**-E-102: {STATE_CODE, SHRP_ID, LAYER_NO} ASPHALT_GRADE = {ASPHALT_GRADE} Requires a non-null entry in ASPHALT_GRADE_OTHER

- If MODIFIER_1 = 27, then MODIFIER_1_OTHER must be non-null

Error message **SPS9_PMA_AC_PROPERTIES**-E-103: {STATE_CODE, SHRP_ID, LAYER_NO} MODIFIER_1 = {MODIFIER_1} Requires a non-null entry in MODIFIER_1_OTHER

- If MODIFIER_2 = 27, then MODIFIER_2_OTHER must be non-null

  Error message **SPS9_PMA_AC_PROPERTIES**-E-104: {STATE_CODE, SHRP_ID, LAYER_NO} MODIFIER_2 = {MODIFIER_2} Requires a non-null entry in MODIFIER_2_OTHER

- If SOURCE = 77, then SOURCE_OTHER must be non-null

  Error message **SPS9_PMA_AC_PROPERTIES**-E-105: {STATE_CODE, SHRP_ID, LAYER_NO} SOURCE = {SOURCE} Requires a non-null entry in SOURCE_OTHER

Table: SPS9_PMA_AGGREGATE_PROP

- For non-null values of AGGR_COMP_TYPE_C*, AGGR_COMP_TYPE_C1 <> AGGR_COMP_TYPE_C2 <> AGGR_COMP_TYPE_C3

  Error message **SPS9_PMA_AGGREGATE_PROP**-E-101: {STATE_CODE, SHRP_ID, LAYER_NO} Two or more of coarse AGGR_COMP_TYPEs C1, C2 and C3 are the same.

- For non-null values of AGGR_COMP_TYPE_F*, AGGR_COMP_TYPE_F1 <> AGGR_COMP_TYPE_F2 <> AGGR_COMP_TYPE_F3

  Error message **SPS9_PMA_AGGREGATE_PROP**-E-102: {STATE_CODE, SHRP_ID, LAYER_NO} Two or more of fine AGGR_COMP_TYPEs F1, F2 and F3 are the same.

- AGGR_COMP_PERCENT_C1 + AGGR_COMP_PERCENT_C2 + AGGR_COMP_PERCENT_C3 = 100

  Error message **SPS9_PMA_AGGREGATE_PROP**-E-103: {STATE_CODE, SHRP_ID, LAYER_NO} Sum of Coarse AGGR_COMP_PERCENTs C1, C2 and C3 are not equal to 100.

- AGGR_COMP_PERCENT_F1 + AGGR_COMP_PERCENT_F2 + AGGR_COMP_PERCENT_F3 = 100

  Error message **SPS9_PMA_AGGREGATE_PROP**-E-104: {STATE_CODE, SHRP_ID, LAYER_NO} Sum of Fine AGGR_COMP_PERCENTs F1, F2 and F3 are not equal to 100.

- If AGGR_COMP_TYPE_C1 = 6, then AGGR_COMP_TYPE_C1_OTHER must be non-null

  Error message **SPS9_PMA_AGGREGATE_PROP**-E-105: {STATE_CODE, SHRP_ID, LAYER_NO} AGGR_COMP_TYPE_C1 = {AGGR_COMP_TYPE_C1} Requires a non-null entry in AGGR_COMP_TYPE_C1_OTHER

- If AGGR_COMP_TYPE_C2 = 6, then AGGR_COMP_TYPE_C2_OTHER must be non-null

  Error message **SPS9_PMA_AGGREGATE_PROP**-E-106: {STATE_CODE, SHRP_ID, LAYER_NO} AGGR_COMP_TYPE_C2 = {AGGR_COMP_TYPE_C2} Requires a non-null entry in AGGR_COMP_TYPE_C2_OTHER

- If AGGR_COMP_TYPE_C3 = 6, then AGGR_COMP_TYPE_C3_OTHER must be non-null

  Error message **SPS9_PMA_AGGREGATE_PROP**-E-107: {STATE_CODE, SHRP_ID, LAYER_NO} AGGR_COMP_TYPE_C3 = {AGGR_COMP_TYPE_C3} Requires a non-null entry in AGGR_COMP_TYPE_C3_OTHER

- If AGGR_COMP_TYPE_F1 = 4, then AGGR_COMP_TYPE_F1_OTHER must be non-null

  Error message **SPS9_PMA_AGGREGATE_PROP**-E-108: {STATE_CODE, SHRP_ID, LAYER_NO} AGGR_COMP_TYPE_F1 = {AGGR_COMP_TYPE_F1} Requires a non-null entry in AGGR_COMP_TYPE_F1_OTHER

- If AGGR_COMP_TYPE_F2 = 4, then AGGR_COMP_TYPE_F2_OTHER must be non-null

  Error message **SPS9_PMA_AGGREGATE_PROP**-E-109: {STATE_CODE, SHRP_ID, LAYER_NO} AGGR_COMP_TYPE_F2 = {AGGR_COMP_TYPE_F2} Requires a non-null entry in AGGR_COMP_TYPE_F2_OTHER

- If AGGR_COMP_TYPE_F3 = 4, then AGGR_COMP_TYPE_F3_OTHER must be non-null

  Error message **SPS9_PMA_AGGREGATE_PROP**-E-110: {STATE_CODE, SHRP_ID, LAYER_NO} AGGR_COMP_TYPE_F3 = {AGGR_COMP_TYPE_F3} Requires a non-null entry in AGGR_COMP_TYPE_F3_OTHER

- If MINERAL_FILLER = 5, then MINERAL_FILLER_OTHER must be non-null

  Error message **SPS9_PMA_AGGREGATE_PROP**-E-111: {STATE_CODE, SHRP_ID, LAYER_NO} MINERAL_FILLER = {MINERAL_FILLER} Requires a non-null entry in MINERAL_OTHER

Tables: SPS9_PMA_COMPACTION, SPS9_PMA_ROLLER

- For a given BREAKDOWN_ROLLER_CODE in **SPS9_PMA_COMPACTION**, a matching ROLLER_CODE must exist in **SPS9_PMA_ROLLER**

  Error message **SPS9_PMA_COMPACTION**-E-101: {STATE_CODE, SHRP_ID, LAYER_NO, LIFT_NO, BREAKDOWN_ROLLER) ROLLER_CODE invalid

- For a given INTERMED_ROLLER_CODE in **SPS9_PMA_COMPACTION**, a matching ROLLER_CODE must exist in **SPS9_PMA_ROLLER**

  Error message **SPS9_PMA_COMPACTION**-E-102: {STATE_CODE, SHRP_ID, LAYER_NO, LIFT_NO, INTERMED_ROLLER) ROLLER_CODE invalid

- For a given FINAL_ROLLER_CODE in **SPS9_PMA_COMPACTION**, a matching ROLLER_CODE must exist in **SPS9_PMA_ROLLER**

  Error message **SPS9_PMA_COMPACTION**-E-103: {STATE_CODE, SHRP_ID, LAYER_NO, LIFT_NO, FINAL_ROLLER) ROLLER_CODE invalid

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Table: SPS9_PMA_CONSTRUCTION

- DATE_COMPLETE >= DATE_BEGAN

Error message **SPS9_PMA_CONSTRUCTION**-E-101: { STATE_CODE, SHRP_ID, LAYER_NO} Operation complete {DATE_COMPLETE} before it began {DATE_BEGAN}

- LAYDOWN_TEMP_MAX >= LAYDOWN_TEMP_MEAN >= LAYDOWN_TEMP_MIN

  Error message **SPS9_PMA_CONSTRUCTION**-E-102 : {STATE_CODE, SHRP_ID, LAYER_NO} maximum laydown temperature {LAYDOWN_TEMP_MAX} >= average laydown temperature {LAYDOWN_TEMP_MEAN} >= minimum laydown temperature {LAYDOWN_TEMP_MIN}

Table: SPS9_PMA_DENSITY

Note to Programmer: All min, average, max tests apply to non-null values only.

- DENSITY_MIN <= DENSITY_MEAN <= DENSITY_MAX

  Error message **SPS9_PMA_DENSITY**-E-101: {STATE_CODE, SHRP_ID} Relationship min {DENSITY_MIN} <= mean {DENSITY_MEAN} <= max {DENSITY_MAX} invalid

- DENSITY_STD is non-null only if NO_MEASUREMENTS > 1
  Error message **SPS9_PMA_DENSITY**-E-102: {STATE_CODE, SHRP_ID} DENSITY_STD value should be non-null

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Table: SPS9_PMA_MIX_DES_PROP

For MIX_DESIGN_TYPE = 4, then MIX_DESIGN_OTHER must be non-null

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Table: SPS9_PMA_MIXTURE_PROP

- For non-null values of BULK_SPEC_GRAVITY·BULK_SPEC_GRAVITY_MIN <= BULK_SPEC_GRAVITY_MEAN <= BULK_SPEC_GRAVITY_MAX

  Error message **SPS9_PMA_MIXTURE_PROP**-E-101: {STATE_CODE, SHRP_ID, LAYER_NO} BULK_SPEC_GRAVITY Relation min {BULK_SPEC_GRAVITY_MIN}, mean {BULK_SPEC_GRAVITY_MEAN}, max {BULK_SPEC_GRAVITY_MAX} invalid

- For non-null values of ASPHALT_CONTENT
  ASPHALT_CONTENT_MIN <= ASPHALT_CONTENT_MEAN <= ASPHALT_CONTENT_MAX

  Error message **SPS9_PMA_MIXTURE_PROP**-E-102: {STATE_CODE, SHRP_ID, LAYER_NO} ASPHALT_CONTENT Relation min {ASPHALT_CONTENT_MIN} , mean {ASPHALT_CONTENT_MEAN} , max {ASPHALT_CONTENT_MAX} invalid

- For non-null values of PCT_AIR_VOIDS
  PCT_AIR_VOIDS_MIN <= PCT_AIR_VOIDS_MEAN <= PCT_AIR_VOIDS_MAX

  Error message **SPS9_PMA_MIXTURE_PROP**-E-103: {STATE_CODE, SHRP_ID, LAYER_NO} PCT_AIR_VOIDS Relation min {PCT_AIR_VOIDS_MIN}, mean {PCT_AIR_VOIDS_MEAN}, max {PCT_AIR_VOIDS_MAX} invalid

- BULK_SPEC_GRAVITY_STD_DEV is non-null only if NO_BULK_SPEC_GRAVITY > 1

  Error message **SPS9_PMA_MIXTURE_PROP**-E-104: {STATE_CODE, SHRP_ID, LAYER_NO, BULK_SPEC_GRAVITY_STD_DEV} Invalid value BULK_SPEC_GRAVITY_STD_DEV.

- ASPHALT_CONTENT_STD_DEV is non-null only if NO_SAMP_ASPHALT_CONTENT > 1

  Error message **SPS9_PMA_MIXTURE_PROP**-E-105: {STATE_CODE, SHRP_ID, LAYER_NO, ASPHALT_CONTENT_STD_DEV} Invalid value ASPHALT_CONTENT_STD_DEV.

- PCT_AIR_VOIDS_STD_DEV is non-null only if NO_SAMP_PCT_AIR_VOIDS > 1

  Error message **SPS9_PMA_MIXTURE_PROP**-E-106: {STATE_CODE, SHRP_ID, LAYER_NO, PCT_AIR_VOIDS_STD_DEV} Invalid value PCT_AIR_VOIDS_STD_DEV.

- If PLANT_TYPE = 3, then PLANT_TYPE_OTHER must be non-null

  Error message **SPS9_PMA_MIXTURE_PROP**-E-107: {STATE_CODE, SHRP_ID, LAYER_NO} PLANT_TYPE = {PLANT_TYPE} Invalid value PLANT_TYPE_OTHER.

- If ANTISTRIP_AGENT_TYPE = 70, then ANTISTRIP_AGENT_TYPE_OTHER must be non-null

  Error message **SPS9_PMA_MIXTURE_PROP**-E-108: {STATE_CODE, SHRP_ID, LAYER_NO} ANTISTRIP_AGENT_TYPE = {ANTISTRIP_AGENT_TYPE} Requires a non-null value in ANTISTRIP_AGENT_TYPE_OTHER

Table: SPS9_PMA_PLACEMENT_INFO

- DATE_PREP_BEGAN <= DATE_PREP_COMPLETE

  Error message **SPS9_PMA_PLACEMENT_INFO**-E-101: {STATE_CODE, SHRP_ID, DATE_PREP_COMPLETE} Surface preparation complete {DATE_COMPLETE} before it began {DATE_PREP_BEGAN}

- If PMA_PLANT_TYPE1 = 3, then PMA_PLANT_TYPE_OTHER1 must be non-null

  Error message **SPS9_PMA_PLACEMENT_INFO**-E-102: {STATE_CODE, SHRP_ID, DATE_COMPLETE} PMA_PLANT_TYPE1 = {PMA_PLANT_TYPE1} Requires a non-null entry in PMA_PLANT_TYPE_OTHER1

- If PMA_PLANT_TYPE2 = 3, then PMA_PLANT_TYPE_OTHER2 must be non-null

  Error message **SPS9_PMA_PLACEMENT_INFO**-E-103: {STATE_CODE, SHRP_ID, DATE_COMPLETE} PMA_PLANT_TYPE2 = {PMA_PLANT_TYPE2} Requires a non-null entry in PMA_PLANT_TYPE_OTHER2

- If PMA_PLANT_TYPE3 = 3, then PMA_PLANT_TYPE_OTHER3 must be non-null

Error message **SPS9_PMA_PLACEMENT_INFO**-E- 104: {STATE_CODE, SHRP_ID, DATE_COMPLETE} PMA_PLANT_TYPE3 = {PMA_PLANT_TYPE3} Requires a non-null entry in PMA_PLANT_TYPE_OTHER3

Table: SPS9_PMA_PLACEMENT_LAYER

No level E checks. If a record is at level D, set it to level E.

Table: SPS_PMA_PROFILE

No level E checks. If a record is at level D, set it to level E.

Table: SPS9_PMA_ROLLER

- If ROLLER_CODE = A, B, C, or D then ROLLER_TIRE_PRES, ROLLER_FREQ, ROLLER_AMP, and ROLLER_SPEED must be null

  Error message **SPS9_PMA_ROLLER**-E-101: {STATE_CODE, SHRP_ID, LAYER_NO, IMP_TYPE, ROLLER_CODE} Invalid value ROLLER_TIRE_PRES and/or ROLLER_FREQUENCY, ROLLER_AMP & ROLLER_SPEED

- If ROLLER_CODE = E, F, G, or H then ROLLER_FREQ, ROLLER_AMP, and ROLLER_SPEED must be null

  Error message **SPS9_PMA_ROLLER**-E-102: {STATE_CODE, SHRP_ID, LAYER_NO, IMP_TYPE, ROLLER_CODE} Invalid value ROLLER_FREQUENCY and/or ROLLER_AMP, ROLLER_SPEED

- If ROLLER_CODE = I, J, K, L, M, N, or P then ROLLER_TIRE_PRES must be null

  Error message **SPS9_PMA_ROLLER**-E-103: {STATE_CODE, SHRP_ID, LAYER_NO, IMP_TYPE, ROLLER_CODE} Invalid value ROLLER_TIRE_PRES.

Table: SPS9_RUT_LEVEL_UP

- If LENGTH_SECTION_COVERED = 1 then OW_START_STA and OW_END_STA, IW_START_STA, and IW_END_STA must be null

  Error message **SPS9_RUT_LEVEL_UP**-E-101: {STATE_CODE, SHRP_ID} One or more invalid STATION location.

- If LENGTH_SECTION_COVERED = 2 then
  1. (OW_START_STA and OW_END_STA) or (IW_START_STA and IW_END_STA) must be non-null
  2. OW_START_STA <= OW_END_STA for non-null values
     IW_START_STA <= IW_END_STA for non-null values

  Error message **SPS9_RUT_LEVEL_UP**-E-102: {STATE_CODE, SHRP_ID} For LENGTH_SECTION_COVERED = {LENGTH_SECTION_COVERED}, Invalid STATION location

- If COMPACTION_EQUIP = 8, then COMPACTION_EQUIP_OTHER must be non-null

  Error message **SPS9_RUT_LEVEL_UP**-E-103: {STATE_CODE, SHRP_ID} COMPACTION_EQUIP = {COMPACTION_EQUIP} Requires a non-null entry in COMPACTION_EQUIP_OTHER

- If LEVEL_UP_MATL = 6, then LEVEL_UP_MATL_OTHER must be non-null

  Error message **SPS9_RUT_LEVEL_UP**-E-104: {STATE_CODE, SHRP_ID} LEVEL_UP_MATL = {LEVEL_UP_MATL} Requires a non-null entry in LEVEL_UP_MATL_OTHER.

- AIR_TEMP_LOW <= AIR_TEMP_HIGH

  Error message **SPS9_RUT_LEVEL_UP**-E-105: {STATE_CODE, SHRP_ID}

  Invalid Low {AIR_TEMP_LOW} and High {AIR_TEMP_HIGH} Temperature relation.

- If RUT_PREP = 6, then RUT_PREP_OTHER must be non-null

  Error message **SPS9_RUT_LEVEL_UP**-E-106: {STATE_CODE, SHRP_ID} RUT_PREP = {RUT_PREP} Requires a non-null value in RUT_PREP_OTHER.

Table: SPS9_SP_PMA_AC_PROPERTIES

- If SOURCE = 77, then SOURCE_OTHER must be non-null

  Error message **SPS9_SP_PMA_AC_PROPERTIES**-E-101: {STATE_CODE, SHRP_ID, LAYER_NO} SOURCE = {SOURCE} Requires a non-null entry in SOURCE_OTHER

Table: SPS9_SP_PMA_AGGREGATE_PROP

- For non-null values of AGGR_COMP_TYPE_C* AGGR_COMP_TYPE_C1 <> AGGR_COMP_TYPE_C2 <> AGGR_COMP_TYPE_C3

  Error message **SPS9_SP_PMA_AGGREGATE_PROP**-E-101: {STATE_CODE, SHRP_ID, LAYER_NO} Two or more of coarse AGGR_COMP_TYPEs C1, C2 and C3 are the same.

- For non-null values of AGGR_COMP_TYPE_F* AGGR_COMP_TYPE_F1 <> AGGR_COMP_TYPE_F2 <> AGGR_COMP_TYPE_F3

  Error message **SPS9_SP_PMA_AGGREGATE_PROP**-E-102: {STATE_CODE, SHRP_ID, LAYER_NO} Two or more of fine AGGR_COMP_TYPEs F1, F2 and F3 are the same.

- AGGR_COMP_PERCENT_C1 + AGGR_COMP_PERCENT_C2 + AGGR_COMP_PERCENT_C3 = 100

  Error message **SPS9_SP_PMA_AGGREGATE_PROP**-E-103: {STATE_CODE, SHRP_ID, LAYER_NO} Sum of Coarse AGGR_COMP_PERCENTs C1, C2 and C3 are not equal to 100.

- AGGR_COMP_PERCENT_F1 + AGGR_COMP_PERCENT_F2 + AGGR_COMP_PERCENT_F3 = 100

Error message **SPS9_SP_PMA_AGGREGATE_PROP**-E-104: {STATE_CODE, SHRP_ID, LAYER_NO} Sum of Fine AGGR_COMP_PERCENTs F1, F2 and F3 are not equal to 100.

- If AGGR_COMP_TYPE_C1 = 6, then AGGR_COMP_TYPE_C1_OTHER must be non-null

  Error message **SPS9_SP_PMA_AGGREGATE_PROP**-E-105: {STATE_CODE, SHRP_ID, LAYER_NO} AGGR_COMP_TYPE_C1 = {AGGR_COMP_TYPE_C1} Requires a non-null entry in AGGR_COMP_TYPE_C1_OTHER

- If AGGR_COMP_TYPE_C2 = 6, then AGGR_COMP_TYPE_C2_OTHER must be non-null

  Error message **SPS9_SP_PMA_AGGREGATE_PROP**-E-106: {STATE_CODE, SHRP_ID, LAYER_NO} AGGR_COMP_TYPE_C2 = {AGGR_COMP_TYPE_C2} Requires a non-null entry in AGGR_COMP_TYPE_C2_OTHER

- If AGGR_COMP_TYPE_C3 = 6, then AGGR_COMP_TYPE_C3_OTHER must be non-null

  Error message **SPS9_SP_PMA_AGGREGATE_PROP**-E-107: {STATE_CODE, SHRP_ID, LAYER_NO} AGGR_COMP_TYPE_C3 = {AGGR_COMP_TYPE_C3} Requires a non-null entry in AGGR_COMP_TYPE_C3_OTHER

- If AGGR_COMP_TYPE_F1 = 4, then AGGR_COMP_TYPE_F1_OTHER must be non-null

  Error message **SPS9_SP_PMA_AGGREGATE_PROP**-E-108: {STATE_CODE, SHRP_ID, LAYER_NO} AGGR_COMP_TYPE_F1 = {AGGR_COMP_TYPE_F1} Requires a non-null entry in AGGR_COMP_TYPE_F1_OTHER

- If AGGR_COMP_TYPE_F2 = 4, then AGGR_COMP_TYPE_F2_OTHER must be non-null

  Error message **SPS9_SP_PMA_AGGREGATE_PROP**-E-109: {STATE_CODE, SHRP_ID, LAYER_NO} AGGR_COMP_TYPE_F2 = {AGGR_COMP_TYPE_F2} Requires a non-null entry in AGGR_COMP_TYPE_F2_OTHER

- If AGGR_COMP_TYPE_F3 = 4, then AGGR_COMP_TYPE_F3_OTHER must be non-null

  Error message **SPS9_SP_PMA_AGGREGATE_PROP**-E-110: {STATE_CODE, SHRP_ID, LAYER_NO} AGGR_COMP_TYPE_F3 = {AGGR_COMP_TYPE_F3} Requires a non-null entry in AGGR_COMP_TYPE_F3_OTHER

- If MINERAL_FILLER = 5, then MINERAL_FILLER_OTHER must be non-null

  Error message **SPS9_SP_PMA_AGGREGATE_PROP**-E-111: {STATE_CODE, SHRP_ID, LAYER_NO} MINERAL_FILLER = {MINERAL_FILLER} Requires a non-null entry in MINERAL_OTHER

Table: SPS9_SP_PMA_MIXTURE_PROP

- For non-null values of BULK_SPEC_GRAVITY,· BULK_SPEC_GRAVITY_MIN <= BULK_SPEC_GRAVITY_MEAN <= BULK_SPEC_GRAVITY_MAX

Error message **SPS9_SP_PMA_MIXTURE_PROP**-E-101: {STATE_CODE, SHRP_ID, LAYER_NO} BULK_SPEC_GRAVITY Relation min {BULK_SPEC_GRAVITY_MIN}, mean {BULK_SPEC_GRAVITY_MEAN}, max {BULK_SPEC_GRAVITY_MAX} invalid

- For non-null values of ASPHALT_CONTENT
  ASPHALT_CONTENT_MIN <= ASPHALT_CONTENT_MEAN <= ASPHALT_CONTENT_MAX

  Error message **SPS9_SP_PMA_MIXTURE_PROP**-E-102: {STATE_CODE, SHRP_ID, LAYER_NO} ASPHALT_CONTENT Relation min {ASPHALT_CONTENT_MIN} , mean {ASPHALT_CONTENT_MEAN} , max {ASPHALT_CONTENT_MAX} invalid

- For non-null values of PCT_AIR_VOIDS
  PCT_AIR_VOIDS_MIN <= PCT_AIR_VOIDS_MEAN <= PCT_AIR_VOIDS_MAX

  Error message **SPS9_SP_PMA_MIXTURE_PROP**-E-103: {STATE_CODE, SHRP_ID, LAYER_NO} PCT_AIR_VOIDS Relation min {PCT_AIR_VOIDS_MIN}, mean {PCT_AIR_VOIDS_MEAN}, max {PCT_AIR_VOIDS_MAX} invalid

- BULK_SPEC_GRAVITY_STD_DEV is non-null only if NO_BULK_SPEC_GRAVITY > 1

  Error message **SPS9_SP_PMA_MIXTURE_PROP**-E-104: {STATE_CODE, SHRP_ID, LAYER_NO, BULK_SPEC_GRAVITY_STD_DEV} Invalid value BULK_SPEC_GRAVITY_STD_DEV.

- ASPHALT_CONTENT_STD_DEV is non-null only if NO_SAMP_ASPHALT_CONTENT > 1

  Error message **SPS9_SP_PMA_MIXTURE_PROP**-E-105: {STATE_CODE, SHRP_ID, LAYER_NO, ASPHALT_CONTENT_STD_DEV} Invalid value ASPHALT_CONTENT_STD_DEV.

- PCT_AIR_VOIDS_STD_DEV is non-null only if NO_SAMP_PCT_AIR_VOIDS > 1

  Error message **SPS9_SP_PMA_MIXTURE_PROP**-E-106: {STATE_CODE, SHRP_ID, LAYER_NO, PCT_AIR_VOIDS_STD_DEV} Invalid value PCT_AIR_VOIDS_STD_DEV.

- If PLANT_TYPE = 3, then PLANT_TYPE_OTHER must be non-null

  Error message **SPS9_SP_PMA_MIXTURE_PROP**-E-107: {STATE_CODE, SHRP_ID, LAYER_NO} PLANT_TYPE = {PLANT_TYPE} Invalid value PLANT_TYPE_OTHER.

- If ANTISTRIP_AGENT_TYPE = 70, then ANTISTRIP_AGENT_TYPE_OTHER must be non-null.

  Error message **SPS9_SP_PMA_MIXTURE_PROP**-E-108: {STATE_CODE, SHRP_ID, LAYER_NO} ANTISTRIP_AGENT_TYPE = {ANTISTRIP_AGENT_TYPE} Requires a non-null value in ANTISTRIP_AGENT_TYPE_OTHER

Table: SPS9_SUBDRAINAGE

- DATE_COMPLETE >= DATE_BEGAN

  Error message **SPS9_SUBDRAINAGE**-E-101: {STATE_CODE, SHRP_ID} Operation complete {DATE_COMPLETE} before it began {DATE_BEGAN}

- If DRAINAGE_PIPE = 7, then: PIPE_DIAMETER must be 0 or null

  Error message **SPS9_SUBDRAINAGE**-E-102: {STATE_CODE, SHRP_ID, DATE_COMPLETE} For DRAINAGE_PIPE = {DRAINAGE_PIPE} Invalid PIPE_DIAMETER

- FILTER_TYPE = 3 or 4, then MAX_PARTICLE_SIZE, NO_4_PASSING, NO_40_PASSING, and NO_100_PASSING must be 0 or null

  Error message **SPS9_SUBDRAINAGE**-E-103: {STATE_CODE, SHRP_ID, DATE_COMPLETE} For FITLER_TYPE = {FILTER_TYPE} Invalid value MAX_PARTICLE_SIZE, and/or NO_4_PASSING, NO_40_PASSING, NO_100_PASSING

- For non-null values of NO_*_PASSSING,
  NO_4_PASSING >= NO_10_PASSING >= NO_40_PASSING >= NO_100_PASSING

  Error message **SPS9_SUBDRAINAGE**-E-104: {STATE_CODE, SHRP_ID, DATE_COMPLETE, NO_PASSING} Invalid NO_n_PASSING relation

- If DRAINAGE_PIPE = 8, then DRAINAGE_PIPE_OTHER must be non-null

  Error message **SPS9_SUBDRAINAGE**-E-105: {STATE_CODE, SHRP_ID, DATE_COMPLETE} DRAINAGE_PIPE = {DRAINAGE_PIPE} Requires a non-null value in DRAINAGE_PIPE_OTHER

- If FILTER_TYPE = 7, then FILTER_TYPE_OTHER must be non-null

  Error message **SPS9_SUBDRAINAGE**-E-106: {STATE_CODE, SHRP_ID, DATE_COMPLETE} FILTER_TYPE = {FILTER_TYPE} Requires a non-null value in FILTER_TYPE_OTHER.

- If TYPE_LOC_FILTER = 3, then TYPE_LOC_FILTER_OTHER must be non-null

  Error message **SPS9_SUBDRAINAGE**-E-107: {STATE_CODE, SHRP_ID, DATE_COMPLETE} TYPE_LOC_FILTER = {TYPE_LOC_FILTER} Requires a non-null value in TYPE_LOC_FILTER_OTHER

- If SUBDRAIN_PURPOSE = 4, then SUBDRAIN_PURPOSE_OTHER must be non-null

  Error message **SPS9_SUBDRAINAGE**-E-108: {STATE_CODE, SHRP_ID, DATE_COMPLETE} SUBDRAIN_PURPOSE = {SUBDRAIN_PURPOSE} Requires a non-null value in SUBDRAIN_PURPOSE_OTHER.

Table: SPS9_SUBGRADE_PREP

- If STABIL_AGENT1 <> 5, then STABIL_AGENT1 <> STABIL_AGENT2

  Error message **SPS9_SUBGRADE_PREP**-E-101: {STATE_CODE, SHRP_ID, DATE_COMPLETE} STABIL_AGENT1 {STABIL_AGENT1} = STABIL_AGENT2 {STABIL_AGENT2}

- If COMPACTION_EQUIP_TYPE = 6, then COMPACTION_EQUIP_TYPE_OTHER must be non-null

Error message **SPS9_SUBGRADE_PREP**-E-102: {STATE_CODE, SHRP_ID} COMPACTION_EQUIP_TYPE_OTHER Requires a non-null entry in DRAINAGE_PIPE_TYPE_OTHER

- If STABIL_AGENT1 = 5, then STABIL_AGENT1_OTHER must be non-null

  Error message **SPS9_SUBGRADE_PREP**-E-103: {STATE_CODE, SHRP_ID} Requires a non-null entry in STABIL_AGENT1_OTHER

- If STABIL_AGENT2 = 5, then STABIL_AGENT2_OTHER must be non-null

  Error message **SPS9_SUBGRADE_PREP**-E-104: {STATE_CODE, SHRP_ID} Requires a non-null entry in STABIL_AGENT2_OTHER

- DATE_COMPLETE >= DATE_BEGAN

  Error message **SPS9_SUBGRADE_PREP**-E-105: {STATE_CODE, SHRP_ID} Operation complete {DATE_COMPLETE} before it began {DATE_BEGAN}

Table: SPS9_UNBOUND_AGGR_BASE

- If COMPACTION_TYPE = 5, then COMPACTION_TYPE_OTHER must be non-null

  Error message **SPS9_UNBOUND_AGGR_BASE**-E-101: {STATE_CODE, SHRP_ID, LAYER_NO} COMPACTION_TYPE = {COMPACTION_TYPE} Requires a non-null entry in COMPACTION_TYPE_OTHER

Table: SPS9_UNDERSEALING

- DATE_COMPLETE $\geq$ DATE_BEGAN

  Error message **SPS9_UNDERSEALING**-E-101: {STATE_CODE, SHRP_ID} Operation complete {DATE_COMPLETE} before it began {DATE_BEGAN}

- TOTAL_SLABS $\geq$ SLABS_UNDERSEALED

  Error message **SPS9_UNDERSEALING**-E-102: {STATE_CODE, SHRP_ID, DATE_COMPLETE} SLABS_UNDERSEALED {SLABS_UNDERSEALED} > TOTAL_SLABS {TOTAL_SLABS}

- If MONITORING_OF_LIFT = 2 or 3, then MEASURE_BEFORE_UNDERSEAL and MEASURE_AFTER_UNDERSEAL must be 2 or null and START_TIME_BEFORE, START_TIME_AFTER, END_TIME_BEFORE, and END_TIME_AFTER must be null

  Error message **SPS9_UNDERSEALING**-E-103: {STATE_CODE, SHRP_ID, DATE_COMPLETE} For MONITORING_OF_LIFT = {MONITORING_OF_LIFT} Invalid MEASURE_BEFORE_UNDERSEAL, and/or MEASURE_AFTER_UNDERSEAL, START_TIME_BEFORE, START_TIME_AFTER, END_TIME_BEFORE, END_TIME_AFTER

- If SUBSEAL_MIX_TYPE = 5, then SUBSEAL_MIX_TYPE_OTHER must be non-null

Error message **SPS9_UNDERSEALING**-E-104: {STATE_CODE, SHRP_ID, DATE_COMPLETE} SUBSEAL_MIX_TYPE = {SUBSEAL_MIX_TYPE} Requires a non-null entry in SUBSEAL_MIX_TYPE_OTHER

- If DETERMINE_UNDERSEAL_AREA = 4, then DETERMINE_UNDERSEAL_AREA_OTHER must be non-null

  Error message **SPS9_UNDERSEALING**-E-105: {STATE_CODE, SHRP_ID, DATE_COMPLETE} DETERMINE_UNDERSEAL_AREA = {DETERMINE_UNDERSEAL_AREA} Requires a non-null entry in DETERMINE_UNDERSEAL_AREA_OTHER

- If MONITORING_OF_LIFT =4, then MONITORING_OF_LIFT_OTHER must be non-null

  Error message **SPS9_UNDERSEALING**-E-106: {STATE_CODE, SHRP_ID, DATE_COMPLETE} MONITORING_OF_LIFT = {MONITORING_OF_LIFT} Requires a non-null entry in MONITORING_OF_LIFT_OTHER

- The first two characters of START_TIME_BEFORE, END_TIME_BEFORE, START_TIME_AFTER, and END_TIME_AFTER should be between 0 and 23

  Error message **SPS9_UNDERSEALING**-E-107: {STATE_CODE, SHRP_ID, DATE_COMPLETE}
  The hours for one or more of START_TIME_BEFORE, END_TIME_BEFORE, START_TIME_AFTER, and END_TIME_AFTER is out of range.

- The last two characters of START_TIME_BEFORE, END_TIME_BEFORE, START_TIME_AFTER, and END_TIME_AFTER should be between 0 and 59

  Error message **SPS9_UNDERSEALING**-E-108: {STATE_CODE, SHRP_ID, DATE_COMPLETE}
  The minutes for one or more of START_TIME_BEFORE, END_TIME_BEFORE, START_TIME_AFTER, and END_TIME_AFTER is out of range.

Tables: SPS9_LAYER_THICKNESS, TST_L05B

- For matching STATE_CODE, SHRP_ID, for each **SPS9_LAYER_THICKNESS**.LAYER_NO, a record in TST_L05B must exist with a matching **TST_L05B**.LAYER_NO

  Error Message **SPS9_LAYER_THICKNESS**-E-103: {STATE_CODE, SHRP_ID, LAYER_NO} A matching record in **TST_L05B** does not exist.

22.0 SMP QC PROGRAMS

22.1 Level 1

A. Initial Level

Records in the IMS are at Level A when they first enter the system and are set back to A when changes are made to a given record or to selected related records.

B. Dependency Checks

No B level checks defined.

C. Minimum Data Checks

Minimum data checks for all SMP data tables are identified below. Data fields with a Condition of "X" must always contain a non-null value, however, data fields with a Condition of "*" are only required to contain a non-null value if a particular condition is met as specified in the accompanying field explanation.

Table	Field	Condition
SMP_ATEMP_RAIN_DAY	No level C checks	
SMP_ATEMP_RAIN_HOUR	No level C checks	
SMP_COMMENT	COMMENT_TYPE	X
	ORDER_NO	X
	SMP_COMMENT_DATE	X
SMP_DRY_DENSITY	DENSITY_DEPTH	X
	DRY_DENSITY	X
	INSTALL_DATE	X
	MOIST_CONT_DENSITY	X
SMP_ELEV_AC_DATA	ELEV_ILE	X
	ELEV_IWP	X
	ELEV_ML	X
	ELEV_OWP	X
	ELEV_PE	X
	LOC_ELEV	X
	SURF_ELEV_TIME	X
SMP_ELEV_AC_OFFSET	OFFSET_ILE	X
	OFFSET_IWP	X

	OFFSET_ML	X
	OFFSET_OWP	X
	OFFSET_PE	X
	REF_ELEVATION	X
SMP_ELEV_PCC_DATA	ELEV_ILE	X
	ELEV_ML	X
	ELEV_PE	X
	LOC_ELEV	X
	SURF_ELEV_TIME	X
SMP_ELEV_PCC_OFFSET	OFFSET_ILE	X
	OFFSET_ML	X
	OFFSET_PE	X
	REF_ELEVATION	X
SMP_ERESIST_ABF_REF_VA	APPLIED_VOLTAGE	X
	RESISTANCE_VOLT	X
SMP_ERESIST_AUTO	ELECTRODE_END	X
	ELECTRODE_START	X
	ERESIST_TIME	X
	VOLTAGE	X
SMP_ERESIST_DEPTH	**S**ELCT_DEPTH	X
	ELECTRODE_NO	X
	INSTALL_DATE	X
SMP_ERESIST_MAN_CONTACT	AMPS	X
	ELECTRODE_END	X
	ELECTRODE_START	X
	ERESIST_TIME	X
	RESISTANCE	X
	VOLTS	X
SMP_ERESIST_MAN_4POINT	AMPS	X
	EAMP_END	X
	EAMP_START	X
	ERESIST_TIME	X
	EVOLTAGE_END	X
	EVOLTAGE_START	X
	RESISTIVITY	X
	VOLTS	X
SMP_FREEZE_STATE	No level C checks	
SMP_FROST_PENETRATION	No level C checks	
SMP_FROST_PRESENCE	No level C checks	
SMP_GRAV_MOIST	INSTALL_DATE	X
	MOIST_CONTENT	X
SMP_JOINT_FAULT_DATA	FAULT_IWP	X
	FAULT_ML	X
	FAULT_OWP	X

	JOINT_TIME	X
	LOC_JOINT	X
SMP_JOINT_FAULT_OFFSET	OFFSET_IWP	X
	OFFSET_ML	X
	OFFSET_OWP	X
SMP_JOINT_GAGE_DATA	GAGE_ILE	X
	GAGE_ML	X
	GAGE_PE	X
	JOINT_TIME	X
	LOC_JOINT	X
SMP_JOINT_GAGE_OFFSET	INSTALL_DATE	X
	OFFSET_ILE	X
	OFFSET_ML	X
	OFFSET_PE	X
SMP_LAYOUT_INFO	DEPTH_THERM_METAL_BOTTOM	*
	DEPTH_THERM_METAL_TOP	*
	* these values shall be non-null only if THERM_PROBE_DESIGN = 1	
	DEPTH_RESIS_TOP	X
	DEPTH_THERM_PVC_TOP	X
	DEPTH_TOP_PIEZOMETER	X
	INSTALL_DATE	X
	LOC_CLIMATE_SENSORS	X
	LOC_INSTRUMENT_HOLE	X
	LOC_PIEZOMETER	X
	OFFSET_CLIMATE_SENSORS	X
	OFFSET_INSTRUMENT_HOLE	X
	OFFSET_PIEZOMETER	X
	PIEZO_DEPTH	X
	THERM_PROBE_DESIGN	X
SMP_MRCTEMP_AUTO_DAY_STAT	AVG_DAY_TEMPERATURE	X
	MAX_TEMPERATURE	X
	MAX_TIME	X
	MIN_TEMPERATURE	X
	MIN_TIME	X
	NO_TEMP_HOUR	X
SMP_MRCTEMP_AUTO_HOUR	AVG_HOUR_TEMPERATURE	X
	TEMPERATURE_TIME	X
	THERM_NO	X
SMP_MRCTEMP_DETPHS	INSTALL_DATE	X
	THERM_DETPH	X
	THERM_NO	X
SMP_MRCTEMP_MAN	INSTRUMENT_TYPE	X
	TEMPERATURE	X
	TEMPERATURE_TIME	X
	THERM_NO	X
SMP_TDR_AUTO	DIST_WAV_POINTS	X

	TDR_TIME	X
	TDR_NO	X
	WAVP_*	X
SMP_TDR_AUTO_CALIBRATION_TLE	CAL_SOIL_DIELECTRIC	X
SMP_TDR_AUTO_DIELECTRICS	APPARENT_LENGTH	X
	DIELECTRIC_CONSTANT	X
	INFLECTION_A	X
	INFLECTION_B	X
	TDR_PROBE_LENGTH	X
	TRACE_TYPE	X
SMP_TDR_AUTO_MOISTURE	GRAVIMETRIC_MOISTURE_CONTENT	X
	VOLUMETRIC_MOISTURE_CONTENT	X
	VOLUMETRIC_MOISTURE_MODEL	X
SMP_TDR_AUTO_MOISTURE_TLE	No level C checks	
SMP_TDR_DEPTHS_LENGTH	INSTALL_DATE	X
	TDR_DEPTH	X
	TDR_NO	X
	TDR_PROBE_LENGTH	X
SMP_TDR_MANUAL_DIELECTRIC	APARNT_LEN_ANALYSIS	*
	*required for MAN_TRACE_TYPE = 1, 3, 4, or 5	
	APARNT_LEN_MIN	**
	**required for MAN_TRACE_ TYPE = 2	
	CONDUCTIVITY	X
	DIELEC_CONST_ANALYSIS	*
	*required for MAN_TRACE_ TYPE = 1, 3, 4, or 5	
	DIELEC_CONST_MIN	**
	**required for MAN_TRACE_ TYPE = 2	
	TDR_PROBE_LENGTH	X
	TDR_NO	X
	MAN_TRACE_TYPE	X
	VELOCITY_PROP	X
SMP_TDR_MANUAL_MOISTURE	DATA_PROCESS_EXTRACT_DATE	X
	VOLUMETRIC_MOISTURE_MODEL	X
SMP_TDR_MOISTURE_SUPPORT	DRY_DENSITY_TDR	X
	SOIL_TYPE	X
	SOURCE_DRY_DENSITY_TDR	X
	SOURCE_SOIL_TYPE	X

D. Expanded Range Checks

Expanded range checks are applied to certain fields to identify data element values that fall outside an expected range. Field names are listed below the bolded table name. Expanded range checks for all SMP data tables are specified below.

Table	Units	Range
SMP_ATEMP_RAIN_DAY		
AVG_DAY_AIR_TEMP	°C	-50.0 - 70.0
MAX_AIR_TEMPERATURE	°C	-50.0 - 70.0
MAX_ATEMP_TIME	hr; min	0 - 24; 0 - 59; (except 0000)
MIN_AIR_TEMPERATURE	°C	-50.0 - 70.0
MIN_ATEMP_TIME	hr; min	0 - 24; 0 - 59; (except 0000)
NO_TEMP_HOUR		0 - 24
SMP_DATE		01-AUG-92 or later
TOTAL_RAIN	mm	0 - 2000
SMP_ATEMP_RAIN_HOUR		
ATEMP_RAIN_TIME	hr; min	0 - 24; 0 - 59
AVG_HOUR_AIR_TEMPERATURE	°C	-50.0 - 70.0
RAIN_HOUR	mm	0 - 100
SMP_DATE		01-AUG-92 or later
SMP_COMMENT		
COMMENT_TYPE		DATA or GENERAL
SMP_COMMENT_DATE		01-AUG-92 or later
SMP_DRY_DENSITY		
DENSITY_DEPTH	m	0.100 - 3.00
DRY_DENSITY	g/cm^3	1.00 - 2.50
INSTALL_DATE		01-AUG-92 or later
MOIST_CONT_DENSITY	%	0.0 - 50.0
SMP_ELEV_AC_DATA		
ELEV_ILE	m	0.0000 - 9.9999
ELEV_IWP	m	0.0000 - 9.9999
ELEV_ML	m	0.0000 - 9.9999
ELEV_OWP	m	0.0000 - 9.9999
ELEV_PE	m	0.0000 - 9.9999
LOC_ELEV	m	-15 - 170
SMP_DATE		01-AUG-92 or later
SURF_ELEV_TIME	hr; min	0 - 24; 0 - 59
SMP_ELEV_AC_OFFSET		
OFFSET_ILE	m	0.00 - 4.00
OFFSET_IWP	m	0.00 - 4.00
OFFSET_ML	m	0.00 - 4.00
OFFSET_OWP	m	0.00 - 4.00
OFFSET_PE	m	0.00 - 4.00
REF_ELEVATION	m	0.0000 - 9.9999
SMP_DATE		01-AUG-92 or later
SMP_ELEV_PCC_DATA		
ELEV_ILE	m	0.0000 - 9.9999

ELEV_ML	m	0.0000 - 9.9999
ELEV_PE	m	0.0000 - 9.9999
LOC_ELEV	m	-15 - 170
SMP_DATE		01-AUG-92 or later
SURF_ELEV_TIME	hr; min	0 - 24; 0 - 59

SMP_ELEV_PCC_OFFSET

OFFSET_ILE	m	0.00 - 4.00
OFFSET_ML	m	0.00 - 4.00
OFFSET_PE	m	0.00 - 4.00
REF_ELEVATION	m	0.0000 - 9.9999
SMP_DATE		01-AUG-92 or later

SMP_ERESIST_ABF_REF_VA

APPLIED_VOLTAGE	mV	1 - 3000
ERESIST_TIME	hr; min	0 - 24; 0 - 59
RESISTANCE_VOLT	mV	1 - 3000
SMP_DATE		01-APR-1999 or later

SMP_ERESIST_AUTO

ELECTRODE_END		2 - 36
ELECTRODE_START		1 - 35
ERESIST_TIME	hr; min	0 - 24; 0 - 59
SMP_DATE		01-AUG-92 or later
VOLTAGE	mV	0 - 3000

SMP_ERESIST_AUTO_ABF

ELECTRODE_END		2 - 36
ELECTRODE_START		1 - 35
ERESIST_TIME	hr; min	0 - 24; 0 - 59
RESISTANCE	Ohm	null, 0.01 - 999999.99
SMP_DATE		01-APR-1999 or later
VOLTAGE	mV	null, 1 - 3000

SMP_ERESIST_DEPTHS

ELCT_DEPTH	m	0.100 - 3.000
ELECTRODE_NO		1 - 36
INSTALL_DATE		01-AUG-92 or later

SMP_ERESIST_MAN_CONTACT

AMPS	A	0.0000001 - 5.0000000
ELECTRODE_END		2 - 36
ELECTRODE_START		1 - 35
ERESIST_TIME	hr; min	0 - 24; 0 - 59
RESISTANCE	omega	0.01 - 999999.99
SMP_DATE		01-AUG-92 or later
VOLTS	V	0.001 - 20.000

SMP_ERESIST_MAN_4POINT

AMPS	A	0.0000001 - 5.0000000
EAMP_END		4 - 36
EAMP_START		1 - 33
ERESIST_TIME	hr; min	0 - 24; 0 - 59
EVOLTAGE_END		3 - 35
EVOLTAGE_START		2 - 34
RESISTIVITY	omega-m	0.01 - 999999.99

SMP_DATE		01-AUG-92 or later
VOLTS	V	0.001 - 20.000

SMP_FREEZE_STATE

DEPTH_NO		1 - 35
INTERPRET_DEPTH	m	0.100 - 3.000
NORM_RESISTANCE		0.000 - 1.000
NORM_RESISTIVITY		0.000 - 1.000
NORM_VOLTAGE		0.000 - 1.000
INTERPRET_SOIL_TEMP	deg C	-50 - 70

SMP_FROST_PENETRATION

FREEZE_FROM	m	0.100 - 3.000
FREEZE_TO	m	0.100 - 3.000
FROZEN_LAYER_NO		1 - 4
DEPTHNO_FROM		1 - 35
DEPTHNO_TO		1 - 35

SMP_FROST_PRESENCE

No Level D Checks

SMP_GRAV_MOIST

INSTALL_DATE		01-AUG-92 or later
MOIST_CONTENT	%	0.00 - 99.99
TDR_NO		1 - 12

SMP_JOINT_FAULT_DATA

FAULT_IWP	mm	-30.0 - 30.0
FAULT_ML	mm	-30.0 - 30.0
FAULT_OWP	mm	-30.0 - 30.0
JOINT_TIME	hr; min	0 - 24; 0 - 59
LOC_JOINT	m	-15 - 170
SMP_DATE		01-AUG-92 or later

SMP_JOINT_FAULT_OFFSET

OFFSET_IWP	m	0.00 - 4.00
OFFSET_ML	m	0.00 - 4.00
OFFSET_OWP	m	0.00 - 4.00
SMP_DATE		01-AUG-92 or later

SMP_JOINT_GAGE_DATA

GAGE_ILE	mm	100.00 - 150.00
GAGE_ML	mm	100.00 - 150.00
GAGE_PE	mm	100.00 - 150.00
JOINT_TIME	hr; min	0 - 24; 0 - 59
LOC_JOINT	m	-15 - 170
SMP_DATE		01-AUG-92 or later

SMP_JOINT_GAGE_OFFSET

INSTALL_DATE		01-AUG-92 or later
OFFSET_ILE	m	0.00 - 4.00
OFFSET_ML	m	0.00 - 4.00
OFFSET_PE	m	0.00 - 4.00

SMP_LAYOUT_INFO

DEPTH_RESIS_TOP	m	0.100 - 0.500
DEPTH_THERM_METAL_BOTTOM	m	0.000 - 0.500
DEPTH_THERM_METAL_TOP	m	0.000 - 0.500
DEPTH_THERM_PVC_TOP	m	0.100 - 0.500
DEPTH_TOP_PIEZOMETER	m	-9.999 - 9.999
LOC_CLIMATE_SENSORS	m	-15 - 0 or 152 - 170
LOC_INSTRUMENT_HOLE	m	-15 - 0 or 152 - 170
LOC_PIEZOMETER	m	-15 - 170
OFFSET_CLIMATE_SENSORS	m	-9.99 - 0
OFFSET_INSTRUMENT_HOLE	m	0.00 - 4.00
OFFSET_PIEZOMETER	m	-9.99 - 0
PIEZO_DEPTH	m	0.00 - 7.00
THERM_PROBE_DESIGN		1 or 2

SMP_MRCTEMP_AUTO_DAY_STATS

AVG_DAY_TEMPERATURE	°C	-50.0 - 70.0
MAX_TEMPERATURE	°C	-50.0 - 70.0
MAX_TIME	hr; min	0 - 24; 0 - 59; (except 0000)
MIN_TEMPERATURE	°C	-50.0 - 70.0
MIN_TIME	hr; min	0 - 24; 0 - 59; (except 0000)
NO_TEMP_HOUR		0 - 24
SMP_DATE		01-AUG-92 or later
THERM_NO		1 - 24

SMP_MRCTEMP_AUTO_HOUR

AVG_HOUR_TEMPERATURE	°C	-50.0 - 70.0
SMP_DATE		01-AUG-92 or later
TEMPERATURE_TIME	hr; min	0 - 24; 0 - 59
THERM_NO		1 - 8

SMP_MRCTEMP_DETPHS

INSTALL_DATE		01-AUG-92 or later
THERM_DEPTH		0.000 - 3.000
THERM_NO		1 - 24

SMP_MRCTEMP_MAN

SMP_DATE		01-AUG-92 or later
TEMPERATURE	°C	-50.0 - 70.0
TEMPERATURE_TIME	hr; min	0 - 24; 0 - 59
THERM_NO		1 - 24

SMP_TDR_AUTO

DIST_WAV_POINTS	m	0.01 - 0.05
SMP_DATE		01-AUG-92 or later
TDR_TIME	hr; min	0 - 24; 0 - 59
TDR_NO		1 - 12
WAVP_*	m*p*	0 - 10000

SMP_TDR_AUTO_CALIBRATION_TLE

TDR_NO		1 – 10
CAL_DRY_DENSITY	Kg/m^3	1000 - 2500
CAL_VOLUMETRIC_MOISTURE_CONTENT	%	1 – 200
CAL_DIELECTRIC_SOLIDS		3.70 – 4.30
CAL_DIELECTRIC_WATER		78.00 – 82.00
CAL_DIELECTRIC_AIR		1.00

CAL_SPECIFIC_GRAVITY		2.300 – 2.900
SOURCE_DRY_DENSITY_TDR		1 – 4, 6, 8, 12, 13

SMP_TDR_AUTO_DIELECTRICS

APPARENT_LENGTH	m	0.20 - 1.70
DIELECTRIC_CONSTANT		1.0 - 70.0
INFLECTION_A	m	0.00 - 2.50
INFLECTION_B	m	0.00 - 2.50
SMP_DATE		>= 01-AUG-1992
TDR_NO		1 - 12
TDR_PROBE_LENGTH	m	0.100 - 0.300
TDR_TIME		first two digits 0 – 23; last two digits 0 - 59
TRACE_TYPE		1 - 4

SMP_TDR_AUTO_MOISTURE

GRAVIMETRIC_MOISTURE_MODEL	%	0.0 - 50.0
SMP_DATE		>= 01-AUG-1992
TDR_TIME		first two digits 0 – 23; last two digits 0 – 59
TDR_NO		1 - 12
VOLUMETRIC_MOISTURE_CONTENT	%	0.0 - 70.0
VOLUMETRIC_MOISTURE_MODEL		1 – 4

SMP_TDR_AUTO_MOISTURE_TLE

TDR_NO		1 – 10
SOIL_DIELECTRIC_CONSTANT		1.0 – 80.0
DRY_DENSITY	Kg/m^3	1000 - 2500
VOLUMETRIC_MOISTURE_CONTENT	%	0.0 - 70.0
GRAVIMETRIC_MOISTURE_CONTENT	%	0.0 – 50.0

SMP_TDR_DEPTHS_LENGTH

INSTALL_DATE		01-AUG-92 or later
TDR_DEPTH		0.100 - 3.000
TDR_NO	hr; min	1 - 12
TDR_PROBE_LENGTH	m	0.100 - 0.300

SMP_TDR_MANUAL_DIELECTRIC

APARNT_LEN_ANALYSIS	m	null, 0.20 - 1.80
APARNT_LEN_MAX	m	null, 0.20 - 1.80
APARNT_LEN_MIN	m	null, 0.20 - 1.80
CONDUCTIVITY		LOW or HIGH
DIELEC_CONST_ANALYSIS		null, 1.0 - 80.0
DIELEC_CONST_MIN		null, 1.0 - 80.0
DIELEC_CONST_MAX		null, 1.0 - 80.0
TDR_PROBE_LENGTH	m	0.200 - 0.207
MAN_TRACE_TYPE		1,2,3,4, or 5
SMP_DATE		01-AUG-1992 or later
TDR_NO		1 - 10
TDR_TIME		First two digits: 0 - 24, last two digits: 0 - 59
VELOCITY_PROP		0.60 - 0.99

SMP_TDR_MANUAL_MOISTURE[1]

[1] Manual upgrades should not be permitted for records failing these Level D checks.

DATA_PROCESS_EXTRACT_DATE		>14-JUN-1999
GRAV_MOIST_CONTENT_ANALYSIS	%	0.0 - 50.0
GRAV_MOIST_CONTENT_MAX	%	0.0 - 50.0
GRAV_MOIST_CONTENT_MIN	%	0.0 - 50.0
SMP_DATE		>01-AUG-1992
TDR_NO		1 - 12
TDR_TIME	hr; min	First two digits 0 - 23, Last two digits 0 - 59
VOLUM_MOIST_CONTENT_ANALYSIS	%	0.0 - 70.0
VOLUM_MOIST_CONTENT_MAX	%	0.0 - 70.0
VOLUM_MOIST_CONTENT_MIN	%	0.0 - 70.0

SMP_TDR_MOISTURE_SUPPORT

ANALYSIS_LIQUID_LIMIT	%	0.0 - 100.0
ANALYSIS_NO_4_PASSING	%	10.0 - 100.0
ANALYSIS_NO_10_PASSING	%	5.0 - 100.0
ANALYSIS_NO_200_PASSING	%	0.0 - 100.0
ANALYSIS_ONE_AND_HALF_PASSING	%	40.0 - 100.0
ANALYSIS_ONE_HALF_PASSING	%	20.0 - 100.0
ANALYSIS_PLASTIC_LIMIT	%	0.0 - 100.0
DRY_DENSITY_TDR	kg/m^3	1000 - 2500
SOIL_TYPE		Coarse or Fine
SOURCE_SOIL_TYPE		1, 2
SOURCE_DRY_DENSITY_TDR		1 - 11
TDR_NO		1 - 12

SMP_WATERTAB_DEPTH_MAN

PIEZO_DEPTH	m	null, 0.00 - 7.00
PIEZO_TIME	hr,min	0 - 24; 0 - 59
SMP_DATE		01-AUG-92 or later
WATERTAB_DEPTH	m	null, 0.00 - 7.00

E. Intramodular Checks

Intramodular checks for all SMP data tables are specified below.

Table: SMP_ATEMP_RAIN_DAY

- For matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO SMP_DATE $\geq$ INSTALL_DATE in **SMP_LAYOUT_INFO** table

  Error message: **SMP_ATEMP_RAIN_DAY**-E-1, No record found in **SMP_LAYOUT_INFO**, or data collection date not $\geq$ installation date.

- For matching SHRP_ID, STATE CODE, CONSTRUCTION_NO, and SMP_DATE, count the number
  of records in **SMP_ATEMP_RAIN_HOUR** table
  If count $\geq$ 20 then
  MIN_AIR_TEMPERATURE, AVG_DAY_AIR_TEMPERATURE, and
  MAX_AIR_TEMPERATURE must be non-null

  Error message: **SMP_ATEMP_RAIN_DAY**-E-2, Daily statistics missing for day with 20 or more hours of data

- If count < 20 then
  MIN_AIR_TEMPERATURE, AVG_DAY_AIR_TEMPERATURE, and
  MAX_AIR_TEMPERATURE must be null

  Error message: **SMP_ATEMP_RAIN_DAY**-E-3, Daily statistics not permitted for day with less than 20 hours of data

- MIN_AIR_TEMPERATURE ≤ AVG_DAY_AIR_TEMPERATURE ≤
  MAX_AIR_TEMPERAUTRE

  Error message: **SMP_ATEMP_RAIN_DAY**-E-4, Daily air temperatures fail minimum air temperature ≤ average daily air temperature ≤ maximum air temperature

- For matching SHRP_ID, STATE_CODE, CONSTRCUTION_NO, and SMP_DATE records in **SMP_ATEMP_RAIN_HOUR** table, compute sum of values in the RAIN_HOUR field (sum_RAIN_HOUR). Compare the value of TOTAL_RAIN from **SMP_ATEMP_RAIN_DAY** to sum_RAIN_HOUR as follows: ABS(TOTAL_RAIN-sum_RAIN_HOUR)≤ 2

  Error message: **SMP_ATEMP_RAIN_DAY**-E-5, Daily rainfall total not equal to sum of hourly rainfall

---

Table: SMP_ATEMP_RAIN_HOUR

- For matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO
  SMP_DATE ≥ INSTALL_DATE in **SMP_LAYOUT_INFO** table

  Error message: **SMP_ATEMP_RAIN_HOUR**-E-1, No record found in **SMP_LAYOUT_INFO**, or data collection date not ≥ installation date.

Table: SMP_DRY_DENSITY

- For matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO, ABS(INSTALL_DATE-**SMP_LAYOUT_INFO**.INSTALL_DATE) ≤ 1

  Error message: **SMP_DRY_DENSITY**-E-1, ABS(install_date - SMP_LAYOUT_INFO.INSTALL_DATE) <= 1, Installation date not close enough to site installation date

- For matching SHRP_ID, STATE_CODE and CONSTRUCTION_NO
  DENSITY_DEPTH > TDR_DEPTH where TDR_NO = 1 and
  DENSITY_DEPTH < TDR_DEPTH where TDR_NO = 10
  in **SMP_TDR_DEPTHS_LENGTH** table

  Error message: **SMP_DRY_DENSITY**-E-2, Density depth exceeded instrument hole depth

Table: SMP_ELEV_AC_DATA

- For matching SHRP_ID, STATE_CODE and CONSTRUCTION _NO, SMP_DATE ≥ INSTALL_DATE in **SMP_LAYOUT_INFO** table

  Error message: **SMP_ELEV_AC_DATA**-E-1, No record found in **SMP_LAYOUT_INFO**, or data collection date not ≥ installation date

---

Table: SMP_ELEV_AC_OFFSET

- For matching SHRP_ID, STATE_CODE and CONSTRUCTION _NO, SMP_DATE > INSTALL_DATE in SMP_LAYOUT_INFO table

  Error message: **SMP_ELEV_AC_OFFSET**-E-1, No record found in **SMP_LAYOUT_INFO**, or data collection date not ≥ installation date

- For matching SHRP_ID, STATE_CODE and CONSTRUCTION _NO
  GPS_SPS = 'G' and EXPERIMENT_NO = 1 in **EXPERIMENT_SECTION** or
  GPS_SPS = 'G' and EXPERIMENT_NO = 2 in **EXPERIMENT_SECTION** or
  GPS_SPS = 'S' and EXPERIMENT_NO = 1 in **EXPERIMENT_SECTION** or
  GPS_SPS = 'S' and EXPERIMENT_NO = 8 in **EXPERIMENT_SECTION**

  Error message: **SMP_ELEV_AC_OFFSET**-E-2, SMP section does not match permitted types in **EXPERIMENT_SECTION**

- OFFSET_PE < OFFSET_OWP < OFFSET_ML < OFFSET_IWP < OFFSET_ILE

  Error message: **SMP_ELEV_AC_OFFSET**-E-3, AC pavement elevation survey offsets not OFFSET_PE < OFFSET_OWP < OFFSET_ML < OFFSET_IWP < OFFSET_ILE

Table: SMP_ELEV_PCC_DATA

- For matching SHRP_ID, STATE_CODE and CONSTRUCTION _NO, SMP_DATE ≥ INSTALL_DATE in **SMP_LAYOUT_INFO** table

  Error message: **SMP_ELEV_PCC_DATA**-E-1, No record found in **SMP_LAYOUT_INFO**, or data collection date not ≥ installation date

---

Table: SMP_ELEV_PCC_OFFSET

- For matching SHRP_ID, STATE_CODE and CONSTRUCTION _NO, SMP_DATE ≥ INSTALL_DATE in **SMP_LAYOUT_INFO** table

  Error message: **SMP_ELEV_PCC_OFFSET**-E-1, No record found in **SMP_LAYOUT_INFO**, or data collection date not ≥ installation date

- For matching SHRP_ID, STATE_CODE and CONSTRUCTION _NO, GPS_SPS = 'G' and EXPERIMENT_NO = 3 in **EXPERIMENT_SECTION** or
  GPS_SPS = 'G' and EXPERIMENT_NO = 4 in **EXPERIMENT_SECTION** or

GPS_SPS = ‘S’ and EXPERIMENT_NO = 2 in **EXPERIMENT_SECTION**

Error message: **SMP_ELEV_PCC_OFFSET**-E-2, SMP section does not match permitted types in **EXPERIMENT_SECTION**

- OFFSET_PE < OFFSET_ML < OFFSET_ILE

  Error message: **SMP_ELEV_PCC_OFFSET**-E-3, PCC elevation survey offsets not OFFSET_PE < OFFSET_ML < OFFSET_ILE

Table: SMP_ERESIST_ABF_REF_VA

- ABS{[RESISTANCE_VOLT/(APPLIED_VOLTAGE-RESISTANCE_VOLT)]-1} <= 0.05

  Error message: **SMP_ERESIST_ABF_REF_VA**-E-5, Resistance value calculated for the internal reference resistor is at least 5% greater than actual value of the resistor for {STATE_CODE, SHRP_ID, SMP_DATE, ERESIST_TIME}

Tables: SMP_ERESIST_ABF_REF_VA, EXPERIMENT_SECTION

- For matching SHRP_ID, STATE_CODE, and CONSTRUCTION_NO, **EXPERIMENT_SECTION**. SEAS_ID must be non-null

  Error message: **SMP_ERESIST_ABF_REF_VA**-E-2, {SHRP_ID, STATE_CODE, CONSTRUCTION_NO} not labeled as SMP site in **EXPERIMENT_SECTION**

Tables: SMP_ERESIST_ABF_REF_VA, **SMP_ERESIST_AUTO_ABF**

- For matching SHRP_ID, STATE_CODE, SMP_DATE, and ERESIST_TIME
  If **SMP_ERESIST_ABF_REF_VA**.APPLIED_VOLTAGE and
  SMP_ERESIST_ABF_REF_VA.RESISTANCE_VOLT are null then
  SMP_ERESIST_AUTO_ABF.VOLTAGE and
  SMP_ERESIST_AUTO_ABF.RESISTANCE must be null for all values of
  SMP_ERESIST_AUTO_ABF.ELECTRODE_START

  Error message: **SMP_ERESIST_ABF_REF_VA**-E-4, Voltage and resistance data for {STATE_CODE, SHRP_ID, SMP_DATE, ERESIST_TIME} in **SMP_ERESIST_ABF_REF_VA** are null while matching data in **SMP_ERESIST_AUTO_ABF** are not

---

Tables: SMP_ERESIST_ABF_REF_VA, SMP_LAYOUT_INFO

- For matching SHRP_ID and STATE_CODE and CONSTRUCTION_NO, SMP_LAYOUT_INFO. RECORD_STATUS = E

  Error message: **SMP_ERESIST_ABF_REF_VA**-E-3, Matching record with RECORD_STATUS = E does not exist in **SMP_LAYOUT_INFO** for {STATE_CODE, SHRP_ID, CONSTRUCTION_NO}

- For matching SHRP_ID, STATE_CODE, and CONSTRUCTION_NO, SMP_DATE >= **SMP_LAYOUT_INFO**.INSTALL_DATE

Error message: **SMP_ERESIST_ABF_REF_VA**-E-1, No record found in **SMP_LAYOUT_INFO**, or data collection date not greater than or equal to installation date for {STATE_CODE, SHRP_ID, CONSTRUCTION_NO}

Table: SMP_ERESIST_AUTO

- For matching SHRP_ID, STATE_CODE and CONSTRUCTION _NO, SMP_DATE ≥ INSTALL_DATE in SMP_LAYOUT_INFO table

  Error message: **SMP_ERESIST_AUTO**-E-1, No record found in **SMP_LAYOUT_INFO**, or data collection date not ≥ installation date

---

Table: SMP_ERESIST_AUTO_ABF

- If VOLTAGE is null, then RESISTANCE must be null

  Error message: **SMP_ERESIST_AUTO_ABF**-E-4, Voltage is null while resistance is not for {STATE_CODE, SHRP_ID, SMP_DATE, ERESIST_TIME, ELECTRODE_START, ELECTRODE_END}

- If RESISTANCE is null, then VOLTAGE must be null

  Error message: **SMP_ERESIST_AUTO_ABF**-E-5, Resistance is null while voltage is not for {STATE_CODE, SHRP_ID, SMP_DATE, ERESIST_TIME, ELECTRODE_START, ELECTRODE_END}

Tables: SMP_ERESIST_AUTO_ABF, **EXPERIMENT_SECTION**

- For matching SHRP_ID, STATE_CODE, and CONSTRUCTION_NO, EXPERIMENT_SECTION. SEAS_ID must be non-null

  Error message: **SMP_ERESIST_AUTO_ABF**-E-1, {SHRP_ID, STATE_CODE, CONSTRUCTION_NO} not labeled as SMP site in **EXPERIMENT_SECTION**

Tables: SMP_ERESIST_AUTO_ABF, SMP_ERESIST_ABF_REF_VA

- If SMP_ERESIST_AUTO_ABF.VOLTAGE and SMP_ERESIST_AUTO_ABF.RESISTANCE for all
  values of **SMP_ERESIST_AUTO_ABF**.ELECTRODE_START are null then
  SMP_ERESIST_ABF_REF_VA.APPLIED_VOLTAGE and
  SMP_ERESIST_ABF_REF_VA.RESISTANCE_VOLT must be null

  Error message: **SMP_ERESIST_AUTO_ABF**-E-6, Voltage and resistance data for {STATE_CODE, SHRP_ID, SMP_DATE, ERESIST_TIME} in **SMP_ERESIST_AUTO_ABF** are null while matching data in **SMP_ERESIST_ABF_REF_VA** are not

---

Tables: SMP_ERESIST_AUTO_ABF, SMP_LAYOUT_INFO

- For matching SHRP_ID and STATE_CODE and CONSTRUCTION_NO
  SMP_LAYOUT_INFO.RECORD_STATUS = E

Error message: **SMP_ERESIST_AUTO_ABF**-E-2, Matching record with RECORD_STATUS = E does not exist in **SMP_LAYOUT_INFO** for {STATE_CODE, SHRP_ID, CONSTRUCTION_NO}

- For matching SHRP_ID, STATE_CODE, and CONSTRUCTION_NO
  SMP_DATE >= **SMP_LAYOUT_INFO**.INSTALL_DATE

  Error message: **SMP_ERESIST_AUTO_ABF**-E-3, No record found in **SMP_LAYOUT_INFO**, or data collection date not ≥ installation date

---

Table: SMP_ERESIST_DEPTHS

- For matching SHRP_ID, STATE_CODE and CONSTRUCTION _NO
  ABS(INSTALL_DATE-SMP_LAYOUT_INFO.INSTALL_DATE) ≤ 1

  Error message: **SMP_ERESIST_DEPTHS**-E-1, ABS(install_date - SMP_LAYOUT_INFO.INSTALL_DATE) <= 1; Installation date not close enough to site installation date

- For matching SHRP_ID, STATE_CODE and CONSTRUCTION _NO
  for ELECTRODE_NO = 1, ELCT_DEPTH > DEPTH_RESIS_TOP in **SMP_LAYOUT_INFO** table

  Error message: **SMP_ERESIST_DEPTHS**-E-2, First electrode depth not > resistivity probe top depth

---

Table: SMP_ERESIST_MAN_4POINT

- For matching SHRP_ID, STATE_CODE and CONSTRUCTION _NO, SMP_DATE > INSTALL_DATE in SMP_LAYOUT_INFO table

  Error message: **SMP_ERESIST_MAN_4POINT**-E-1, No record found in **SMP_LAYOUT_INFO**, or data collection date not ≥ installation date

---

Table: SMP_ERESIST_MAN_CONTACT

- For matching SHRP_ID, STATE_CODE and CONSTRUCTION _NO, SMP_DATE > INSTALL_DATE in SMP_LAYOUT_INFO table

  Error message: **SMP_ERESIST_MAN_CONTACT**-E-1**,** No record found in **SMP_LAYOUT_INFO**, or data collection date not ≥ installation date

---

Tables: SMP_FREEZE_STATE, SMP_LAYOUT_INFO

- There must be a record in **SMP_LAYOUT_INFO** with matching STATE_CODE, SHRP_ID, and with INSTALL_DATE < SMP_DATE

  Error message: **SMP_FREEZE_STATE**-E-101, There is no matching record in SMP_LAYOUT_INFO, or SMP_DATE not greater than INSTALL_DATE.

Tables: SMP_FREEZE_STATE, SMP_ERESIST_AUTO, SMP_ERESIST_MAN_4POINT, SMP_ERESIST_MAN_CONTACT, SMP_ERESIST_AUTO_ABF

- Where NORM_RESISTANCE, NORM_RESISTIVITY, or NORM_VOLTAGE is not null, there must be a record in SMP_ERESIST_AUTO, SMP_ERESIST_MAN_4POINT, SMP_ERESIST_MAN_CONTACT, or SMP_ERESIST_AUTO_ABF with matching STATE_CODE, SHRP_ID and SMP_DATE

  Error message: **SMP_FREEZE_STATE**-E-102, There must be a matching record in SMP_ERESIST_AUTO, SMP_ERESIST_MAN_4POINT, SMP_ERESIST_MAN_CONTACT, or SMP_ERESIST_AUTO_ABF.

*Note to Programmer: Since **SMP_FREEZE_STATE** was derived from **SMP_ERESIST_AUTO, SMP_ERESIST_MAN_4POINT,** and/or **SMP_ERESIST_MAN_CONTACT**, a record for that date should exist in at least one of these tables.*

Tables: SMP_FREEZE_STATE, SMP_MRCTEMP_AUTO_DAY_STATS

- Where TEMPERATURE_SOURCE = 1, there must be a record in SMP_MRCTEMP_AUTO_DAY_STATS with matching SHRP_ID, STATE_CODE, AND SMP_DATE

  Error message: **SMP_FREEZE_STATE**-E-103, There must be a matching record in SMP_MRCTEMP_AUTO_DAY_STATS.

Tables: SMP_FREEZE_STATE, EXPERIMENT_SECTION

- For matching SHRP_ID, STATE_CODE and CONSTRUCTION _NO **EXPERIMENT_SECTION**.SEAS_ID must be non-null

  Error message: **SMP_FREEZE_STATE**-E-104, Test section is not identified as an SMP section in EXPERIMENT_SECTION.

Table: SMP_FREEZE_STATE

- Where FREEZE_STATE = “F” and INTERPRET_BASIS = “1", SOIL_TEMPERATURE must be less than 0

  Error message: **SMP_FREEZE_STATE**-E-105, For FREEZE_STATE = ‘F’ and INTERPRET_BASIS = ‘1’, SOIL_TEMPERATURE must be less than zero.

- Where FREEZE_STATE = “N” and INTERPRET_BASIS = “1", SOIL_TEMPERATURE must be greater than 0

  Error message: **SMP_FREEZE_STATE**-E-106, For FREEZE_STATE = ‘N’ and INTERPRET_BASIS = ‘1’, SOIL_TEMPERATURE must be greater than zero.

Table: SMP_FROST_PENETRATION

- FREEZE_FROM must be less than FREEZE_TO

  Error message: **SMP_FROST_PENETRATION**-E-101, FREEZE_FROM must be less than FREEZE_TO.

Tables: SMP_FROST_PENETRATION, SMP_FROST_PRESENCE

- For matching SHRP_ID, STATE_CODE and SMP_DATE, SMP_FROST_PRESENCE.RECORD_STATUS must be “E”

  Error message: **SMP_FROST_PENETRATION**-E-102, All matches in SMP_FROST_PRESENCE must be at Level E.

Tables: SMP_FROST_PRESENCE, SMP_FREEZE_STATE

- There must be a record in **SMP_FREEZE_STATE** with matching STATE_CODE, SHRP_ID, and SMP_DATE

  Error message: **SMP_FROST_PRESENCE** -E-101, There is no matching record in SMP_FREEZE_STATE.

- For matching STATE_CODE, SHRP_ID and SMP_DATE, SMP_FREEZE_STATE.RECORD_STATUS must be “E”

  Error message: **SMP_FROST_PRESENCE**-E-102, All matches in SMP_FREEZE_STATE must be at Level E.

Table: SMP_GRAV_MOIST

- For matching SHRP_ID, STATE_CODE and CONSTRUCTION _NO, ABS(INSTALL_DATE-SMP_LAYOUT_INFO.INSTALL_DATE)<=1

  Error message: **SMP_GRAV_MOIST**-E-1, ABS(install_date - SMP_LAYOUT_INFO.INSTALL_DATE) <= 1; Installation date not close enough to site installation date

---

Table: SMP_JOINT_FAULT_DATA

- For matching SHRP_ID, STATE_CODE and CONSTRUCTION _NO, SMP_DATE > INSTALL_DATE in SMP_LAYOUT_INFO table

  Error message: **SMP_JOINT_FAULT_DATA**-E-1, No record found in **SMP_LAYOUT_INFO**, or data collection date not $\geq$ installation date

---

Table: SMP_JOINT_FAULT_OFFSET

- For matching SHRP_ID, STATE_CODE and CONSTRUCTION _NO, SMP_DATE > INSTALL_DATE in SMP_LAYOUT_INFO table

Error message: **SMP_JOINT_FAULT_OFFSET**-E-1, No record found in **SMP_LAYOUT_INFO**, or data collection date not ≥ installation date

- For matching SHRP_ID, STATE_CODE and CONSTRUCTION _NO
  GPS_SPS = 'G' and EXPERIMENT_NO = 3 in **EXPERIMENT_SECTION** or
  GPS_SPS = 'G' and EXPERIMENT_NO = 4 in **EXPERIMENT_SECTION** or
  GPS_SPS = 'S' and EXPERIMENT_NO = 2 in **EXPERIMENT_SECTION**

  Error message: **SMP_JOINT_FAULT_OFFSET**-E-2, SMP section does not match permitted types in **EXPERIMENT_SECTION**

- OFFSET_OWP < OFFSET_ML < OFFSET_IWP

  Error message: **SMP_JOINT_FAULT_OFFSET**-E-3, Joint fault offsets not OFFSET_OWP < OFFSET_ML < OFFSET_IWP

Table: SMP_JOINT_GAGE_DATA

- For matching SHRP_ID, STATE_CODE and CONSTRUCTION _NO, SMP_DATE ≥ INSTALL_DATE in **SMP_LAYOUT_INFO** table

  Error message: **SMP_JOINT_GAGE_DATA**-E-1, No record found in **SMP_LAYOUT_INFO**, or data collection date not ≥ installation date

---

Table: SMP_JOINT_GAGE_OFFSET

- For matching SHRP_ID, STATE_CODE and CONSTRUCTION _NO, SMP_DATE ≥ INSTALL_DATE in **SMP_LAYOUT_INFO** table

  Error message: **SMP_JOINT_GAGE_OFFSET**-E-1, No record found in **SMP_LAYOUT_INFO**, or data collection date not ≥ installation date

- For matching SHRP_ID, STATE_CODE and CONSTRUCTION _NO
  GPS_SPS = 'G' and EXPERIMENT_NO = 3 in **EXPERIMENT_SECTION** or
  GPS_SPS = 'G' and EXPERIMENT_NO = 4 in **EXPERIMENT_SECTION** or
  GPS_SPS = 'S' and EXPERIMENT_NO = 2 in **EXPERIMENT_SECTION**

  Error message: **SMP_JOINT_GAGE_OFFSET**-E-2, SMP section does not match permitted types in **EXPERIMENT_SECTION**

- OFFSET_PE < OFFSET_ML < OFFSET_ILE

  Error message: **SMP_JOINT_GAGE_OFFSET**-E-3, Joint gage offsets not OFFSET_PE < OFFSET_ML < OFFSET_ILE

Table: SMP_LAYOUT_INFO

- For matching SHRP_ID, STATE_CODE and CONSTRUCTION _NO, INSTALL_DATE ≥ CN_ASSIGN_DATE in **EXPERIMENT_SECTION** table

  Error message: **SMP_LAYOUT_INFO**-E-1, Installation date not >= construction number assign date

- For matching SHRP_ID, STATE_CODE and CONSTRUCTION _NO, if LOC_INSTRUMENT_HOLE < 0 then LOC_PIEZOMETER > 0 and < 35 AND LOC_CLIMATE_SENSORS < 0 and > -15

  Error message: **SMP_LAYOUT_INFO**-E-2, Instrument installation location data not consistent

- if LOC_INSTRUMENT_HOLE . 150, then LOC_PIEZOMETER > 120 and < 155 AND LOC_CLIMATE_SENSORS > 150 and < 170

  Error message: **SMP_LAYOUT_INFO**-E-3, Instrument installation location data not consistent

- DEPTH_THERM_METAL_TOP < DEPTH_THERM_METAL_BOTTOM

  Error message: **SMP_LAYOUT_INFO**-E-4, Depth of metal MRC thermistor top not < depth of metal bottom

- DEPTH_THERM_PVC_TOP > DEPTH_THERM_METAL_BOTTOM

  Error message: **SMP_LAYOUT_INFO**-E-5, Depth of PVC thermistor top not > depth of metal bottom

- If DEPTH_RESIS_TOP is not null, then DEPTH_RESIS_TOP > DEPTH_THERM_METAL_BOTTOM

  Error message: **SMP_LAYOUT_INFO**-E-6, Depth of resistivity probe top not > depth of metal thermistor bottom

---

Table: SMP_MRCTEMP_AUTO_DAY_STATS

- For matching SHRP_ID, STATE_CODE and CONSTRUCTION _NO, SMP_DATE ≥ INSTALL_DATE in **SMP_LAYOUT_INFO** table

  Error message: **SMP_MRCTEMP_AUTO_DAY_STATS**-E-1, No record found in **SMP_LAYOUT_INFO**, or data collection date not ≥ installation date

- For each THERM_NO, MIN_TEMPERATURE ≤ AVG_DAY_TEMPERATURE ≤ MAX_TEMPERATURE

  Error message: **SMP_MRCTEMP_AUTO_DAY_STATS**-E-2, Daily MRC temperatures fail minimum temperature < average daily temperature < maximum temperature

- For THERM_NO = X, MAX_TEMPERATURE - MIN_TEMPERATURE ≤ Y

  Error message: **SMP_MRCTEMP_AUTO_DAY_STATS**-E-3, For THERM_NO X, difference between daily max. and daily min. temperature not ≤ Y where:
  X is a give MRC sensor number.
  Y is the specified temperature range for a sensor X as shown in Table 22-1.

Table 22-1. Checks for table **SMP_MRCTEMP_AUTO_DAY_STATS.**

MRC Thermistor No. (THERM_NO (X))	Y IN deg C
1	50
2	40
3	30
4	25
5	20
6	10
7	8
8	5
9	4
10	3
11	3
12	2
13	2
14	2
15	2
16	2
17	2
18	2

Table: SMP_MRCTEMP_AUTO_HOUR

- For matching SHRP_ID, STATE_CODE and CONSTRUCTION _NO, SMP_DATE ≥ INSTALL_DATE in **SMP_LAYOUT_INFO** table

  Error message: **SMP_MRCTEMP_AUTO_HOUR**-E-1, No record found in **SMP_LAYOUT_INFO**, or data collection date not ≥ installation date

---

Table: SMP_MRCTEMP_DEPTHS

- For matching SHRP_ID, STATE_CODE and CONSTRUCTION _NO, ABS(INSTALL_DATE-**SMP_LAYOUT_INFO**.INSTALL_DATE) ≤ 1

  Error message: **SMP_MRCTEMP_DEPTHS**-E-1, ABS(install_date - SMP_LAYOUT_INFO.INSTALL_DATE) <= 1; Installation date not close enough to site installation date

- For matching SHRP_ID, STATE_CODE and CONSTRUCTION _NO, THERM_DEPTH for THERM_NO = 4 ≥ DEPTH_THERM_PVC_TOP in **SMP_LAYOUT_INFO** table

  Error message: **SMP_MRCTEMP_DEPTHS**-E-2, Thermistor sensor 4 depth not ≥ PVC thermistor top depth

---

Table: SMP_MRCTEMP_MAN

- For matching SHRP_ID, STATE_CODE and CONSTRUCTION _NO, SMP_DATE ≥ INSTALL_DATE in **SMP_LAYOUT_INFO** table

  Error message: **SMP_MRCTEMP_MAN**-E-1, No record found in **SMP_LAYOUT_INFO**, or data collection date not ≥ installation date

---

Table: SMP_TDR_AUTO

- For matching SHRP_ID, STATE_CODE and CONSTRUCTION _NO, SMP_DATE ≥ INSTALL_DATE in **SMP_LAYOUT_INFO** table

  Error message: **SMP_TDR_AUTO**-E-1, No record found in **SMP_LAYOUT_INFO**, or data collection date not ≥ installation date

---

Tables: SMP_TDR_AUTO_CALIBRATION_TLE, SMP_TDR_DEPTHS_LENGTH

- There must be a record in **SMP_TDR_DEPTHS_LENGTH** with matching STATE_CODE, SHRP_ID, and TDR_NO with RECORD_STATUS = 'E'

  Error message: **SMP_TDR_AUTO_CALIBRATION_TLE**-E-101 {STATE_CODE, SHRP_ID, TDR_NO}, There is no matching location in **SMP_TDR_DEPTHS_LENGTH** at level E.

Tables: SMP_TDR_AUTO_DIELECTRIC, SMP_TDR_AUTO

- For matching STATE_CODE, SHRP_ID, and CONSTRUCTION _NO, SMP_DATE ≥ **SMP_LAYOUT_INFO**.INSTALL_DATE

  Error message: **SMP_TDR_AUTO_DIELECTRIC**-E-1, No record found in **SMP_LAYOUT_INFO**, or data collection date not ≥ installation date

- For each instance of STATE_CODE, SHRP_ID, CONSTRUCTION _NO, SMP_DATE, TDR_TIME, TDR_NO, there should be a record with the same key field values in table **SMP_TDR_AUTO**

Error message: **SMP_TDR_AUTO_DIELECTRIC**-E-2, No data exists in table **SMP_TDR_AUTO** for this set of key fields.

Tables: SMP_TDR_AUTO_DIELECTRIC, SMP_TDR_DEPTHS_LENGTH

- For matching SHRP_ID, STATE_CODE, CONSTRUCTION _NO, and TDR_NO, a matching record must exist in **SMP_TDR_DEPTHS_LENGTH**

  Error message: **SMP_TDR_AUTO_DIELECTRIC**-E-3, Matching record does not exist in **SMP_TDR_DEPTHS_LENGTH** for CONSTRUCTION_NO = {value}

- For matching SHRP_ID, STATE_CODE, CONSTRUCTION _NO, and TDR_NO, TDR_PROBE_LENGTH = **SMP_TDR_DEPTHS_LENGTH**.TDR_PROBE_LENGTH

  Error message: **SMP_TDR_AUTO_DIELECTRIC**-E-4, TDR probe length does not match length in **SMP_TDR_DEPTHS_LENGTH**

Tables: SMP_TDR_AUTO_MOISTURE, SMP_LAYOUT_INFO

- For matching STATE_CODE, SHRP_ID, and CONSTRUCTION _NO, SMP_DATE $\geq$ **SMP_LAYOUT_INFO**.INSTALL_DATE

  Error message: **SMP_TDR_AUTO_MOISTURE**-E-1, No record found in **SMP_LAYOUT_INFO**, or data collection date not $\geq$ installation date or no matching record in **SMP_LAYOUT_INFO**

Tables: SMP_TDR_AUTO_MOISTURE, SMP_TDR_AUTO_DIELECTRIC

- For matching SHRP_ID, STATE_CODE, SMP_DATE, TDR_TIME, and TDR_NO, a record must exist in **SMP_TDR_AUTO_DIELECTRIC** with **SMP_TDR_AUTO_DIELECTRIC**.RECORD_STATUS = E

  Error message: **SMP_TDR_AUTO_MOISTURE**-E-3, Matching record with RECORD_STATUS = E does not exist in **SMP_TDR_AUTO_DIELECTRIC**

  *Note to Programmer: level E QC checks for **SMP_TDR_AUTO_DIELECTRIC** must be executed prior to those for **SMP_TDR_AUTO_MOISTURE** to satisfy this check.)*

Tables: SMP_TDR_AUTO_MOISTURE, SMP_TDR_DEPTHS_LENGTH

- Matching record must exist in **SMP_TDR_DEPTHS_LENGTH** and **SMP_TDR_DEPTHS_LENGTH**. TDR_DEPTH must be non-null

  Error message: **SMP_TDR_AUTO_MOISTURE**-E-2, Matching record does not exist in **SMP_TDR_DEPTHS_LENGTH** with non-null TDR_DEPTH for CONSTRUCTION _NO = {value}

Table: SMP_TDR_AUTO_MOISTURE, SMP_TDR_MOISTURE_SUPPORT

- For matching SHRP_ID, STATE_CODE, and TDR_NO, a record must exist in **SMP_TDR_MOISTURE_SUPPORT** with **SMP_TDR_MOISTURE_SUPPORT**.RECORD_STATUS = E

  Error message: **SMP_TDR_AUTO_MOISTURE**-E-4, Matching record with RECORD_STATUS = E does not exist in **SMP_TDR_MOISTURE_SUPPORT**

Tables: SMP_TDR_AUTO_MOISTURE_TLE, SMP_TDR_AUTO

- There must be a record in **SMP_TDR_AUTO** with matching STATE_CODE, SHRP_ID, SMP_DATE, TDR_NO, and TDR_TIME with RECORD_STATUS = 'E'

  Error message: **SMP_TDR_AUTO_MOISTURE_TLE**-E-101 {STATE_CODE, SHRP_ID, and TDR_NO}, There is no matching location in **SMP_TDR_AUTO** at level E.

Tables: SMP_TDR_AUTO_MOISTURE_TLE, SMP_TDR_AUTO_CALIBRATION_TLE

- There must be a record in **SMP_TDR_AUTO_CALIBRATION_TLE** with matching STATE_CODE, SHRP_ID, SMP_DATE, TDR_NO, and TDR_TIME with RECORD_STATUS = 'E'

  Error message: **SMP_TDR_AUTO_MOISTURE_TLE**-E-102 {STATE_CODE, SHRP_ID, SMP_DATE, TDR_NO, TDR_TIME}, There is no matching location in **SMP_TDR_AUTO_CALIBRATION_TLE** at level E.

Table: SMP_TDR_DEPTHS_LENGTH

- For matching SHRP_ID, STATE_CODE and CONSTRUCTION _NO, ABS(INSTALL_DATE - **SMP_LAYOUT_INFO**.INSTALL_DATE) $\leq$ 1

  Error message: **SMP_TDR_DEPTHS_LENGTH**-E-1, ABS(install_date -SMP_LAYOUT_INFO. INSTALL_DATE) <= 1; Installation date not close enough to site installation date

- For matching SHRP_ID, STATE_CODE and CONSTRUCTION _NO, for TDR_NO = 1, TDR_DEPTH > DEPTH_THERM_PVC_TOP in **SMP_LAYOUT_INFO** table

  Error message: **SMP_TDR_DEPTHS_LENGTH**-E-2, Depth of first TDR sensor not > depth of PVC thermistor top

---

Table: SMP_TDR_MANUAL_DIELECTRIC

- For matching SHRP_ID, STATE_CODE, CONSTRUCTION_NO, a matching record must exist in **EXPERIMENT_SECTION**

  Error message: **SMP_TDR_MANUAL_DIELECTRIC**-E-1, Test section with matching construction no. does not exist in **EXPERIMENT_SECTION**

- For matching SHRP_ID, STATE_CODE, CONSTRUCTION_NO, **EXPERIMENT_SECTION**.SEAS_ID must be non-null

Error message: **SMP_TDR_MANUAL_DIELECTRIC**-E-2, Test section/CN not labeled as SMP in **EXPERIMENT_SECTION**

- For matching SHRP_ID, STATE_CODE, and CONSTRUCTION_NO, SMP_DATE ≥ **SMP_LAYOUT_INFO**.INSTALL_DATE

  Error message: **SMP_TDR_MANUAL_DIELECTRIC**-E-3, No record found in **SMP_LAYOUT_INFO**, or data collection date not greater than or equal to installation date

- For matching SHRP_ID, STATE_CODE, CONSTRUCTION_NO, and TDR_NO, Matching record must exist in **SMP_TDR_DEPTHS_LENGTH**

  Error message: **SMP_TDR_MANUAL_DIELECTRIC**-E-4, Matching record does not exist in **SMP_TDR_DEPTHS_LENGTH** for SMP_DATE ≥ **SMP_TDR_DEPTHS_LENGTH**.INSTALL_DATE

- For matching SHRP_ID, STATE_CODE, CONSTRUCTION_NO, and TDR_NO, TDR_PROBE_LENGTH = **SMP_TDR_DEPTHS_LENGTH**.TDR_PROBE_LENGTH

  Error message: **SMP_TDR_MANUAL_DIELECTRIC**-E-5, TDR probe length does not match length in **SMP_TDR_DEPTHS_LENGTH**

- If APARNT_LEN_MIN is non-null, then DIELEC_CONST_MIN must be non-null

  Error message: **SMP_TDR_MANUAL_DIELECTRIC**-E-6, Minimum dielectric constant is null while minimum apparent length is non-null

- If APARNT_LEN_ANALYSIS is non-null, then DIELEC_CONST_ANALYSIS must be non-null

  Error message: **SMP_TDR_MANUAL_DIELECTRIC**-E-7, Analysis dielectric constant is null while analysis apparent length is non-null

- If APARNT_LEN_MAX is non-null then DIELEC_CONST_MAX must be non-null

  Error message: **SMP_TDR_M7ANUAL_DIELECTRIC**-E-8, Maximum dielectric constant is null while maximum apparent length is non-null

- If DIELEC_CONST_MIN is non-null then APARNT_LEN_MIN must be non-null

  Error message: **SMP_TDR_MANUAL_DIELECTRIC**-E-9, Minimum apparent length is null while minimum dielectric constant is non-null

- If DIELEC_CONST_ANALYSIS is non-null then APARNT_LEN_ANALYSIS must be non-null

  Error message: **SMP_TDR_MANUAL_DIELECTRIC**-E-10, Analysis apparent length is null while analysis dielectric constant is non-null

- If DIELEC_CONST_MAX is non-null then APARNT_LEN_MAX must be non-null

  Error message: **SMP_TDR_MANUAL_DIELECTRIC**-E-11, Maximum apparent length is null while maximum dielectric constant is non-null

- If APARNT_LEN_MAX is non-null, then APARNT_LEN_MIN must be non-null

Error message: **SMP_TDR_MANUAL_DIELECTRIC**-E-12, Minimum apparent length is null while maximum apparent length is non-null (**Comment** - The specified order of this check is important because it is allowable for APARNT_LEN_MIN to be non-null while APARNT_LEN_MAX is null.)

- For each record in which APARNT_LEN_MIN, APARNT_LEN_ANALYSIS, and APARNT_LEN_MAX are all non-null, APARNT_LEN_MIN ≤ APARNT_LEN_ANALYSIS ≤ APARNT_LEN_MAX

  Error message: **SMP_TDR_MANUAL_DIELECTRIC**-E-13, Apparent lengths fail MIN ≤ ANALYSIS ≤ MAX test

- For each record in which DIELEC_CONST_MIN, DIELEC_CONST_ANALYSIS, and DIELEC_CONST_MAX are all non-null, DIELEC_CONST_MIN ≤ DIELEC_CONST_ANALYSIS ≤ DIELEC_CONST_MAX

  Error message: **SMP_TDR_MANUAL_DIELECTRIC**-E-14, Dielectric constants fail MIN ≤ ANALYSIS ≤ MAX test

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Tables: SMP_TDR_MOISTURE_SUPPORT, TST_SS01_UG01_UG02

- For each instance of STATE_CODE, SHRP_ID, and non-null values of ANALYSIS_ONE_AND_HALF_PASSING, ANALYSIS_ONE_HALF_PASSING, ANALYSIS_NO_4_PASSING, ANALYSIS_NO_10_PASSING, and ANALYSIS_NO_200_PASSING in **SMP_TDR_MOISTURE_SUPPORT**, at least one record with matching STATE_CODE and SHRP_ID and non-null ONE_AND_HALF_PASSING, ONE_HALF_PASSING, NO_4_PASSING, NO_10_PASSING, and NO_200_PASSING must exist at level "E" in **TST_SS01_UG01_UG02**

  Error message: **SMP_TDR_MOISTURE_SUPPORT**-E-1, No data exist in table **TST_SS01_UG01_UG02** for this set of key fields and non-null gradation parameter values.

Tables: SMP_TDR_MOISTURE_SUPPORT, TST_UG04_SS03

- For each instance of STATE_CODE, SHRP_ID, and a non-null value of ANALYSIS_PLASTIC_LIMIT or ANALYSIS_LIQUID_LIMIT in **SMP_TDR_MOISTURE_SUPPORT**, at least one record with matching STATE_CODE and SHRP_ID and non-null PLASTIC_LIMIT or LIQUID_LIMIT must also be in **TST_UG04_SS03**

  Error message: **SMP_TDR_MOISTURE_SUPPORT**-E-2, No data exist in table **TST_UG04_SS03** for this set of key fields and non-null Atterberg limits.

The level E QC checks must be performed on **SMP_TDR_MANUAL_DIELECTRIC** and **SMP_TDR_MOISTURE_SUPPORT** prior to performing the following checks:

Table: SMP_TDR_MANUAL_MOISTURE[2]

- For each record in which VOLUM_MOIST_CONTENT_ANALYSIS, VOLUM_MOIST_CONTENT_MIN, and VOLUM_MOIST_CONTENT_MAX are all non-null,

[2] Manual upgrades should not be permitted for records failing these level E checks.

VOLUM_MOIST_CONTENT_MIN <= VOLUM_MOIST_CONTENT_ANALYSIS <= VOLUM_MOIST_CONTENT_MAX

Error message: SMP_TDR_MANUAL_MOISTURE-E-101 {STATE_CODE, SHRP_ID, SMP_DATE, TDR_TIME, TDR_NO} Volumetric moisture contents fail MIN<=ANALYSIS<=MAX test.

- For each record in which GRAV_MOIST_CONTENT_ANALYSIS, GRAV_MOIST_CONTENT_MIN, and GRAV_MOIST_CONTENT_MAX are non-null, GRAV_MOIST_CONTENT_MIN <= GRAV_MOIST_CONTENT_ANALYSIS <= GRAV_MOIST_CONTENT_MAX

  Error message: SMP_TDR_MANUAL_MOISTURE-E-102 {STATE_CODE, SHRP_ID, SMP_DATE, TDR_TIME, TDR_NO} Gravimetric moisture contents fail MIN <= ANALYSIS <= MAX test.

- For each record in which VOLUM_MOIST_CONTENT_ANALYSIS and GRAV_MOIST_CONTENT_ANALYSIS are non-null and non-zero, 1.0 <= VOLUM_MOIST_CONTENT_ANALYSIS/GRAV_MOIST_CONTENT_ANALYSIS <= 3.0

  Error message: SMP_TDR_MANUAL_MOISTURE-E-103 {STATE_CODE, SHRP_ID, SMP_DATE, TDR_TIME, TDR_NO} Ratio of VOLUM_MOIST_CONTENT_ANALYSIS and GRAV_MOIST_CONTENT_ANALYSIS is not in range of 1.0 to 3.0.

- For each record in which VOLUM_MOIST_CONTENT_MIN and GRAV_MOIST_CONTENT_MIN are non-null and non-zero, 1.0 <= VOLUM_MOIST_CONTENT_MIN/GRAV_MOIST_CONTENT_MIN <= 3.0

  Error message: SMP_TDR_MANUAL_MOISTURE-E-104 {STATE_CODE, SHRP_ID, SMP_DATE, TDR_TIME, TDR_NO} Ratio of VOLUM_MOIST_CONTENT_MIN and GRAV_MOIST_CONTENT_MIN is not in range of 1.0 to 3.0.

- For each record in which VOLUM_MOIST_CONTENT_MAX and GRAV_MOIST_CONTENT_MAX are non-null and non-zero, 1.0 <= VOLUM_MOIST_CONTENT_MAX/GRAV_MOIST_CONTENT_MAX <= 3.0

  Error message: SMP_TDR_MANUAL_MOISTURE-E-105 {STATE_CODE, SHRP_ID, SMP_DATE, TDR_TIME, TDR_NO} Ratio of VOLUM_MOIST_CONTENT_MAX and GRAV_MOIST_CONTENT_MAX is not in range of 1.0 to 3.0.

Tables: SMP_TDR_MANUAL_MOISTURE, EXPERIMENT_SECTION[3]

- For matching SHRP_ID, STATE_CODE, and CONSTRUCTION_NO, **EXPERIMENT_SECTION**. SEAS_ID must be non-null

  Error message:SMP_TDR_MANUAL_MOISTURE-E-106{STATE_CODE, SHRP_ID, CONSTRUCTION_NO} Test section/ CONSTRUCTION_NO not labeled as SMP site in EXPERIMENT_SECTION table.

Tables: SMP_TDR_MANUAL_MOISTURE, SMP_TDR_MANUAL_DIELECTRIC*

[3] Manual upgrades should not be permitted for records failing these level E checks.

- For matching SHRP_ID, STATE_CODE, SMP_DATE, TDR_TIME, and TDR_NO, **SMP_TDR_MANUAL_DIELECTRIC**.RECORD_STATUS = “E”

  Error message: SMP_TDR_MANUAL_MOISTURE-E-107 {STATE_CODE, SHRP_ID, SMP_DATE, TDR_TIME, TDR_NO} RECORD_STATUS in **SMP_TDR_MANUAL_DIELECTRIC** is not at level E.

- For matching SHRP_ID, STATE_CODE, SMP_DATE, TDR_TIME, and TDR_NO, if **SMP_TDR_MANUAL_DIELECTRIC**.DIELEC_CONST_ANALYSIS is non-null then VOLUM_MOIST_CONTENT_ANALYSIS must be non-null

  Error message: SMP_TDR_MANUAL_MOISTURE-E-108 {STATE_CODE, SHRP_ID, SMP_DATE, TDR_TIME, TDR_NO} Analysis volumetric moisture content is null while analysis dielectric constant is non-null.

- For matching SHRP_ID, STATE_CODE, SMP_DATE, TDR_TIME, and TDR_NO, if **SMP_TDR_MANUAL_DIELECTRIC**.DIELEC_CONST_ANALYSIS is null then VOLUM_MOIST_CONTENT_ANALYSIS must be null

  Error message: SMP_TDR_MANUAL_MOISTURE-E-109 {STATE_CODE, SHRP_ID, SMP_DATE, TDR_TIME, TDR_NO} Volumetric moisture content for analysis is non-null while dielectric constant for analysis is null.

- For matching SHRP_ID, STATE_CODE, SMP_DATE, TDR_TIME, and TDR_NO, if **SMP_TDR_MANUAL_DIELECTRIC**.DIELEC_CONST_MIN is non-null then VOLUM_MOIST_CONTENT_MIN must be non-null

  Error message: SMP_TDR_MANUAL_MOISTURE-E-110 {STATE_CODE, SHRP_ID, SMP_DATE, TDR_TIME, TDR_NO} Minimum volumetric moisture content is null while minimum dielectric constant is non-null.

- For matching SHRP_ID, STATE_CODE, SMP_DATE, TDR_TIME, and TDR_NO, if **SMP_TDR_MANUAL_DIELECTRIC**.DIELEC_CONST_MIN is null then VOLUM_MOIST_CONTENT_MIN must be null

  Error message: SMP_TDR_MANUAL_MOISTURE-E-111 {STATE_CODE, SHRP_ID, SMP_DATE, TDR_TIME, TDR_NO} Minimum volumetric moisture content is non-null while minimum dielectric constant is null.

- For matching SHRP_ID, STATE_CODE, SMP_DATE, TDR_TIME, and TDR_NO, if **SMP_TDR_MANUAL_DIELECTRIC**.DIELEC_CONST_MAX is non-null then VOLUM_MOIST_CONTENT_MAX must be non-null

  Error message: SMP_TDR_MANUAL_MOISTURE-E-112 {STATE_CODE, SHRP_ID, SMP_DATE, TDR_TIME, TDR_NO} Maximum volumetric moisture content is null while maximum dielectric constant is non-null.

- For matching SHRP_ID, STATE_CODE, SMP_DATE, TDR_TIME, and TDR_NO, if **SMP_TDR_MANUAL_DIELECTRIC**.DIELEC_CONST_MAX is null then VOLUM_MOIST_CONTENT_MAX must be null

  Error message: SMP_TDR_MANUAL_MOISTURE-E-116 {STATE_CODE, SHRP_ID, SMP_DATE, TDR_TIME, TDR_NO} Maximum volumetric moisture content is non-null while maximum dielectric constant is null.

Tables: SMP_TDR_MANUAL_MOISTURE, SMP_TDR_MOISTURE_SUPPORT[4]

- For matching SHRP_ID, STATE_CODE, and TDR_NO, if VOLUM_MOIST_CONTENT_ANALYSIS is non-null and **SMP_TDR_MOISTURE_SUPPORT**.DRY_DENSITY_TDR is non-null then GRAV_MOIST_CONTENT_ANALYSIS must be non-null

  Error message: SMP_TDR_MANUAL_MOISTURE-E-113 {STATE_CODE, SHRP_ID, TDR_NO} Gravimetric moisture content for analysis is null while VOLUM_MOIST_CONTENT_ANALYSIS and DRY_DENSITY_TDR are not.

- For matching SHRP_ID, STATE_CODE, and TDR_NO, if VOLUM_MOIST_CONTENT_MIN is non-null and **SMP_TDR_MOISTURE_SUPPORT**.DRY_DENSITY_TDR is non-null then GRAV_MOIST_CONTENT_MIN must be non-null

  Error message: SMP_TDR_MANUAL_MOISTURE-E-114 {STATE_CODE, SHRP_ID, TDR_NO} Minimum gravimetric moisture content is null while VOLUM_MOIST_CONTENT_MIN and DRY_DENSITY_TDR are not.

- For matching SHRP_ID, STATE_CODE, and TDR_NO, if VOLUM_MOIST_CONTENT_MAX is non-null and **SMP_TDR_MOISTURE_SUPPORT**.DRY_DENSITY_TDR is non-null then GRAV_MOIST_CONTENT_MAX must be non-null

  Error message: SMP_TDR_MANUAL_MOISTURE-E-115 {STATE_CODE, SHRP_ID, TDR_NO} Maximum gravimetric moisture content is null while VOLUM_MOIST_CONTENT_MAX and DRY_DENSITY_TDR are not.

Table: SMP_WATERTAB_DEPTH_MAN

- For matching SHRP_ID, STATE_CODE and CONSTRUCTION _NO, SMP_DATE $\geq$ INSTALL_DATE in **SMP_LAYOUT_INFO** table

  Error message: **SMP_WATERTAB_DEPTH_MAN**-E-1, No record found in **SMP_LAYOUT_INFO**, or data collection date not $\geq$ installation date

- For matching SHRP_ID, STATE_CODE and CONSTRUCTION _NO, PIEZO_DEPTH $\leq$ PIEZO_DEPTH in **SMP_LAYOUT_INFO** table

  Error message: **SMP_WATERTAB_DEPTH_MAN**-E-2, Water depth in piezometer pipe not < pipe physical length

- If PIEZO_DEPTH and WATERAB_DEPTH are null then comment must exist in SMP_COMMENT with matching SHRP_ID, STATE_CODE, CONSTRUCTION_NO, and SMP_COMMENT_DATE = **SMP_WATERAB_DEPTH_MAN**.SMP_DATE and **SMP_WATERAB_DEPTH_MAN**.TABLE_NAME = SMP_WATERAB_DEPTH_MAN

  Error message: **SMP_WATERTAB_DEPTH_MAN**-E-3, If PIEZO_DEPTH and WATERTAB_DEPTH are null, then a SMP_COMMENT must exist in SMP_COMMENTS.

[4] Manual upgrades should not be permitted for records failing these level E checks.

23.0 AWS QC PROGRAMS

23.1 Level 1

A. Initial Level

Records in the IMS are at Level A when they first enter the system and are set back to A when changes are made to a given record or to selected related records.

B. Dependency Checks

No B level checks are identified.

C. Minimum Data Checks

Tables and accompanying fields that must be included in a data record are identified below. Explanations are provided for those fields having certain condition as to when they are required (i.e. X = always; * = conditional).

Table	Field	Condition
AWS_COMMENT	AWS_COMMENT	X
AWS_DAILY_DATA	No level C checks	
AWS_HOURLY_DATA	No level C checks	
AWS_HUMIDITY_MONTH	MAX_MON_HUM_AVG	X
	MAX_MON_HUM_STDEV	X
	MIN_MON_HUM_AVG	X
	MIN_MON_HUM_STDEV	X
	NUMBER_MON_HUMID_DAYS	X
AWS_LINK	AWS_ID	X
AWS_LOCATION	DATUM	X
	COORDINATE_DETERMINATION	X
AWS_PRECIPITATION_MONTH	INTENSE_PRECIP_DAYS	X
	NUMBER_MON_PRECIP_HOURS	X
	TOTAL_MON_PRECIP	X
	WET_DAYS	X
AWS_SOLAR_MONTH	MEAN_MON_SOLAR_AVG	X
	MEAN_MON_SOLAR_STDEV	X
	NUMBER_MON_SOLAR_DAYS	X
AWS_TEMP_MONTH	DAYS_ABOVE_32_C	X

	DAYS_BELOW_0_C	X
	FREEZE_INDEX	X
	FREEZE_THAW	X
	MAX_MON_TEMP	X
	MAX_MON_TEMP_AVG	X
	MAX_MON_TEMP_STDEV	X
	MEAN_MON_TEMP_AVG	X
	MEAN_MON_TEMP_STDEV	X
	MIN_MON_TEMP	X
	MIN_MON_TEMP_AVG	X
	MIN_MON_TEMP_STDEV	X
	NUMBER_MON_TEMP_DAYS	X
AWS_WIND_MONTH	MAX_MON_WIND_SPD	X
	MEAN_MON_WIND_AVG	X
	MEAN_MON_WIND_STDEV	X
	NUMBER_MON_WIND_DAYS	X

D. Expanded Range Checks

Expanded range checks are applied to certain fields to identify data element values that fall outside an expected range. Field names are listed below the bolded table name.

Table	Units	Range
AWS_COMMENT		
AWS_COMMENT_DATE		01-AUG-92 or later
AWS_DAILY_DATA		
AWS_DATE		01-AUG-92 or later
MAX_DAY_HUMIDITY	%	0 - 100
MAX_DAY_TEMP	deg C	-50 - 50
MAX_DAY_WIND_SPD	m/s	0 - 40
MAX_DAY_WIND_SPD_DIR	deg	0 - 359
MEAN_DAY_SOLAR	W/m^2	0 - 500
MEAN_DAY_TEMP	deg C	-50 - 50
MEAN_DAY_WIND_DIR	deg	0 - 359
MEAN_DAY_WIND_SPD	m/s	0 - 20
MIN_DAY_HUMIDITY	%	0 - 100
MIN_DAY_TEMP	deg C	-50 - 50
NUMBER_HUMID_HOURS		20 - 24
NUMBER_PRECIP_HOURS		1 - 24
NUMBER_SOLAR_HOURS		20 - 24
NUMBER_TEMP_HOURS		20 - 24
NUMBER_WIND_HOURS		20 - 24
TOTAL_DAY_PRECIP	mm	0 - 200
AWS_HOURLY_DATA		
AWS_DATE		01-AUG-92 or later
AWS_HOUR	hr	1 - 24
MAX_HR_HUMIDITY	%	0 - 100
MAX_HR_TEMP	deg C	-50 - 50
MAX_HR_WIND_SPD	m/s	0 - 40
MAX_HR_WIND_SPD_DIR	deg	0 - 359

MEAN_HR_TEMP	deg C	-50 - 50
MEAN_HR_WIND_DIR	deg	0 - 359
MEAN_HR_WIND_SPD	m/s	0 - 30
MIN_HR_HUMIDITY	%	0 - 100
MIN_HR_TEMP	deg C	-50 - 50
TOTAL_HR_PRECIP	mm	0 - 100
TOTAL_HR_SOLAR	W/m^2	0 - 1100

AWS_HUMIDITY_MONTH

MAX_MON_HUM_AVG	%	0 - 100
MIN_MON_HUM_AVG	%	0 - 100
MONTH		1 - 12
NUMBER_MON_HUMID_DAYS		24 - Days in Month
YEAR		≥1992

AWS_LINK

No level D checks

AWS_LOCATION

ELEVATION	m	-50 - 3000
INSTALLATION_DATE		01-AUG-92 or later
LATITUDE	deg	15 - 75
LONGITUDE	deg	-45 - -170

AWS_PRECIPITATION_MONTH

INTENSE_PRECIP_DAYS		0 - Days in Month
MONTH		0 - 12
NUMBER_MON_PRECIP_HOURS		0 - Hours in Month
TOTAL_MON_PRECIP	mm	0 - 1000
WET_DAYS		0 - Days in Month
YEAR		≥1992

AWS_SOLAR_MONTH

MEAN_MON_SOLAR_AVG	W/m^2	0 - 500
MONTH		1 - 12
NUMBER_MON_SOLAR_DAYS		24 - Days in Month
YEAR		≥1992

AWS_TEMP_MONTH

DAYS_ABOVE_32_C		0 - Days in Month
DAYS_BELOW_0_C		0 - Days in Month
FREEZE_INDEX	deg C Degree Days	0 - 900
FREEZE_THAW		0 - Days in Month
MAX_MON_TEMP	deg C	-50 - 50
MAX_MON_TEMP_AVG	deg C	-50 - 50
MEAN_MON_TEMP_AVG	deg C	-50 - 50
MIN_MON_TEMP	deg C	-50 - 50
MIN_MON_TEMP_AVG	deg C	-50 - 50
MONTH		1 - 12
NUMBER_MON_TEMP_DAYS		24 - Days in Month
YEAR		≥1992

AWS_WIND_MONTH

MAX_MON_WIND_SPD	m/s	0 - 20
MEAN_MON_WIND_AVG	m/s	0 - 40
MONTH		1 - 12

NUMBER_MON_WIND_DAYS	24 - Days in Month
YEAR	≥1992

E. Intramodular Checks

Each E-type check is separated by a single line. In general, each bullet represents a procedure, action etc.

Table: AWS_COMMENT

- TABLE_NAME must always be a valid AWS table

Table: AWS_DAILY_DATA

- If NUMBER_TEMP_HOURS is not null, then MEAN_DAY_TEMP, MAX_DAY_TEMP and MIN_DAY_TEMP must also be non-null
- If NUMBER_HUMID_HOURS is not null, then MAX_DAY_HUMIDITY and MIN_DAY_HUMIDITY must also be non-null
- If NUMBER_PRECIP_HOURS is not null, then TOTAL_DAY_PRECIP must also be non-null
- If NUMBER_SOLAR_HOURS is not null, then MEAN_DAY_SOLAR must also be non-null
- If NUMBER_WIND_HOURS is not null, then MEAN_DAY_WIND_SPD, MEAN_DAY_WIND_DIR, MAX_DAY_WIND_SPD, MAX_DAY_WIND_SPD_TIME and MAX_DAY_WIND_SPD_DIR must also be non-null
- For matching AWS_ID and AWS_DATE records in **AWS_HOURLY_DATA** table, compute sum of TOTAL_HR_PRECIP (sum_TOTAL_HR_PRECIP). Compare TOTAL_DAY_PRECIP from **AWS_DAILY_DATA** against sum_TOTAL_HR_PRECIP as follows:

  ABS(TOTAL_DAY_PRECIP – sum_TOTAL_HR_PRECIP) ≤ 2

Table: AWS_HOURLY_DATA

- MEAN_HR_TEMP, MAX_HR_TEMP and MIN_HR_TEMP must all be either null or non-null
- MAX_HR_HUMIDITY and MIN_HR_HUMIDITY must both be either null or non-null
- MEAN_HR_WIND_SPD, MEAN_HR_WIND_DIR, MAX_HR_WIND_SPD, MAX_HR_WIND_SPD_TIME and MAX_HR_WIND_SPD_DIR must all be either null or non-null

---

Tables: AWS_LINK and AWS_LOCATION

- All records in **AWS_LINK** table must have a matching record in **AWS_LOCATION** for AWS_ID

Error message: AWS_LINK E-101 {AWS_ID} Matching record does not exist in **AWS_LOCATION** table.

Table: AWS_LOCATION

- If DATUM = 8, then DATUM_OTHER must be non null

  Error message: AWS_LOCATION E-101 {AWS_ID, DATUM} DATUM field is populated with other and there is no entry in the DATUM_OTHER field.

Table: AWS_TEMP_MONTH

- DAYS_ABOVE_32_C must always be $\leq$ NUMBER_MON_TEMP_DAYS
- DAYS_BELOW_0_C must always be $\leq$ NUMBER_MON_TEMP_DAYS

Table: AWS_PRECIPITATION_MONTH

- Level E checks on records in **AWS_DAILY_DATA**, including the one above, must be performed prior to this check so that the RECORD_STATUS for records passing these checks have previously been upgraded. For all records in **AWS_DAILY_DATA** with matching AWS_ID, YEAR = right (AWS_DATE, 4), AND month = MID (AWS_DATE, 3,3):

  RECORD_STATUS=E

  Error message: All daily records are not at level E.

  Note: If a record fails this check, its RECORD_STATUS should not be upgraded and none of the following checks should be performed.

- For records in **AWS_DAILY_DATA** with matching AWS_ID, YEAR = right (AWS_DATE, 4), and MONTH = mid(AWS_DATE, 3, 3), Compute sum of TOTAL_DAY_PRECIP (sum_TOTAL_DAY_PRECIP). Compare TOTAL_MON_PRECIP from **AWS_PRECIPITATION_MONTH** against sum_TOTAL_DAY_PRECIP as follows:

  ABS(TOTAL_MON_PRECIP - sum of TOTAL_DAY_PRECIP) $\leq$ 5

  Error message: Monthly rainfall total not equal to sum of daily rainfall

- For records in **AWS_DAILY_DATA** with matching AWS_ID, YEAR = right (AWS_DATE, 4), and MONTH = mid (AWS_DATE, 3,3), compute sum of NUMBER_PRECIP_HOURS (sum_NUMBER_PRECIP_HOURS). Compare NUMBER_MON_PRECIP_HOURS from **AWS_PRECIPITATION_MONTH** against sum_NUMBER_PRECIP_HOURS, as follows: NUMBER_MON_PRECIP_HOURS = sum_NUMBER_PRECIP_HOURS

  Error message: Monthly rainfall hour total not equal to sum of daily rainfall hours

24.0 DLR QC PROGRAMS

24.1 Level 1

A. Initial Level

Records in the IMS are at Level A when they first enter the system and are set back to A when changes are made to a given record or to selected related records.

B. Dependency Checks

No B level checks defined.

C. Minimum Data Checks

Tables and accompanying fields that must be included in a data record are identified below. Explanations are provided for those fields having certain conditions as to when they are required (i.e., X = always; * = conditional).

Table	Field	Condition
DLR LVDT CONFIG AC	BALANCE	X
	CHANNEL	X
	SENSOR HOLE NUMBER	X
	SENSOR LAYER NUMBER	X
	X AC	X
	Y AC	X
	Z	X
DLR LVDT CONFIG PCC	BALANCE	X
	CHANNEL	X
	SENSOR HOLE NUMBER	X
	SENSOR LAYER NUMBER	X
	X	X
	Y	X
	Z	X
DLR LVDT TRACE SUM AC	CHANNEL	X
	LVDT BEGIN OFFSET	X
	LVDT END OFFSET	X
	LVDT RANGE	X
	LVDT VALUE RAW 1	X
	LVDT VALUE SMOOTH 1	X
	NUMBER OF POINTS	X
	POINT TYPE 1	X

	TIME RAW 1	X
	TIME SMOOTH 1	X
DLR LVDT TRACE SUM PCC	CHANNEL	X
	LVDT BEGIN OFFSET	X
	LVDT END OFFSET	X
	LVDT RANGE	X
	LVDT VALUE RAW 1	X
	LVDT VALUE SMOOTH 1	X
	NUMBER OF POINTS	X
	POINT TYPE 1	X
	TIME RAW 1	X
	TIME SMOOTH 1	X
DLR MASTER AC	DATA COLLECTION SOFTWARE	X
	END EVENT	X
	NUMBER OF CHANNELS	X
	POSTTRIGGER	X
	PRETRIGGER	X
	SAMPLING RATE	X
	SOFTWARE VERSION	X
	START EVENT	X
	TYPE OF AD CONVERTER	X
DLR MASTER PCC	DATA COLLECTION SOFTWARE	X
	END EVENT	X
	NUMBER OF CHANNELS	X
	POSTTRIGGER	X
	PRETRIGGER	X
	SAMPLING RATE	X
	SLAB1 LENGTH	X
	SLAB1 WIDTH	X
	SLAB2 LENGTH	X
	SLAB2 WIDTH	X
	SOFTWARE VERSION	X
	START EVENT	X
	TYPE OF AD CONVERTER	X
DLR PRESSURE CONFIG AC	BALANCE	X
	CHANNEL	X
	SENSOR LAYER NUMBER	X
	X AC	X
	Y AC	X
	Z	X
DLR PRESSURE TRACE SUM AC	CHANNEL	X
	NUMBER OF POINTS	X
	POINT TYPE 1	X
	PRESSURE BEGIN OFFSET	X
	PRESSURE END OFFSET	X

	PRESSURE RANGE	X
	PRESSURE VALUE RAW 1	X
	PRESSURE VALUE SMOOTH 1	X
	TIME RAW 1	X
	TIME SMOOTH 1	X
DLR STRAIN CONFIG AC	ACTIVE ARMS	X
	BALANCE	X
	CHANNEL	X
	SENSOR LAYER NUMBER	X
	X AC	X
	Y AC	X
	Z	X
DLR STRAIN CONFIG PCC	ACTIVE ARMS	X
	BALANCE	X
	CHANNEL	X
	SENSOR LAYER NUMBER	X
	X	X
	Y	X
	Z	X
DLR STRAIN TRACE SUM AC	CHANNEL	X
	NUMBER OF POINTS	X
	POINT TYPE 1	X
	STRAIN BEGIN OFFSET	X
	STRAIN END OFFSET	X
	STRAIN RANGE	X
	STRAIN VALUE RAW 1	X
	STRAIN VALUE SMOOTH 1	X
	TIME RAW 1	X
	TIME SMOOTH 1	X
DLR STRAIN TRACE SUM PCC	CHANNEL	X
	NUMBER OF POINTS	X
	POINT TYPE 1	X
	STRAIN BEGIN OFFSET	X
	STRAIN END OFFSET	X
	STRAIN RANGE	X
	STRAIN VALUE RAW 1	X
	STRAIN VALUE SMOOTH 1	X
	TIME RAW 1	X
	TIME SMOOTH 1	X
DLR TEST MATRIX	DESIRED SPEED	X
	RUN TIME	X
	TRUCK ID	X
	WHEEL PATH OFFSET V	*[1]

[1] One of the two indicated must be present.

	WHEEL PATH OFFSET M	*[1]
DLR TRUCK GEOMETRY	FRONT AXLE WIDTH	X
	REAR AXLE WIDTH	X
	AXLE2 WHEELBASE	X
	TANDEM SPACING	X
	TIRE TYPE	X
	TIRE PRESSURE	X

D. Expanded Range Checks

Expanded range checks are applied to certain fields to identify data element values that fall outside an expected range. Field names are listed below the bolded table name. Expanded range checks for all DLR data tables are specified below:

Table	Units	Range
DLR LVDT CONFIG AC		
BALANCE		Y or N
CARD GAIN		0 - 999
CHANNEL		0 - 999
POST GAIN		0 - 999
X AC	mm	0 - 9999
Y AC	mm	0 - 5000
Z	mm	0.0 - 600.0
DLR LVDT CONFIG PCC		
BALANCE		Y or N
CARD GAIN		0 - 999
CHANNEL		0 - 999
POST GAIN		0 - 999
X	mm	0 - 9999
Y	mm	0 - 5000
Z	mm	0.0 - 600.0
DLR LVDT TRACE SUM AC		
CHANNEL		0 - 999
POINT TYPE 1		P, V
POINT TYPE 2		P, V
POINT TYPE 3		P, V
POINT TYPE 4		P, V
POINT TYPE 5		P, V
POINT TYPE 6		P, V
POINT TYPE 7		P, V
POINT TYPE 8		P, V
POINT TYPE 9		P, V
POINT TYPE 10		P, V
DLR LVDT TRACE SUM PCC		

CHANNEL		0 - 999
POINT TYPE 1		P or V
POINT TYPE 2		P or V
POINT TYPE 3		P or V
POINT TYPE 4		P or V
POINT TYPE 5		P or V
POINT TYPE 6		P or V
POINT TYPE 7		P or V
POINT TYPE 8		P or V
POINT TYPE 9		P or V
POINT TYPE 10		P or V

DLR MASTER AC

AUTOBALANCE		Y or N
END EVENT		1 - 3
NUMBER OF CHANNELS		1 - 999
POSTTRIGGER	s	0.01 - 10.00
PRETRIGGER	s	0.01 - 10.00
REVISION DATE	mm-dd-yyyy	> 01-01-1990
SAMPLING RATE	Hz	1 - 10000
START EVENT		1 - 3

DLR_MASTER_PCC

AUTOBALANCE		Y or N
END EVENT		1 - 3
NUMBER OF CHANNELS		1 - 999
POSTTRIGGER	s	0.01 - 10.00
PRETRIGGER	s	0.01 - 10.00
REVISION DATE	mm-dd-yyyy	> 01-01-1990
SAMPLING RATE	Hz	1 - 10000
SLAB1 LENGTH	mm	3000 - 5000
SLAB1 WIDTH	mm	2000 - 5000
SLAB2 LENGTH	mm	3000 - 5000
SLAB2 WIDTH	mm	2000 - 5000
START EVENT		1 - 3

DLR PRESSURE CONFIG AC

BALANCE		Y or N
CARD GAIN		0 - 999
CHANNEL		0 - 999
POST GAIN		0 - 999
X AC	mm	0 - 9999
Y AC	mm	0 - 5000
Z	mm	0.0 - 600.0

DLR PRESSURE TRACE SUM AC

CHANNEL		0 - 999
POINT TYPE 1		P, V
POINT TYPE 2		P, V

POINT TYPE 3		P, V
POINT TYPE 4		P, V
POINT TYPE 5		P, V
POINT TYPE 6		P, V
POINT TYPE 7		P, V
POINT TYPE 8		P, V
POINT TYPE 9		P, V
POINT TYPE 10		P, V

DLR STRAIN CONFIG AC

ACTIVE ARMS		1 - 4
BALANCE		Y or N
CARD GAIN		0 - 999
CHANNEL		0 - 999
EXCITATION TYPE		V or mA
GAUGE FACTOR		1.00 - 4.00
GAUGE RESISTANCE	Ohms	120 or 350
GAUGE VOLTAGE	Volts	1.0, 2.5 or 5.0
POST GAIN		0 - 999
X AC	mm	0 - 9999
Y AC	mm	0 - 5000
Z	mm	0.0 - 600.0

DLR STRAIN CONFIG PCC

ACTIVE ARMS		1 - 4
BALANCE		Y or N
CARD GAIN		0 - 999
CHANNEL		0 - 999
EXCITATION TYPE		V or mA
GAUGE FACTOR		1.00 - 4.00
GAUGE RESISTANCE	Ohms	120 or 350
GAUGE VOLTAGE	Volts	1.0, 2.5 or 5.0
POST GAIN		0 - 999
X	mm	0 - 9999
Y	mm	0 - 5000
Z	mm	0.0 - 600.0

DLR STRAIN TRACE SUM AC

CHANNEL		0 - 999
POINT TYPE 1		P, V
POINT TYPE 2		P, V
POINT TYPE 3		P, V
POINT TYPE 4		P, V
POINT TYPE 5		P, V
POINT TYPE 6		P, V
POINT TYPE 7		P, V
POINT TYPE 8		P, V
POINT TYPE 9		P, V
POINT TYPE 10		P, V

DLR STRAIN TRACE SUM PCC		
CHANNEL		0 - 999
POINT TYPE 1		P or V
POINT TYPE 2		P or V
POINT TYPE 3		P or V
POINT TYPE 4		P or V
POINT TYPE 5		P or V
POINT TYPE 6		P or V
POINT TYPE 7		P or V
POINT TYPE 8		P or V
POINT TYPE 9		P or V
POINT TYPE 10		P or V
DLR TEST MATRIX		
DESIRED SPEED	km/h	20 - 100
REVISION DATE	mm-dd-yyyy	>01-01-1990
RUN NUMBER		1 - 999
DLR TRUCK GEOMETRY		
FRONT AXLE WIDTH	mm	1800 - 3000
REAR AXLE WIDTH	mm	1800 - 3000
AXLE2 WHEELBASE	m	3.00 - 10.00
AXLE3 WHEELBASE	m	3.00 - 15.00
TANDEM SPACING	mm	300 - 1800
TIRE PRESSURE	kPa	200 - 1500

E. Intramodular Checks

Intramodular checks for all DLR data tables are specified below. Each E-type check is separated by a single line. In general, each bullet represents a procedure, action etc.

Table: DLR_LVDT_CONFIG_AC, **DLR_MASTER_AC**

- STATE_CODE, SHRP_ID and TEST_NAME must exist in **DLR_MASTER_AC**

  Error Message: Test has not been defined.

Table: DLR_LVDT_CONFIG_PCC, **DLR_MASTER_PCC**

- STATE_CODE, SHRP_ID and TEST_NAME must exist in **DLR_MASTER_PCC**

  Error Message: Test has not been defined **DLR_MASTER_PCC**

Table: DLR_LVDT_TRACE_SUM_AC

In the following, (I+1) and (I) are the successive numbers for the variables (I = 1 to 9):

- POINT_TYPE_(I+1) cannot exist without POINT_TYPE_(I) being non-null
- LVDT_VALUE_RAW_(I+1) cannot exist without LVDT_VALUE_RAW_(I) being non-null
- TIME_RAW_(I+1) cannot exist without TIME_RAW_(I) being non-null
- LVDT_VALUE_SMOOTH_(I+1) cannot exist without LVDT_VALUE_SMOOTH_(I) being non-null
- TIME_SMOOTH_(I+1) cannot exist without TIME_SMOOTH_(I) being non-null
- TIME_RAW_(I+1) must be greater than TIME_RAW_(I)
- TIME_SMOOTH_(I+1) must be greater than TIME_SMOOTH_(I)

Table: DLR_LVDT_TRACE_SUM_AC, DLR_MASTER_AC

- For matching STATE_CODE, SHRP_ID and TEST_NAME, a matching record must exist in **DLR_MASTER_AC**

  Error Message: The test has not been defined in **DLR_MASTER_AC**

Table: DLR_LVDT_TRACE_SUM_AC, DLR_LVDT_CONFIG_AC

- For matching STATE_CODE, SHRP_ID, TEST_NAME and TAG_ID, a matching record must exist in **DLR_LVDT_CONFIG_AC**.

  Error Message: Sensor does not have corresponding configuration information

---

Table: DLR_LVDT_TRACE_SUM_AC, DLR_TEST_MATRIX

- For matching STATE_CODE, SHRP_ID, TEST_NAME and RUN_NUMBER, a matching record must exist in **DLR_TEST_MATRIX**

  Error Message: Run number not defined in **DLR_TEST_MATRIX**

Table: DLR_LVDT_TRACE_SUM_PCC

In the following, (I+1) and (I) are the successive numbers for the variables (I from 1 to 9):

- POINT_TYPE_(I+1) cannot exist without POINT_TYPE_(I) being non-null
- LVDT_VALUE_RAW_(I+1) cannot exist without LVDT_VALUE_RAW_(I) being non-null
- TIME_RAW_(I+1) cannot exist without TIME_RAW_(I) being non-null

- LVDT_VALUE_SMOOTH_(I+1) cannot exist without LVDT_VALUE_SMOOTH_(I) being non-null
- TIME_SMOOTH_(I+1) cannot exist without TIME_SMOOTH_(I) being non-null
- TIME_RAW_(I+1) must be greater than TIME_RAW_(I)
- TIME_SMOOTH_(I+1) must be greater than TIME_SMOOTH_(I)

Table: DLR_LVDT_TRACE_SUM_PCC, DLR_MASTER_PCC

- For matching STATE_CODE, SHRP_ID and TEST_NAME, a matching record must exist in **DLR_MASTER_PCC**

  Error Message: Test has not been defined in **DLR_MASTER_PCC**

Table: DLR_LVDT_TRACE_SUM_PCC, DLR_LVDT_CONFIG_PCC

- For matching STATE_CODE, SHRP_ID, TEST_NAME and TAG_ID, a matching record must exist in **DLR_LVDT_CONFIG_PCC**

  Error Message: Sensor does not have corresponding configuration information

---

Table: DLR_LVDT_TRACE_SUM_PCC, DLR_TEST_MATRIX

- For matching STATE_CODE, SHRP_ID, TEST_NAME and RUN_NUMBER, a matching record must exist in **DLR_TEST_MATRIX**

  Error Message: Run number not defined in **DLR_TEST_MATRIX**

Table: DLR_MASTER_AC

- STATE_CODE and SHRP_ID must exist in **EXPERIMENT_SECTION**

  Error Message: Section reference is not valid.

Table: DLR_MASTER_PCC

- STATE_CODE and SHRP_ID must exist in **EXPERIMENT_SECTION**

  Error Message: Section reference is not valid.

Table: DLR_PRESSURE_CONFIG_AC, DLR_MASTER_AC

- STATE_CODE, SHRP_ID and TEST_NAME must exist in **DLR_MASTER_AC**

  Error Message: Test has not been defined.

Table: DLR_PRESSURE_TRACE_SUM_AC

In the following, (I+1) and (I) are the successive numbers for the variables (I = 1 to 9):

- POINT_TYPE_(I+1) cannot exist without POINT_TYPE_(I) being non-null
- PRESSURE_VALUE_RAW_(I+1) cannot exist without PRESSURE_VALUE_RAW_(I) being non-null
- TIME_RAW_(I+1) cannot exist without TIME_RAW_(I) being non-null
- PRESSURE_VALUE_SMOOTH_(I+1) cannot exist without PRESSURE_VALUE_SMOOTH_(I) being non-null
- TIME_SMOOTH_(I+1) cannot exist without TIME_SMOOTH_(I) being non-null
- TIME_RAW_(I+1) must be greater than TIME_RAW_(I)
- TIME_SMOOTH_(I+1) must be greater than TIME_SMOOTH_(I)

Table: DLR_PRESSURE_TRACE_SUM_AC, DLR_MASTER_AC

- For matching STATE_CODE, SHRP_ID and TEST_NAME, a matching record must exist in **DLR_MASTER_AC**

  Error Message: The test has not been defined in **DLR_MASTER_AC**

Table: DLR_PRESSURE_TRACE_SUM_AC, DLR_PRESSURE_CONFIG_AC

- For matching STATE_CODE, SHRP_ID ,TEST_NAME and TAG_ID, a matching record must exist in **DLR_PRESSURE_CONFIG_AC**

  Error Message: Sensor does not have corresponding configuration information.

Table: DLR_PRESSURE_TRACE_SUM_AC, DLR_TEST_MATRIX

- For matching STATE_CODE, SHRP_ID, TEST_NAME and RUN_NUMBER, a matching record must exist in **DLR_TEST_MATRIX**

  Error Message: Run number not defined in **DLR_TEST_MATRIX**

Table: DLR_STRAIN_CONFIG_AC, DLR_MASTER_AC

- STATE_CODE, SHRP_ID and TEST_NAME must exist in **DLR_MASTER_AC**

  Error Message: The test has not been defined.

Table: DLR_STRAIN_CONFIG_PCC, DLR_MASTER_PCC

- STATE_CODE, SHRP_ID and TEST_NAME must exist in **DLR_MASTER_PCC**

  Error Message: Test has not been defined in **DLR_MASTER_PCC**.

Table: DLR_STRAIN_TRACE_SUM_AC

In the following, (I+1) and (I) are the successive numbers for the variables (I = 1 to 9):

- POINT_TYPE_(I+1) cannot exist without POINT_TYPE_(I) being non-null
- STRAIN_VALUE_RAW_(I+1) cannot exist without STRAIN_VALUE_RAW_(I) being non-null
- TIME_RAW_(I+1) cannot exist without TIME_RAW_(I) being non-null
- STRAIN_VALUE_SMOOTH_(I+1) cannot exist without STRAIN_VALUE_SMOOTH_(I) being non-null
- TIME_SMOOTH_(I+1) cannot exist without TIME_SMOOTH_(I) being non-null
- TIME_RAW_(I+1) must be greater than TIME_RAW_(I)
- TIME_SMOOTH_(I+1) must be greater than TIME_SMOOTH_(I)

Table: DLR_STRAIN_TRACE_SUM_AC, DLR_MASTER_AC

- For matching STATE_CODE, SHRP_ID and TEST_NAME, a matching record must exist in **DLR_MASTER_AC**

  Error Message: Test has not been defined in **DLR_MASTER_AC**

Table: DLR_STRAIN_TRACE_SUM_AC, DLR_STRAIN_CONFIG_AC

- For matching STATE_CODE, SHRP_ID, TEST_NAME and TAG_ID, a matching record must exist in **DLR_STRAIN_CONFIG_AC**

  Error Message: Sensor does not have corresponding configuration information

---

Table: DLR_STRAIN_TRACE_SUM_AC, DLR_TEST_MATRIX

- For matching STATE_CODE, SHRP_ID, TEST_NAME and RUN_NUMBER, a matching record must exist in **DLR_TEST_MATRIX**

  Error Message: Run Number not defined in **DLR_TEST_MATRIX**

Table: DLR_STRAIN_TRACE_SUM_PCC

In the following, (I+1) and (I) are the successive numbers for the variables (I from 1 to 9):

- POINT_TYPE_(I+1) cannot exist without POINT_TYPE_(I) being non-null
- STRAIN_VALUE_RAW_(I+1) cannot exist without STRAIN_VALUE_RAW_(I) being non-null
- TIME_RAW_(I+1) cannot exist without TIME_RAW_(I) being non-null
- STRAIN_VALUE_SMOOTH_(I+1) cannot exist without STRAIN_VALUE_SMOOTH_(I) being non-null
- TIME_SMOOTH_(I+1) cannot exist without TIME_SMOOTH_(I) being non-null
- TIME_RAW_(I+1) must be greater than TIME_RAW_(I)
- TIME_SMOOTH_(I+1) must be greater than TIME_SMOOTH_(I)

Table: DLR_STRAIN_TRACE_SUM_PCC, DLR_MASTER_PCC

- For matching STATE_CODE, SHRP_ID and TEST_NAME, a matching record must exist in **DLR_MASTER_PCC**

  Error Message: Test has not been defined in **DLR_MASTER_PCC**

Table: DLR_STRAIN_TRACE_SUM_PCC, DLR_STRAIN_CONFIG_PCC

- For matching STATE_CODE, SHRP_ID, TEST_NAME and TAG_ID, a matching record must exist in table, **DLR_STRAIN_CONFIG_PCC**

  Error Message: Sensor does not have corresponding configuration information

---

Table: DLR_STRAIN_TRACE_SUM_PCC, **DLR_TEST_MATRIX**

- For matching STATE_CODE, SHRP_ID, TEST_NAME and RUN_NUMBER, a matching record must exist in **DLR_TEST_MATRIX**

  Error Message: Run number not defined in **DLR_TEST_MATRIX**

Table: DLR_TEST_MATRIX, **DLR_TRUCK_GEOMETRY**

- For matching STATE_CODE, a matching record must exist in **DLR_TRUCK_GEOMETRY**

  Error Message: Testing truck not defined in **DLR_TRUCK_GEOMETRY**

- Only one of WHEEL_PATH_OFFSET_V or WHEEL_PATH_OFFSET_M is non-null

---

Table: DLR_TRUCK_GEOMETRY, EXPERIMENT_SECTION

- STATE_CODE must exist in **EXPERIMENT_SECTION**.

  Error Message: Section reference not valid

25.0 ADMINISTRATION TABLES QC PROGRAMS

25.1 Level 1

Please note that the results of the following **EXPERIMENT_SECTION** checks are recorded in EXP_SECT_RS, not in RECORD_STATUS.

A. Initial Level

Records in the IMS are at Level A when they first enter the system and are set back to A when changes are made to a given record or to selected related records.

B. Dependency Checks

There are no Level B checks for **EXPERIMENT_SECTION**. However, the following statements should be performed before continuing with Level C checks:

- If STATUS = 'R', set EXP_SECT_RS = '!' and do not perform any **EXPERIMENT_SECTION** QC on this record
- If EXP_SECT_RS at 'A', set to 'B'

C. Minimum Data Checks

Minimum data checks for **EXPERIMENT_SECTION** are identified below. Data fields with a Condition of X must always contain a non-null value, however, data fields with a Condition of * are only required to contain a non-null value if a particular condition is met as specified in the accompanying field explanation.

Table	Field	Condition
EXPERIMENT_SECTION	ASSIGN_DATE	X
	CN_ASSIGN_DATE	X
	EXP_SECT_RS	X
	EXPERIMENT_NO	X
	GPS_SPS	X
	RECORD_STATUS	X
SECTION_COORDINATES	DATUM	X
	COORDINATE_DETERMINATION	X

D. Expanded Range Checks

Expanded range checks are applied to certain fields to identify data element values that fall outside an expected range. Field names are listed below the bolded table name.

Table	Units	Range
EXPERIMENT_SECTION		
ASSIGN_DATE		>= 01-Jan-1987 <= CN_ASSIGN_DATE
BASIC_INFO_RS		null, A - E
CLIMATIC_RS		null, A - E
CN_ASSIGN_DATE		>= 01-JAN-1987
CONSTRUCTION_NO		>= 1
DEASSIGN_DATE		null, > CN_ASSIGN_DATE <= Current Date
EXP_SECT_RS		A - E
EXPERIMENT_NO		1, 2, 3, 4, 5, 6A, 6B, 6C, 6D, 6S, 7A, 7B, 7C, 7D, 7F, 7R, 7S, 9 (GPS);1, 2, 3, 4, 5, 6, 7, 8, 9A, 9C, 9J, 9N, 9O, 9P (SPS)
GPS_SPS		G, S
PAV_STRUCT_RS		null, A - E
RECORD_STATUS		A - E, *, !
SEAS_ID		null, A - Q
STATUS		null, O, R
SUPPLEMENTAL		null, S
TRAFFIC_RS		null, A - E
MON_CATEGORY		
MON_CAT_ASSIGN_DATE		≥ 01-Oct-2000, < 01-Jan-2008
MON_CAT_DEASSIGN_DATE		< 01-Jan-2008
MONITORING_CATEGORY		C, G, S1, S2
MONITORING_CHANGE_REASON[1]		1 – 7
SECTION_COORDINATES		
LATITUDE	Degrees	15 - 75
LONGITUDE	Degrees	-45 - -170

E. Intramodular Checks

Before doing QC, **EXPERIMENT_SECTION** should be sorted in ascending order by STATE_CODE, SHRP_ID, CONSTRUCTION_NO order and **MON_CATEGORY** should be in ascending order by STATE_CODE, SHRP_ID, and MON_CAT_ASSIGN_DATE. All records at Level E should be reset to D before running the Level E QC.

---

[1] This field cannot be manually upgraded for a value of 99 or null. A new code must be obtained via the SPR process describing the reason to replace the 99.

Table: EXPERIMENT_SECTION

- If CONSTRUCTION_NO >1, then CONSTRUCTION_NO - 1 must exist for matching STATE_CODE and SHRP_ID

  Error Message: **EXPERIMENT_SECTION**-E-1, If CONSTRUCTION_NO > 1, then CONSTRUCTION_NO - 1 must exist.

- If CONSTRUCTION_NO =1, then CN_ASSIGN_DATE = ASSIGN_DATE

  Error Message: **EXPERIMENT_SECTION**-E-2, If CONSTRUCTION_NO = 1, then CN_ASSIGN_DATE must equal ASSIGN_DATE.

- If STATUS is non-null, then DEASSIGN_DATE must be non-null

  Error Message: **EXPERIMENT_SECTION-E**-3, if STATUS is non-null, then DEASSIGN_DATE must be non-null.

- If DEASSIGN_DATE null, then STATUS must be null

  Error Message: **EXPERIMENT_SECTION**-E-4, if DEASSIGN_DATE is non-null, then STATUS must be non-null.

For any pair of CONSTRUCTION_NO [CN] and CONSTRUCTION_NO+1 [CN+1] (i.e. 1, 2 or 2, 3, etc.) perform the following checks:

- CN_ASSIGN_DATE(CN) < CN_ASSIGN_DATE(CN+1)

  Error Message: **EXPERIMENT_SECTION**-E-5, CN_ASSIGN_DATE(CN) must be less than CN_ASSIGN_DATE(CN+1)

- If STATUS(CN) ! = null, then STATUS(CN+1) ! = null

  Error Message: **EXPERIMENT_SECTION**-E-6, If STATUS(CN) is null, then STATUS(CN+1) must be non-null.

- If STATUS(CN+1) = null, then STATUS(CN) = null

  Error Message: **EXPERIMENT_SECTION**-E-7, If STATUS(CN+1) is null, then STATUS(CN) must be non-null.

- If EXPERIMENT_NO(CN) = EXPERIMENT_NO(CN+1) then ASSIGN_DATE(CN) = ASSIGN_DATE(CN+1), DEASSIGN_DATE(CN) = DEASSIGN_DATE(CN+1) (even if NULL), CN_ASSIGN_DATE(CN+1) > ASSIGN_DATE(CN+1), else DEASSIGN_DATE(CN) = non-null, ASSIGN_DATE(CN) < ASSIGN_DATE(CN+1), DEASSIGN_DATE(CN)=CN_ASSIGN_DATE(CN+1)=ASSIGN_DATE(CN+1)

  Error Message: **EXPERIMENT_SECTION**-E-8, If EXPERIMENT_NO(CN) is equal to EXPERIMENT_NO(CN+1), then ASSIGN_DATE(CN) must equal ASSIGN_DATE(CN+1), and DEASSIGN_DATE(CN) must equal DEASSIGN_DATE(CN+1) (even if NULL), and CN_ASSIGN_DATE(CN+1) > ASSIGN_DATE(CN+1). Check all values.

  Error Message: **EXPERIMENT_SECTION**-E-9, If EXPERIMENT_NO(CN) is NOT equal to EXPERIMENT_NO(CN+1), then DEASSIGN_DATE(CN) must be non-null, and ASSIGN_DATE(CN) must be less than ASSIGN_DATE(CN+1), and DEASSIGN_DATE(CN)

must be equal to CN_ASSIGN_DATE(CN+1) which must be equal to ASSIGN_DATE(CN+1). Check all values.

- If EXPERIMENT_NO(CN) <> EXPERIMENT_NO(CN+1), then GPS_SPS(CN+1) must be 'G'

  Error Message: **EXPERIMENT_SECTION**-E-10, If EXPERIMENT_NO(CN) NOT equal to EXPERIMENT_NO(CN+1), then GPS_SPS(CN+1) must = 'G'.

- If EXPERIMENT_NO(CN) <> EXPERIMENT_NO(CN+1), and (If GPS_SPS(CN) = G and
  EXPERIMENT_NO(CN) in (1,2) then EXPERIMENT_NO(CN+1) in (6B,6C,6S,3,4,5)
  EXPERIMENT_NO(CN) in (3,4,5) then EXPERIMENT_NO(CN+1) in (7B,7C,7F,7R,9)
  EXPERIMENT_NO(CN) in (6A,6B) then EXPERIMENT_NO(CN+1) in (6C,6D,6S)
  EXPERIMENT_NO(CN) in (7A,7B) then EXPERIMENT_NO(CN+1) in (7C,7D,7S,9)
  EXPERIMENT_NO(CN) in (7R) then EXPERIMENT_NO(CN+1) in (7B,7C,7F,9)
  EXPERIMENT_NO(CN) = 9 then EXPERIMENT_NO(CN+1) must also = 9

  Error Message: **EXPERIMENT_SECTION**-E-11a, If EXPERIMENT_NO(CN) NOT equal to EXPERIMENT_NO(CN+1) and GPS_SPS(CN) = 'G' and EXPERIMENT_NO(CN) in (appropriate entry from list, above), then EXPERIMENT_NO(CN+1) must be in (corresponding entry, above).

OR

  (If GPS_SPS(CN) = S and
  EXPERIMENT_NO(CN) in (1,3,9N) or in (5) with SHRP_ID in ?501or in (8) with SHRP_ID in (?801- ?806), then EXPERIMENT_NO(CN+1) in GPS (6B,6C,6S, 3, 4, 5)
  EXPERIMENT_NO(CN) in (2,4) or in (6) with SHRP_ID in (?601, ?602, ?605), then EXPERIMENT_NO(CN+1) in GPS (7B,7C,7D,7F,7R,7S,9)
  EXPERIMENT_NO(CN) in (5,9O) and SHRP_ID <> ?501, then EXPERIMENT_NO(CN+1) in GPS (6C,6D,6S)
  EXPERIMENT_NO(CN) = 6 and SHRP_ID not in (?601,?602,?605), then EXPERIMENT_NO(CN+1) in GPS (7B,7C,7F,7R,9)
  EXPERIMENT_NO(CN) = 7, then EXPERIMENT_NO(CN+1) must also = 7
  EXPERIMENT_NO(CN) = 8 and SHRP_ID in (?807-?812), then EXPERIMENT_NO(CN+1) in GPS (7B,7C,7F,7R,9)
  EXPERIMENT_NO(CN) in (9C,9J), then EXPERIMENT_NO(CN+1) in GPS (7C,7D,7S,9)

  Error Message: **EXPERIMENT_SECTION**-E-11b, If EXPERIMENT_NO(CN) NOT equal to EXPERIMENT_NO(CN+1) and GPS_SPS(CN) = 'S' and EXPERIMENT_NO(CN) in (appropriate entry from list, above), then EXPERIMENT_NO(CN+1) must be in (corresponding entry, above).

- If EXPERIMENT_NO is in (9A, 9P) then RIGHT(SHRP_ID,2) = "00"

  Error Message: **EXPERIMENT_SECTION**-E-12, If EXPERIMENT_NO is in (9A, 9P), then RIGHT(SHRP_ID,2)=00.

- If EXPERIMENT_NO is in (9O, 9C, 9N, 9J) then RIGHT(SHRP_ID, 2) <> "00"

  Error Message: **EXPERIMENT_SECTION**-E-13, If EXPERIMENT_NO is in (9O, 9C, 9N, 9J), then right(shrp_id,2)<>00.

- If CONSTRUCTION_NO >1, then EXP_SECT_RS(CN) <= EXP_SECT_RS(CN-1)

Error Message: **EXPERIMENT_SECTION**-E-14, If CONSTRUCTION_NO > 1, then EXP_SECT_RS(CN) cannot exceed EXP_SECT_RS(CN-1). ***Therefore, cannot upgrade this record from D to E.***

- If CONSTRUCTION_NO >1, then each entry in EXPERIMENT_SECTION.CN_CHANGE_REASON must have a matching record in either RHB_IMP or MNT_IMP

  Error Message: **EXPERIMENT_SECTION**-E-22, If CONSTRUCTION_NO > 1, then each entry in EXPERIMENT_SECTION.CN_CHANGE_REASON must have a matching record in either RHB_IMP or MNT_IMP.

Tables: EXPERIMENT_SECTION, MON_CATEGORY

These checks do not set an edit flag. They are intended to ensure completeness of the **MON_CATEGORY** table.

- If GPS_SPS = “S” and SHRP_ID does not end in '00', or if GPS_SPS = “G” for maximum CONSTRUCTION_NO, if STATUS=null or DEASSIGN_DATE> 10/1/2000, then a record with matching STATE_CODE, SHRP_ID must exist in **MON_CATEGORY**

  Error message: **MON_CATEGORY** E-101: No monitoring category for section {STATE_CODE, SHRP_ID}; add **MON_CATEGORY** record.

Tables: MON_CATEGORY, EXPERIMENT_SECTION

- For matching STATE_CODE and SHRP_ID, if GPS_SPS = “G”, MONITORING_CATEGORY cannot equal S1 or S2

  Error message: **MON_CATEGORY** E-124: {STATE_CODE, SHRP_ID} is in GPS experiment; monitoring category cannot be S1 or S2.

- For matching STATE_CODE, SHRP_ID if status = ‘O’, using the records with maximum MON_CAT_ASSIGN_DATE, and maximum CONSTRUCTION_NO for respective tables, **MON_CATEGORY**.MON_CAT_DEASSIGN_DATE must be non-null and greater than **EXPERIMENT_SECTION**.CN_ASSIGN_DATE and less than or equal to **EXPERIMENT_SECTION**.DEASSIGN_DATE

  Error message: **MON_CATEGORY** E-113: {STATE_CODE, SHRP_ID} out-of-study, invalid monitoring period {MON_CAT_ASSIGN_DATE} to {MON_CAT_DEASSIGN_DATE}.

Table: MON_CATEGORY

- MON_CAT_DEASSIGN_DATE> MON_CAT_ASSIGN_DATE

  Error message: **MON_CATEGORY** 110: {STATE_CODE, SHRP_ID} was removed from this monitoring category before being assigned to it.

- For each STATE_CODE, SHRP_ID combination ordered from the earliest to latest value of MON_CAT_ASSIGN_DATE, the values of MONITORING_CATEGORY should be ordered

like S1, S2, G, C[2]

Error message: **MON_CATEGORY** E-120: {STATE_CODE, SHRP_ID} has gone from lower to higher monitoring frequency on {MON_CAT_ASSIGN_DATE}. If this is correct, apply manual RECORD_STATUS upgrade.

- For a set of records with matching STATE_CODE, SHRP_ID, there can be no gaps or overlaps in the sequence of MON_CAT_ASSIGN_DATE, MON_CAT_DEASSIGN_DATE values

  Error message: **MON_CATEGORY** E-122: {STATE_CODE, SHRP_ID} not all days are included in the monitoring period or some days have multiple monitoring categories.

Table: SECTION_COORDINATES

- If DATUM = 8, then DATUM_OTHER must be non null

  Error message: **SECTION_COORDINATES** E-101: {STATE_CODE, SHRP_ID, DATUM} DATUM field is populated with other and there is no entry in the DATUM_OTHER field.

Tables: SECTION_COORDINATES, EXPERIMENT_SECTION

- All records in SECTION_COORDINATES table must have a matching record in EXPERIMENT_SECTION for SHRP_ID and STATE_CODE

  Error message: **SECTION_COORDINATES** E-102: {STATE_CODE, SHRP_ID} Test section does not exist in EXPERIMENT_SECTION.

25.2 Guidelines for setting RS fields in the EXPERIMENT_SECTION table

The RS fields in **EXPERIMENT_SECTION** include:
EXP_SECT_RS
CLIMATIC_RS
PAV_STRUCT_RS
TRAFFIC_RS
BASIC_INFO_RS
RECORD_STATUS (This field is set based on the values of EXP_SECT_RS and BASIC_INFO_RS)

EXP_SECT_RS
This field is set based on the QC checks listed earlier in chapter 25.

CLIMATIC_RS
GPS
For CONSTRUCTION_NO = 1 and matching STATE_CODE, SHRP_ID:
If **CLM_SITE_VWS_LINK**.RECORD_STATUS is not null, then

---

[2] Sequences in date order like S1, G; S2, C; or S1, S2 would all pass this check. A sequence like S2, S1; C, G, or S2, G, S2 should all bring up the error message. For example, a project is changed from S2 to G because the agency cannot participate in the SPS traffic data collection plan and only sampled WIM will be provided. In summer of 2002 the state joins the national pooled fund study for SPS traffic and the project has at least 5 years of life remaining. The section is approved for upgrade back to S2.

- CLIMATIC_RS = **CLM_SITE_VWS_LINK**.RECORD_STATUS

Else

- CLIMATIC_RS = NULL

For CONSTRUCTION_NO > 1, set CLIMATE_RS = CLIMATE_RS for matching record in **EXPERIMENT_SECTION** with CONSTRUCTION_NO = 1

SPS - Project Level

SPS 1, 2, 7, 8

For matching STATE_CODE, SHRP_ID:
If **CLM_SITE_VWS_LINK**.RECORD_STATUS is not null, then

- CLIMATIC_RS = **CLM_SITE_VWS_LINK**.RECORD_STATUS

Else

- CLIMATIC_RS = NULL

SPS 3, 4, 5, 6, 9

For matching STATE_CODE, SHRP_ID, find linked **SPS_GPS_LINK**.LINKED_GPS_ID.
If link record found then:
For matching STATE_CODE, SHRP_ID:
If **CLM_SITE_VWS_LINK**.RECORD_STATUS is not null, then

- CLIMATIC_RS = **CLM_SITE_VWS_LINK**.RECORD_STATUS

Else

- CLIMATIC_RS = NULL

If link record NOT found then:
For matching STATE_CODE and Project Level SHRP_ID for original SPS section:
If **CLM_SITE_VWS_LINK**.RECORD_STATUS is not null, then

- CLIMATIC_RS = **CLM_SITE_VWS_LINK**.RECORD_STATUS

Else

- CLIMATIC_RS = NULL

SPS Section Level

All SPS

Set equal to matching SPS Project Level CLIMATIC_RS

PAV_STRUCT_RS

For matching STATE_CODE, SHRP_ID, and CONSTRUCTION_NO:

- PAV_STRUCT_RS = MIN(**TST_L05B**.RECORD_STATUS)

TRAFFIC_RS

GPS

For matching STATE_CODE, SHRP_ID:

- TRAFFIC_RS = MAX(**TRF_MONITOR_LTPP_LN**.RECORD_STATUS)

SPS

For matching STATE_CODE and Project level SHRP_ID, find linked **SPS_GPS_LINK**.LINKED_GPS_ID.
If link record found then:
For matching STATE_CODE, and LINKED_GPS_ID

- TRAFFIC_RS = MAX(**TRF_MONITOR_LTPP_LN**.RECORD_STATUS)

Else
For matching STATE_CODE and Project level SHRP_ID

- TRAFFIC_RS = MAX(**TRF_MONITOR_LTPP_LN**.RECORD_STATUS)

BASIC_INFO_RS

GPS

If CONSTRUCTION_NO = 1

For matching STATE_CODE, SHRP_ID:

If (INV_AGE.RECORD_STATUS, INV_ID.RECORD_STATUS, INV_GENERAL.RECORD_STATUS) are not null, then

- BASIC_INFO_RS = MIN(**INV_AGE**.RECORD_STATUS, **INV_ID**.RECORD_STATUS, **INV_GENERAL.**RECORD_STATUS)

Else

- BASIC_INFO_RS = NULL

If CONSTRUCTION_NO > 1

For matching STATE_CODE, SHRP_ID, CONSTRUCTION_NO = 1

If GPS_SPS = S then

- Use SPS Section Level Checks to determine BASIC_INFO_RS

Else

If (**INV_AGE**.RECORD_STATUS.INV_ID.RECORD_STATUS, **INV_GENERAL**.RECORD_STATUS) are not null, then

- BASIC_INFO_RS = MIN(**INV_AGE**.RECORD_STATUS, **INV_ID.**RECORD_STATUS, **INV_GENERAL**.RECORD_STATUS)

Else

- BASIC_INFO_RS = NULL

SPS - Project Level

SPS 1, 2, 8

For matching STATE_CODE, SHRP_ID:

If all matching **SPS_ID**.RECORD_STATUS are not null, then

- BASIC_INFO_RS = MIN(**SPS_ID**.RECORD_STATUS)

Else

- BASIC_INFO_RS = NULL

SPS 3, 4, 5, 6, 7

For matching STATE_CODE, SHRP_ID, find linked **SPS_GPS_LINK**.LINKED_GPS_ID.

If linked record found, then:

For matching STATE_CODE, LINKED_GPS_ID:

If (**INV_AGE**.RECORD_STATUS, **INV_ID**.RECORD_STATUS, **INV_GENERAL**.RECORD_STATUS) are not null, then

- BASIC_INFO_RS = MIN(**INV_AGE**.RECORD_STATUS, I**NV_ID**.RECORD_STATUS, **INV_GENERAL**.RECORD_STATUS)

Else

- BASIC_INFO_RS = NULL

If linked record NOT found, then:

For matching STATE_CODE, and Project Level SHRP_ID for original SPS section:

If (**INV_AGE.**RECORD_STATUS, **INV_ID**.RECORD_STATUS, **INV_GENERAL**.RECORD_STATUS) are not null, then

- BASIC_INFO_RS = MIN(**INV_AGE**.RECORD_STATUS, **INV_ID**.RECORD_STATUS, **INV_GENERAL**.RECORD_STATUS)

Else

- BASIC_INFO_RS = NULL

SPS 9

For matching STATE_CODE, SHRP_ID, find linked **SPS_GPS_LINK**.LINKED_GPS_ID.

If linked record found, then:

For matching STATE_CODE, LINKED_GPS_ID:

If (**INV_AGE**.RECORD_STATUS, **INV_ID**.RECORD_STATUS, **INV_GENERAL**.RECORD_STATUS) are not null, then

- BASIC_INFO_RS = MIN(**INV_AGE**.RECORD_STATUS, **INV_ID**.RECORD_STATUS, **INV_GENERAL.**RECORD_STATUS)

Else

- BASIC_INFO_RS = NULL

If linked record NOT found, then:

For STATE_CODE, and Project Level SHRP_ID matching original SPS section, look for record in **INV_ID**:

If record found, then:

If (**INV_AGE**.RECORD_STATUS, **INV_ID**.RECORD_STATUS, **INV_GENERAL**.RECORD_STATUS) are not null, then

- BASIC_INFO_RS = MIN(**INV_AGE**.RECORD_STATUS, **INV_ID**.RECORD_STATUS, **INV_GENERAL**.RECORD_STATUS)

Else

- BASIC_INFO_RS = NULL

If record NOT found, then:

Find all matching STATE_CODE, and Project Level SHRP_ID records in SPS_ID:

If matching (**SPS_ID**.RECORD_STATUS) are not null, then

- BASIC_INFO_RS = MIN(**SPS_ID**.RECORD_STATUS)

Else

- BASIC_INFO_RS = NULL

SPS Section Level

All SPS

For matching STATE_CODE, and SUBSTR(TEST_SECTION, 3, 4)=SHRP_ID in **SPS_PROJECT_STATIONS** table, get MIN(**SPS_PROJECT_STATIONS**.RECORD_STATUS):

If (**EXPERIMENT_SECTION**.EXP_SECT_RS, MIN(**SPS_PROJECT_STATIONS**.RECORD_STATUS)) are not null, then

- BASIC_INFO_RS = MIN(**EXPERIMENT_SECTION**.EXP_SECT_RS, MIN(**SPS_PROJECT_STATIONS.**RECORD_STATUS))

Else

- BASIC_INFO_RS = NULL

RECORD_STATUS

If BASIC_INFO_RS is null, then

- RECORD_STATUS = A

Else

- RECORD_STATUS = MIN(BASIC_INFO_RS, EXP_SECT_RS)

The last level "E" check ensures that the RECORD_STATUS of any CN > 1 cannot have a value of RECORD_STATUS greater than that of CN-1. This will ensure that data will not be released for a higher CN if any CN below it is not at level "E".

- If CN>1, then RECORD_STATUS(CN) = MIN (RECORD_STATUS(CN-1),RECORD_STATUS(CN))

NOTE: After setting the various *_RS values and completion of level E checks, RECORD_STATUS can have the following values:

Value	Definition
A - E	Releasable sections (STATUS != ‘R’)
!	Rejected sections (STATUS = ‘R’)

26.0 SPS MISCELLANEOUS

26.1 Level 1

A. Initial Level

Records in the IMS are at Level A when they first enter the system and are set back to A when changes are made to a given record or to selected related records.

B. Dependency Checks

For each record in SPS_General, the corresponding project level record must be at Level E in **SPS_ID** and **SPS_PROJECT_STATIONS**.

SINIT C Checks (Section Minimum Range Checks)

Minimum data checks for the section data tables are listed below. Data fields with a Condition of "X" must always contain a non-null value, however, data fields with a Condition of "*" are only required to contain a non-null value if a particular condition is met as specified in the accompanying field explanation.

Table	Field	Condition
SPS_GENERAL	DRAINAGE_LOCATION	X
	DRAINAGE_TYPE	X
	LANE_NUMBER_MONITORED	X
	LANE_WIDTH	X
	O_SH_PAVED_WIDTH	X
	O_SH_SURFACE_TYPE	X
	O_SH_WIDTH	X
	PAVEMENT_TYPE	X

SINIT D Checks (Section Expanded Range Checks)

Expanded range checks are applied to certain fields to identify data element values that fall outside an expected range. Field names are listed below the bolded table name. Expanded range checks for the Section data tables are listed below.

Table	Units	Range
SPS_GENERAL for SPS1		
DRAINAGE_LOCATION		1 - 3
DRAINAGE_TYPE		1, 2, 6
LANE_NUMBER_MONITORED		1
LANE_WIDTH	ft	10 - 15
O_SH_SURFACE_TYPE		3
O_SH_WIDTH	ft	3 - 15
O_SH_PAVED_WIDTH	ft	3 - 15

PAVEMENT_TYPE		1 - 2
SPS_GENERAL for SPS2		
DRAINAGE_LOCATION		1 - 3
DRAINAGE_TYPE		1, 6
LANE_NUMBER_MONITORED		1
LANE_WIDTH	ft	11 - 13
	(where SHRP_ID in ET1[1])	
		13 - 15
	(where SHRP_ID in SET2[2])	
O_SH_PAVED_WIDTH	ft	4 - 12
O_SH_SURFACE_TYPE		1 - 6
O_SH_WIDTH	ft	4 - 12
PAVEMENT_TYPE		17, 18, 20, 21, 23
SPS_GENERAL for SPS8		
DRAINAGE_LOCATION		1 - 3
DRAINAGE_TYPE		1, 6
LANE_NUMBER_MONITORED		1
LANE_WIDTH		10 - 15
O_SH_PAVED_WIDTH		3 - 15
O_SH_SURFACE_TYPE		3, 4, 5
O_SH_WIDTH		3 - 15
PAVEMENT_TYPE		
For SHRP_IDs ?801-?806		1
For SHRP_IDs ?807-?812		17
SPS_GENERAL for SPS9		
DRAINAGE_LOCATION		1 - 3
DRAINAGE_TYPE		1, 2, 6
LANE_NUMBER_MONITORED		1
LANE_WIDTH		10 - 15
O_SH_PAVED_WIDTH		3 - 15
O_SH_SURFACE_TYPE		3, 4, 5
O_SH_WIDTH		3 - 15
PAVEMENT_TYPE		1 - 3, 28 - 30

SINIT E Checks (Section Intramodular Checks)

Intramodular checks for the Section tables are listed below:

Table: SPS_GENERAL for SPS1

- O_SH_WIDTH >= O_SH_PAVED_WIDTH
- I_SH_WIDTH >= I_SH_PAVED_WIDTH

---

[1] SET1 is list of SHRP_IDs like (?201, ?204, ?205, ?208, ?209, ?212, ?214, ?215, ?218, ?219, ?222, ?223, ?225, ?228, ?229, ?232, ?233, ?236, ?238, ?239, ?242, ?243, ?245, ?248, ?249, ?252)

[2] Set2 is list of SHRP_IDs like (?202, ?203, ?206, ?207, ?210, ?211, ?213, ?216, ?217, ?220, ?221, ?224, ?226, ?227, ?230, ?231, ?234, ?235, ?237, ?240, ?241, ?244, ?246, ?247, ?250, ?251)

If the last three digits of SHRP_ID between ?110 - ?112 or ?122 - ?124 then:

- DRAINAGE_LOCATION must be 1
- DRAINAGE_TYPE must be 6
- DRAINPIPE_DIAMETER must be non-null
- LATERALS_SPACING must be non-null

If the last three digits of SHRP_ID between ?101 - ?106 or ?113 - ?118 then:

- DRAINAGE_LOCATION must be 3
- DRAINAGE_TYPE must be 1
- DRAINPIPE_DIAMETER must be null
- LATERALS_SPACING must be null

If the last three digits of SHRP_ID between ?107 - ?109 or ?119 - ?121 then:

- DRAINAGE_LOCATION must be 1
- DRAINAGE_TYPE must be 2 or 6
- DRAINPIPE_DIAMETER must be non-null
- LATERALS_SPACING must be non-null

SPS_GENERAL for SPS2

- O_SH_SURFACE_TYPE must be 3 or 4
- O_SH_WIDTH $\geq$ O_SH_PAVED_WIDTH

If neither null, then:

- I_SH_WIDTH $\geq$ I_SH_PAVED_WIDTH

For SHRP_ID = ?209 - ?212, ?221 - ?224, ?229 - ?230, ?235 - ?236, ?241 - ?244 and ?249 - ?252 then:

- DRAINAGE_LOCATION must be 1
- DRAINAGE_TYPE must be 6
- DRAINAGE_DIAMETER must be non null
- LATERALS_SPACING must be non null

For SHRP_ID = ?201 - ?208, ?213 - ?220, ?225 - ?228, ?231 - ?234, ?237 - ?240 and ?245 - ?248 then:

- DRAINAGE_LOCATION must be 3
- DRAINAGE_TYPE must be 1
- DRAINAGE_DIAMETER must be null
- LATERALS_SPACING must be null

Table: SPS_GENERAL for SPS8

- If DRAINAGE_LOCATION = 3, then the following must hold true:
  DRAINAGE_TYPE = 1
  DRAINAGE_DIAMETER = 0 or null
  LATERALS_SPACING = 0 or null

- If DRAINAGE_TYPE = 6, then the following must hold true:
  DRAINAGE_DIAMETER > 0
  LATERALS_SPACING > 0
- If DRAINAGE_TYPE = 7, then OTHER_DRAINAGE_TYPE must be non-null
- If I_SH_SURFACE_TYPE = 6, then I_SH_SURFACE_TYPE_OTHER must be non-null
- If O_SH_SURFACE_TYPE = 6, then O_SH_SURFACE_TYPE_OTHER must be non-null
- If O_SH_SURFACE_TYPE <> 1, then O_SH_WIDTH and O_SH_SURFACE_THICK must be non-null
- If I_SH_BASE_TYPE <> 21, then I_SH_BASE_THICK must be non-null
- If O_SH_BASE_TYPE <> 21, then O_SH_BASE_THICK must be non-null

---

C. Minimum Data Elements

Tables and accompanying fields that must be included in a data record are identified below. Explanations are provided for those fields having certain conditions as to when they are required (i.e., X = always; * = conditionally).

Table	Field	Condition
SPS_CUT_FILL_LOCATIONS	CUT_FILL_TYPE	X
SPS_INTERSECTIONS	PROJECT_STATION_NO	X

D. Expanded Range Checks

Expanded range checks are applied to certain fields to identify data element values that fall outside an expected range. Field names are listed below the bolded table name. Expanded range checks for all miscellaneous SPS data tables are specified below.

Table	Units	Range
SPS_CUT_FILL_LOCATIONS		
CUT_FILL_END	m	15 - 155[3]
CUT_FILL_START	m	0 – 152
CUT_FILL_TYPE		1 - 3, 5
SPS_PROJECT_STATIONS		
DIRECTION_OF_TRAVEL		1 – 5
SECTION_CUT_FILL	m	1 – 4
SECTION_END	m	152 – 15240
SECTION_START		0 – 15500

E. Intramodular Checks

Each E-type check is separated by a single line. In general, each bullet represents a procedure, action, etc., of the check.

SPS_CUT_FILL_LOCATIONS

- CUT_FILL_END > CUT_FILL_START

  Error message: **SPS_CUT_FILL_LOCATIONS**-E-103 {STATE_CODE, SHRP_ID, TRANSITION_ORDER_NO} CUT_FILL_END {CUT_FILL_END} <= CUT_FILL_START {CUT_FILL_START}

- Each record must represent a cut/fill transition within the section and have a matching record in SPS_PROJECT_STATIONS with SECTION_CUT_FILL = 4

  Error Message: SPS_CUT_FILL_LOCATIONS-E-102 {STATE_CODE, SHRP_ID, TRANSITION_ORDER_NO} Record must represent a cut/fill transition within the section and have a matching record in SPS_PROJECT_STATIONS with SECTION_CUT_FILL=4

Table: **SPS_GPS_LINK**

- For each record, the last two characters of SHRP_ID="00"

  Error Message: The last two characters of SHRP_ID are not 00.

Table: SPS_GPS_LINK, EXPERIMENT_SECTION

For each record in the **SPS_GPS_LINK** table:

- At least one matching record with STATE_CODE and SHRP_ID must exist in **EXPERIMENT_SECTION**

  Error Message: Record with matching STATE_CODE = {value} and SHRP_ID = {value} does not exist in **EXPERIMENT_SECTION**.

- For matching STATE_CODE and SHRP_ID, **EXPERIMENT_SECTION**.GPS_SPS="S"

  Error Message: Test section specified with STATE_CODE and SHRP_ID in GPS_SPS_LINK is not indicated as a SPS test section in **EXPERIMENT_SECTION**.

- At least one record must exist in **EXPERIMENT_SECTION** with matching STATE_CODE and **SPS_GPS_LINK**.LINKED_GPS_ID = **EXPERIMENT_SECTION**.SHRP_ID

  Error Message: Record with matching STATE_CODE= {value} and LINKED_GPS_ID={value} does not exist in **EXPERIMENT_SECTION**.

- For matching STATE_CODE and **SPS_GPS_LINK**.LINKED_GPS_ID = **EXPERIMENT_SECTION**.SHRP_ID, **EXPERIMENT_SECTION**.GPS_SPS="G".

  Error Message: Test section specified with STATE_CODE and LINKED_GPS_ID in GPS_SPS_LINK is not indicated as a GPS test section in EXPERIMENT_SECTION.

SPS_PROJECT_STATIONS

- The first 4 characters of TEST_SECTION must be STATE_CODE + first 2 characters of PROJECT_ID

  Error Message: **SPS_PROJECT_STATIONS**-E-101 Initial TEST_SECTION characters invalid {STATE_CODE, PROJECT_ID, TEST_SECTION}

- SECTION_END > SECTION_START

  Error Message: **SPS_PROJECT_STATIONS**-E-102 {STATE_CODE, PROJECT_ID, TEST_SECTION} SECTION_END {SECTION_END} <= SECTION_START {SECTION_START}

SPS_PROJECT_STATIONS must be sorted by STATE_CODE, PROJECT_ID, and ORDER_NO before doing the following checks:

- For a set of records with matching STATE_CODEs and PROJECT_IDs, ORDER_NO and ORDER_NO-1 must exist, where ORDER_NO >= 2

  Error message: **SPS_PROJECT_STATIONS**-E-103 {STATE_CODE, PROJECT_ID} Missing sections between {ORDER_NO-1} and {ORDER_NO}

- START_STATION (ORDER_NO) > END_STATION (ORDER_NO-1)+ 15, where ORDER_NO >= 2

  Error message: **SPS_PROJECT_STATIONS**-E-104 {STATE_CODE, PROJECT_ID} ORDER_NO {ORDER_NO} and ORDER_NO-1 {ORDER_NO-1} are overlapping sections

  If SHRP_ID like ?602 or ?605, then
- 302 <= SECTION_END-SECTION_START <= 305

  Else

  If SPS4, then
- SECTION_END-SECTION_START <= 153

  Else
- 152 <= SECTION_END-SECTION_START <= 153

  Error Message: **SPS_PROJECT_STATIONS**-E-108 (See QC Manual for exceptions)

SPS_PROJECT_STATIONS, EXPERIMENT_SECTION

- TEST_SECTION must exist as a combination of STATE_CODE, SHRP_ID in **EXPERIMENT_SECTION**

  Error message: **SPS_PROJECT_STATIONS**-E-105 TEST_SECTION invalid {STATE_CODE, PROJECT_ID, TEST_SECTION}

SPS_PROJECT_STATIONS, SPS_CUT_FILL_LOCATIONS

- If **SPS_PROJECT_STATIONS**.CUT_FILL_TYPE = 4, then for TEST_SECTION in SPS_PROJECT_STATIONS matching the combination of STATE_CODE and SHRP_ID in **SPS_CUT_FILL_LOCATIONS**, two or more records must exist in SPS_CUT_FILL_LOCATIONS

  Error message: **SPS_PROJECT_STATIONS**-E-107 {STATE_CODE, PROJECT_ID, TEST_SECTION} Must have at least 2 records in **SPS_CUT_FILL_LOCATIONS** for SECTION_CUT_FILL=4. # records exist.

SPS_INTERSECTIONS

- Section_Start(MIN(ORDER_NO)) <= PROJECT_STATION_NO <= SECTION_END(MAX(ORDER_NO))

  Error Message: **SPS_INTERSECTIONS**-E-1, PROJECT_STATION_NO must be within SECTION_START_NO (ORDER_NO=1) and SECTION_END for MAX(ORDER_NO) in **SPS_PROJECT_STATIONS**

- For each record in **SPS_INTERSECTIONS**, at least one record with matching STATE_CODE and PROJECT_ID (SHRP_ID) must exist in **SPS_PROJECT_STATIONS**.

  Error Massage: **SPS_INTERSECTIONS**-E-2a, No matching records exist in **SPS_PROJECT_STATIONS.**

- Each matching record in **SPS_PROJECT_STATIONS** must have RECORD_STATUS='E'

  Error Massage: **SPS_INTERSECTIONS**-E-2b, All matching **SPS_PROJECT_STATIONS** records are NOT at level E**.**

27.0 DRAINAGE QC PROGRAMS

27.1 Level 1

A. Initial Level

Records in the IMS are at Level A when they first enter the system and are set back to A when changes are made to a given record or to selected related records.

B. Dependency Checks

No dependency checks are required.

C. Minimum Data Elements

Tables and accompanying fields that must be included in a data record are identified below. Explanations are provided for those fields having certain conditions as to when they are required (i.e., X = always; * = conditionally).

Table	Field	Condition
MON_DRAIN_MASTER	EXIT_DEPTH	X
	RODENT_SCREEN	X
	LATERAL_DIAMETER	X
	NEAREST_SECTION	X
	EROSION_CONTROL	X
MON_DRAIN_CONDITION	OPENING_CONDITION	X
	PRESENCE_OF_DEBRIS	X
	DITCH_VEGETATION	X
	DITCH_CLEANING	X
	DITCH_WATER	X
	DRAIN_WATER	X
	OUTLET_EROSION	X
	SURVEY_AIR_TEMP	X
	PROCESS_DATE	X
MON_DRAIN_INSPECT	CONDITION_PASSABLE	X
	PROCESS_DATE	X
MON_DRAIN_PERM_MEAS	CORE_EDGE_DIST	X
	PATB_TOP_ELEV	X
	PVMT_EDGE_ELEV	X
MON_DRAIN_PERM_CALC	HPAVT	X

HPATB	X
MAX_INFLOW_RATE	X
ELEV_HEAD	X
FLOW_LENGTH	X
HYD_GRADIENT	X
FLOW_PLUME_WIDTH	X
CROSS_SECTION_FLOW_AREA	X
HYDRAULIC_CONDUCTIVITY	X

D. Expanded Range Checks

Expanded range checks are applied to certain fields to identify data element values that fall outside an expected range. Field names are listed below the bolded table name.

Table	Units	Range
MON_DRAIN_MASTER		
END_OFFSET	m	0.0 – 50.0
LATERAL_DIAMETER	mm	0 – 180
MAINLINE_DIAMETER	mm	0 – 180
MON_DRAIN_CONDITION		
SURVEY_AIR_TEMP	deg C	-15.0 – 45.0
MON_DRAIN_INSPECT		
PROBE_DISTANCE	m	0.0 – 140.0
MON_DRAIN_PERM_MEAS		
SS_INFILTRATION	Gal/min	0-8
MON_DRAIN_PERM_CALC		
No Level D Checks		

E. Intramodular Checks

Each E-type check is separated by a single line. In general, each bullet represents a procedure, action, etc., of the check.

Checks on **MON_DRAIN_MASTER** must be completed before remaining level E QC is run.

Table: MON_DRAIN_MASTER

- If EROSION_CONTROL = ‘4’, then EROSION_CONTROL_OTHER must be non-null

  Error message: **MON_DRAIN_MASTER**-E-1 EROSION_CONTROL= {EROSION_CONTROL} requires non-null entry in EROSION_CONTROL_OTHER.

- If LATERAL_TYPE = ‘6’, then LATERAL_TYPE_OTHER must be non-null

  Error message: **MON_DRAIN_MASTER**-E-2 LATERAL_TYPE = {LATERAL_TYPE} requires non-null entry in LATERAL_TYPE_OTHER.

- If INTERSECT_TYPE = ‘5’, then INTERSECT_TYPE_OTHER must be non-null

  Error message: **MON_DRAIN_MASTER**-E-3 INTERSECT_TYPE = {INTERSECT_TYPE} requires non-null entry in INTERSECT_TYPE_OTHER.

- If MAINLINE_TYPE = ‘6’, then MAINLINE_TYPE_OTHER must be non-null

  Error message: **MON_DRAIN_MASTER**-E-4 MAINLINE_TYPE = {MAINLINE_TYPE} requires non-null entry in MAINLINE_TYPE_OTHER.

- If MON_DRAIN_MASTER.MAINLINE_TYPE is not equal to six, then MON_DRAIN_MASTER.MAINLINE_DIAMETER can not be NULL.

  Error message: **MON_DRAIN_MASTER**-E-6 MAINLINE_DIAMETER can not be NULL when MAINLINE_TYPE is not equal to six.

Tables: MON_DRAIN_MASTER, EXPERIMENT_SECTION

- A record must exist in **EXPERIMENT_SECTION** with matching STATE_CODE and SHRP_ID = SITE_ID

  Error message: **MON_DRAIN_MASTER**-E-5 No record of project in EXPERIMENT_SECTION.

Tables: MON_DRAIN_INSPECT, MON_DRAIN_MASTER

- A record with matching STATE_CODE, SITE_ID, LATERAL_ID must exist in **MON_DRAIN_MASTER** with RECORD_STATUS = ‘E’

  Error Message: **MON_DRAIN_INSPECT**-E-1 Matching record does not exist in **MON_DRAIN_MASTER** with RECORD_STATUS = ‘E’.

Table: MON_DRAIN_CONDITION

- If DITCH_VEGETATION = ‘4’ Then DITCH_VEGETATION_OTHER must be non-null

  Error message: **MON_DRAIN_CONDITION**-E-1 DITCH_VEGETATION = {REASON} requires non-null entry in DITCH_VEGETATION_OTHER.

Tables: MON_DRAIN_CONDITION, MON_DRAIN_MASTER

- A record with matching STATE_CODE, SITE_ID, LATERAL_ID must exist in **MON_DRAIN_MASTER** with RECORD_STATUS = ‘E’

  Error Message: **MON_DRAIN_CONDITION**-E-2 Matching record does not exist in **MON_DRAIN_MASTER** with RECORD_STATUS = ‘E’.

Tables: MON_DRAIN_CONDITION, MON_DRAIN_INSPECT

- If OPENING_CONDITION = 3 and PRESENCE_OF_DEBRIS = 3, there must be a record with matching STATE_CODE, SITE_ID, LATERAL_ID, SURVEY_DATE in **MON_DRAIN_INSPECT**

  Error Message: MON_DRAIN_CONDITION-E-3, For OPENING_CONDITION = 3 and PRESENCE_OF_DEBRIS = 3, there must be matching record in **MON_DRAIN_INSPECT.**

- If OPENING_CONDITION = 1 and PRESENCE_OF_DEBRIS = 1, there must not be a record with matching STATE_CODE, SITE_ID, LATERAL_ID, SURVEY_DATE in **MON_DRAIN_INSPECT**

  Error Message: **MON_DRAIN_CONDITION-E-4,** For OPENING_CONDITION = 1 and PRESENCE_OF_DEBRIS = 1, no matching record in **MON_DRAIN_INSPECT** should exist.

Tables: MON_DRAIN_PERM_CALC, MON_DRAIN_PERM_MEAS

- There must be a record in **MON_DRAIN_PERM_MEAS** with matching STATE_CODE, SHRP_ID, and POINT_LOC at level 'E'

  Error message: **MON_DRAIN_PERM_CALC**-E-101, There must be a matching record in **MON_DRAIN_PERM_MEAS** at Level E.

Tables: MON_DRAIN_PERM_MEAS, TST_L05B

- There must be a record in **TST_L05B** with matching STATE_CODE, SHRP_ID, and CONSTRUCTION_NO with LAYER_TYPE = 'TB'

  Error message: **MON_DRAIN_PERM_MEAS**-E-101, There is no PATB layer identified in **TST_L05B** for this section.

28.0 GROUND PENETRATING RADAR (GPR) QC PROGRAMS

28.1 Level 1

A. Initial Level

Records in the IMS are at Level A when they first enter the system and are set back to A when changes are made to a given record or to selected related records.

B. Dependency Checks

No dependency checks are performed.

C. Minimum Data Elements

Tables and accompanying fields that must be included in a data record are identified below. Explanations are provided for those fields having certain conditions as to when they are required (i.e., X = always; * = conditionally).

Table	Field	Condition
GPR_MASTER	ANALYSIS_SOFTWARE_VER	X
	PLATE_HIGH_CAL_SLOPE	X
	PLATE_HIGH_CAL_INTERCEPT	X
	RAW_DATA_FILE	X
GPR_THICK_POINT	LAYER_TYPE	X
	SECTION_STAT_INCLUDE_FLAG	X
GPR_THICK_SECT	LAYER_THICK_MEAN	X
	LAYER_DIELECTRIC_MEAN	X
	LAYER_TYPE_SECTION	X

D. Expanded Range Checks

Expanded range checks are applied to certain fields to identify data element values that fall outside an expected range. Field names are listed below the bolded table name.

Table	Units	Range
GPR_MASTER		
PLATE_HIGH_CAL_SLOPE		-2 - 1
PLATE_HIGH_CAL_INTERCEPT		2 - 10

GPR_THICK_POINT

POINT_LOC	m	-35 - 335
LAYER_DIELECTRIC_CONST		1 - 80
LAYER_THICKNESS	mm	0 - 500

E. Intramodular Checks

Each E-type check is separated by a single line. In general, each bullet represents a procedure, action, etc., of the check. Checks must be performed in the sequence of GPR_MASTER, GPR_THICK_POINT, GPR_THICK_SECT, then GPR_LINK_LAYER.

Table: GPR_MASTER, EXPERIMENT_SECTION

- A record must exist in EXPERIMENT_SECTION with matching STATE_CODE and SHRP_ID

  Error message: GPR_MASTER-E-1, {STATE_CODE, SHRP_ID} No record of section in EXPERIMENT_SECTION.

Tables: GPR_THICK_POINT, GPR_MASTER

- A record with matching STATE_CODE, SHRP_ID, GPR_DATE, GPR_TIME, LANE_POSITION must exist in GPR_MASTER with RECORD_STATUS = 'E'

  Error Message: GPR_THICK_POINT-E-1 {STATE_CODE, SHRP_ID, GPR_DATE, GPR_TIME, LANE_POSITION} Matching record does not exist in GPR_MASTER with RECORD_STATUS = 'E'.

Tables: GPR_THICK_SECT, GPR_THICK_POINT

- There must be a record with matching STATE_CODE, SHRP_ID, GPR_DATE, GPR_TIME, LANE_POSITION in GPR_THICK_POINT with SECTION_STAT_INCLUDE_FLAG = 1

  Error Message: GPR_THICK_SECT-E-1 {STATE_CODE, SHRP_ID, GPR_DATE, GPR_TIME, LANE_POSITION} For each record in GPR_THICK_SECT, there must be at least one record in GPR_THICK_POINT with SECTION_STAT_INCLUDE_FLAG = 1.

- For matching STATE_CODE, SHRP_ID, GPR_DATE, GPR_TIME, LANE_POSITION in GPR_THICK_POINT where SECTION_STAT_INCLUDE_FLAG = 1, RECORD_STATUS must = 'E'

  Error Message: GPR_THICK_SECT-E-2 {STATE_CODE, SHRP_ID, GPR_DATE, GPR_TIME, LANE_POSITION} Each matching record in GPR_THICK_POINT with SECTION_STAT_INCLUDE_FLAG = 1 must have RECORD_STATUS = 'E'.

Tables: GPR_LINK_LAYER, GPR_THICK_SECT

- A record with matching STATE_CODE, SHRP_ID, GPR_DATE, GPR_TIME, LANE_POSITION must exist in GPR_THICK_SECT with RECORD_STATUS = 'E'.

Error Message: GPR_LINK_LAYER-E-1 {STATE_CODE, SHRP_ID, GPR_DATE, GPR_TIME, LANE_POSITION} Matching record does not exist in GPR_THICK_SECT with RECORD_STATUS = 'E'.

Tables: GPR_LINK_LAYER, TST_L05B

- There must be a record with matching STATE_CODE, SHRP_ID, TST_L05B.LAYER_NO = L05B_LAYER_NO in TST_L05B

Appendix A

TEST SECTION DESIGNATIONS

To provide a logical basis for test section designations, a broad-based experimental approach has been used. Test sections are classified as GPS or SPS. The fundamental difference between these two classifications is that at the start of the LTPP program, the GPS test sections are existing pavements and the SPS projects are sites where multiple test sections of differing experimental treatment factors are constructed. When a GPS or SPS test section is rehabilitated, it can be assigned to a GPS rehabilitation designation.

While the LTPP test section classification methodology is based on experimental concepts, data users are encouraged to develop their own classification methods to meet specific analytical objectives. For example, the SPS-1 experiment is designed to extend the findings from the GPS-1 and -2 studies.

In the published literature, the LTPP projects are designated by experiment designs. A factorial combination approach has been used for the development of the experiment design designation of each GPS and SPS experiment. This approach requires the identification of significant pavement and environmental/loading factors considered to have an influence on pavement performance. Pavement factors include such variables as layer thickness, base type, base thickness, joint spacing, and percent steel reinforcement, which are varied as appropriate for the pavement type being studied. Environmental/loading factors include moisture (wet/dry), temperature (freeze/no-freeze), sub-grade classification (fine/coarse grained), and traffic loading rate (low/high).

The combination of these selected factors form an experimental factorial that is used as the sampling basis for test sections included in each study. Within GPS, these factorials are more properly considered as sampling templates used in the selection of pavement structures included in the studies. Since GPS consists mostly of pavements that were constructed and in service prior to the start of the LTPP program, it is impossible to find pavements with all of the combinations defined within the factorial. SPS is a more controlled experiment requiring construction of the specified pavement structures. While the SPS experimental factorials are closer to a classical experiment design, between-site construction deviations should be considered in many types of statistical analyses.

A.1 General Pavement Studies

The GPS program is a series of studies on selected in-service pavements structured to develop a comprehensive national pavement performance database. These studies are restricted to pavements that incorporate materials and designs representing good engineering practices and that have strategic future importance. Because of the nationwide thrust of the program, the studies are limited to pavement structures in common use across the United States.

The GPS test sections are located on pavement structures constructed up to 15 years prior to the start of the LTPP program. Although detailed research-level measurements on these pavements during the early years of their lives are not available, the GPS test sections offer the potential for development of earlier results than those possible from newly constructed test sections. As the SPS test sections are rehabilitated, they are reclassified into the GPS experiment designations. Table A.1 provides a list of the titles of each of the experiments. A more comprehensive definition is provided in Appendix B of the PPDB User Reference Guide.

It should be noted that the proposed GPS-8 study of bonded portland cement concrete (PCC) overlays on PCC pavements was not pursued because of lack of an adequate number of nominated in-service projects. An SPS study on bonded PCC overlays, SPS-7, was formulated to address this type of rehabilitation alternative.

Table A.1. List of GPS experiments.

Experiment	Experiment Title
GPS-1	Asphalt Concrete (AC) Pavement on Granular Base
GPS-2	AC Pavement on Bound Base
GPS-3	Jointed Plain Concrete Pavement (JPCP)
GPS-4	Jointed Reinforced Concrete Pavement (JRCP)
GPS-5	Continuously Reinforced Concrete Pavement (CRCP)
GPS-6A	Existing AC Overlay of AC Pavement (existing at the start of the program)
GPS-6B	AC Overlay Using Conventional Asphalt of AC Pavement–No Milling
GPS-6C	AC Overlay Using Modified Asphalt of AC Pavement–No Milling
GPS-6D	AC Overlay on Previously Overlaid AC Pavement Using Conventional Asphalt
GPS-6S	AC Overlay of Milled AC Pavement Using Conventional or Modified Asphalt
GPS-7A	Existing AC Overlay on PCC Pavement
GPS-7B	AC Overlay Using Conventional Asphalt on PCC Pavement
GPS-7C	AC Overlay Using Modified Asphalt on PCC Pavement
GPS-7D	AC Overlay on Previously Overlaid PCC Pavement Using Conventional Asphalt
GPS-7F	AC Overlay Using Conventional or Modified Asphalt on Fractured PCC Pavement
GPS-7R	Concrete Pavement Restoration Treatments With No Overlay
GPS-7S	Second AC Overlay, Which Includes Milling or Geotextile Application, on PCC Pavement With Previous AC Overlay
GPS-9	Unbonded PCC Overlay on PCC Pavement

A.2 Specific Pavement Studies

The SPS program is a long-term study of specially constructed, maintained, or rehabilitated pavement sections incorporating a controlled set of experiment design and construction features. The objective of SPS is to provide a more detailed and complete base of data to extend and refine the results obtained from the GPS studies. The SPS program incorporates nine studies grouped into the five categories as illustrated by Table A.2. Appendix B of the PPDB User Reference Guide provides a more complete definition of each of the experiments.

Essentially, the SPS program involves monitoring newly constructed sections or existing pavement sections subjected to maintenance or rehabilitation treatments. Each SPS experiment requires construction of multiple test sections at each site. The number of test sections may range from two for SPS-8 to twelve for SPS-1 and -2. In addition, a highway agency may construct supplemental test sections on an SPS site to investigate other factors of interest to the agency. The following definitions apply only to the core sections within each experiment. The supplemental sections that may have been constructed by a highway agency are based on the respective agency's research interests and are typically not consistent among highway agencies.

Table A.2. List of SPS Experiments by Category.

Category	Experiment	Title	Core[1] Sections
Pavement Structural Factors	SPS-1	Strategic Study of Structural Factors for Flexible Pavements	100 - 124
	SPS-2	Strategic Study of Structural Factors for Rigid Pavements	200 - 252
Pavement Maintenance	SPS-3	Preventive Maintenance Effectiveness of Flexible Pavements	300, 310, 320, 330, 340, 350
	SPS-4	Preventive Maintenance Effectiveness of Rigid Pavements	400, 410, 420, 430
Pavement Rehabilitation	SPS-5	Rehabilitation of AC Pavements	500 - 509
	SPS-6	Rehabilitation of Jointed Portland Cement Concrete (JPCC) Pavements	600 - 608
	SPS-7	Bonded PCC Overlays of Concrete Pavements	700 - 709
Environmental Effects	SPS-8	Study of Environmental Effects in the Absence of Heavy Loads	800 - 812
Asphalt Aggregate	SPS-9P	Validation and Refinements of Superpave® Asphalt Specifications and Mix Design Process	900 - 903

[1] Core sections are often referred to as "non-supplemental" sections.

Category	Experiment	Title	Core[1] Sections
Mixture Specifications	SPS-9A	Superpave® Asphalt Binder Study	

Appendix B

TABLE OF UNITS

Units	Description
$	dollars
$/lf	dollars per linear foot
$/sq yd	dollars per square yard
%	percent
%/min	percent per minute
.01 in	hundredths of an inch
.01 mm	hundredths of a millimeter
.1 mm	tenths of a millimeter
1/16 in	sixteenths of an inch
1/s	inverse seconds
1000s $	thousands of dollars
1000s $/lane mi	thousands of dollars per lane mile
A	amperes
Hz	hertz
MPa	megapascals
Megapoise	megapoises
N	newtons
Ohms	ohms
V	volts
W/m^2	watts per square meter
Watts	watts

Units	Description
centistokes	centistokes
centistokes/s	centistokes per second
cm	centimeters
cm/min	centimeters per minute
cm/sec	centimeters per second
cu ft	cubic feet
cu mm	cubic millimeters
cycles	cycles
days	days
deg C	degrees Celsius
deg C degree days	degree days (C)
deg F	degrees Fahrenheit
degree	degrees
dynes/sq cm	dynes per square centimeter
ft	feet
ft-lbs/cu in	foot-pounds per cubic inch
ft/day	feet per day
ft/lane	feet per lane
ft/sec sq	feet per seconds squared
g	grams
g/25mm	grams per 25 millimeters
g/cm3	grams per cubic centimeter
g/min	grams per minute
gal	gallons

Units	Description
gal water/gal emuls	gallons of water/gallon of emulsion
gal/cu yd	gallons per cubic yard
gal/min	gallons per minute
gal/sq ft	gallons per square foot
gal/sq yd	gallons per square yard
hh:mm	hours:minutes
hr	hours
hr,min	hours,minutes
hr/min	hours/minutes
hr;min	hours;minutes
in	inches
in of Hg	inches of Mercury
in sq/ in cu	square inches per cubic inches
in/mi	inches per mile
kN	kilonewtons
kPa	kilopascals
kg/cu m	kilograms per cubic meter
km/h	kilometers per hour
kph	kilometers per hour
ksi	thousands of pounds per square inch (kpsi)
lb	pounds
lb/cu yd	pounds per cubic yard
lb/gal	pounds per gallon
lb/sq yd	pounds per square yard

Units	Description
lbf	pound force
lf	linear feet
m	meters
m/km	meters per kilometer
m/s	meters per second
mV	millivolts
mi	miles
microns	microns
microseconds	microseconds
microstrain	microstrain
mils	mils
min	minutes
mm	millimeters
mm Hg	millimeters of Mercury
mm-dd-yyyy	month-day-year
mm/day	millimeters per day
mm/mm/deg C	millimeters per millimeter per degree Celsius
months	months
mph	miles per hour
m*ρ*	millirho
ohm	ohms
ohm-meter	ohm-meter
pcf	pounds per cubic foot
pci	psi per inch

Units	Description
poise	poise
poise/s	poise per second
psf	pounds per square foot
psi	pounds per square inch
rpm	rotations per minute
s	seconds
sq ft	square feet
sq in	square inches
sq m	square meters
sq mm	square millimeters
sq yd	square yards
tons	tons
tons/sq ft	tons per square feet
vib/min	vibrations per minute
yr	Year

Appendix C

DATABASE CONSTRAINTS BY MODULE

Database constraints are integrity constraints that are stored in and enforced by the database. An integrity constraint is a rule specified for a column/field in a database table. The LTPP database utilizes several types of constraints, as described below. This appendix lists constraints for each field in each database table. Only fields with constraints are listed. The tables are organized alphabetically by data module.

Non-null constraints are defined on many database fields. Fields with bolded names are defined as non-null. Therefore, they must have a value in every data record.

Each table in the database also has a primary key constraint defined. Fields identified with (PK) are part of the primary key. This constraint requires that no two rows of a table have duplicate values in the specified field or set of fields, and each primary key field is non-null.

Some fields are constrained to a list of coded values. The fields that have an entry in the CODE LIST column are constrained to the codes identified by that entry. (The entries in the CODE LIST column are the Code Types.) For example, in the COMMENTS table, there is a STATE_CODE field which is constrained to the codes in the STATE_PROVINCE Code Type. The codes defined for each Code Type are provided in Appendix D.

Foreign key constraints, or referential integrity constraints, are also used in a few of the LTPP data modules. A referential integrity constraint requires that for each row of a table, the value of the foreign key matches a value in the parent table. The last column, in this appendix, lists the parent table, if a foreign key constraint has been defined. For example, in the GPR_LINK_LAYER table, there are five fields that have "GPR_MASTER" listed in the PARENT TABLE column. Those five fields make up the foreign key in the GPR_LINK_LAYER table and there must be an exact match of those values in one row of the GPR_MASTER table.

Constraints for the Administration (ADM) Module

Table: CODES

FIELD NAME*	CODE LIST	PARENT TABLE
CODETYPE		
CODE		

Table: CODETYPES

FIELD NAME*	CODE LIST	PARENT TABLE
CODETYPE (PK)		

Table: COMMENTS

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID		
STATE_CODE	STATE_PROVINCE	
ORDER_NO		
COMMENT_TYPE		
TABLENAME		

Table: COMMENTS_GENERAL

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE	STATE_PROVINCE	

Table: EXPERIMENT_SECTION

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
CONSTRUCTION_NO (PK)		

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: EXPERIMENT_SECTION

FIELD NAME*	CODE LIST	PARENT TABLE
CN_ASSIGN_DATE		
CN_CHANGE_REASON	MAINT_WORK	
RECORD_STATUS		
GPS_SPS	GPS_SPS	
EXPERIMENT_NO	EXPERIMENT	
STATUS	STATUS	
ASSIGN_DATE		

Table: LTPPDD

FIELD NAME*	CODE LIST	PARENT TABLE
TABLENAME (PK)		
FIELDNAME (PK)		

Table: LTPPTD

FIELD NAME*	CODE LIST	PARENT TABLE
TABLENAME (PK)		

Table: REGIONS

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
REGION_CODE (PK)	REGION	

Table: SECTION_COORDINATES

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
LATITUDE		
LONGITUDE		
DATUM	MAP_DATUM	
COORDINATE_DETERMINATION	COORD_DETERMINE	

Table: SHRP_DATA_SHEETS

FIELD NAME*	CODE LIST	PARENT TABLE
MODULE		
SHEETNO		

***Key fields are marked with (PK) and non-null fields are bolded.**

Constraints for the Automated Weather Station (AWS) Module

Table: AWS_COMMENT

FIELD NAME*	CODE LIST	PARENT TABLE
AWS_ID (PK)		
ORDER_NO (PK)		
COMMENT_TYPE (PK)		
AWS_COMMENT_DATE (PK)		
TABLE_NAME (PK)		

Table: AWS_DAILY_DATA

FIELD NAME*	CODE LIST	PARENT TABLE
AWS_ID (PK)		AWS_LOCATION
AWS_DATE (PK)		

Table: AWS_HOURLY_DATA

FIELD NAME*	CODE LIST	PARENT TABLE
AWS_ID (PK)		AWS_LOCATION
AWS_DATE (PK)		
AWS_HOUR (PK)		

Table: AWS_HUMIDITY_MONTH

FIELD NAME*	CODE LIST	PARENT TABLE
AWS_ID (PK)		AWS_LOCATION
YEAR (PK)		
MONTH (PK)		

Table: AWS_LINK

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
AWS_ID (PK)		

Table: AWS_LOCATION

FIELD NAME*	CODE LIST	PARENT TABLE
AWS_ID (PK)		
LATITUDE		
LONGITUDE		
DATUM	MAP_DATUM	
COORDINATE_DETERMINATION	COORD_DETERMINE	
ELEVATION		

Table: AWS_PRECIPITATION_MONTH

FIELD NAME*	CODE LIST	PARENT TABLE
AWS_ID (PK)		AWS_LOCATION
YEAR (PK)		
MONTH (PK)		

Table: AWS_SOLAR_MONTH

FIELD NAME*	CODE LIST	PARENT TABLE
AWS_ID (PK)		AWS_LOCATION
YEAR (PK)		
MONTH (PK)		

Table: AWS_TEMP_MONTH

FIELD NAME*	CODE LIST	PARENT TABLE
AWS_ID (PK)		AWS_LOCATION
YEAR (PK)		
MONTH (PK)		

Table: AWS_WIND_MONTH

FIELD NAME*	CODE LIST	PARENT TABLE
AWS_ID (PK)		AWS_LOCATION
YEAR (PK)		

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: AWS_WIND_MONTH

FIELD NAME*	CODE LIST	PARENT TABLE
MONTH (PK)		

Constraints for the Climate (CLM) Module

Table: CLM_OWS_HUMIDITY_ANNUAL

FIELD NAME*	CODE LIST	PARENT TABLE
WEATHER_STATION_ID (PK)		
YEAR (PK)		

Table: CLM_OWS_HUMIDITY_DAILY

FIELD NAME*	CODE LIST	PARENT TABLE
WEATHER_STATION_ID (PK)		
WS_DATE (PK)		
RECORD_STATUS		

Table: CLM_OWS_HUMIDITY_MONTH

FIELD NAME*	CODE LIST	PARENT TABLE
WEATHER_STATION_ID (PK)		
YEAR (PK)		
MONTH (PK)		

Table: CLM_OWS_LOCATION

FIELD NAME*	CODE LIST	PARENT TABLE
WEATHER_STATION_ID (PK)		
WS_TYPE	WS_TYPE	

Table: CLM_OWS_PRECIP_ANNUAL

FIELD NAME*	CODE LIST	PARENT TABLE
WEATHER_STATION_ID (PK)		
YEAR (PK)		

Table: CLM_OWS_PRECIP_DAILY

FIELD NAME*	CODE LIST	PARENT TABLE
WEATHER_STATION_ID (PK)		
WS_DATE (PK)		
RECORD_STATUS		

Table: CLM_OWS_PRECIP_MONTH

FIELD NAME*	CODE LIST	PARENT TABLE
WEATHER_STATION_ID (PK)		
YEAR (PK)		
MONTH (PK)		

Table: CLM_OWS_TEMP_ANNUAL

FIELD NAME*	CODE LIST	PARENT TABLE
WEATHER_STATION_ID (PK)		
YEAR (PK)		

Table: CLM_OWS_TEMP_DAILY

FIELD NAME*	CODE LIST	PARENT TABLE
WEATHER_STATION_ID (PK)		
WS_DATE (PK)		
RECORD_STATUS		

Table: CLM_OWS_TEMP_MONTH

FIELD NAME*	CODE LIST	PARENT TABLE
WEATHER_STATION_ID (PK)		
YEAR (PK)		
MONTH (PK)		

Table: CLM_OWS_WIND_ANNUAL

FIELD NAME*	CODE LIST	PARENT TABLE
WEATHER_STATION_ID (PK)		
YEAR (PK)		

Table: CLM_OWS_WIND_DAILY

***Key fields are marked with (PK) and non-null fields are bolded.**

FIELD NAME*	CODE LIST	PARENT TABLE
WEATHER_STATION_ID (PK)		
WS_DATE (PK)		
RECORD_STATUS		

Table: CLM_OWS_WIND_MONTH

FIELD NAME*	CODE LIST	PARENT TABLE
WEATHER_STATION_ID (PK)		
YEAR (PK)		
MONTH (PK)		

Table: CLM_SITE_VWS_LINK

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
VWS_ID (PK)		

Table: CLM_VWS_HUMIDITY_ANNUAL

FIELD NAME*	CODE LIST	PARENT TABLE
VWS_ID (PK)		
YEAR (PK)		

Table: CLM_VWS_HUMIDITY_DAILY

FIELD NAME*	CODE LIST	PARENT TABLE
VWS_ID (PK)		
VWS_DATE (PK)		
RECORD_STATUS		

Table: CLM_VWS_HUMIDITY_MONTH

FIELD NAME*	CODE LIST	PARENT TABLE
VWS_ID (PK)		
YEAR (PK)		
MONTH (PK)		

Table: CLM_VWS_OWS_LINK

FIELD NAME*	CODE LIST	PARENT TABLE
VWS_ID (PK)		
WEATHER_STATION_ID (PK)		

Table: CLM_VWS_PRECIP_ANNUAL

FIELD NAME*	CODE LIST	PARENT TABLE
VWS_ID (PK)		
YEAR (PK)		

Table: CLM_VWS_PRECIP_DAILY

FIELD NAME*	CODE LIST	PARENT TABLE
VWS_ID (PK)		
VWS_DATE (PK)		
RECORD_STATUS		

Table: CLM_VWS_PRECIP_MONTH

FIELD NAME*	CODE LIST	PARENT TABLE
VWS_ID (PK)		
YEAR (PK)		
MONTH (PK)		

Table: CLM_VWS_TEMP_ANNUAL

FIELD NAME*	CODE LIST	PARENT TABLE
VWS_ID (PK)		
YEAR (PK)		

Table: CLM_VWS_TEMP_DAILY

FIELD NAME*	CODE LIST	PARENT TABLE
VWS_ID (PK)		

Table: CLM_VWS_TEMP_DAILY

FIELD NAME*	CODE LIST	PARENT TABLE
VWS_DATE (PK)		
RECORD_STATUS		

Table: CLM_VWS_TEMP_MONTH

FIELD NAME*	CODE LIST	PARENT TABLE
VWS_ID (PK)		
YEAR (PK)		
MONTH (PK)		

Table: CLM_VWS_WIND_ANNUAL

FIELD NAME*	CODE LIST	PARENT TABLE
VWS_ID (PK)		
YEAR (PK)		

Table: CLM_VWS_WIND_DAILY

FIELD NAME*	CODE LIST	PARENT TABLE
VWS_ID (PK)		
VWS_DATE (PK)		
RECORD_STATUS		

Table: CLM_VWS_WIND_MONTH

FIELD NAME*	CODE LIST	PARENT TABLE
VWS_ID (PK)		
YEAR (PK)		
MONTH (PK)		

Constraints for the Dynamic Load Response (DLR) Module

Table: DLR_LVDT_CONFIG_AC

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
TEST_NAME (PK)		
TAG_ID (PK)		
BALANCE	Y_N	
MEGADAC_FILTER	MEGADAC_FILTER	

Table: DLR_LVDT_CONFIG_PCC

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
TEST_NAME (PK)		
TAG_ID (PK)		
BALANCE	Y_N	
MEGADAC_FILTER	MEGADAC_FILTER	

Table: DLR_LVDT_TRACE_SUM_AC

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
TEST_NAME (PK)		
RUN_NUMBER (PK)		
TAG_ID (PK)		
POINT_TYPE_1	DLR_POINT_TYPE	
POINT_TYPE_2	DLR_POINT_TYPE	
POINT_TYPE_3	DLR_POINT_TYPE	
POINT_TYPE_4	DLR_POINT_TYPE	
POINT_TYPE_5	DLR_POINT_TYPE	
POINT_TYPE_6	DLR_POINT_TYPE	
POINT_TYPE_7	DLR_POINT_TYPE	
POINT_TYPE_8	DLR_POINT_TYPE	
POINT_TYPE_9	DLR_POINT_TYPE	
POINT_TYPE_10	DLR_POINT_TYPE	

Table: DLR_LVDT_TRACE_SUM_PCC

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
TEST_NAME (PK)		
RUN_NUMBER (PK)		
TAG_ID (PK)		
POINT_TYPE_1	DLR_POINT_TYPE	
POINT_TYPE_2	DLR_POINT_TYPE	
POINT_TYPE_3	DLR_POINT_TYPE	
POINT_TYPE_4	DLR_POINT_TYPE	
POINT_TYPE_5	DLR_POINT_TYPE	
POINT_TYPE_6	DLR_POINT_TYPE	
POINT_TYPE_7	DLR_POINT_TYPE	
POINT_TYPE_8	DLR_POINT_TYPE	
POINT_TYPE_9	DLR_POINT_TYPE	
POINT_TYPE_10	DLR_POINT_TYPE	

Table: DLR_MASTER_AC

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
TEST_NAME (PK)		
START_EVENT	DLR_TRIGGER	
END_EVENT	DLR_TRIGGER	

Table: DLR_MASTER_PCC

FIELD NAME*	CODE LIST	PARENT TABLE

Table: DLR_MASTER_PCC

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
TEST_NAME (PK)		
START_EVENT	DLR_TRIGGER	
END_EVENT	DLR_TRIGGER	

Table: DLR_PRESSURE_CONFIG_AC

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
TEST_NAME (PK)		
TAG_ID (PK)		
BALANCE	Y_N	
MEGADAC_FILTER	MEGADAC_FILTER	

Table: DLR_PRESSURE_TRACE_SUM_AC

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
TEST_NAME (PK)		
RUN_NUMBER (PK)		
TAG_ID (PK)		
POINT_TYPE_1	DLR_POINT_TYPE	
POINT_TYPE_2	DLR_POINT_TYPE	
POINT_TYPE_3	DLR_POINT_TYPE	
POINT_TYPE_4	DLR_POINT_TYPE	
POINT_TYPE_5	DLR_POINT_TYPE	
POINT_TYPE_6	DLR_POINT_TYPE	
POINT_TYPE_7	DLR_POINT_TYPE	
POINT_TYPE_8	DLR_POINT_TYPE	
POINT_TYPE_9	DLR_POINT_TYPE	
POINT_TYPE_10	DLR_POINT_TYPE	

Table: DLR_STRAIN_CONFIG_AC

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
TEST_NAME (PK)		
TAG_ID (PK)		
BALANCE	Y_N	
MEGADAC_FILTER	MEGADAC_FILTER	

Table: DLR_STRAIN_CONFIG_PCC

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
TEST_NAME (PK)		
TAG_ID (PK)		
BALANCE	Y_N	
MEGADAC_FILTER	MEGADAC_FILTER	

Table: DLR_STRAIN_TRACE_SUM_AC

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
TEST_NAME (PK)		
RUN_NUMBER (PK)		
TAG_ID (PK)		
POINT_TYPE_1	DLR_POINT_TYPE	
POINT_TYPE_2	DLR_POINT_TYPE	
POINT_TYPE_3	DLR_POINT_TYPE	
POINT_TYPE_4	DLR_POINT_TYPE	
POINT_TYPE_5	DLR_POINT_TYPE	
POINT_TYPE_6	DLR_POINT_TYPE	
POINT_TYPE_7	DLR_POINT_TYPE	

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: DLR_STRAIN_TRACE_SUM_AC

FIELD NAME*	CODE LIST	PARENT TABLE
POINT_TYPE_8	DLR_POINT_TYPE	
POINT_TYPE_9	DLR_POINT_TYPE	
POINT_TYPE_10	DLR_POINT_TYPE	

Table: DLR_STRAIN_TRACE_SUM_PCC

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
TEST_NAME (PK)		
RUN_NUMBER (PK)		
TAG_ID (PK)		
POINT_TYPE_1	DLR_POINT_TYPE	
POINT_TYPE_2	DLR_POINT_TYPE	
POINT_TYPE_3	DLR_POINT_TYPE	
POINT_TYPE_4	DLR_POINT_TYPE	
POINT_TYPE_5	DLR_POINT_TYPE	
POINT_TYPE_6	DLR_POINT_TYPE	
POINT_TYPE_7	DLR_POINT_TYPE	
POINT_TYPE_8	DLR_POINT_TYPE	
POINT_TYPE_9	DLR_POINT_TYPE	
POINT_TYPE_10	DLR_POINT_TYPE	

Table: DLR_TEST_MATRIX

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
TEST_NAME (PK)		
RUN_NUMBER (PK)		

Table: DLR_TRUCK_GEOMETRY

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
TRUCK_ID (PK)		

Constraints for the Ground Penetrating Radar (GPR) Module

Table: GPR_LINK_LAYER

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)		GPR_MASTER
SHRP_ID (PK)		GPR_MASTER
GPR_DATE (PK)		GPR_MASTER
GPR_TIME (PK)		GPR_MASTER
LANE_POSITION (PK)	LANE_POSITION	GPR_MASTER
GPR_LAYER_NO (PK)		
L05B_LAYER_NO (PK)		

Table: GPR_MASTER

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)		
SHRP_ID (PK)		
GPR_DATE (PK)		
GPR_TIME (PK)		
LANE_POSITION (PK)	LANE_POSITION	

Table: GPR_THICK_POINT

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)		GPR_MASTER
SHRP_ID (PK)		GPR_MASTER
GPR_DATE (PK)		GPR_MASTER
GPR_TIME (PK)		GPR_MASTER
LANE_POSITION (PK)	LANE_POSITION	GPR_MASTER
POINT_LOC (PK)		
GPR_LAYER_NO (PK)		
LAYER_DIELECTRIC_CONST		
LAYER_THICKNESS		
LAYER_TYPE	LAYER_TYPE	
SECTION_STAT_INCLUDE_FLAG	SECTION_STAT_INCLUDE_FLAG	

Table: GPR_THICK_SECT

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)		GPR_MASTER
SHRP_ID (PK)		GPR_MASTER
GPR_DATE (PK)		GPR_MASTER
GPR_TIME (PK)		GPR_MASTER
LANE_POSITION (PK)	LANE_POSITION	GPR_MASTER
GPR_LAYER_NO (PK)		
LAYER_TYPE_SECTION	LAYER_TYPE	

***Key fields are marked with (PK) and non-null fields are bolded.**

Constraints for the Inventory (INV) Module

Table: INV_ADMIX

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
LAYER_NO (PK)		
ADMIXTURE_TYPE (PK)	INV_ADMIX_TYPE	

Table: INV_AGE

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		

Table: INV_AGGR_COMP

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
LAYER_NO (PK)		
AGGR_COMP_TEXTURE (PK)	INV_TEXTURE	
AGGR_COMP_TYPE (PK)	INV_AGGR_COMP	

Table: INV_AGGR_DUR

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
LAYER_NO (PK)		
AGGR_DUR_TEXTURE (PK)	INV_TEXTURE	
AGGR_DUR_TEST_TYPE (PK)	AGGR_DUR	

Table: INV_DEICE_SITE_DATA

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
FREQ_SNOW_REMOVAL	FREQUENCY_DEICE	
FREQ_DEICE_APPL	FREQUENCY_DEICE	

Table: INV_DEICE_TYPES

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DEICE_TYPE (PK)	DEICE_TYPE	
DEICE_DISCONTINUED	DEICE_TYPE	

Table: INV_GENERAL

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
PAVEMENT_TYPE	PAVEMENT	
SUB_DRAINAGE_LOCATION	SUBDRAIN_EXTENT	
SUB_DRAINAGE_TYPE	SUB_DRAINAGE_TYPE	

Table: INV_GRADATION

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
LAYER_NO (PK)		

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: INV_ID

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
COUNTY	COUNTY	
FUNCTIONAL_CLASS	CLASS	
ROUTE_SIGNING	ROUTE_SIGNING	
DIRECTION_OF_TRAVEL	DIRECTION_OF_TRAVEL	

Table: INV_LAYER

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
LAYER_NO (PK)		
DESCRIPTION	DESCRIPTION	
MATERIAL_TYPE	MAT_TYPE	
LAYER_TYPE	LAYER_TYPE_INV	

Table: INV_MAJOR_IMP

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
MAJOR_IMP_YEAR (PK)		
MAJOR_IMP_TYPE (PK)	MAINT_WORK	

Table: INV_MODIFIER

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
LAYER_NO (PK)		
ASPHALT_MODIFIER_TYPE (PK)	MODIFIER	

Table: INV_PCC_JOINT

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
LAYER_NO (PK)		
TRANS_CONT_JLTS	TRANS_CONT_JLTS_INV	
DOWEL_COATING	DOWEL_COATING	
MLTD_METHOD	MLTD_METHOD	
TRANS_METHOD	TRANS_METHOD	
LONG_TYPE	LONG_JOINT_FORMED	
SH_TRAFFIC_LANE_TYPE	SH_JOINT_FORMED	
TRANS_SEAL_TYPE	TRANS_SEAL_TYPE	

Table: INV_PCC_MIXTURE

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
LAYER_NO (PK)		
CEMENT_TYPE	PC_TYPE	
GEOL_CLASS_COARSE_AGGR	GEOL_CLASS	
PAVER_TYPE	PAVER_TYPE	
CONCRETE_CURE_METHOD	CONCRETE_CURE	
CONCRETE_TEXTURE_METHOD	CONCRETE_TEXTURE_METHOD	

Table: INV_PCC_STEEL

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: INV_PCC_STEEL

FIELD NAME*	CODE LIST	PARENT TABLE
CONSTRUCTION_NO		
LAYER_NO (PK)		
REINFORCING_TYPE	REINFORCING_TYPE	
REINFORCE_PLACE_METHOD	REINFORCE_PLACE_METHOD	

Table: INV_PCC_STRENGTH

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
LAYER_NO (PK)		
ELASTIC_MOD_METHOD	ELASTIC_MODULUS_METHOD	
FLEXURAL_STRENGTH_TYPE	FLEXURAL_STRENGTH_TYPE	

Table: INV_PMA

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
LAYER_NO (PK)		
GEOL_CLASS_COARSE_AGGR	GEOL_CLASS	
MINERAL_FILLER	MINERAL_FILLER	

Table: INV_PMA_ASPHALT

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
LAYER_NO (PK)		
ASPHALT_GRADE	ASPHALT	
SOURCE	REFINER	
LAB_AGE_TEST_PROC	LAB_AGE_TEST_PROC	

Table: INV_PMA_COMPACTION

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
LAYER_NO (PK)		
LIFT_NO (PK)		
BREAKDOWN_ROLLER_CODE	ROLLER_CODE	
INTERMED_ROLLER_CODE	ROLLER_CODE	
FINAL_ROLLER_CODE	ROLLER_CODE	

Table: INV_PMA_CONSTRUCTION

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
LAYER_NO (PK)		

Table: INV_PMA_ORIG_MIX

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
LAYER_NO (PK)		
SAMPLE_TYPE (PK)	SAMPLE_TYPE	
ASPHALT_PLANT_TYPE	PLANT_TYPE	
ANTISTRIP_AGENT_TYPE	ANTISTRIP	
ANTISTRIP_AGENT_CODE	LIQUID_SOLID	
MOISTURE_SUSCEPT_TEST	MOIST_SUSCEPT_TEST	

Table: INV_PMA_ROLLER

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
LAYER_NO (PK)		
ROLLER_CODE (PK)	ROLLER_CODE	

Table: INV_SHOULDER

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
SHOULDER_TYPE (PK)	SHOULDER_TYPE	
SH_SURFACE_TYPE	SH_SURFACE_TYPE	
SH_BASE_TYPE	BASE_MAT	
SH_JOINTS	YES_NO	
SH_REINFORCED	YES_NO	

Table: INV_STABIL

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
LAYER_NO (PK)		
STABIL_AGENT_TYPE (PK)	STABIL_AGENT_INV	

Table: INV_SUBGRADE

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
LAYER_NO (PK)		
AASHTO_SOIL_CLASS	AASHTO_SOIL_CLASS	
TEST_TYPE	TEST_TYPE	
MAX_LAB_DRY_DENSITY_TEST	MAX_LAB_DRY_DENSITY_TEST	
SWELL_PRESSURE_CODE	SWELL_PRESSURE_TEST	
FROST_SUSCEPTIBILITY_CODE	FROST_SUSCEPTIBILITY_CODE	

Table: INV_UNBOUND

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
LAYER_NO (PK)		
AASHTO_SOIL_CLASS	AASHTO_SOIL_CLASS	
MAX_DRY_DENSITY_TEST	MAX_DRY_DENSITY_TEST	
COMP_TEST_TYPE	COMP_TEST_TYPE	
TEST_TYPE	TEST_TYPE	

Constraints for the Maintenance (MNT) Module

Table: MNT_ASPHALT_CRACK_SEAL

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
SHRP_CASE_NO (PK)		
CRACK_SEVERITY	CRACK_SEVERITY	
CRACK_TYPE	DISTRESS_TYPE	
CRACK_SEAL_MATL	MNT_5_4	
CRACK_SEAL_MATL_SOURCE	MNT_SOURCE	
SURFACE_MOISTURE	SURFACE_MOISTURE	
CONDITION_SOURCE	MNT_SOURCE	
CLEAN_METHOD	CLEAN_METHOD_SEAL	
CLEAN_METHOD_SOURCE	MNT_SOURCE	

Table: MNT_ASPHALT_PATCH

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
SHRP_CASE_NO (PK)		
REASON	DISTRESS_TYPE	
SECONDARY_REASON	DISTRESS_TYPE	
PATCH_MATL	PATCH_MATL_AC	
SURFACE_MATL_1	PATCH_MATERIAL	
SURFACE_MATL_2	PATCH_MATERIAL	
SURFACE_MATL_SOURCE	MNT_SOURCE	
COMPACTION	MNT_6_7	
COMPACTION_SOURCE	MNT_SOURCE	
LOC_SIZE_METHOD	LOC_SIZE_METHOD	
LOC_SIZE_METHOD_SOURCE	MNT_SOURCE	
CUT_METHOD	CUT_METHOD_PART	
CUT_METHOD_SOURCE	MNT_SOURCE	

Table: MNT_ASPHALT_SEAL

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
SHRP_CASE_NO (PK)		
REASON	SEAL_REASON	
SEAL_TYPE	MNT_3_4	
SEAL_TYPE_SOURCE	MNT_SOURCE	
ASPHALT_GRADE	ASPHALT	
ASPHALT_GRADE_SOURCE	MNT_SOURCE	
CEMENT_MATL_SOURCE	MNT_SOURCE	
AGG_SOURCE	MNT_SOURCE	
SEAL_THICKNESS_SOURCE	MNT_SOURCE	
SURFACE_MOISTURE	SURFACE_MOISTURE	
CONDITION_SOURCE	MNT_SOURCE	
CRACK_SEVERITY	CRACK_SEVERITY	
CRACK_TYPE	DISTRESS_TYPE	
GRADATION_SOURCE	MNT_SOURCE	
PRECOATED_AGG	YES_NO	
PRECOATED_AGG_SOURCE	MNT_SOURCE	
SEAL_ROLLER	SEAL_ROLLER	
SEAL_ROLLER_SOURCE	MNT_SOURCE	
SEAL_CURE_TIME	SEAL_CURE_TIME	
SEAL_CURE_TIME_SOURCE	MNT_SOURCE	
SURFACE_CONDITION	MNT_SOURCE	
INITIAL_PREP	SURFACE_PREP	
FINAL_PREP	MNT_4_7	

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: MNT_COST

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		

Table: MNT_GMG

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
SHRP_CASE_NO (PK)		
PAVE_TYPE	PAVE_TYPE_MNT	
METHOD	METHOD_GMG_MNT	
GMG_REASON	GRINDING_REASON	
GMG_EXTENT	GMG_EXTENT	
AVG_DEPTH_SOURCE	MNT_SOURCE	
HEAD_WIDTH_SOURCE	MNT_SOURCE	
GROOVE_WIDTH_SOURCE	MNT_SOURCE	
BLADE_SPACING_SOURCE	MNT_SOURCE	

Table: MNT_HIST

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_CASE_NO (PK)		
MAJOR_IMP_TYPE	MAINT_WORK	
MAINT_LOC	LOCATION	
MAINT_MATERIAL	MAINT_MAT	

Table: MNT_IMP

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
IMP_DATE (PK)		
IMP_TYPE (PK)	MAINT_WORK	
RECORD_STATUS		
CONSTRUCTION_NO		
DATA_AVAIL_IMS	Y_N	

Table: MNT_PCC_CRACK_SEAL

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
BOND_BREAK	BOND_BREAK	
CRACK_CLEAN	CRACK_CLEAN	
CRACK_SEAL_TYPE	SEAL_TYPE	

Table: MNT_PCC_FULL_DEPTH

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
SHRP_CASE_NO (PK)		
REASON	DISTRESS_TYPE	
SECONDARY_REASON	DISTRESS_TYPE	
PATCH_MATL	PATCH_MATL_PCC	
PATCH_MATL_SOURCE	MNT_SOURCE	
PATCH_REPLACE_MATL	REPLACE_MATL	
SLAB_REPLACE_MATL	REPLACE_MATL	
REPLACE_MATL_SOURCE	MNT_SOURCE	

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: MNT_PCC_FULL_DEPTH

FIELD NAME*	CODE LIST	PARENT TABLE
BOUNDARY_METHOD	BOUNDARY_METHOD	
BOUNDARY_METHOD_SOURCE	MNT_SOURCE	
CUT_METHOD	CUT_METHOD_FULL	
CUT_METHOD_SOURCE	MNT_SOURCE	
TRANSFER_SYS_TRANS	TRANSFER_SYS	
TRANSFER_SYS_LONG	TRANSFER_SYS	
TRANS_SYS_SOURCE	MNT_SOURCE	
TRANSFER_DEVICE	TRANSFER_DEVICE	
TRANSFER_DEVICE_SOURCE	MNT_SOURCE	
STEEL	NO_YES	
REBAR_SOURCE	MNT_SOURCE	
DOWEL_COAT_TRANS	DOWEL_COAT	
DOWEL_COAT_LONG	DOWEL_COAT	
DOWEL_COAT_SOURCE	MNT_SOURCE	
SAW_CUT_SOURCE	MNT_SOURCE	
CONC_BREAK_METHOD	CONC_BREAK_METHOD	
CONC_BREAK_METHOD_SOURCE	MNT_SOURCE	
CONC_REMOVAL	CONC_REMOVAL	
CONC_REMOVAL_SOURCE	MNT_SOURCE	
STEEL_PLACE_METHOD	STEEL_PLACE_METHOD	
STEEL_PLACE_SOURCE	MNT_SOURCE	
MIX_SOURCE	MNT_SOURCE	
CEMENT_TYPE	PC_TYPE	
CEMENT_TYPE_SOURCE	MNT_SOURCE	
AIR_CONTENT_SOURCE	MNT_SOURCE	
ADMIXTURE_1	PCCA	
ADMIXTURE_2	PCCA	
ADMIXTURE_SOURCE	MNT_SOURCE	
SLUMP_SOURCE	MNT_SOURCE	
TEST_SOURCE	MNT_SOURCE	
SURFACE_MOISTURE	SURFACE_MOISTURE	
CONDITION_SOURCE	MNT_SOURCE	
MAX_AGG_SOURCE	MNT_SOURCE	
JOINT_METHOD_SH	JOINT_METHOD	
JOINT_METHOD_TRANS	JOINT_METHOD	
JOINT_METHOD_LONG	JOINT_METHOD	
JOINT_METHOD_SOURCE	MNT_SOURCE	
BOND_BREAKER	YES_NO	
CURE_METHOD_1	CURE_METHOD	
CURE_METHOD_2	CURE_METHOD	
CURE_METHOD_SOURCE	MNT_SOURCE	
TRAFFIC_OPEN_SOURCE	MNT_SOURCE	
CONSOLIDATE_METHOD	CONSOLIDATE_METHOD_FULL	
FINISH_METHOD	FINISH_METHOD_A	
FINISH_METHOD_SOURCE	MNT_SOURCE	
TRANS_JOINT_PATCH	TRANS_JOINT	
TRANS_JOINT_SLAB	TRANS_JOINT	
TRANS_JOINT_SOURCE	MNT_SOURCE	
JOINTS_MATCHED	YES_NO	

Table: MNT_PCC_JOINT_RESEAL

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
SHRP_CASE_NO (PK)		
REMOVAL_METHOD	REMOVAL_METHOD	
REMOVAL_METHOD_SOURCE	MNT_SOURCE	
SEAL_RES_SOURCE	MNT_SOURCE	
BOND_BREAK	BOND_BREAK	
REFACED	REFACED	
SIDEWALL_CLEAN	SIDEWALL_CLEAN	
SIDEWALL_CLEAN_SOURCE	MNT_SOURCE	
JOINT_SEAL_TYPE	SEAL_TYPE	
JOINT_SEAL_TYPE_SOURCE	MNT_SOURCE	

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: MNT_PCC_JOINT_RESEAL

FIELD NAME*	CODE LIST	PARENT TABLE
SEAL_DEPTH_SOURCE	MNT_SOURCE	
SEALS_DIFFERENT	YES_NO	

Table: MNT_PCC_PART_DEPTH

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
SHRP_CASE_NO (PK)		
REASON	DISTRESS_TYPE	
SECONDARY_REASON	DISTRESS_TYPE	
BOUNDARY_METHOD	BOUNDARY_METHOD_PART	
BOUNDARY_METHOD_SOURCE	MNT_SOURCE	
CUT_METHOD	CUT_METHOD_PART	
CUT_METHOD_SOURCE	MNT_SOURCE	
BREAK_METHOD	BREAK_METHOD	
BREAK_METHOD_SOURCE	MNT_SOURCE	
CLEAN_METHOD	CLEAN_METHOD_PATCH	
CLEAN_METHOD_SOURCE	MNT_SOURCE	
PATCH_MATL	PATCH_MATL_PCC	
PATCH_MATL_SOURCE	MNT_SOURCE	
BOND_AGENT	BOND_AGENT	
BOND_AGENT_SOURCE	MNT_SOURCE	
MIX_SOURCE	MNT_SOURCE	
CEMENT_TYPE	PC_TYPE	
CEMENT_TYPE_SOURCE	MNT_SOURCE	
AIR_CONTENT_SOURCE	MNT_SOURCE	
ADMIXTURE_1	PCCA	
ADMIXTURE_2	PCCA	
ADMIXTURE_SOURCE	MNT_SOURCE	
SLUMP_SOURCE	MNT_SOURCE	
TEST_SOURCE	MNT_SOURCE	
MAX_AGG_SOURCE	MNT_SOURCE	
CURE_METHOD_1	CURE_METHOD	
CURE_METHOD_2	CURE_METHOD	
CURE_METHOD_SOURCE	MNT_SOURCE	
TRAFFIC_OPEN_SOURCE	MNT_SOURCE	
SURFACE_MOISTURE	SURFACE_MOISTURE	
CONDITION_SOURCE	MNT_SOURCE	
CONSOLIDATE_METHOD	CONSOLIDATE_METHOD_PART	
CONSOLIDATE_METHOD_SOURCE	MNT_SOURCE	
FINISH_METHOD	FINISH_METHOD_A	
FINISH_METHOD_SOURCE	MNT_SOURCE	
JOINT_METHOD_SH	JOINT_METHOD	
JOINT_METHOD_TRANS	JOINT_METHOD	
JOINT_METHOD_LONG	JOINT_METHOD	
JOINT_METHOD_SOURCE	MNT_SOURCE	

***Key fields are marked with (PK) and non-null fields are bolded.**

Constraints for the Monitoring (MON) Module

Table: MON_CATEGORY

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
MON_CAT_ASSIGN_DATE (PK)		
MONITORING_CATEGORY	MONITORING_CATEGORY	
MONITORING_CHANGE_REASON	MONITORING_CHANGE_REASON	

Table: MON_DEFL_BUFFER_SHAPE

FIELD NAME*	CODE LIST	PARENT TABLE
DEFL_UNIT_ID (PK)		
BUFFER_ORDER_NO (PK)		
BUFFER_SHAPE	BUFFER_SHAPE	

Table: MON_DEFL_DEV_CONFIG

FIELD NAME*	CODE LIST	PARENT TABLE
CONFIGURATION_NO (PK)		
RECORD_STATUS		

Table: MON_DEFL_DEV_SENSORS

FIELD NAME*	CODE LIST	PARENT TABLE
CONFIGURATION_NO (PK)		MON_DEFL_DEV_CONFIG (CASCADE DELETE)
SENSOR_NO (PK)		
RECORD_STATUS		
CENTER_OFFSET_FLAG	OFFSET_FLAG	

Table: MON_DEFL_DROP_DATA

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	MON_DEFL_LOC_INFO (CASCADE DELETE)
SHRP_ID (PK)		MON_DEFL_LOC_INFO (CASCADE DELETE)
TEST_DATE (PK)		MON_DEFL_LOC_INFO (CASCADE DELETE)
TEST_TIME (PK)		MON_DEFL_LOC_INFO (CASCADE DELETE)
DEFL_UNIT_ID (PK)		MON_DEFL_LOC_INFO (CASCADE DELETE)
POINT_LOC (PK)		MON_DEFL_LOC_INFO (CASCADE DELETE)
LANE_NO (PK)	LANE_SPEC	MON_DEFL_LOC_INFO (CASCADE DELETE)
DROP_NO (PK)		
RECORD_STATUS		
CONSTRUCTION_NO		
DROP_HEIGHT	DROP_HEIGHT	
HISTORY_STORED	Y_N	
NON_DECREASING_DEFL	NON_DEC_DEFL	

Table: MON_DEFL_EST_SENSOR_OFFSET

FIELD NAME*	CODE LIST	PARENT TABLE
CONFIGURATION_NO (PK)		MON_DEFL_DEV_SENSORS (CASCADE DELETE)
SENSOR_NO (PK)		MON_DEFL_DEV_SENSORS (CASCADE DELETE)
RECORD_STATUS		

Table: MON_DEFL_FLX_BAKCAL_BASIN

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
TEST_DATE (PK)		
LANE_NO (PK)	LANE_SPEC	

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: MON_DEFL_FLX_BAKCAL_BASIN

FIELD NAME*	CODE LIST	PARENT TABLE
POINT_LOC (PK)		
TEST_TIME (PK)		
DROP_HEIGHT (PK)	DROP_HEIGHT	
CONSTRUCTION_NO		
AVG_DROP_LOAD		
NO_DROPS		
MEAN_DEFL_1		
MEAN_DEFL_2		
MEAN_DEFL_3		
MEAN_DEFL_4		
MEAN_DEFL_5		
MEAN_DEFL_6		
MEAN_DEFL_7		
PLATE_RADIUS		
DATA_PROCESS_EXTRACT_DATE		

Table: MON_DEFL_FLX_BAKCAL_LAYER

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
CN_REF_DATE (PK)		
BAKCAL_LAYER_NO (PK)		
CONSTRUCTION_NO		
REF_CONSTRUCTION_NO		
BAKCAL_LAYER_THICKNESS		
LAYER_TYPE	LAYER_TYPE	
DATA_PROCESS_EXTRACT_DATE		

Table: MON_DEFL_FLX_BAKCAL_POINT

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
TEST_DATE (PK)		
BAKCAL_LAYER_NO (PK)		
LANE_NO (PK)	LANE_SPEC	
POINT_LOC (PK)		
TEST_TIME (PK)		
DROP_HEIGHT (PK)	DROP_HEIGHT	
CONSTRUCTION_NO		
REF_CONSTRUCTION_NO		
ERROR_RMSE		
ELASTIC_MODULUS		
ELASTIC_MODULUS_FLAG	OUTLIER_FLAG	
SECTION_STAT_INCLUDE_FLAG	SECTION_STAT_INCLUDE_FLAG	
MODULUS_ASSUMED	Y_N	
DATA_PROCESS_EXTRACT_DATE		

Table: MON_DEFL_FLX_BAKCAL_SECT

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
TEST_DATE (PK)		
BAKCAL_LAYER_NO (PK)		
DROP_HEIGHT (PK)	DROP_HEIGHT	
CONSTRUCTION_NO		
REF_CONSTRUCTION_NO		
TOTAL_NO_BASINS		
DATA_PROCESS_EXTRACT_DATE		

Table: MON_DEFL_FLX_NMODEL_POINT

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
TEST_DATE (PK)		
BAKCAL_LAYER_NO (PK)		

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: MON_DEFL_FLX_NMODEL_POINT

FIELD NAME*	CODE LIST	PARENT TABLE
LANE_NO (PK)	LANE_SPEC	
POINT_LOC (PK)		
TEST_TIME (PK)		
CONSTRUCTION_NO		
REF_CONSTRUCTION_NO		
ERROR_RMSE		
MODEL_NO	EQUATION_TYPE	
MODULUS_HIGHEST_LOAD		
MODULUS_HIGHEST_LOAD_FLAG	OUTLIER_FLAG	
MODULUS_ASSUMED	Y_N	
DATA_PROCESS_EXTRACT_DATE		
SECTION_STAT_INCLUDE_FLAG	SECTION_STAT_INCLUDE_FLAG	

Table: MON_DEFL_FLX_NMODEL_SECT

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
TEST_DATE (PK)		
BAKCAL_LAYER_NO (PK)		
CONSTRUCTION_NO		
REF_CONSTRUCTION_NO		
MODEL_NO	EQUATION_TYPE	
TOTAL_NO_BASINS		
DATA_PROCESS_EXTRACT_DATE		

Table: MON_DEFL_LOC_INFO

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	MON_DEFL_MASTER (CASCADE DELETE)
SHRP_ID (PK)		MON_DEFL_MASTER (CASCADE DELETE)
TEST_DATE (PK)		MON_DEFL_MASTER (CASCADE DELETE)
TEST_TIME (PK)		
DEFL_UNIT_ID (PK)		MON_DEFL_MASTER (CASCADE DELETE)
POINT_LOC (PK)		
LANE_NO (PK)	LANE_SPEC	
RECORD_STATUS		
CONSTRUCTION_NO		
CONFIGURATION_NO		

Table: MON_DEFL_MASTER

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
TEST_DATE (PK)		
DEFL_UNIT_ID (PK)		
CONSTRUCTION_NO		
RECORD_STATUS		
FILTER_MODE	FILTER_MODE	

Table: MON_DEFL_RGD_BAKCAL_BASIN

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
TEST_DATE (PK)		
LANE_NO (PK)	LANE_SPEC	
FWD_PASS (PK)		
POINT_LOC (PK)		
TEST_TIME (PK)		
DROP_HEIGHT (PK)	DROP_HEIGHT	
CONSTRUCTION_NO		
RECORD_STATUS		
AVG_DROP_LOAD		

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: MON_DEFL_RGD_BAKCAL_BASIN

FIELD NAME*	CODE LIST	PARENT TABLE
NO_DROPS		
MEAN_DEFL_1		
MEAN_DEFL_3		
MEAN_DEFL_5		
MEAN_DEFL_6		
PLATE_RADIUS		
DATA_PROCESS_EXTRACT_DATE		

Table: MON_DEFL_RGD_BAKCAL_LAYER

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
CN_REF_DATE (PK)		
CONSTRUCTION_NO		
RECORD_STATUS		
REF_CONSTRUCTION_NO		
BAKCAL_PCC_THICKNESS		
MODULUS_RATIO		
BAKCAL_POISSON_RATIO		
L05B_PCC_LAYER_NO_1		
DATA_PROCESS_EXTRACT_DATE		

Table: MON_DEFL_RGD_BAKCAL_POINT

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
TEST_DATE (PK)		
LANE_NO (PK)	LANE_SPEC	
FWD_PASS (PK)		
POINT_LOC (PK)		
TEST_TIME (PK)		
DROP_HEIGHT (PK)	DROP_HEIGHT	
CONSTRUCTION_NO		
RECORD_STATUS		
REF_CONSTRUCTION_NO		
SECT_STAT_INCLUDE_FLAG_DL	SECTION_STAT_INCLUDE_FLAG	
K_VAL_FLAG	ACCEPT_FLAG	
RAD_REL_STIFF_DL_FLAG	ACCEPT_FLAG	
EPCC_DL_FULL_BOND_FLAG	ACCEPT_FLAG	
EPCC_DL_FULL_SLIP_FLAG	ACCEPT_FLAG	
SECT_STAT_INCLUDE_FLAG_ES	SECTION_STAT_INCLUDE_FLAG	
ESUBGR_FLAG	ACCEPT_FLAG	
RAD_REL_STIFF_ES_FLAG	ACCEPT_FLAG	
EPCC_ES_FULL_BOND_FLAG	ACCEPT_FLAG	
EPCC_ES_FULL_SLIP_FLAG	ACCEPT_FLAG	

Table: MON_DEFL_RGD_BAKCAL_SECT

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
TEST_DATE (PK)		
LANE_NO (PK)	LANE_SPEC	
FWD_PASS (PK)		
CONSTRUCTION_NO		
RECORD_STATUS		
REF_CONSTRUCTION_NO		
TOTAL_NO_BASINS		
DL_STAT_FLAG	STAT_FLAG	
ES_STAT_FLAG	STAT_FLAG	
MODULUS_RATIO		
BOND	BOND	

Table: MON_DEFL_TEMP_DEPTHS

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	

Table: MON_DEFL_TEMP_DEPTHS

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
TEST_DATE (PK)		
POINT_LOC (PK)		
RECORD_STATUS		
CONSTRUCTION_NO		

Table: MON_DEFL_TEMP_VALUES

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
TEST_DATE (PK)		
POINT_LOC (PK)		
TIME_LAYER_TEMP (PK)		
RECORD_STATUS		
CONSTRUCTION_NO		

Table: MON_DIS_AC_REV

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
SURVEY_DATE (PK)		
CONSTRUCTION_NO		
PHOTO_VIDEO	PHOTO_VIDEO	

Table: MON_DIS_CRCP_REV

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
SURVEY_DATE (PK)		
CONSTRUCTION_NO		
PHOTO_VIDEO	PHOTO_VIDEO	

Table: MON_DIS_JPCC_FAULT

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
SURVEY_DATE (PK)		
POINT_LOC (PK)		
CRACK_OR_JOINT (PK)	CRACK_JOINT	
WELL_SEALED	Y_N	
FAULT_MEASURE_DEVICE	FAULT_MEASURE_DEVICE	

Table: MON_DIS_JPCC_FAULT_SECT

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
SURVEY_DATE (PK)		
CRACK_OR_JOINT (PK)	CRACK_JOINT	
CONSTRUCTION_NO		
RECORD_STATUS		
EDGE_FAULT_STATUS	FAULT_STATUS	
WHEELPATH_FAULT_STATUS	FAULT_STATUS	

Table: MON_DIS_JPCC_REV

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
SURVEY_DATE (PK)		
CONSTRUCTION_NO		
PHOTO_VIDEO	PHOTO_VIDEO	
JT_SEALED	Y_N	

Table: MON_DIS_LINK

***Key fields are marked with (PK) and non-null fields are bolded.**

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
SURVEY_ID (PK)		
TABLENAME (PK)		
SURVEY_DATE		
CONSTRUCTION_NO		

Table: MON_DIS_PADIAS42_AC

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
SURVEY_DATE (PK)		
CONSTRUCTION_NO		

Table: MON_DIS_PADIAS42_CRCP

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
SURVEY_DATE (PK)		
CONSTRUCTION_NO		

Table: MON_DIS_PADIAS42_JPCC

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
SURVEY_DATE (PK)		

Table: MON_DIS_PADIAS_AC

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
SURVEY_DATE (PK)		
CONSTRUCTION_NO		

Table: MON_DIS_PADIAS_CRCP

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
SURVEY_DATE (PK)		
CONSTRUCTION_NO		

Table: MON_DIS_PADIAS_JPCC

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
SURVEY_DATE (PK)		
CONSTRUCTION_NO		

Table: MON_DRAIN_CONDITION

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)		MON_DRAIN_MASTER
SITE_ID (PK)		MON_DRAIN_MASTER
LATERAL_ID (PK)		MON_DRAIN_MASTER
SURVEY_DATE (PK)		
OPENING_CONDITION	LATERAL_CRUSH	
PRESENCE_OF_DEBRIS	SILT_DEBRIS	
DITCH_VEGETATION	DITCH_VEG	
DITCH_CLEANING	Y_N	
DITCH_WATER	WATER_FLOW	
DRAIN_WATER	WATER_FLOW	
OUTLET_EROSION	Y_N	
VIDEO_TAKEN	Y_N	
PUMPING_EVIDENT	Y_N	

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: MON_DRAIN_INSPECT

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)		MON_DRAIN_CONDITION
SITE_ID (PK)		MON_DRAIN_CONDITION
LATERAL_ID (PK)		MON_DRAIN_CONDITION
SURVEY_DATE (PK)		MON_DRAIN_CONDITION
PROBE_DISTANCE (PK)		
DRAIN_CONDITION		
PHOTO_TAKEN	Y_N	
CONDITION_PASSABLE	Y_N	

Table: MON_DRAIN_MASTER

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)		
SITE_ID (PK)		
LATERAL_ID (PK)		
PROJECT_STATION		
END_OFFSET		
EXIT_DEPTH	EXIT_DEPTH	
EROSION_CONTROL	EROSION_CONTROL	
RODENT_SCREEN	Y_N	
LATERAL_TYPE	PIPE_TYPE	
INTERSECT_TYPE	INTERSECT_TYPE	
MAINLINE_TYPE	PIPE_TYPE	

Table: MON_DROP_SEP

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
SURVEY_DATE (PK)		
POINT_LOC (PK)		
WELL_SEALED	Y_N	

Table: MON_FRICTION

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
FRICTION_DATE (PK)		
FRICTION_TIME (PK)		
FRICTION_METHOD	FRICTION_METHOD	

Table: MON_PROFILE_DATA

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE	STATE_PROVINCE	MON_PROFILE_MASTER (CASCADE DELETE)
SHRP_ID		MON_PROFILE_MASTER (CASCADE DELETE)
PROFILE_DATE		MON_PROFILE_MASTER (CASCADE DELETE)
PROFILE_TIME		MON_PROFILE_MASTER (CASCADE DELETE)
RUN_NUMBER		MON_PROFILE_MASTER (CASCADE DELETE)
SEQUENCE_NO		

Table: MON_PROFILE_MASTER

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
CONSTRUCTION_NO		
PROFILE_DATE (PK)		
PROFILE_TIME (PK)		
RUN_NUMBER (PK)		
START_METHOD	START_STOP_METHOD	

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: MON_PROFILE_MASTER

FIELD NAME*	CODE LIST	PARENT TABLE
STOP_METHOD	START_STOP_METHOD	
WAVE_LENGTH_INIT	WAVE_LENGTH_INIT	
RCO_CODE	RCO_CODE	
DEVICE_CODE	DEVICE_CODE_PROFILE	
SENSOR_TYPE	SENSOR_TYPE	

Table: MON_RUT_DEPTH_POINT

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
SURVEY_DATE (PK)		
POINT_LOC (PK)		

Table: MON_T_PROF_CROSS_SLOPE

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	MON_T_PROF_PROFILE
SHRP_ID (PK)		MON_T_PROF_PROFILE
SURVEY_DATE (PK)		MON_T_PROF_PROFILE
POINT_LOC (PK)		MON_T_PROF_PROFILE
RECORD_STATUS		
CONSTRUCTION_NO		
ELEVATION_DIFF		
T_PROF_WIDTH		

Table: MON_T_PROF_DEV_CONFIG

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		MON_T_PROF_MASTER (CASCADE DELETE)
STATE_CODE (PK)	STATE_PROVINCE	MON_T_PROF_MASTER (CASCADE DELETE)
CONSTRUCTION_NO		
SURVEY_DATE (PK)		MON_T_PROF_MASTER (CASCADE DELETE)

Table: MON_T_PROF_INDEX_POINT

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
SURVEY_DATE (PK)		
POINT_LOC (PK)		
CONSTRUCTION_NO		
RECORD_STATUS		
NEGATIVE_AREA		
NEGATIVE_AREA_FLAG	OUTLIER_FLAG	
POSITIVE_AREA		
POSITIVE_AREA_FLAG	OUTLIER_FLAG	
FILL_AREA		
FILL_AREA_FLAG	OUTLIER_FLAG	
LLH_DEPTH_1_8		
LLH_DEPTH_1_8_FLAG	OUTLIER_FLAG	
LLH_OFFSET_1_8_FLAG	OUTLIER_FLAG	
LLH_WIDTH_1_8_FLAG	OUTLIER_FLAG	
RLH_DEPTH_1_8		
RLH_DEPTH_1_8_FLAG	OUTLIER_FLAG	
RLH_OFFSET_1_8_FLAG	OUTLIER_FLAG	
RLH_WIDTH_1_8_FLAG	OUTLIER_FLAG	
LLH_DEPTH_WIRE_REF		
LLH_DEPTH_WIRE_REF_FLAG	OUTLIER_FLAG	
LLH_OFFSET_WIRE_REF_FLAG	OUTLIER_FLAG	
LLH_WIDTH_WIRE_REF_FLAG	OUTLIER_FLAG	
RLH_DEPTH_WIRE_REF		
RLH_DEPTH_WIRE_REF_FLAG	OUTLIER_FLAG	
RLH_OFFSET_WIRE_REF_FLAG	OUTLIER_FLAG	
RLH_WIDTH_WIRE_REF_FLAG	OUTLIER_FLAG	

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: MON_T_PROF_INDEX_POINT

FIELD NAME*	CODE LIST	PARENT TABLE
TRANS_PROFILE_MEASURE_LENGTH		
DATA_PROCESS_EXTRACT_DATE		
SECTION_STAT_INCLUDE_FLAG	SECTION_STAT_INCLUDE_FLAG	

Table: MON_T_PROF_INDEX_SECTION

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
SURVEY_DATE (PK)		
CONSTRUCTION_NO		
RECORD_STATUS		
T_PROF_DEVICE_CODE	DEVICE_CODE_RUT	
NO_PROFILES		
MAX_MEAN_DEPTH_1_8		
MAX_MEAN_DEPTH_WIRE_REF		
DATA_PROCESS_EXTRACT_DATE		

Table: MON_T_PROF_MASTER

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
SURVEY_DATE (PK)		
CONSTRUCTION_NO		
DEVICE_CODE	DEVICE_CODE_RUT	

Table: MON_T_PROF_PROFILE

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		MON_T_PROF_MASTER (CASCADE DELETE)
STATE_CODE (PK)	STATE_PROVINCE	MON_T_PROF_MASTER (CASCADE DELETE)
CONSTRUCTION_NO		
SURVEY_DATE (PK)		MON_T_PROF_MASTER (CASCADE DELETE)
POINT_LOC (PK)		

Constraints for the Rehabilitation (RHB) Module

Table: RHB_ACO_AGGR_PROP

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		
AGGR_COMP_TYPE_C1	COARSE_AGG_COMP	
AGGR_COMP_TYPE_C2	COARSE_AGG_COMP	
AGGR_COMP_TYPE_C3	COARSE_AGG_COMP	
AGGR_COMP_TYPE_F1	FINE_AGG_COMP	
AGGR_COMP_TYPE_F2	FINE_AGG_COMP	
AGGR_COMP_TYPE_F3	FINE_AGG_COMP	
GEOL_CLASS_COARSE_AGGR	GEOL_CLASS	
MINERAL_FILLER	MINERAL_FILLER	
AGGR_DUR_TYPE_C1	AGGR_DUR	
AGGR_DUR_TYPE_C2	AGGR_DUR	
AGGR_DUR_TYPE_C3	AGGR_DUR	
AGGR_DUR_TYPE_M1	AGGR_DUR	

Table: RHB_ACO_LAB_AGED_AC

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		
LAB_AGE_TEST_PROC	LAB_AGE_TEST_PROC	

Table: RHB_ACO_LAB_MIX

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		
ASPHALT_GRADE	ASPHALT	

Table: RHB_ACO_MIX_PROP

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		
SAMPLE_TYPE (PK)	SAMPLE_TYPE	
ASPHALT_PLANT_TYPE	PLANT_TYPE	
ANTISTRIP_AGENT_TYPE	ANTISTRIP	
ANTISTRIP_AGENT_CODE	LIQUID_SOLID	
MOIST_SUSCEPT_TEST	MOIST_SUSCEPT_TEST	

Table: RHB_ACO_PROP

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		
ASPHALT_GRADE	ASPHALT	
SOURCE	REFINER	
MODIFIER_1	MODIFIER	
MODIFIER_2	MODIFIER	

Table: RHB_ACO_SP_AGGR_PROP

***Key fields are marked with (PK) and non-null fields are bolded.**

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
DATE_COMPLETE (PK)		
LAYER_NO (PK)		

Table: RHB_ACO_SP_MIX_PROP

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
DATE_COMPLETE (PK)		
LAYER_NO (PK)		
SAMPLE_TYPE (PK)	SAMPLE_TYPE	

Table: RHB_ACO_SP_PROP

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
DATE_COMPLETE (PK)		
LAYER_NO (PK)		
SOURCE	REFINER	

Table: RHB_CAUSE_INFO

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
DATE_RHB_SCHEDULED (PK)		
PRIMARY_REASON_RHB	PRIMARY_REASON_RHB	
GEN_PAVEMENT_RHB_CAUSE	GEN_PAVEMENT_RHB_CAUSE	
RHB_DIS_WP_CRACK	Y_N	
RHB_DIS_NWP_CRACK	Y_N	
RHB_DIS_RAVELING	Y_N	
RHB_DIS_JNT_SPALL	Y_N	
RHB_DIS_RUTTING	Y_N	
RHB_DIS_SHOVING	Y_N	
RHB_DIS_BLEEDING	Y_N	
RHB_DIS_PUNCHOUT	Y_N	
RHB_DIS_ROUGHNESS	Y_N	
RHB_DIS_FAULTING	Y_N	
RHB_DIS_SCALING	Y_N	
RHB_DIS_CONDITION_IDX	Y_N	
RHB_DIS_SURF_FRICTION	Y_N	
RHB_DIS_POL_AGG	Y_N	
RHB_DIS_POTHOLE	Y_N	
RHB_DIS_OTHER	Y_N	
RHB_REASON_ADDED_LANE	Y_N	
RHB_REASON_ROUTE_REALIGN	Y_N	
RHB_REASON_ADJ_LAND_USE	Y_N	
RHB_REASON_POLITICAL	Y_N	
RHB_REASON_NON_PAVE_OTHER	Y_N	

Table: RHB_CMRAP_COMBINED_AGG

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		

Table: RHB_CMRAP_COMBINE_AC

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		
RECYCLE_AGENT_TYPE	RECYCLE	

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: RHB_CMRAP_COMBINE_AC

FIELD NAME*	CODE LIST	PARENT TABLE
MODIFIER_1	MODIFIER	
MODIFIER_2	MODIFIER	

Table: RHB_CMRAP_GEN_INFO

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		
BREAKUP_METHOD	BREAKUP_METHOD	
PAVEMENT_PROCESSING	PAVEMENT_PROCESSING	

Table: RHB_CMRAP_LAB_AGED_AC

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		
LAB_AGE_TEST_PROC	LAB_AGE_TEST_PROC	

Table: RHB_CMRAP_LAB_MIX

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		

Table: RHB_CMRAP_MIX_PROP

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		
SAMPLE_TYPE (PK)	SAMPLE_TYPE	
ANTISTRIP_AGENT_TYPE	ANTISTRIP	
ANTISTRIP_AGENT_CODE	LIQUID_SOLID	
MOIST_SUSCEPT_TEST	MOIST_SUSCEPT_TEST	

Table: RHB_CMRAP_NEW_AC_PROP

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		
ASPHALT_GRADE	ASPHALT	
SOURCE	REFINER	
DRY_AGG	COATING_ABILITY	
DRY_AGG_AFTER_SPRAY	COATING_ABILITY	
WET_AGG	COATING_ABILITY	
WET_AGG_AFTER_SPRAY	COATING_ABILITY	

Table: RHB_CMRAP_RECLAIM_AC

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: RHB_CMRAP_UNTREAT_AGGR

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		
AGGR_COMP_TYPE_C1	COARSE_AGG_COMP	
AGGR_COMP_TYPE_C2	COARSE_AGG_COMP	
AGGR_COMP_TYPE_C3	COARSE_AGG_COMP	
AGGR_COMP_TYPE_F1	FINE_AGG_COMP	
AGGR_COMP_TYPE_F2	FINE_AGG_COMP	
AGGR_COMP_TYPE_F3	FINE_AGG_COMP	
GEOL_CLASS_COARSE_AGGR	GEOL_CLASS	
COARSE_SOURCE	AGGR_SOURCE	
FINE_SOURCE	AGGR_SOURCE	
MINERAL_FILLER	MINERAL_FILLER	
AGGR_DUR_TYPE_C1	AGGR_DUR	
AGGR_DUR_TYPE_C2	AGGR_DUR	
AGGR_DUR_TYPE_C3	AGGR_DUR	
AGGR_DUR_TYPE_M1	AGGR_DUR	

Table: RHB_CRACK_SEAT_PCC

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		
BREAKER_TYPE	PAVEMENT_BREAKER	
ROLLER_TYPE	ROLLER_TYPE	
BEFORE_BREAKING	YES_NO	
AFTER_BREAKING	YES_NO	
AFTER_SEATING	YES_NO	
AFTER_OVERLAY	YES_NO	
DEFLECTION_MEASURE_DEVICE	DEFLECTION_MEASURE_DEVICE	
SURFACE_PREP	SURFACE_PREP_CRACK_SEAT	

Table: RHB_HEATER_SCARIF

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		
IMP_TYPE (PK)	MAINT_WORK	
HEAT_SCARIF_TYPE	HEATER_SCARIF_TYPE	
SURFACE_TREAT_TYPE	SURFACE_TREAT_TYPE	
REJUVENATE_AGENT	RECYCLE	
BREAKDOWN_ROLLER_CODE	ROLLER_CODE	
INTERMED_ROLLER_CODE	ROLLER_CODE	
FINAL_ROLLER_CODE	ROLLER_CODE	

Table: RHB_HMRAP_COMBINED_AGG

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		

Table: RHB_HMRAP_COMBINE_AC

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: RHB_HMRAP_COMBINE_AC

FIELD NAME*	CODE LIST	PARENT TABLE
LAYER_NO (PK)		
RECYCLE_AGENT_TYPE	RECYCLE	
MODIFIER_1	MODIFIER	
MODIFIER_2	MODIFIER	

Table: RHB_HMRAP_GEN_INFO

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		
BREAKUP_METHOD	BREAKUP_METHOD	
PAVEMENT_PROCESSING	PAVEMENT_PROCESSING	

Table: RHB_HMRAP_LAB_AGED_AC

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		
LAB_AGE_TEST_PROC	LAB_AGE_TEST_PROC	

Table: RHB_HMRAP_LAB_MIX

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		

Table: RHB_HMRAP_MIX_PROP

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		
SAMPLE_TYPE (PK)	SAMPLE_TYPE	
ASPHALT_PLANT_TYPE	PLANT_TYPE	
ANTISTRIP_AGENT_TYPE	ANTISTRIP	
ANTISTRIP_AGENT_CODE	LIQUID_SOLID	
MOIST_SUSCEPT_TEST	MOIST_SUSCEPT_TEST	

Table: RHB_HMRAP_NEW_AC_PROP

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		
ASPHALT_GRADE	ASPHALT	
SOURCE	REFINER	

Table: RHB_HMRAP_RECLAIM_AC

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		

Table: RHB_HMRAP_UNTREAT_AGGR

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		
AGGR_COMP_TYPE_C1	COARSE_AGG_COMP	
AGGR_COMP_TYPE_C2	COARSE_AGG_COMP	
AGGR_COMP_TYPE_C3	COARSE_AGG_COMP	
AGGR_COMP_TYPE_F1	FINE_AGG_COMP	
AGGR_COMP_TYPE_F2	FINE_AGG_COMP	
AGGR_COMP_TYPE_F3	FINE_AGG_COMP	
GEOL_CLASS_COARSE_AGGR	GEOL_CLASS	
COARSE_SOURCE	AGGR_SOURCE	
FINE_SOURCE	AGGR_SOURCE	
MINERAL_FILLER	MINERAL_FILLER	
AGGR_DUR_TYPE_C1	AGGR_DUR	
AGGR_DUR_TYPE_C2	AGGR_DUR	
AGGR_DUR_TYPE_C3	AGGR_DUR	
AGGR_DUR_TYPE_M1	AGGR_DUR	

Table: RHB_IMP

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
IMP_DATE (PK)		
IMP_TYPE (PK)	MAINT_WORK	
DATA_AVAIL_IMS	Y_N	

Table: RHB_LAYER

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		
DESCRIPTION	DESCRIPTION	
MATERIAL_TYPE	MAT_TYPE	

Table: RHB_LOAD_TRANSFER

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		
RESTORATION_TYPE	LOAD_TRANS_RESTORATION	
INSTALL_FREQUENCY	INSTALL_FREQUENCY	
BACKFILL_MATERIAL	BACKFILL_MATERIAL	
BOND_AGENT	BOND_AGENT_BACKFILL	

Table: RHB_MILL_AND_GRIND

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		
METHOD_USED	METHOD_GMG_RHB	
SURFACE_PREP_EXTENT	GMG_EXTENT	

Table: RHB_PCCO_AGGR

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: RHB_PCCO_AGGR

FIELD NAME*	CODE LIST	PARENT TABLE
CONSTRUCTION_NO		
LAYER_NO (PK)		
AGGR_COMP_C1	PCCO_COARSE_AGG	
AGGR_COMP_C2	PCCO_COARSE_AGG	
AGGR_COMP_C3	PCCO_COARSE_AGG	
GEOL_CLASS_COARSE_AGGR	GEOL_CLASS	
AGGR_COMP_TYPE_F1	FINE_AGG_COMP	
AGGR_COMP_TYPE_F2	FINE_AGG_COMP	
AGGR_COMP_TYPE_F3	FINE_AGG_COMP	
AGGR_DUR_TYPE_C1	AGGR_DUR	
AGGR_DUR_TYPE_C2	AGGR_DUR	
AGGR_DUR_TYPE_C3	AGGR_DUR	
AGGR_DUR_TYPE_M1	AGGR_DUR	

Table: RHB_PCCO_CONSTRUCTION

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		
PAVER_TYPE	PAVER_TYPE	
CONCRETE_CURE_METHOD	CONCRETE_CURE	
CONCRETE_TEXTURE_METHOD	CONCRETE_TEXTURE_METHOD	
BOND_CONDITION	BOND_CONDITION	
SURFACE_PREP	SURFACE_PREP_RHB	
GROUT_TYPE	GROUT_TYPE	
BOND_PREVENT	BOND_PREVENT	
JOINTS_MATCH	YES_NO	

Table: RHB_PCCO_JOINT_DATA

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		
TRANS_CONT_JLTS	TRANS_CONT_JLTS_RHB	
DOWEL_COATING	DOWEL_COATING	
MLTD_METHOD	MLTD_METHOD	
TRANS_METHOD	TRANS_METHOD	
LONG_TYPE	LONG_JOINT_FORMED	
SH_TRAFFIC_LANE_TYPE	SH_JOINT_FORMED	
TRANS_SEAL_TYPE	TRANS_SEAL_TYPE	
JOINT_SEAL_BACKER	JOINT_SEAL_BACKER	

Table: RHB_PCCO_MIXTURE

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		
CEMENT_TYPE	PC_TYPE	
ADMIXTURE_TYPE_1	PCCA	
ADMIXTURE_TYPE_2	PCCA	
ADMIXTURE_TYPE_3	PCCA	

Table: RHB_PCCO_STEEL

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: RHB_PCCO_STEEL

FIELD NAME*	CODE LIST	PARENT TABLE
REINFORCING_TYPE	REINFORCING_TYPE	
REINFORCE_PLACE_METHOD	REINFORCE_PLACE_METHOD	

Table: RHB_PCCO_STRENGTH

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		
FLEXURAL_STRENGTH_TYPE	FLEXURAL_STRENGTH_TYPE	
ELASTIC_MOD_METHOD	ELASTIC_MODULUS_METHOD	

Table: RHB_PMA_COMPACTION

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		
LIFT_NO (PK)		
IMP_TYPE (PK)	MAINT_WORK	
BREAKDOWN_ROLLER_CODE	ROLLER_CODE	
INTERMED_ROLLER_CODE	ROLLER_CODE	
FINAL_ROLLER_CODE	ROLLER_CODE	

Table: RHB_PMA_CONSTRUCTION

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		
IMP_TYPE (PK)	MAINT_WORK	
RECYCLING_TYPE	RECYCLING_TYPE	
MIX_PROCEDURE	MIX_PROCEDURE	
ASPHALT_PLANT_TYPE	PLANT_TYPE	
AERATED	YES_NO	
SPREAD_MIX_METHOD	SPREAD_MIX_METHOD	

Table: RHB_PMA_ROLLER

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		
ROLLER_CODE (PK)	ROLLER_CODE	
IMP_TYPE (PK)	MAINT_WORK	

Table: RHB_PRESSURE_RELIEF

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		
PRESSURE_RELIEF_REASON	PRESSURE_RELIEF_REASON	
CUT_REMOVE_METHOD	CUT_REMOVE_METHOD	
AGG_EXPANSIVE	NO_YES	
JOINT_SEALANT_TYPE	SEAL_TYPE	
JOINT_FILLER_TYPE	FILLER_TYPE	

Table: RHB_RCYPCC_COMBINED_AGGR

***Key fields are marked with (PK) and non-null fields are bolded.**

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		
AGGR_DUR_TYPE_C1	AGGR_DUR	
AGGR_DUR_TYPE_C2	AGGR_DUR	
AGGR_DUR_TYPE_C3	AGGR_DUR	
AGGR_DUR_TYPE_M1	AGGR_DUR	

Table: RHB_RCYPCC_CONSTRUCTION

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		
BREAKUP_EQUIPMENT	BREAKUP_EQUIPMENT	
SEPARATE_METHOD	SEPARATE_METHOD	
PAVER_TYPE	PAVER_TYPE	
CONCRETE_CURE_METHOD	CONCRETE_CURE	
CONCRETE_TEXTURE_METHOD	CONCRETE_TEXTURE_METHOD	

Table: RHB_RCYPCC_JOINT

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		
TRANS_CONT_JLTS	TRANS_CONT_JLTS_RHB	
DOWEL_COATING	DOWEL_COATING	
MLTD_METHOD	MLTD_METHOD	
TRANS_METHOD	TRANS_METHOD	
LONG_TYPE	LONG_JOINT_FORMED	
SH_TRAFFIC_LANE_TYPE	SH_JOINT_FORMED	
TRANS_SEAL_TYPE	TRANS_SEAL_TYPE	
JOINT_SEAL_BACKER	JOINT_SEAL_BACKER	

Table: RHB_RCYPCC_MIXTURE

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		
CEMENT_TYPE	PC_TYPE	
ADMIXTURE_TYPE_1	PCCA	
ADMIXTURE_TYPE_2	PCCA	
ADMIXTURE_TYPE_3	PCCA	

Table: RHB_RCYPCC_NEW_AGGR

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		
AGGR_COMP_C1	PCCO_COARSE_AGG	
AGGR_COMP_C2	PCCO_COARSE_AGG	
AGGR_COMP_C3	PCCO_COARSE_AGG	
GEOL_CLASS_COARSE_AGGR	GEOL_CLASS	
AGGR_COMP_TYPE_F1	FINE_AGG_COMP	
AGGR_COMP_TYPE_F2	FINE_AGG_COMP	
AGGR_COMP_TYPE_F3	FINE_AGG_COMP	
AGGR_DUR_TYPE_C1	AGGR_DUR	

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: RHB_RCYPCC_NEW_AGGR

FIELD NAME*	CODE LIST	PARENT TABLE
AGGR_DUR_TYPE_C2	AGGR_DUR	
AGGR_DUR_TYPE_C3	AGGR_DUR	
AGGR_DUR_TYPE_M1	AGGR_DUR	

Table: RHB_RCYPCC_STEEL

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		
REINFORCING_TYPE	REINFORCING_TYPE	
REINFORCE_PLACE_METHOD	REINFORCE_PLACE_METHOD	

Table: RHB_RCYPCC_STRENGTH

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		
FLEXURAL_STRENGTH_TYPE	FLEXURAL_STRENGTH_TYPE	
ELASTIC_MOD_METHOD	ELASTIC_MODULUS_METHOD	

Table: RHB_RESTORE_AC_SHOULDER

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
IMP_TYPE (PK)	MAINT_WORK	
SHOULDER_RESTORED	LOCATION_OF_LANE	
I_SH_SURFACE_TYPE	SURFACE_MAT	
I_SH_BASE_TYPE	BASE_MAT	
O_SH_SURFACE_TYPE	SURFACE_MAT	
O_SH_BASE_TYPE	BASE_MAT	
SHOULDER_RESTORE_TYPE	SHOULDER_RESTORE	
AC_MATERIAL_TYPE	AC_MATERIAL_TYPE	
LANE_SH_JOINT_SEALANT	JOINT_SEALANT	
JOINT_SEAL_TYPE	JOINT_SEAL_TYPE_LS	

Table: RHB_RESTORE_PCC_SHOULDER

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
IMP_TYPE (PK)	MAINT_WORK	
SHOULDER_RESTORED	LOCATION_OF_LANE	
I_SH_SURFACE_TYPE	SURFACE_MAT	
I_SH_BASE_TYPE	BASE_MAT	
O_SH_SURFACE_TYPE	SURFACE_MAT	
O_SH_BASE_TYPE	BASE_MAT	
SHOULDER_SYSTEM_TYPE	SHOULDER_SYSTEM_TYPE	
JOINTS_MATCH	YES_NO	
JOINT_TYPE	JOINT_TYPE	
JOINT_TIE_SYSTEM_TYPE	JOINT_TIE_SYSTEM_TYPE	
JOINT_SEALANT	JOINT_SEALANT	
JOINT_SEALANT_TYPE	JOINT_SEAL_TYPE_LS	
JOINT_SEAL_BACKER_TYPE	JOINT_SEAL_BACKER	

Table: RHB_SUBDRAINAGE

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	

Table: RHB_SUBDRAINAGE

FIELD NAME*	CODE LIST	PARENT TABLE
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
SUBDRAIN_TYPE (PK)	SUBDRAIN_TYPE	
IMP_TYPE (PK)	MAINT_WORK	
SUBDRAIN_EXTENT	SUBDRAIN_EXTENT	
DRAINAGE_PIPE_TYPE	DRAINAGE_PIPE	
FILTER_TYPE	FILTER_TYPE	
TYPE_LOC_FILTER	TYPE_LOC_FILTER	
SUBDRAIN_PURPOSE	SUBDRAIN_PURPOSE	

Table: RHB_SUBSEALING_PCC

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONSTRUCTION_NO		
LAYER_NO (PK)		
IMP_TYPE (PK)	MAINT_WORK	
SUBSEAL_MIXTURE_TYPE	SUBSEAL_MIXTURE	
AC_GRADE	ASPHALT	
CEMENT_TYPE	PC_TYPE	
ADDITIVE_TYPE	PCCA	
AREA_DETERMINATION	AREA_DETERMINATION	
MONITORING_LIFT	MONITORING_OF_LIFT	
BEFORE_SUBSEAL	YES_NO	
AFTER_SUBSEAL	YES_NO	

Constraints for the Seasonal Monitoring (SMP) Module

Table: SMP_ATEMP_RAIN_DAY

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
SMP_DATE (PK)		

Table: SMP_ATEMP_RAIN_HOUR

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
SMP_DATE (PK)		
ATEMP_RAIN_TIME (PK)		

Table: SMP_COMMENT

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
ORDER_NO (PK)		
COMMENT_TYPE (PK)		
SMP_COMMENT_DATE (PK)		
TABLE_NAME (PK)		

Table: SMP_DRY_DENSITY

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
INSTALL_DATE (PK)		
DENSITY_DEPTH (PK)		

Table: SMP_ELEV_AC_DATA

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
SMP_DATE (PK)		
SURF_ELEV_TIME (PK)		
LOC_ELEV (PK)		

Table: SMP_ELEV_AC_OFFSET

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
SMP_DATE (PK)		

Table: SMP_ELEV_PCC_DATA

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
SMP_DATE (PK)		
SURF_ELEV_TIME (PK)		
LOC_ELEV (PK)		

Table: SMP_ELEV_PCC_OFFSET

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
SMP_DATE (PK)		

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: SMP_ERESIST_ABF_REF_VA

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
SMP_DATE (PK)		
ERESIST_TIME (PK)		
RECORD_STATUS		
CONSTRUCTION_NO		

Table: SMP_ERESIST_AUTO

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
SMP_DATE (PK)		
ERESIST_TIME (PK)		
ELECTRODE_START (PK)		
ELECTRODE_END (PK)		

Table: SMP_ERESIST_AUTO_ABF

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
SMP_DATE (PK)		
ERESIST_TIME (PK)		
ELECTRODE_START (PK)		
ELECTRODE_END (PK)		
RECORD_STATUS		
CONSTRUCTION_NO		

Table: SMP_ERESIST_DEPTHS

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
INSTALL_DATE (PK)		
ELECTRODE_NO (PK)		

Table: SMP_ERESIST_MAN_4POINT

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
SMP_DATE (PK)		
ERESIST_TIME (PK)		
EAMP_START (PK)		
EAMP_END (PK)		
EVOLTAGE_START (PK)		
EVOLTAGE_END (PK)		

Table: SMP_ERESIST_MAN_CONTACT

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
SMP_DATE (PK)		
ERESIST_TIME (PK)		
ELECTRODE_START (PK)		
ELECTRODE_END (PK)		

Table: SMP_FREEZE_STATE

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
SMP_DATE (PK)		

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: SMP_FREEZE_STATE

FIELD NAME*	CODE LIST	PARENT TABLE
DEPTH_NO (PK)		
CONSTRUCTION_NO		
RECORD_STATUS		
INTERPRET_DEPTH		
FREEZE_STATE	FREEZE_STATE	
INTERPRET_BASIS	INTERPRET_BASIS	
TEMPERATURE_SOURCE	TEMP_SOURCE	

Table: SMP_FROST_PENETRATION

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	SMP_FROST_PRESENCE
SHRP_ID (PK)		SMP_FROST_PRESENCE
SMP_DATE (PK)		SMP_FROST_PRESENCE
FROZEN_LAYER_NO (PK)		
CONSTRUCTION_NO		
RECORD_STATUS		
FREEZE_STATE		
DEPTH_NO_FROM		
DEPTH_NO_TO		
FREEZE_FROM		
FREEZE_TO		

Table: SMP_FROST_PRESENCE

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
SMP_DATE (PK)		
FROZEN_LAYERS		
CONSTRUCTION_NO		
RECORD_STATUS		

Table: SMP_GRAV_MOIST

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
INSTALL_DATE (PK)		
TDR_NO (PK)		

Table: SMP_JOINT_FAULT_DATA

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
SMP_DATE (PK)		
LOC_JOINT (PK)		
JOINT_TIME (PK)		

Table: SMP_JOINT_FAULT_OFFSET

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
SMP_DATE (PK)		

Table: SMP_JOINT_GAGE_DATA

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
SMP_DATE (PK)		
LOC_JOINT (PK)		
JOINT_TIME (PK)		

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: SMP_JOINT_GAGE_OFFSET

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
INSTALL_DATE (PK)		

Table: SMP_LAYOUT_INFO

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
INSTALL_DATE (PK)		
THERM_PROBE_DESIGN	THERM_PROBE_DESIGN	

Table: SMP_MRCTEMP_AUTO_DAY_STATS

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
SMP_DATE (PK)		
THERM_NO (PK)		

Table: SMP_MRCTEMP_AUTO_HOUR

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
SMP_DATE (PK)		
TEMPERATURE_TIME (PK)		
THERM_NO (PK)		

Table: SMP_MRCTEMP_DEPTHS

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
INSTALL_DATE (PK)		
THERM_NO (PK)		

Table: SMP_MRCTEMP_MAN

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
SMP_DATE (PK)		
TEMPERATURE_TIME (PK)		
THERM_NO (PK)		

Table: SMP_TDR_AUTO

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
SMP_DATE (PK)		
TDR_TIME (PK)		
TDR_NO (PK)		

Table: SMP_TDR_AUTO_CALIBRATION_TLE

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
TDR_NO (PK)		
RECORD_STATUS		
CAL_DRY_DENSITY		
CAL_VMC		

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: SMP_TDR_AUTO_CALIBRATION_TLE

FIELD NAME*	CODE LIST	PARENT TABLE
CAL_DIELECTRIC_SOLIDS		
CAL_DIELECTRIC_WATER		
CAL_DIELECTRIC_AIR		
CAL_SPECIFIC_GRAVITY		
SOURCE_DRY_DENSITY_TDR	SOURCE_DRY_DENSITY_TDR	
DRY_DENSITY_ADJUSTMENT	DRY_DENSITY_ADJUSTMENT	

Table: SMP_TDR_AUTO_DIELECTRIC

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
SMP_DATE (PK)		
TDR_TIME (PK)		
TDR_NO (PK)		
CONSTRUCTION_NO		
RECORD_STATUS		
TRACE_TYPE	TRACE_TYPE	

Table: SMP_TDR_AUTO_MOISTURE

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
SMP_DATE (PK)		
TDR_TIME (PK)		
TDR_NO (PK)		
CONSTRUCTION_NO		
RECORD_STATUS		
VOLUMETRIC_MOISTURE_MODEL	VOLUMETRIC_MOISTURE_MODEL	

Table: SMP_TDR_AUTO_MOISTURE_TLE

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
SMP_DATE (PK)		
TDR_TIME (PK)		
TDR_NO (PK)		
CONSTRUCTION_NO		
RECORD_STATUS		
TDR_COMMENT	TDR_COMMENT	

Table: SMP_TDR_DEPTHS_LENGTH

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
INSTALL_DATE (PK)		
TDR_NO (PK)		

Table: SMP_TDR_MANUAL_DIELECTRIC

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
SMP_DATE (PK)		
TDR_TIME (PK)		
TDR_NO (PK)		
CONSTRUCTION_NO		
RECORD_STATUS		
MAN_TRACE_TYPE	MAN_TRACE_TYPE	

Table: SMP_TDR_MANUAL_MOISTURE

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	SMP_TDR_MANUAL_DIELECTRIC
SHRP_ID (PK)		SMP_TDR_MANUAL_DIELECTRIC
SMP_DATE (PK)		SMP_TDR_MANUAL_DIELECTRIC

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: SMP_TDR_MANUAL_MOISTURE

FIELD NAME*	CODE LIST	PARENT TABLE
TDR_TIME (PK)		SMP_TDR_MANUAL_DIELECTRIC
TDR_NO (PK)		SMP_TDR_MANUAL_DIELECTRIC
VOLUMETRIC_MOISTURE_MODEL	VOLUMETRIC_MOISTURE_MODEL	

Table: SMP_TDR_MOISTURE_SUPPORT

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
TDR_NO (PK)		
RECORD_STATUS		
SOURCE_SOIL_TYPE	SOURCE_SOIL_TYPE	
SOURCE_DRY_DENSITY_TDR	SOURCE_DRY_DENSITY_TDR	

Table: SMP_WATERTAB_DEPTH_MAN

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
SMP_DATE (PK)		
PIEZO_TIME (PK)		

Constraints for the General SPS Information (SPS) Module

Table: SPS_CUT_FILL_LOCATIONS

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
TRANSITION_ORDER_NO (PK)		
RECORD_STATUS		
CUT_FILL_TYPE	CUT_FILL_TYPE	
CUT_FILL_START		
CUT_FILL_END		

Table: SPS_GENERAL

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
PAVEMENT_TYPE	PAVEMENT	
DRAINAGE_LOCATION	DRAINAGE_LOCATION	
DRAINAGE_TYPE	DRAINAGE_TYPE	
I_SH_SURFACE_TYPE	SHOULDER_SURFACE_TYPE	
I_SH_BASE_TYPE	BASE_MAT	
O_SH_SURFACE_TYPE	SHOULDER_SURFACE_TYPE	
O_SH_BASE_TYPE	BASE_MAT	

Table: SPS_GPS_LINK

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
LINKED_GPS_ID (PK)		

Table: SPS_ID

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
COUNTY	COUNTY	
FUNCTIONAL_CLASS	CLASS	
ROUTE_SIGNING	ROUTE_SIGNING	
DIRECTION_OF_TRAVEL	DIRECTION_OF_TRAVEL	

Table: SPS_INTERSECTIONS

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
ORDER_NO (PK)		
RAMP_EXITS	Y_N	
RAMP_ENTRANCES	Y_N	
STOP_SIGNS	Y_N	
SIGNALS	Y_N	
UNSIGNALED	Y_N	

Table: SPS_PROJECT_STATIONS

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
PROJECT_ID (PK)		
ORDER_NO (PK)		
RECORD_STATUS		
TEST_SECTION		
SECTION_START		
SECTION_END		
SECTION_CUT_FILL	CUT_FILL_TYPE	
DIRECTION_OF_TRAVEL (PK)	DIRECTION_OF_TRAVEL	

***Key fields are marked with (PK) and non-null fields are bolded.**

Constraints for the SPS1 Construction (SPS1) Module

Table: SPS1_LAYER

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
LAYER_NO (PK)		
DESCRIPTION	DESCRIPTION	
MATERIAL_TYPE	MAT_TYPE	

Table: SPS1_LAYER_THICKNESS

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
STATION_NO (PK)		
OFFSET (PK)		

Table: SPS1_NOTES_AND_COMMENTS

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	

Table: SPS1_PMA_AC_PROPERTIES

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
LAYER_NO (PK)		
ASPHALT_GRADE	ASPHALT	
SOURCE	REFINER	
MODIFIER_1	MODIFIER	
MODIFIER_2	MODIFIER	

Table: SPS1_PMA_AGGREGATE_PROP

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
LAYER_NO (PK)		
AGGR_COMP_TYPE_C1	COARSE_AGG_COMP	
AGGR_COMP_TYPE_C2	COARSE_AGG_COMP	
AGGR_COMP_TYPE_C3	COARSE_AGG_COMP	
AGGR_COMP_TYPE_F1	FINE_AGG_COMP	
AGGR_COMP_TYPE_F2	FINE_AGG_COMP	
AGGR_COMP_TYPE_F3	FINE_AGG_COMP	
MINERAL_FILLER	MINERAL_FILLER	
AGGR_DUR_TYPE_C1	AGGR_DUR	
AGGR_DUR_TYPE_C2	AGGR_DUR	
AGGR_DUR_TYPE_C3	AGGR_DUR	
AGGR_DUR_TYPE_M1	AGGR_DUR	

Table: SPS1_PMA_COMPACTION

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
LAYER_NO (PK)		
LIFT_NO (PK)		
BREAKDOWN_ROLLER_CODE	ROLLER_CODE	
INTERMED_ROLLER_CODE	ROLLER_CODE	
FINAL_ROLLER_CODE	ROLLER_CODE	

Table: SPS1_PMA_CONSTRUCTION

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
LAYER_NO (PK)		

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: SPS1_PMA_DENSITY_PROFILE

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
ATB_MEASURE	MEASURE	
BINDER_MEASURE	MEASURE	
SURFACE_MEASURE	MEASURE	
FRICTION_MEASURE	MEASURE	
PROFILOGRAPH_TYPE	PROFILOGRAPH_TYPE	
INTERP_METHOD	INTERPRETATION_METHOD	
INCENTIVE_PAYMENT	Y_N	

Table: SPS1_PMA_MIXTURE_PROP

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
LAYER_NO (PK)		
SAMPLE_TYPE	SAMPLE_TYPE	
ASPHALT_PLANT_TYPE	PLANT_TYPE	
ANTISTRIP_AGENT_TYPE	ANTISTRIP	
ANTISTRIP_AGENT_CODE	LIQUID_SOLID	

Table: SPS1_PMA_PLACEMENT_DATA

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
PLANT_TYPE1	PLANT_TYPE	
PLANT_TYPE2	PLANT_TYPE	
PLANT_TYPE3	PLANT_TYPE	
LONG_SURFACE_JOINT_LOC	JOINT_LOC	

Table: SPS1_PMA_ROLLER

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
LAYER_NO (PK)		
ROLLER_CODE (PK)	ROLLER_CODE	

Table: SPS1_SUBGRADE_PREP

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
COMPACTION_EQUIP_TYPE	COMPACTION_EQUIP_TYPE	
STABIL_AGENT1	STABIL_AGENT_SPS	
STABIL_AGENT2	STABIL_AGENT_SPS	

Table: SPS1_UNBOUND_AGG_BASE

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
LAYER_NO (PK)		
COMPACTION_TYPE	COMPACTION_TYPE	

Constraints for the SPS2 Construction (SPS2) Module

Table: SPS2_LAYER

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
LAYER_NO (PK)		
DESCRIPTION	DESCRIPTION	
MATERIAL_TYPE	MAT_TYPE	

Table: SPS2_LAYER_THICKNESS

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
STATION_NO (PK)		
OFFSET (PK)		

Table: SPS2_NOTES_AND_COMMENTS

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	

Table: SPS2_PCC_FULL_DEPTH

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
REASON	DISTRESS_TYPE	
SECONDARY_REASON	DISTRESS_TYPE	
PATCH_MATL	PATCH_MATL_PCC	
BOUNDARY_METHOD	BOUNDARY_METHOD	
CUT_METHOD	CUT_METHOD_FULL	
TRANSFER_DEVICE	TRANSFER_DEVICE	
STEEL	NO_YES	
DOWEL_COAT_TRANS	DOWEL_COAT	
CONC_BREAK_METHOD	CONC_BREAK_METHOD	
CONC_REMOVAL	CONC_REMOVAL	
STEEL_PLACE_METHOD	STEEL_PLACE_METHOD	
CEMENT_TYPE	PC_TYPE	
ADMIXTURE_1	PCCA	
ADMIXTURE_2	PCCA	
SURFACE_MOISTURE	SURFACE_MOISTURE	
JOINT_METHOD_SH	JOINT_METHOD	
JOINT_METHOD_TRANS	JOINT_METHOD	
JOINT_METHOD_LONG	JOINT_METHOD	
BOND_BREAKER	YES_NO	
CURE_METHOD_1	CURE_METHOD	
CURE_METHOD_2	CURE_METHOD	
CONSOLIDATE_METHOD	CONSOLIDATE_METHOD_FULL	
FINISH_METHOD	FINISH_METHOD_A	
TRANS_JOINT_PATCH	TRANS_JOINT	
TRANS_JOINT_SLAB	TRANS_JOINT	
JOINTS_MATCHED	YES_NO	

Table: SPS2_PCC_JOINT_DATA

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
LAYER_NO (PK)		
TRANS_CONT_JLTS	TRANS_CONT_JLTS_SPS	
DOWEL_COATING	DOWEL_COATING	
MLTD_METHOD	MLTD_METHOD	
CHK_DOWEL_BEFORE_PLACE	Y_N	
CHK_DOWEL_AFTER_PLACE	Y_N	
TRANS_METHOD	TRANS_METHOD	

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: SPS2_PCC_JOINT_DATA

FIELD NAME*	CODE LIST	PARENT TABLE
LONG_TYPE	LONG_JOINT_FORMED	
SH_TRAFFIC_LANE_TYPE	SH_JOINT_FORMED_SPS	
TRANS_SEAL_TYPE	TRANS_SEAL_TYPE	

Table: SPS2_PCC_MIXTURE_DATA

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
LAYER_NO (PK)		
CEMENT_TYPE	PC_TYPE	
ADMIXTURE_TYPE_1	PCCA	
ADMIXTURE_TYPE_2	PCCA	
ADMIXTURE_TYPE_3	PCCA	
AGGR_DUR_TYPE_C1	AGGR_DUR	
AGGR_DUR_TYPE_C2	AGGR_DUR	
AGGR_DUR_TYPE_C3	AGGR_DUR	
AGGR_DUR_TYPE_M1	AGGR_DUR	
AGGR_COMP_TYPE_C1	COARSE_AGG_COMP	
AGGR_COMP_TYPE_C2	COARSE_AGG_COMP	
AGGR_COMP_TYPE_C3	COARSE_AGG_COMP	
GEOL_CLASS_COARSE_AGGR	GEOL_CLASS	
AGGR_COMP_TYPE_F1	FINE_AGG_COMP	
AGGR_COMP_TYPE_F2	FINE_AGG_COMP	
AGGR_COMP_TYPE_F3	FINE_AGG_COMP	

Table: SPS2_PCC_PLACEMENT_DATA

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
LAYER_NO (PK)		
PAVER_TYPE	PAVER_TYPE	
DOWEL_PLACE_METHOD	DOWEL_PLACE_METHOD	
CONSOLIDATION	CONSOLIDATE_METHOD_FULL	
FINISHING	FINISH_METHOD_A	
CURING	CONCRETE_CURE	
TEXTURING	TEXTURING	

Table: SPS2_PCC_PROFILE_DATA

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_MEASURED (PK)		
PROFILOGRAPH_TYPE	PROFILOGRAPH_TYPE	
INTERPRETATION_METHOD	INTERPRETATION_METHOD	
SURFACE_PROFILE_INCENTIVE	Y_N	
DIAMOND_GRIND_CORRECTED	Y_N	
GRINDING_REASON	GRINDING_REASON	

Table: SPS2_PCC_STEEL

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
LAYER_NO (PK)		
REINFORCING_TYPE	REINFORCING_TYPE	
REINFORCE_PLACE_METHOD	REINFORCE_PLACE_METHOD	

Table: SPS2_PMA_AC_PROPERTIES

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
LAYER_NO (PK)		
ASPHALT_GRADE	ASPHALT	
SOURCE	REFINER	
MODIFIER_1	MODIFIER	
MODIFIER_2	MODIFIER	

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: SPS2_PMA_AGGREGATE_PROP

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
LAYER_NO (PK)		
AGGR_COMP_TYPE_C1	COARSE_AGG_COMP	
AGGR_COMP_TYPE_C2	COARSE_AGG_COMP	
AGGR_COMP_TYPE_C3	COARSE_AGG_COMP	
AGGR_COMP_TYPE_F1	FINE_AGG_COMP	
AGGR_COMP_TYPE_F2	FINE_AGG_COMP	
AGGR_COMP_TYPE_F3	FINE_AGG_COMP	
MINERAL_FILLER	MINERAL_FILLER	
AGGR_DUR_TYPE_C1	AGGR_DUR	
AGGR_DUR_TYPE_C2	AGGR_DUR	
AGGR_DUR_TYPE_C3	AGGR_DUR	
AGGR_DUR_TYPE_M1	AGGR_DUR	

Table: SPS2_PMA_COMPACTION

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
LAYER_NO (PK)		
LIFT_NO (PK)		
BREAKDOWN_ROLLER_CODE	ROLLER_CODE	
INTERMED_ROLLER_CODE	ROLLER_CODE	
FINAL_ROLLER_CODE	ROLLER_CODE	

Table: SPS2_PMA_CONSTRUCTION

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
LAYER_NO (PK)		

Table: SPS2_PMA_MIXTURE_PROP

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
LAYER_NO (PK)		
SAMPLE_TYPE	SAMPLE_TYPE	
ANTISTRIP_AGENT_TYPE	ANTISTRIP	
ANTISTRIP_AGENT_CODE	LIQUID_SOLID	

Table: SPS2_PMA_PLACEMENT_DATA

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
PLANT_TYPE1	PLANT_TYPE	
PLANT_TYPE2	PLANT_TYPE	

Table: SPS2_PMA_ROLLER

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
LAYER_NO (PK)		
ROLLER_CODE (PK)	ROLLER_CODE	

Table: SPS2_SUBGRADE_PREP

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
COMPACTION_EQUIP_TYPE	COMPACTION_EQUIP_TYPE	
STABIL_AGENT1	STABIL_AGENT_SPS	
STABIL_AGENT2	STABIL_AGENT_SPS	

Table: SPS2_UNBOUND_AGG_BASE

***Key fields are marked with (PK) and non-null fields are bolded.**

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
LAYER_NO (PK)		
COMPACTION_TYPE	COMPACTION_TYPE	

Constraints for the SPS3 Construction (SPS3) Module

Table: SPS3_CHIP

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
SEAL_TYPE	MNT_3_4	
ASPHALT_GRADE	ASPHALT	
RATE_ADJUSTED	YES_NO	
AGG_TYPE	GEOL_CLASS	
SURFACE_PREP	SURFACE_PREP	
PAVE_COND	CONDITION	
SURFACE_MOISTURE	SURFACE_MOISTURE_SPS34	
SURFACE_COND	SURFACE_COND	
CRACK_SEVERITY	CRACK_SEVERITY	
CRACK_TYPE	DISTRESS_TYPE	
AGG_COND	CONDITION	
AGG_COND_MOIST	AGG_COND_MOIST	

Table: SPS3_CHIP_EQUIP

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
EXCEEDS_5	YES_NEVER	
FINAL_COVERAGES	YES_NEVER	
CLEANED	YES_NEVER	
BITUMETER_EQUIPPED	YES_NEVER	
BITUMETER_VISIBLE	YES_NEVER	
BITUMETER_USED	YES_NEVER	
TACHOMETER_EQUIPPED	YES_NEVER	
TACHOMETER_VISIBLE	YES_NEVER	
TACHOMETER_USED	YES_NEVER	
HEATERS_EQUIPPED	YES_NEVER	
THERMOMETER_VISIBLE	YES_NEVER	
THERMOMETER_CONTACT_FREE	YES_NEVER	
CIRCULATORY_EQUIPPED	YES_NEVER	
LAP	LAP	
UNIFORM_SPRAY	YES_NEVER	
ATOMIZATION	YES_NEVER	
LOC_MISSED	YES_NEVER	
HANDSPRAYER_USED	YES_NEVER	
PAPER_USED_BEGIN	YES_NEVER	
PAPER_USED_END	YES_NEVER	
STREAKING	YES_NEVER	
END_NOZZLES_USED	YES_NEVER	
SELF_PROPELLED	YES_NO	
UNIFORM_AGG_SPREAD	YES_NEVER	
AGG_STREAK	YES_NEVER	
POWER_BROOM	YES_NO	
MATL_REMOVED	MATL_EST	
MATL_REMAIN	MATL_EST	

Table: SPS3_CRACK

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
SURFACE_PREP	SURFACE_PREP	
PAVE_COND	CONDITION	
SURFACE_MOISTURE	SURFACE_MOISTURE_SPS34	
SURFACE_COND	SURFACE_COND	
CRACK_SEVERITY	CRACK_SEVERITY	
CRACK_TYPE	DISTRESS_TYPE	
TRANS_CRACKS_ROUTED	YES_NEVER	
DIAG_CRACKS_ROUTED	YES_NEVER	

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: SPS3_CRACK

FIELD NAME*	CODE LIST	PARENT TABLE
LONG_CRACKS_ROUTED	YES_NEVER	
ONE_PASS_ROUTING	YES_NEVER	
CRACK_CLEAN	YES_NEVER	
CRACK_DRY	YES_NEVER	
LANCE_USED	YES_NEVER	
CHARRED	YES_NEVER	
HOT_PLACED	YES_NEVER	
REHEATED	YES_NO	
FLUSH_HOSE	YES_NEVER	
FLUSH_FILLER	YES_NEVER	
CHAMBER_HEATED	YES_NEVER	
HOSE_HEATED	YES_NEVER	
MATL_AGITATION	YES_NEVER	
THERMOMETER_VISIBLE	YES_NEVER	
BLOT_MATL_USED	YES_NEVER	
FINISH_SEAL	FINISH_SEAL	

Table: SPS3_ROLLER

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
ORDER_NO (PK)		

Table: SPS3_SLURRY

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
SEAL_TYPE	MNT_3_4	
ASPHALT_GRADE	ASPHALT	
AGG_TYPE	GEOL_CLASS	
MINERAL_FILL_TYPE	MODIFIER	
RATE_ADJUSTED	YES_NO	
SURFACE_PREP	SURFACE_PREP	
PAVE_COND	CONDITION	
SURFACE_MOISTURE	SURFACE_MOISTURE_SPS34	
SURFACE_COND	SURFACE_COND	
CRACK_SEVERITY	CRACK_SEVERITY	
CRACK_TYPE	DISTRESS_TYPE	
AGG_COND	CONDITION	
AGG_COND_MOIST	AGG_COND_MOIST	

Table: SPS3_SLURRY_EQUIP

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_COMPLETE (PK)		
CONT_MIX	YES_NEVER	
APPORTION_MIX	YES_NEVER	
CONT_DISCHARGE	YES_NEVER	
PREWET_AGG	YES_NEVER	
BLENDED	YES_NEVER	
METER_DEVICE	YES_NEVER	
MINERAL_AGG_FED	YES_NEVER	
FINES_FEEDER	YES_NEVER	
FOG_SPRAY	YES_NEVER	
SQUEEGEE	YES_NEVER	
REAR_STRIKEOFF	YES_NEVER	
STRIKEOFF_CONTACT	YES_NEVER	
STEERING	YES_NEVER	
CLEAN_BOX	YES_NEVER	
BOX_OVERLOAD	YES_NEVER	
BOX_EVEN_FILL	YES_NEVER	
UNMIX_AGG	YES_NEVER	

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: SPS3_SLURRY_EQUIP

FIELD NAME*	CODE LIST	PARENT TABLE
SEGREGATION	YES_NEVER	
SLURRY_REMAIN_MIXED	YES_NEVER	
EMULSION_BREAK	YES_NEVER	
MATL_BUILDUP	YES_NEVER	
DRAG	DRAG	
SURFACE_TEXTURE	SURFACE_TEXTURE	

Constraints for the SPS4 Construction (SPS4) Module

Table: SPS4_BENKELMAN_GENERAL

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
SURFACE_MOISTURE	SURFACE_MOISTURE_SPS34	
PURPOSE_OF_TESTING	TEST_PURPOSE	
TESTING_DEVICE_SOURCE	DEVICE_SOURCE	

Table: SPS4_BENKELMAN_MEASURE

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
BEFORE_AFTER_REGROUT (PK)	BEFORE_AFTER	
STATION (PK)		
LOCATION_OF_AXLE (PK)	SIDE_LOCATION	
TESTING_AT	LOCATION_AT	

Table: SPS4_CONTROL_GENERAL

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
SHOULDER_JOINT	NUMBER_SEALED	
TRANS_JOINT	NUMBER_SEALED	
LONG_JOINT	NUMBER_SEALED	
TRANS_CRACK	NUMBER_SEALED	
LONG_CRACK	NUMBER_SEALED	
DIAGONAL_CRACK	NUMBER_SEALED	
JOINT_OPEN_PROCESS	JOINT_OPEN_PROCESS	
PATCHING	PATCHING	

Table: SPS4_CONTROL_LONG

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		

Table: SPS4_CONTROL_RANDOM

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		

Table: SPS4_CONTROL_SHOULDER

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		

Table: SPS4_CONTROL_TRANS

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: SPS4_CRACK_SEAL_GENERAL

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
CONCRETE_SHOULDER_JOINT	NUMBER_SEALED	
TRANSVERSE_JOINT	NUMBER_SEALED	
LONGITUDINAL_JOINT	NUMBER_SEALED	
DIAGONAL_CRACK	NUMBER_SEALED	
TRANSVERSE_CRACK	NUMBER_SEALED	
LONGITUDINAL_CRACK	NUMBER_SEALED	
SHOULDER_PATCHING_COMPLETED	YES_NO	
CONCRETE_PATCHING_COMPLETED	YES_NO	
MATL_BURNED_BY_AIR_LANCE	FREQUENCY	
FIELD_NOTES_AVAILABLE	YES_NO	

Table: SPS4_CRACK_SEAL_PVMT

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
SEALANT_TYPE	SEALANT_TYPE	
SUPPLY_UNIT	SUPPLY_UNIT	
INDIRECT_OIL_HEATING	YES_NO	
APPL_METHOD	APPL_METHOD	
BACKER_TYPE	BOND_BREAK	
SEAL_REMOVAL_METHOD	SEAL_REMOVAL_METHOD	
SPALLING_CAUSED_BY_REMOVAL	SPALLING_AMOUNT	
WATER_SAWING_SEAL	YES_NO	
JOINT_SAWED	REFACED	
WATER_SAWING_REFACING	YES_NO	
SAW_IN_ONE_PASS	YES_NO	
SPALLING_CAUSED_BY_SAW	SPALLING_AMOUNT	
WALL_SAWED_VERTICAL	FREQUENCY	
WATER_BLAST_RESERVOIR	YES_NO	
WATER_FLUSH_RESERVOIR	YES_NO	
AIR_CLEAN_DRY_RESERVOIR	YES_NO	
AIR_LANCE	YES_NO	
SANDBLAST_RESERVOIR	YES_NO	
T_RESERVOIR_CONDITION	CONDITION	
T_RESERVOIR_MOISTURE	RESERVOIR_MOISTURE	
L_RESERVOIR_CONDITION	CONDITION	
L_RESERVOIR_MOISTURE	RESERVOIR_MOISTURE	
SEALANT_TOOLED	YES_NO	
HOSE_CONNECT_WAND	YES_NO	
HOSE_BACKFLUSHED	YES_NO	
T_SEALANT_BONDED_TO_BOTH	SEALANT_BONDED_TO_BOTH	
T_FILM_ON_SILICONE	YES_NO	
T_BUBBLES_PRESENT	BUBBLES_PRESENT	
T_SEALANT_TACKY	YES_NO	
L_SEALANT_BONDED_TO_BOTH	SEALANT_BONDED_TO_BOTH	
L_FILM_ON_SILICONE	YES_NO	
L_BUBBLES_PRESENT	BUBBLES_PRESENT	
L_SEALANT_TACKY	YES_NO	

Table: SPS4_CRACK_SEAL_PVMT_MEAS

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		

Table: SPS4_CRACK_SEAL_RAND

FIELD NAME*	CODE LIST	PARENT TABLE

Table: SPS4_CRACK_SEAL_RAND

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
SEALANT_TYPE	SEALANT_TYPE	
SUPPLY_UNIT	SUPPLY_UNIT	
INDIRECT_OIL_HEATING	YES_NO	
APPL_METHOD	APPL_METHOD	
BACKER_TYPE	BOND_BREAK	
SEAL_REMOVAL_METHOD	SEAL_REMOVAL_METHOD	
SPALLING_CAUSED_BY_REMOVAL	SPALLING_AMOUNT	
WATER_SAWING_SEAL	YES_NO	
JOINT_SAWED	REFACED	
WATER_SAWING_REFACING	YES_NO	
SAW_IN_ONE_PASS	YES_NO	
SPALLING_CAUSED_BY_SAW	SPALLING_AMOUNT	
WALL_SAWED_VERTICAL	FREQUENCY	
WATER_BLAST_RESERVOIR	YES_NO	
WATER_FLUSH_RESERVOIR	YES_NO	
AIR_CLEAN_DRY_RESERVOIR	YES_NO	
AIR_LANCE	YES_NO	
SANDBLAST_RESERVOIR	YES_NO	
RESERVOIR_CONDITION	CONDITION	
RESERVOIR_MOISTURE	RESERVOIR_MOISTURE	
SEALANT_TOOLED	YES_NO	
HOSE_CONNECT_WAND	YES_NO	
HOSE_BACKFLUSHED	YES_NO	
SEALANT_BONDED_TO_BOTH	SEALANT_BONDED_TO_BOTH	
FILM_ON_SILICONE	YES_NO	
BUBBLES_PRESENT	BUBBLES_PRESENT	
SEALANT_TACKY	YES_NO	

Table: SPS4_CRACK_SEAL_RAND_MEAS

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		

Table: SPS4_CRACK_SEAL_SH

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
SEALANT_TYPE	SEALANT_TYPE	
SUPPLY_UNIT	SUPPLY_UNIT	
INDIRECT_OIL_HEATING	YES_NO	
APPL_METHOD	APPL_METHOD	
BACKER_TYPE	BOND_BREAK	
SEAL_REMOVAL_METHOD	SEAL_REMOVAL_METHOD	
SPALLING_CAUSED_BY_REMOVAL	SPALLING_AMOUNT	
WATER_SAWING_SEAL	YES_NO	
JOINT_SAWED	REFACED	
WATER_SAWING_REFACING	YES_NO	
SAW_IN_ONE_PASS	YES_NO	
SPALLING_CAUSED_BY_SAW	SPALLING_AMOUNT	
WALL_SAWED_VERTICAL	FREQUENCY	
WATER_BLAST_RESERVOIR	YES_NO	
WATER_FLUSH_RESERVOIR	YES_NO	
AIR_CLEAN_DRY_RESERVOIR	YES_NO	
AIR_LANCE	YES_NO	
SANDBLAST_RESERVOIR	YES_NO	
RESERVOIR_CONDITION	CONDITION	
RESERVOIR_MOISTURE	RESERVOIR_MOISTURE	
SEALANT_TOOLED	YES_NO	

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: SPS4_CRACK_SEAL_SH

FIELD NAME*	CODE LIST	PARENT TABLE
HOSE_CONNECT_WAND	YES_NO	
HOSE_BACKFLUSHED	YES_NO	
SEALANT_BONDED_TO_BOTH	SEALANT_BONDED_TO_BOTH	
FILM_ON_SILICONE	YES_NO	
BUBBLES_PRESENT	BUBBLES_PRESENT	
SEALANT_TACKY	YES_NO	

Table: SPS4_CRACK_SEAL_SH_MEAS

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		

Table: SPS4_DYNAFLECT_GENERAL

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
SURFACE_MOISTURE	SURFACE_MOISTURE_SPS34	
TEST_PURPOSE	TEST_PURPOSE	
DEVICE_SOURCE	DEVICE_SOURCE	

Table: SPS4_DYNAFLECT_MEASURE

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
STATION (PK)		
SIDE_OF_JOINT_CRACK (PK)	SIDE_LOCATION	
LOCATION_AT	LOCATION_DYNAFLECT	

Table: SPS4_FWD_MEASUREMENTS

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
SURFACE_MOISTURE	SURFACE_MOISTURE_SPS34	
TEST_PURPOSE	TEST_PURPOSE	

Table: SPS4_TRANSIENT_GENERAL

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
SURFACE_MOISTURE	SURFACE_MOISTURE_SPS34	
TEST_PURPOSE	TEST_PURPOSE	

Table: SPS4_TRANSIENT_MEASURE

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
STATION (PK)		
OFFSET (PK)		
LOCATION_AT (PK)	LOCATION_AT	
SIDE_OF_JOINT_CRACK	SIDE_LOCATION	
LOCATION_DESC	LOCATION_DESC	

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: SPS4_UNDERSEAL_GENERAL

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
CEMENT_TYPE	PC_TYPE	
FLY_ASH_TYPE	PCCA	
METHOD_SLAB_PANEL	AREA_DETERMINATION	
HOLE_INSTALL_METHOD	HOLE_INSTALL_UNDERSEAL	
HOLE_VOLUME_DETERMINED	FREQUENCY	
TOT_VOL_GROUT_DETERMINED	YES_NO	
HOLES_PLUGGED	YES_NO	
EST_EXCESS_GROUT	FREQUENCY	
UPLIFT_MONITORED	FREQUENCY	
TRAFFIC_RESTRICTED	FREQUENCY	
METHOD_TRAFFIC_RESTRICTION	METHOD_TRAFFIC_RESTRICTION	
SAME_CONTROLS_USED	FREQUENCY	
FIELD_NOTES_AVAILABLE	YES_NO	

Table: SPS4_UNDERSEAL_INIT_GROUT

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
SURFACE_MOISTURE	SURFACE_MOISTURE_SPS34	
WATER_FLUSH_HOLES	YES_NO	
HOLES_RETAIN_DRILL_FLUSH	FREQUENCY	
CHAMBER_CLEANLINESS	CONDITION	
GROUT_WELL_BLENDED	FREQUENCY	
STABILITY_CHECKED_AFTER	YES_NO	
UNSTABLE_SLABS_REGROUTED	YES_NO	

Table: SPS4_UNDERSEAL_PRES_GROUT

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
JOINT_NO (PK)		
HOLE_NO (PK)		
CUTOFF_CRITERIA	CUTOFF_CRITERIA	
INITIAL_OR_REGROUT	INITIAL_OR_REGROUT	

Table: SPS4_UNDERSEAL_REGROUT

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
SURFACE_MOISTURE	SURFACE_MOISTURE_SPS34	
WATER_FLUSH_HOLES	YES_NO	
HOLES_RETAIN_DRILL_FLUSH	FREQUENCY	
CHAMBER_CLEANLINESS	CONDITION	
GROUT_WELL_BLENDED	FREQUENCY	
STABILITY_CHECKED_AFTER	YES_NO	
UNSTABLE_SLABS_REGROUTED	YES_NO	

***Key fields are marked with (PK) and non-null fields are bolded.**

Constraints for the SPS5 Construction (SPS5) Module

Table: SPS5_AC_PATCHES

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE		
DATE_BEGAN (PK)		
PRIMARY_DISTRESS	DISTRESS_TYPE	
SECONDARY_DISTRESS	DISTRESS_TYPE	
LOC_SIZE_METHOD	LOC_SIZE_METHOD	
PATCH_BOUNDARY_METHOD	PATCH_BOUNDARY_METHOD	
COMPACTION	COMPACTION	
PATCH_MATERIAL	PATCH_MATERIAL	
ROAD_MOISTURE	ROAD_MOISTURE	
COMPACTION_2	COMPACTION	

Table: SPS5_LAYER

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
LAYER_NO (PK)		
DESCRIPTION	DESCRIPTION	
MATERIAL_TYPE	MAT_TYPE	

Table: SPS5_LAYER_THICKNESS

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
STATION_NO (PK)		
OFFSET (PK)		

Table: SPS5_MILLED_SECTIONS

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
MACRO_TEXTURE	MACRO_TEXTURE	
PATCH_AFTER_MILLING	Y_N	
LAYER_THICKER_MILL_DEPTH	Y_N	
MILL_LAYER_MATL	MILL_LAYER_MATL	

Table: SPS5_NOTES_AND_COMMENTS

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	

Table: SPS5_OVERLAY

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
SURFACE_PREP	SURFACE_PREP_OVERLAY	
TACK_COAT_MATL	TACK_COAT_MATL	
PLANT_TYPE1	PLANT_TYPE	
PLANT_TYPE2	PLANT_TYPE	
PLANT_TYPE3	PLANT_TYPE	
LONG_SURFACE_JOINT_LOC	JOINT_LOC	

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: SPS5_OVERLAY_LAYERS

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
LAYER_NO (PK)		
MATERIAL_TYPE	SURFACE_MAT	
TACK_COAT_BETWEEN_LIFTS	Y_N	

Table: SPS5_PMA_COMPACTION

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
LAYER_NO (PK)		
LIFT_NO (PK)		
BREAKDOWN_ROLLER_CODE	ROLLER_CODE	
INTERMED_ROLLER_CODE	ROLLER_CODE	
FINAL_ROLLER_CODE	ROLLER_CODE	

Table: SPS5_PMA_CONSTRUCTION

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
LAYER_NO (PK)		

Table: SPS5_PMA_ROLLER

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
LAYER_NO (PK)		
ROLLER_CODE (PK)	ROLLER_CODE	

Table: SPS5_QC_MEASUREMENTS

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
RUT_MEASURE	MEASURE	
MILL_MEASURE	MEASURE	
BINDER_MEASURE	MEASURE	
SURFACE_MEASURE	MEASURE	
FRICTION_MEASURE	MEASURE	
PROFILOGRAPH_TYPE	PROFILOGRAPH_TYPE	
INTERP_METHOD	INTERPRETATION_METHOD	
INCENTIVE_PAYMENT	Y_N	

Table: SPS5_RUT_LEVEL_UP

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
LEVEL_UP_LAYER_LOC	LEVEL_UP_LAYER_LOC	
LENGTH_SECTION_COVERED	LENGTH_SECTION_COVERED	
COMPACTION_EQUIP	COMPACTION	
LEVEL_UP_MATL	LEVEL_UP_MATL	
ROAD_MOISTURE	ROAD_MOISTURE	

***Key fields are marked with (PK) and non-null fields are bolded.**

Constraints for the SPS6 Construction (SPS6) Module

Table: SPS6_CRACK_SEAT_PCC

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
BREAKER_TYPE	BREAKER_TYPE	
BEFORE_BREAKING	YES_NO	
AFTER_BREAKING	YES_NO	
AFTER_SEATING	YES_NO	
AFTER_OVERLAY	YES_NO	
SURFACE_PREP	SURFACE_PREP_CRACK_SEAT	

Table: SPS6_DIAMOND_GRIND

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
GRINDING_REASON	GRINDING_REASON	

Table: SPS6_LAYER

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
LAYER_NO (PK)		
DESCRIPTION	DESCRIPTION	
MATERIAL_TYPE	MAT_TYPE	

Table: SPS6_LAYER_THICKNESS

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
STATION_NO (PK)		
OFFSET (PK)		

Table: SPS6_LOAD_TRANSFER

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
BACKFILL_MATERIAL	BACKFILL_MATERIAL	
BOND_AGENT	BOND_AGENT_BACKFILL	

Table: SPS6_NOTES_AND_COMMENTS

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	

Table: SPS6_OVERLAY

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
SURFACE_PREP	SURFACE_PREP_OVERLAY	
TACK_COAT_MATL	TACK_COAT_MATL	
PLANT_TYPE1	PLANT_TYPE	
PLANT_TYPE2	PLANT_TYPE	
PLANT_TYPE3	PLANT_TYPE	

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: SPS6_OVERLAY

FIELD NAME*	CODE LIST	PARENT TABLE
LONG_SURFACE_JOINT_LOC	JOINT_LOC	

Table: SPS6_OVERLAY_LAYERS

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
LAYER_NO (PK)		
MATERIAL_TYPE	SURFACE_MAT	
TACK_COAT_BETWEEN_LIFTS	Y_N	

Table: SPS6_PCC_CRACK_SEAL

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
BOND_BREAK	BOND_BREAK	
CRACK_CLEAN	CRACK_CLEAN	
CRACK_SEAL_TYPE	SEAL_TYPE	

Table: SPS6_PCC_FULL_DEPTH

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
REASON	DISTRESS_TYPE	
SECONDARY_REASON	DISTRESS_TYPE	
PATCH_MATL	PATCH_MATL_PCC	
BOUNDARY_METHOD	BOUNDARY_METHOD	
CUT_METHOD	CUT_METHOD_FULL	
TRANSFER_DEVICE	TRANSFER_DEVICE	
STEEL	NO_YES	
DOWEL_COAT_TRANS	DOWEL_COAT	
CONC_BREAK_METHOD	CONC_BREAK_METHOD	
CONC_REMOVAL	CONC_REMOVAL	
STEEL_PLACE_METHOD	STEEL_PLACE_METHOD	
CEMENT_TYPE	PC_TYPE	
ADMIXTURE_1	PCCA	
ADMIXTURE_2	PCCA	
SURFACE_MOISTURE	SURFACE_MOISTURE	
JOINT_METHOD_SH	JOINT_METHOD	
JOINT_METHOD_TRANS	JOINT_METHOD	
JOINT_METHOD_LONG	JOINT_METHOD	
BOND_BREAKER	YES_NO	
CURE_METHOD_1	CURE_METHOD	
CURE_METHOD_2	CURE_METHOD	
CONSOLIDATE_METHOD	CONSOLIDATE_METHOD_FULL	
FINISH_METHOD	FINISH_METHOD_A	
TRANS_JOINT_PATCH	TRANS_JOINT	
TRANS_JOINT_SLAB	TRANS_JOINT	
JOINTS_MATCHED	YES_NO	

Table: SPS6_PCC_JOINT_RESEAL

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
REMOVAL_METHOD	REMOVAL_METHOD	
BOND_BREAK	BOND_BREAK	
REFACED	REFACED	
SIDEWALL_CLEAN	SIDEWALL_CLEAN_SPS6	

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: SPS6_PCC_JOINT_RESEAL

FIELD NAME*	CODE LIST	PARENT TABLE
SEALS_DIFFERENT	YES_NO	
CONTRACTION_SEAL_TYPE	SEAL_TYPE	
EXPANSION_SEAL_TYPE	SEAL_TYPE	

Table: SPS6_PCC_PART_DEPTH

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
REASON	DISTRESS_TYPE	
SECONDARY_REASON	DISTRESS_TYPE	
BOUNDARY_METHOD	BOUNDARY_METHOD_PART	
CUT_METHOD	CUT_METHOD_PART	
BREAK_METHOD	BREAK_METHOD	
CLEAN_METHOD	CLEAN_METHOD_PATCH	
PATCH_MATL	PATCH_MATL_PCC	
BOND_AGENT	BOND_AGENT	
CEMENT_TYPE	PC_TYPE	
ADMIXTURE_1	PCCA	
ADMIXTURE_2	PCCA	
CURE_METHOD_1	CURE_METHOD	
CURE_METHOD_2	CURE_METHOD	
SURFACE_MOISTURE	SURFACE_MOISTURE	
CONSOLIDATE_METHOD	CONSOLIDATE_METHOD_PART	
FINISH_METHOD	FINISH_METHOD_A	
JOINT_METHOD_SH	JOINT_METHOD	
JOINT_METHOD_TRANS	JOINT_METHOD	
JOINT_METHOD_LONG	JOINT_METHOD	

Table: SPS6_PMA_COMPACTION

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
LAYER_NO (PK)		
LIFT_NO (PK)		
BREAKDOWN_ROLLER_CODE	ROLLER_CODE	
INTERMED_ROLLER_CODE	ROLLER_CODE	
FINAL_ROLLER_CODE	ROLLER_CODE	

Table: SPS6_PMA_CONSTRUCTION

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
LAYER_NO (PK)		

Table: SPS6_PMA_ROLLER

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
LAYER_NO (PK)		
ROLLER_CODE (PK)	ROLLER_CODE	

Table: SPS6_QC_MEASUREMENTS

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: SPS6_QC_MEASUREMENTS

FIELD NAME*	CODE LIST	PARENT TABLE
RUT_MEASURE	MEASURE	
MILL_MEASURE	MEASURE	
BINDER_MEASURE	MEASURE	
SURFACE_MEASURE	MEASURE	
FRICTION_MEASURE	MEASURE	
PROFILOGRAPH_TYPE	PROFILOGRAPH_TYPE	
INTERP_METHOD	INTERPRETATION_METHOD	
INCENTIVE_PAYMENT	Y_N	

Table: SPS6_SAW_AND_SEAL

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		

Table: SPS6_SUBDRAINAGE

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
DRAINAGE_PIPE_TYPE	DRAINAGE_PIPE	
FILTER_TYPE	FILTER_TYPE	
TYPE_LOC_FILTER	TYPE_LOC_FILTER	
SUBDRAIN_PURPOSE	SUBDRAIN_PURPOSE	

Table: SPS6_TRANSFER_EFFICIENCY

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
POINT_DISTANCE (PK)		

Table: SPS6_UNDERSEALING

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
SUBSEAL_MIX_TYPE	SUBSEAL_MIX_TYPE	
CEMENT_TYPE	PC_TYPE	
ADDITIVE_TYPE	PCCA	
DETERMINE_UNDERSEAL_AREA	AREA_DETERMINATION	
MONITORING_OF_LIFT	MONITORING_OF_LIFT	
MEASURE_BEFORE_UNDERSEAL	YES_NO	
MEASURE_AFTER_UNDERSEAL	YES_NO	

Constraints for the SPS7 Construction (SPS7) Module

Table: SPS7_DELAMINATION

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
DELAM_DETECTION_METHOD	DELAM_DETECTION_METHOD	

Table: SPS7_LAYER

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
LAYER_NO (PK)		
DESCRIPTION	DESCRIPTION	
MATERIAL_TYPE	MAT_TYPE	

Table: SPS7_LAYER_THICKNESS

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
STATION_NO (PK)		
OFFSET (PK)		

Table: SPS7_LOAD_TRANSFER

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
BACKFILL_MATERIAL	BACKFILL_MATERIAL	

Table: SPS7_MILLING

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		

Table: SPS7_NOTES_AND_COMMENTS

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	

Table: SPS7_PCCO_JOINT_DATA

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
TRANS_METHOD	TRANS_METHOD	
LONG_TYPE	LONG_JOINT_FORMED	
SH_TRAFFIC_LANE_TYPE	SH_JOINT_FORMED	
TRANS_SEAL_TYPE	TRANS_SEAL_TYPE	
JOINT_SEAL_BACKER	JOINT_SEAL_BACKER	

Table: SPS7_PCC_CRACK_SEAL

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: SPS7_PCC_CRACK_SEAL

FIELD NAME*	CODE LIST	PARENT TABLE
BOND_BREAK	BOND_BREAK	
CRACK_CLEAN	CRACK_CLEAN	
CRACK_SEAL_TYPE	SEAL_TYPE	

Table: SPS7_PCC_FULL_DEPTH

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
REASON	DISTRESS_TYPE	
SECONDARY_REASON	DISTRESS_TYPE	
PATCH_MATL	PATCH_MATL_PCC	
BOUNDARY_METHOD	BOUNDARY_METHOD	
CUT_METHOD	CUT_METHOD_FULL	
TRANSFER_DEVICE	TRANSFER_DEVICE	
STEEL	NO_YES	
DOWEL_COAT_TRANS	DOWEL_COAT	
CONC_BREAK_METHOD	CONC_BREAK_METHOD	
CONC_REMOVAL	CONC_REMOVAL	
STEEL_PLACE_METHOD	STEEL_PLACE_METHOD	
CEMENT_TYPE	PC_TYPE	
ADMIXTURE_1	PCCA	
ADMIXTURE_2	PCCA	
SURFACE_MOISTURE	SURFACE_MOISTURE	
JOINT_METHOD_SH	JOINT_METHOD	
JOINT_METHOD_TRANS	JOINT_METHOD	
JOINT_METHOD_LONG	JOINT_METHOD	
BOND_BREAKER	YES_NO	
CURE_METHOD_1	CURE_METHOD	
CURE_METHOD_2	CURE_METHOD	
CONSOLIDATE_METHOD	CONSOLIDATE_METHOD_FULL	
FINISH_METHOD	FINISH_METHOD_A	
TRANS_JOINT_PATCH	TRANS_JOINT	
TRANS_JOINT_SLAB	TRANS_JOINT	
JOINTS_MATCHED	YES_NO	

Table: SPS7_PCC_JOINT_RESEAL

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
REMOVAL_METHOD	REMOVAL_METHOD	
BOND_BREAK	BOND_BREAK	
REFACED	REFACED	
SIDEWALL_CLEAN	SIDEWALL_CLEAN_SPS7	
SEALS_DIFFERENT	YES_NO	
CONTRACTION_SEAL_TYPE	SEAL_TYPE	
EXPANSION_SEAL_TYPE	SEAL_TYPE	

Table: SPS7_PCC_OVERLAY

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
CONCRETE_CURE_METHOD	CONCRETE_CURE	
CONCRETE_TEXTURE_METHOD	CONCRETE_TEXTURE_METHOD	
GROUT_TYPE	GROUT_TYPE	
CEMENT_TYPE	PC_TYPE	
ADDITIVE_TYPE	PCCA	

Table: SPS7_PCC_PART_DEPTH

FIELD NAME*	CODE LIST	PARENT TABLE

Table: SPS7_PCC_PART_DEPTH

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
REASON	DISTRESS_TYPE	
SECONDARY_REASON	DISTRESS_TYPE	
BOUNDARY_METHOD	BOUNDARY_METHOD_PART	
CUT_METHOD	CUT_METHOD_PART	
BREAK_METHOD	BREAK_METHOD	
CLEAN_METHOD	CLEAN_METHOD_PATCH	
PATCH_MATL	PATCH_MATL_PCC	
BOND_AGENT	BOND_AGENT	
CEMENT_TYPE	PC_TYPE	
ADMIXTURE_1	PCCA	
ADMIXTURE_2	PCCA	
CURE_METHOD_1	CURE_METHOD	
CURE_METHOD_2	CURE_METHOD	
SURFACE_MOISTURE	SURFACE_MOISTURE	
CONSOLIDATE_METHOD	CONSOLIDATE_METHOD_PART	
FINISH_METHOD	FINISH_METHOD_A	
JOINT_METHOD_SH	JOINT_METHOD	
JOINT_METHOD_TRANS	JOINT_METHOD	
JOINT_METHOD_LONG	JOINT_METHOD	

Table: SPS7_QC_MEASUREMENTS

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
PROFILOGRAPH_TYPE	PROFILOGRAPH_TYPE	
INTERP_METHOD	INTERPRETATION_METHOD	
INCENTIVE_PAYMENT	Y_N	

Table: SPS7_REFLECTIVE_CRACK

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
TRANS_BAR_PLACE_METHOD	PLACE_METHOD	
RECESSED_SLOT_METHOD	RECESSED_SLOT_METHOD	
LONG_BAR_PLACE_METHOD	PLACE_METHOD	

Table: SPS7_REMOVAL_CLEANING

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
REMOVAL_CLEAN_METHOD	REMOVAL_CLEAN_METHOD	
REMOVAL_CLEAN_REASON	REMOVAL_CLEAN_REASON	

Table: SPS7_SUBDRAINAGE

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
DRAINAGE_PIPE_TYPE	DRAINAGE_PIPE	
FILTER_TYPE	FILTER_TYPE	
TYPE_LOC_FILTER	TYPE_LOC_FILTER	
SUBDRAIN_PURPOSE	SUBDRAIN_PURPOSE	

Table: SPS7_TRANSFER_EFFICIENCY

***Key fields are marked with (PK) and non-null fields are bolded.**

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
POINT_DISTANCE (PK)		

Table: SPS7_UNDERSEALING

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO		
DATE_COMPLETE (PK)		
SUBSEAL_MIX_TYPE	SUBSEAL_MIXTURE	
CEMENT_TYPE	PC_TYPE	
ADDITIVE_TYPE	PCCA	
DETERMINE_UNDERSEAL_AREA	AREA_DETERMINATION	
MONITORING_OF_LIFT	MONITORING_OF_LIFT	
MEASURE_BEFORE_UNDERSEAL	YES_NO	
MEASURE_AFTER_UNDERSEAL	YES_NO	

Constraints for the SPS8 Construction (SPS8) Module

Table: SPS8_LAYER

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
LAYER_NO (PK)		
DESCRIPTION	DESCRIPTION	
MATERIAL_TYPE	MAT_TYPE	

Table: SPS8_LAYER_THICKNESS

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
STATION_NO (PK)		
OFFSET (PK)		

Table: SPS8_NOTES_AND_COMMENTS

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	

Table: SPS8_PCC_FULL_DEPTH

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO (PK)		
DATE_COMPLETE (PK)		
REASON	DISTRESS_TYPE	
SECONDARY_REASON	DISTRESS_TYPE	
PATCH_MATL	PATCH_MATL_PCC	
BOUNDARY_METHOD	BOUNDARY_METHOD	
CUT_METHOD	CUT_METHOD_FULL	
TRANSFER_DEVICE	TRANSFER_DEVICE	
STEEL	NO_YES	
DOWEL_COAT_TRANS	DOWEL_COAT	
CONC_BREAK_METHOD	CONC_BREAK_METHOD	
CONC_REMOVAL	CONC_REMOVAL	
STEEL_PLACE_METHOD	STEEL_PLACE_METHOD	
CEMENT_TYPE	PC_TYPE	
ADMIXTURE_1	PCCA	
ADMIXTURE_2	PCCA	
SURFACE_MOISTURE	SURFACE_MOISTURE	
JOINT_METHOD_SH	JOINT_METHOD	
JOINT_METHOD_TRANS	JOINT_METHOD	
JOINT_METHOD_LONG	JOINT_METHOD	
BOND_BREAKER	YES_NO	
CURE_METHOD_1	CURE_METHOD	
CURE_METHOD_2	CURE_METHOD	
CONSOLIDATE_METHOD	CONSOLIDATE_METHOD_FULL	
FINISH_METHOD	FINISH_METHOD_A	
TRANS_JOINT_PATCH	TRANS_JOINT	
TRANS_JOINT_SLAB	TRANS_JOINT	
JOINTS_MATCHED	YES_NO	

Table: SPS8_PCC_JOINT_DATA

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
LAYER_NO (PK)		
TRANS_CONT_JLTS	TRANS_CONT_JLTS_SPS	
DOWEL_COATING	DOWEL_COATING	
MLTD_METHOD	MLTD_METHOD	
CHK_DOWEL_BEFORE_PLACE	Y_N	
CHK_DOWEL_AFTER_PLACE	Y_N	
TRANS_METHOD	TRANS_METHOD	

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: SPS8_PCC_JOINT_DATA

FIELD NAME*	CODE LIST	PARENT TABLE
LONG_TYPE	LONG_JOINT_FORMED	
SH_TRAFFIC_LANE_TYPE	SH_JOINT_FORMED_SPS	
TRANS_SEAL_TYPE	TRANS_SEAL_TYPE	

Table: SPS8_PCC_MIXTURE_DATA

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
LAYER_NO (PK)		
CEMENT_TYPE	PC_TYPE	
ADMIXTURE_TYPE_1	PCCA	
ADMIXTURE_TYPE_2	PCCA	
ADMIXTURE_TYPE_3	PCCA	
AGGR_DUR_TYPE_C1	AGGR_DUR	
AGGR_DUR_TYPE_C2	AGGR_DUR	
AGGR_DUR_TYPE_C3	AGGR_DUR	
AGGR_DUR_TYPE_M1	AGGR_DUR	
AGGR_COMP_TYPE_C1	COARSE_AGG_COMP	
AGGR_COMP_TYPE_C2	COARSE_AGG_COMP	
AGGR_COMP_TYPE_C3	COARSE_AGG_COMP	
GEOL_CLASS_COARSE_AGGR	GEOL_CLASS	
AGGR_COMP_TYPE_F1	FINE_AGG_COMP	
AGGR_COMP_TYPE_F2	FINE_AGG_COMP	
AGGR_COMP_TYPE_F3	FINE_AGG_COMP	

Table: SPS8_PCC_PLACEMENT_DATA

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
LAYER_NO (PK)		
PAVER_TYPE	PAVER_TYPE	
DOWEL_PLACE_METHOD	DOWEL_PLACE_METHOD	
CONSOLIDATION	CONSOLIDATE_METHOD_FULL	
FINISHING	FINISH_METHOD_A	
CURING	CONCRETE_CURE	
TEXTURING	TEXTURING	

Table: SPS8_PCC_PROFILE_DATA

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_MEASURED (PK)		
PROFILOGRAPH_TYPE	PROFILOGRAPH_TYPE	
INTERPRETATION_METHOD	INTERPRETATION_METHOD	
SURFACE_PROFILE_INCENTIVE	Y_N	
DIAMOND_GRIND_CORRECTED	Y_N	
GRINDING_REASON	GRINDING_REASON	

Table: SPS8_PMA_AC_PROPERTIES

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
LAYER_NO (PK)		
ASPHALT_GRADE	ASPHALT	
SOURCE	REFINER	
MODIFIER_1	MODIFIER	
MODIFIER_2	MODIFIER	

Table: SPS8_PMA_AGGREGATE_PROP

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
LAYER_NO (PK)		
AGGR_COMP_TYPE_C1	COARSE_AGG_COMP	
AGGR_COMP_TYPE_C2	COARSE_AGG_COMP	

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: SPS8_PMA_AGGREGATE_PROP

FIELD NAME*	CODE LIST	PARENT TABLE
AGGR_COMP_TYPE_C3	COARSE_AGG_COMP	
AGGR_COMP_TYPE_F1	FINE_AGG_COMP	
AGGR_COMP_TYPE_F2	FINE_AGG_COMP	
AGGR_COMP_TYPE_F3	FINE_AGG_COMP	
MINERAL_FILLER	MINERAL_FILLER	
AGGR_DUR_TYPE_C1	AGGR_DUR	
AGGR_DUR_TYPE_C2	AGGR_DUR	
AGGR_DUR_TYPE_C3	AGGR_DUR	
AGGR_DUR_TYPE_M1	AGGR_DUR	

Table: SPS8_PMA_COMPACTION

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
LAYER_NO (PK)		
LIFT_NO (PK)		
BREAKDOWN_ROLLER_CODE	ROLLER_CODE	
INTERMED_ROLLER_CODE	ROLLER_CODE	
FINAL_ROLLER_CODE	ROLLER_CODE	

Table: SPS8_PMA_CONSTRUCTION

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
LAYER_NO (PK)		

Table: SPS8_PMA_DENSITY_PROFILE

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
ATB_MEASURE	MEASURE	
BINDER_MEASURE	MEASURE	
SURFACE_MEASURE	MEASURE	
FRICTION_MEASURE	MEASURE	
PROFILOGRAPH_TYPE	PROFILOGRAPH_TYPE	
INTERP_METHOD	INTERPRETATION_METHOD	
INCENTIVE_PAYMENT	Y_N	

Table: SPS8_PMA_MIXTURE_PROP

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
LAYER_NO (PK)		
SAMPLE_TYPE	SAMPLE_TYPE	
ASPHALT_PLANT_TYPE	PLANT_TYPE	
ANTISTRIP_AGENT_TYPE	ANTISTRIP	
ANTISTRIP_AGENT_CODE	LIQUID_SOLID	

Table: SPS8_PMA_PLACEMENT_DATA

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
PLANT_TYPE1	PLANT_TYPE	
PLANT_TYPE2	PLANT_TYPE	
PLANT_TYPE3	PLANT_TYPE	
LONG_SURFACE_JOINT_LOC	JOINT_LOC	

Table: SPS8_PMA_ROLLER

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
LAYER_NO (PK)		
ROLLER_CODE (PK)	ROLLER_CODE	

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: SPS8_SUBGRADE_PREP

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
COMPACTION_EQUIP_TYPE	COMPACTION_EQUIP_TYPE	
STABIL_AGENT1	STABIL_AGENT_SPS	
STABIL_AGENT2	STABIL_AGENT_SPS	

Table: SPS8_UNBOUND_AGG_BASE

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
LAYER_NO (PK)		
COMPACTION_TYPE	COMPACTION_TYPE	

Constraints for the SPS9 Construction (SPS9) Module

Table: SPS9_AC_PATCHES

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
DATE_COMPLETE (PK)		
RECORD_STATUS		
CONSTRUCTION_NO		
PRIMARY_DISTRESS	DISTRESS_TYPE	
SECONDARY_DISTRESS	DISTRESS_TYPE	
LOC_SIZE_METHOD	LOC_SIZE_METHOD	
PATCH_BOUNDARY_METHOD	PATCH_BOUNDARY_METHOD	
COMPACTION	COMPACTION	
COMPACTION_2	COMPACTION	
PATCH_MATERIAL	PATCH_MATERIAL	
ROAD_MOISTURE	ROAD_MOISTURE	

Table: SPS9_DIAMOND_GRIND

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
DATE_COMPLETE (PK)		
RECORD_STATUS		
CONSTRUCTION_NO		
GRINDING_REASON	GRINDING_REASON	

Table: SPS9_LAYER

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
LAYER_NO (PK)		
RECORD_STATUS		
DESCRIPTION	DESCRIPTION	
MATERIAL_TYPE	MAT_TYPE	

Table: SPS9_LAYER_THICKNESS

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
STATION_NO (PK)		
OFFSET (PK)		
LAYER_NO (PK)		
RECORD_STATUS		

Table: SPS9_LOAD_TRANSFER

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
DATE_COMPLETE (PK)		
RECORD_STATUS		
CONSTRUCTION_NO		
BACKFILL_MATERIAL	BACKFILL_MATERIAL	
BOND_AGENT_BACKFILL	BOND_AGENT_BACKFILL	

Table: SPS9_LOAD_TRANS_EFFICIENCY

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
DATE_COMPLETE (PK)		
POINT_DISTANCE (PK)		
RECORD_STATUS		
CONSTRUCTION_NO		

Table: SPS9_MILLED_SECTIONS

FIELD NAME*	CODE LIST	PARENT TABLE

Table: SPS9_MILLED_SECTIONS

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
DATE_COMPLETE (PK)		
RECORD_STATUS		
CONSTRUCTION_NO		
MACRO_TEXTURE	MACRO_TEXTURE	
PATCH_AFTER_MILLING	Y_N	
MILL_LAYER_MATL	MILL_LAYER_MATL	
MILLED_THE_SAME	Y_N	

Table: SPS9_NOTES_AND_COMMENTS

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
RECORD_STATUS		

Table: SPS9_PCC_CRACK_SEAL

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
DATE_COMPLETE (PK)		
RECORD_STATUS		
CONSTRUCTION_NO		
BOND_BREAK	BOND_BREAK	
CRACK_CLEAN	CRACK_CLEAN	
CRACK_SEAL_TYPE	SEAL_TYPE	

Table: SPS9_PCC_FULL_DEPTH

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
DATE_COMPLETE (PK)		
RECORD_STATUS		
CONSTRUCTION_NO		
REASON	DISTRESS_TYPE	
SECONDARY_REASON	DISTRESS_TYPE	
PATCH_MATL_PCC	PATCH_MATL_PCC	
BOUNDARY_METHOD	BOUNDARY_METHOD	
CUT_METHOD_FULL	CUT_METHOD_FULL	
TRANSFER_DEVICE	TRANSFER_DEVICE	
STEEL	NO_YES	
DOWEL_COAT_TRANS	DOWEL_COAT	
CONC_BREAK_METHOD	CONC_BREAK_METHOD	
CONC_REMOVAL	CONC_REMOVAL	
STEEL_PLACE_METHOD	STEEL_PLACE_METHOD	
CEMENT_TYPE	PC_TYPE	
ADMIXTURE_1	PCCA	
ADMIXTURE_2	PCCA	
SURFACE_MOISTURE	SURFACE_MOISTURE	
JOINT_METHOD_SH	JOINT_METHOD	
JOINT_METHOD_TRANS	JOINT_METHOD	
JOINT_METHOD_LONG	JOINT_METHOD	
BOND_BREAKER	YES_NO	
CURE_METHOD_1	CURE_METHOD	
CURE_METHOD_2	CURE_METHOD	
CONSOLIDATE_METHOD_FULL	CONSOLIDATE_METHOD_FULL	
FINISH_METHOD	FINISH_METHOD_A	
TRANS_JOINT_PATCH	TRANS_JOINT	
TRANS_JOINT_SLAB	TRANS_JOINT	
JOINTS_MATCHED	YES_NO	

Table: SPS9_PCC_JOINT_RESEAL

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: SPS9_PCC_JOINT_RESEAL

FIELD NAME*	CODE LIST	PARENT TABLE
DATE_COMPLETE (PK)		
RECORD_STATUS		
CONSTRUCTION_NO		
REMOVAL_METHOD	REMOVAL_METHOD	
BOND_BREAK	BOND_BREAK	
REFACED	REFACED	
SIDEWALL_CLEAN	SIDEWALL_CLEAN_SPS6	
SEALS_DIFFERENT	YES_NO	
CONTRACTION_SEAL_TYPE	SEAL_TYPE	
EXPANSION_SEAL_TYPE	SEAL_TYPE	

Table: SPS9_PCC_PART_DEPTH

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
DATE_COMPLETE (PK)		
RECORD_STATUS		
CONSTRUCTION_NO		
REASON	DISTRESS_TYPE	
SECONDARY_REASON	DISTRESS_TYPE	
BOUNDARY_METHOD_PART	BOUNDARY_METHOD_PART	
CUT_METHOD_PART	CUT_METHOD_PART	
BREAK_METHOD	BREAK_METHOD	
CLEAN_METHOD_PATCH	CLEAN_METHOD_PATCH	
PATCH_MATL_PCC	PATCH_MATL_PCC	
BOND_AGENT	BOND_AGENT	
CEMENT_TYPE	PC_TYPE	
ADMIXTURE_1	PCCA	
ADMIXTURE_2	PCCA	
CURE_METHOD_1	CURE_METHOD	
CURE_METHOD_2	CURE_METHOD	
SURFACE_MOISTURE	SURFACE_MOISTURE	
CONSOLIDATE_METHOD_PART	CONSOLIDATE_METHOD_PART	
FINISH_METHOD	FINISH_METHOD_A	
JOINT_METHOD_SH	JOINT_METHOD	
JOINT_METHOD_TRANS	JOINT_METHOD	
JOINT_METHOD_LONG	JOINT_METHOD	

Table: SPS9_PMA_AC_PROPERTIES

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
LAYER_NO (PK)		
RECORD_STATUS		
ASPHALT_GRADE	ASPHALT	
SOURCE	REFINER	
MODIFIER_1	MODIFIER	
MODIFIER_2	MODIFIER	

Table: SPS9_PMA_AGGREGATE_PROP

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
LAYER_NO (PK)		
RECORD_STATUS		
AGGR_COMP_TYPE_C1	COARSE_AGG_COMP	
AGGR_DUR_TYPE_C1	AGGR_DUR	
AGGR_COMP_TYPE_C2	COARSE_AGG_COMP	
AGGR_DUR_TYPE_C2	AGGR_DUR	
AGGR_COMP_TYPE_C3	COARSE_AGG_COMP	
AGGR_DUR_TYPE_C3	AGGR_DUR	
AGGR_COMP_TYPE_F1	FINE_AGG_COMP	
AGGR_COMP_TYPE_F2	FINE_AGG_COMP	
AGGR_COMP_TYPE_F3	FINE_AGG_COMP	
MINERAL_FILLER	SPS9_MINERAL_FILLER	

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: SPS9_PMA_AGGREGATE_PROP

FIELD NAME*	CODE LIST	PARENT TABLE
AGGR_DUR_TYPE_M1	AGGR_DUR	

Table: SPS9_PMA_COMPACTION

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
LAYER_NO (PK)		
LIFT_NO (PK)		
RECORD_STATUS		
CONSTRUCTION_NO		
DATE_COMPLETE		
BREAKDOWN_ROLLER_CODE	ROLLER_CODE	
INTERMED_ROLLER_CODE	ROLLER_CODE	
FINAL_ROLLER_CODE	ROLLER_CODE	
COMPACTED_THICK		

Table: SPS9_PMA_CONSTRUCTION

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
LAYER_NO (PK)		
RECORD_STATUS		
DATE_BEGAN		
DATE_COMPLETE		
CONSTRUCTION_NO		

Table: SPS9_PMA_DENSITY

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
LAYER_NO (PK)		
RECORD_STATUS		
MEASURE_METHOD	MEASURE	

Table: SPS9_PMA_MIXTURE_PROP

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
LAYER_NO (PK)		
RECORD_STATUS		
SAMPLE_TYPE (PK)	SAMPLE_TYPE	
ANTISTRIP_AGENT_TYPE	ANTISTRIP	
ANTISTRIP_AGENT_CODE	LIQUID_SOLID	

Table: SPS9_PMA_MIX_DES_PROP

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
LAYER_NO (PK)		
MIX_DESIGN_TYPE	HMA_MIX_DESIGN_METHOD	
ASPHALT_GRADE	ASPHALT	

Table: SPS9_PMA_PLACEMENT_INFO

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
DATE_PREP_COMPLETE (PK)		
RECORD_STATUS		
SURFACE_PREP	SURFACE_PREP	
TACK_COAT_MATL	TACK_COAT_MATL	
PMA_PLANT_TYPE1	PLANT_TYPE	
PMA_PLANT_TYPE2	PLANT_TYPE	
PMA_PLANT_TYPE3	PLANT_TYPE	
LAYDOWN_WIDTH		

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: SPS9_PMA_PLACEMENT_INFO

FIELD NAME*	CODE LIST	PARENT TABLE
LONG_SURFACE_JOINT_LOC	JOINT_LOC	

Table: SPS9_PMA_PLACEMENT_LAYER

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
LAYER_NO (PK)		
RECORD_STATUS		
MATERIAL_TYPE	MATERIAL_TYPE	
LIFT_1_THICKNESS		
LIFT_TACK_COAT	Y_N	

Table: SPS9_PMA_PROFILE

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
RECORD_STATUS		
PROFILOGRAPH_TYPE	PROFILOGRAPH_TYPE	
INTERPRETATION_METHOD	INTERPRETATION_METHOD	
INCENTIVE_PAYMENT	Y_N	

Table: SPS9_PMA_ROLLER

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
LAYER_NO (PK)		
ROLLER_CODE (PK)	ROLLER_CODE	
RECORD_STATUS		
CONSTRUCTION_NO		
DATE_COMPLETE		

Table: SPS9_RUT_LEVEL_UP

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
RECORD_STATUS		
CONSTRUCTION_NO		
LEVEL_UP_LAYER_LOC	LOCATION_OF_LANE	
LENGTH_SECTION_COVERED	LENGTH_SECTION_COVERED	
RUT_PREP	RUT_PREP	
COMPACTION_EQUIP	COMPACTION	
LEVEL_UP_MATL	LEVEL_UP_MATL	
ROAD_MOISTURE	ROAD_MOISTURE	

Table: SPS9_SP_PMA_AC_PROPERTIES

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
LAYER_NO (PK)		
RECORD_STATUS		
SOURCE	REFINER	

Table: SPS9_SP_PMA_AGGREGATE_PROP

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
LAYER_NO (PK)		
RECORD_STATUS		
AGGR_COMP_TYPE_C1	COARSE_AGG_COMP	
AGGR_COMP_TYPE_C2	COARSE_AGG_COMP	
AGGR_COMP_TYPE_C3	COARSE_AGG_COMP	
AGGR_COMP_TYPE_F1	FINE_AGG_COMP	
AGGR_COMP_TYPE_F2	FINE_AGG_COMP	
AGGR_COMP_TYPE_F3	FINE_AGG_COMP	

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: SPS9_SP_PMA_AGGREGATE_PROP

FIELD NAME*	CODE LIST	PARENT TABLE
MINERAL_FILLER	SPS9_MINERAL_FILLER	

Table: SPS9_SP_PMA_MIXTURE_PROP

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
LAYER_NO (PK)		
RECORD_STATUS		
SAMPLE_TYPE (PK)	SAMPLE_TYPE	
ANTISTRIP_AGENT_TYPE	ANTISTRIP	
ANTISTRIP_AGENT_CODE	LIQUID_SOLID	

Table: SPS9_SUBDRAINAGE

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
DATE_COMPLETE (PK)		
RECORD_STATUS		
CONSTRUCTION_NO		
DRAINAGE_PIPE	DRAINAGE_PIPE	
FILTER_TYPE	FILTER_TYPE	
TYPE_LOC_FILTER	TYPE_LOC_FILTER	
SUBDRAIN_PURPOSE	SUBDRAIN_PURPOSE	

Table: SPS9_SUBGRADE_PREP

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
RECORD_STATUS		
CONSTRUCTION_NO		
COMPACTION_EQUIP_TYPE	COMPACTION_EQUIP_TYPE	
STABIL_AGENT1	STABIL_AGENT_SPS	
STABIL_AGENT2	STABIL_AGENT_SPS	

Table: SPS9_UNBOUND_AGG_BASE

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
LAYER_NO (PK)		
RECORD_STATUS		
CONSTRUCTION_NO		
COMPACTION_TYPE	COMPACTION_TYPE	

Table: SPS9_UNDERSEALING

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
DATE_COMPLETE (PK)		
RECORD_STATUS		
CONSTRUCTION_NO		
SUBSEAL_MIX_TYPE	SUBSEAL_MIX_TYPE	
CEMENT_TYPE	PC_TYPE	
ADDITIVE_TYPE	PCCA	
DETERMINE_UNDERSEAL_AREA	AREA_DETERMINATION	
MONITORING_OF_LIFT	MONITORING_OF_LIFT	
MEASURE_BEFORE_UNDERSEAL	YES_NO	
MEASURE_AFTER_UNDERSEAL	YES_NO	

***Key fields are marked with (PK) and non-null fields are bolded.**

Constraints for the Traffic (TRF) Module

Table: TRF_BASIC_INFO

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
RECORD_STATUS		
PAVE_TYPE_TRF	PAVE_TYPE_TRF	
FUNC_CLASS	FUNC_CLASS	
DIR_TRAV_LTPP	DIR_TRAV_LTPP	
ACCESS_CONTROL	Y_N	
MEDIAN	Y_N	
FUNC_CLASS_MOD	FUNC_CLASS	

Table: TRF_CALIBRATION_AVC

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	TRF_EQUIPMENT_MASTER
SHRP_ID (PK)		TRF_EQUIPMENT_MASTER
WIM_AVC_CALIB_DATE (PK)		TRF_EQUIPMENT_MASTER
RECORD_STATUS		
AVC_METH_VOL_MEASURE	AVC_METH_VOL_MEASURE	
AVC_METH_COUNT_LENGTH	AVC_METH_COUNT_LENGTH	
FHWA_OTHER_1	VEHICLE_CLASS	
FHWA_OTHER_2	VEHICLE_CLASS	
FHWA_OTHER_3	VEHICLE_CLASS	
FHWA_OTHER_4	VEHICLE_CLASS	

Table: TRF_CALIBRATION_WIM

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	TRF_EQUIPMENT_MASTER
SHRP_ID (PK)		TRF_EQUIPMENT_MASTER
WIM_AVC_CALIB_DATE (PK)		TRF_EQUIPMENT_MASTER
RECORD_STATUS		
WIM_CALIB_TECHNIQUE	WIM_CALIB_TECHNIQUE	
WIM_CALIB_TRUCK1_TYPE	VEHICLE_CLASS	
WIM_CALIB_TRUCK1_SUSPNSN	WIM_CALIB_TRUCK_SUSPNSN	
WIM_CALIB_TRUCK2_TYPE	VEHICLE_CLASS	
WIM_CALIB_TRUCK2_SUSPNSN	WIM_CALIB_TRUCK_SUSPNSN	
WIM_CALIB_TRUCK3_TYPE	VEHICLE_CLASS	
WIM_CALIB_TRUCK3_SUSPNSN	WIM_CALIB_TRUCK_SUSPNSN	
WIM_AUTO_CALIB	WIM_AUTO_CALIB	

Table: TRF_EQUIPMENT_MASTER

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
WIM_AVC_CALIB_DATE (PK)		
RECORD_STATUS		
TYPE_EQUIP_CALIB	TYPE_EQUIPMENT_CALIB	
REASON_CALIB	REASON_CALIB	
SENSORS_LTPP_BENDING_PLATES	Y_N	
SENSORS_LTPP_PIEZO_CABLE	SENSORS_LTPP_PIEZO_CABLE	
SENSORS_LTPP_QUARTZ_PIEZO	Y_N	
SENSORS_LTPP_CAPACITANCE_PADS	Y_N	
SENSORS_LTPP_INDUCTANCE_LOOPS	Y_N	
SENSORS_LTPP_LOAD_CELLS	Y_N	
SENSORS_LTPP_OTHER	Y_N	
TRF_CALIBRATION_PROTOCOL	TRF_CAL_PROTOCOL	

Table: TRF_HIST_CLASS_DATA

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	TRF_HIST_CLASS_MASTER
SHRP_ID (PK)		TRF_HIST_CLASS_MASTER
CLASS_COUNT_BEGIN_DATE (PK)		TRF_HIST_CLASS_MASTER

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: TRF_HIST_CLASS_DATA

FIELD NAME*	CODE LIST	PARENT TABLE
VEHICLE_CLASS (PK)	VEHICLE_CLASS	
RECORD_STATUS		

Table: TRF_HIST_CLASS_MASTER

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
CLASS_COUNT_BEGIN_DATE (PK)		
RECORD_STATUS		
FUNC_CLASS	FUNC_CLASS	
CLASS_COUNT_TYPE	CLASS_COUNT_TYPE	
CLASS_EQUIPMENT_TYPE	CLASS_EQUIPMENT_TYPE	
CLASS_NO_TRUCKS		
METH_VEHICLE_CLASS	METH_VEHICLE_CLASS	

Table: TRF_HIST_EST_ESAL

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
YEAR_HIST_EST (PK)		
AADT_TRUCK_COMBO		
ANL_KESAL_LTPP_LN_YR		
METH_EST_AADT_TOT	METH_EST_AADT_TOT	
METH_EST_TRK_TOT	METH_EST_TRK_TOT	
METH_EST_AADT_LTPP	METH_EST_VOL_LTPP	
METH_EST_TRK_LTPP	METH_EST_VOL_LTPP	
METH_EST_ESAL_VEH	METH_EST_ESAL_VEH	
ESAL_EST_WGHTSRC	ESAL_EST_WGHTSRC	
ESAL_EST_WGHTSCALE	ESAL_EST_WGHTSCALE	

Table: TRF_HIST_VOLUME_COUNT

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
COUNT_BEGIN_DATE (PK)		
RECORD_STATUS		
COUNT_DURATION_UNIT	COUNT_DURATION_UNIT	
COUNT_TYPE	COUNT_TYPE	
TOTAL_NO_VEHICLES_COUNT		
COUNT_AADT_LTPP_LN		

Table: TRF_HIST_WEIGHT_AXLES

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
WEIGHT_BEGIN_DATE (PK)		
VEHICLE_CLASS (PK)	VEHICLE_CLASS	
AXLE_GROUP (PK)	AXLE_GROUP	
WEIGHT_RANGE_LOW (PK)		
RECORD_STATUS		
WEIGHT_RANGE_HIGH		
NUMBER_AXLES		

Table: TRF_HIST_WEIGHT_DATA

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
WEIGHT_BEGIN_DATE (PK)		
VEHICLE_CLASS (PK)		
RECORD_STATUS		
NO_VEHICLES_WEIGHED		

Table: TRF_HIST_WEIGHT_MASTER

FIELD NAME*	CODE LIST	PARENT TABLE

Table: TRF_HIST_WEIGHT_MASTER

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
WEIGHT_BEGIN_DATE (PK)		
RECORD_STATUS		
FUNC_CLASS	FUNC_CLASS	
DIRECTION_OF_TRAVEL	DIRECTION_OF_TRAVEL	
WEIGHT_EQUIPMENT_TYPE	WEIGHT_EQUIPMENT_TYPE	
WEIGHT_COUNT_DURATION_HOUR		
WEIGHT_COUNT_LANE	WEIGHT_COUNT_LANE	
WEIGHT_COUNT_PURPOSE	WEIGHT_COUNT_PURPOSE	
METH_VEHICLE_CLASS	METH_VEHICLE_CLASS	
PAVE_TYPE_TRF	PAVE_TYPE_TRF	

Table: TRF_MEPDG_AADTT_LTPP_LN

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
YEAR (PK)		
TRF_DATA_TYPE (PK)	TRF_DATA_TYPE	
AADTT		

Table: TRF_MEPDG_AX_DIST

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
YEAR (PK)		
MONTH (PK)		
VEHICLE_CLASS (PK)	VEHICLE_CLASS	
AXLE_GROUP (PK)	AXLE_GROUP	
WEIGHT_BIN_LOW (PK)		

Table: TRF_MEPDG_AX_DIST_ANL

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
YEAR (PK)		
VEHICLE_CLASS (PK)	VEHICLE_CLASS	
AXLE_GROUP (PK)	AXLE_GROUP	
WEIGHT_BIN_LOW (PK)		

Table: TRF_MEPDG_AX_DIST_ANL_VAR

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
VEHICLE_CLASS (PK)	VEHICLE_CLASS	
AXLE_GROUP (PK)	AXLE_GROUP	
WEIGHT_BIN_LOW (PK)		

Table: TRF_MEPDG_AX_PER_TRUCK

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
YEAR (PK)		
VEHICLE_CLASS (PK)	VEHICLE_CLASS	
AXLE_GROUP (PK)	AXLE_GROUP	
AXLES_TRUCK		

Table: TRF_MEPDG_HOURLY_DIST

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
YEAR (PK)		
HOUR (PK)		
RECORD_STATUS		

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: TRF_MEPDG_HOURLY_DIST

FIELD NAME*	CODE LIST	PARENT TABLE
PCT_HOURLY		

Table: TRF_MEPDG_MONTH_ADJ_FACTR

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
YEAR (PK)		
MONTH (PK)		
VEHICLE_CLASS (PK)	VEHICLE_CLASS	
TRF_DATA_TYPE (PK)	TRF_DATA_TYPE	
MONTHLY_RATIO		

Table: TRF_MEPDG_VEH_CLASS_DIST

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
YEAR (PK)		
VEHICLE_CLASS (PK)	VEHICLE_CLASS	
TRF_DATA_TYPE (PK)	TRF_DATA_TYPE	
PERCENT_OF_TRUCKS		

Table: TRF_MONITOR_AXLE_DISTRIB

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
YEAR (PK)		
VEHICLE_CLASS (PK)	VEHICLE_CLASS	
AXLE_GROUP (PK)	AXLE_GROUP	
RECORD_STATUS		
AX_CT_01		
AX_CT_02		
AX_CT_03		
AX_CT_04		
AX_CT_05		
AX_CT_06		
AX_CT_07		
AX_CT_08		
AX_CT_09		
AX_CT_10		
AX_CT_11		
AX_CT_12		
AX_CT_13		
AX_CT_14		
AX_CT_15		
AX_CT_16		
AX_CT_17		
AX_CT_18		
AX_CT_19		
AX_CT_20		
AX_CT_21		
AX_CT_22		
AX_CT_23		
AX_CT_24		
AX_CT_25		
AX_CT_26		
AX_CT_27		
AX_CT_28		
AX_CT_29		
AX_CT_30		
AX_CT_31		
AX_CT_32		
AX_CT_33		
AX_CT_34		
AX_CT_35		
AX_CT_36		

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: TRF_MONITOR_AXLE_DISTRIB

FIELD NAME*	CODE LIST	PARENT TABLE
AX_CT_37		
AX_CT_38		
AX_CT_39		
AX_CT_40		
WEIGHT_BIN_SIZE		

Table: TRF_MONITOR_AXLE_SUMMARY

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_YEAR (PK)		
MODIFICATION_NO (PK)		
AXLE_GROUP (PK)	AXLE_GROUP	
ANNUAL_AXLE_NUMBER_EST (PK)		

Table: TRF_MONITOR_BASIC_INFO

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_YEAR (PK)		
MODIFICATION_NO (PK)		
AVC_SITE_LOCATION	SITE_LOCATION	
WIM_SITE_LOCATION	SITE_LOCATION	
DATA_AVAILABILITY	DATA_AVAILABILITY	
PAVEMENT_TYPE	PAVEMENT_TYPE	

Table: TRF_MONITOR_LTPP_LN

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
YEAR (PK)		
VEHICLE_CLASS (PK)	VEHICLE_CLASS	
RECORD_STATUS		
TRUCKS_LTPP_LN		
DAYS_OF_WEEK_COUNTED	DAYS_SPANNED	
DAYS_OF_WEEK_WEIGHED	DAYS_SPANNED	

Table: TRF_MONITOR_VEHICLE_DISTRIB

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
DATE_YEAR (PK)		
MODIFICATION_NO (PK)		
VEHICLE_TYPE (PK)	VEHICLE_TYPE	

Table: TRF_MON_EST_ESAL

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
YEAR_MON_EST (PK)		
AADT_TRUCK_COMBO		
ANL_KESAL_LTPP_LN_YR		
METH_EST_AADT_TOT	METH_EST_AADT_TOT	
METH_EST_TRK_TOT	METH_EST_TRK_TOT	
METH_EST_AADT_LTPP	METH_EST_VOL_LTPP	
METH_EST_TRK_LTPP	METH_EST_VOL_LTPP	
METH_EST_ESAL_VEH	METH_EST_ESAL_VEH	
ESAL_EST_WGHTSRC	ESAL_EST_WGHTSRC	
ESAL_EST_WGHTSCALE	ESAL_EST_WGHTSCALE	

***Key fields are marked with (PK) and non-null fields are bolded.**

Constraints for the Materials Testing (TST) Module

Table: TST_AC01

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
FIELD_LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
TEST_NO (PK)	TEST_NO	
LOC_NO (PK)		
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	
VISUAL_EXAM_1	VISUAL_ACPC	
VISUAL_EXAM_2	VISUAL_ACPC	
VISUAL_EXAM_3	VISUAL_ACPC	
VISUAL_EXAM_4	VISUAL_ACPC	
VISUAL_EXAM_5	VISUAL_ACPC	
VISUAL_EXAM_6	VISUAL_ACPC	
COMMENTS_1	COMMENT	
COMMENTS_2	COMMENT	
COMMENTS_3	COMMENT	
COMMENTS_4	COMMENT	
COMMENTS_5	COMMENT	
COMMENTS_6	COMMENT	

Table: TST_AC01_LAYER

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_AC01 (CASCADE DELETE)
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_AC01 (CASCADE DELETE)
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
FIELD_LAYER_NO (PK)		TST_AC01 (CASCADE DELETE)
FIELD_LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		TST_AC01 (CASCADE DELETE)
TEST_NO (PK)	TEST_NO	TST_AC01 (CASCADE DELETE)
LAYER_NO (PK)		
LOC_NO (PK)		TST_AC01 (CASCADE DELETE)
CONSTRUCTION_NO		TST_L05B
LAYER_DESCRIPTION	DESCRIPTION	

Table: TST_AC02

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
TEST_NO (PK)	TEST_NO	
LOC_NO (PK)		
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	
PARAFFIN_COATED	Y_N	
COMMENTS_1	COMMENT	
COMMENTS_2	COMMENT	
COMMENTS_3	COMMENT	
COMMENTS_4	COMMENT	
COMMENTS_5	COMMENT	
COMMENTS_6	COMMENT	

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: TST_AC03

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
TEST_NO (PK)	TEST_NO	
LOC_NO (PK)		
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	
COMMENTS_1	COMMENT	
COMMENTS_2	COMMENT	
COMMENTS_3	COMMENT	
COMMENTS_4	COMMENT	
COMMENTS_5	COMMENT	
COMMENTS_6	COMMENT	

Table: TST_AC04

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
TEST_NO (PK)	TEST_NO	
LOC_NO (PK)		
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	
COMMENTS_1	COMMENT	
COMMENTS_2	COMMENT	
COMMENTS_3	COMMENT	
COMMENTS_4	COMMENT	
COMMENTS_5	COMMENT	
COMMENTS_6	COMMENT	

Table: TST_AC05

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
TEST_NO (PK)	TEST_NO	
LOC_NO (PK)		
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	
COMMENTS_1	COMMENT	
COMMENTS_2	COMMENT	
COMMENTS_3	COMMENT	
COMMENTS_4	COMMENT	
COMMENTS_5	COMMENT	
COMMENTS_6	COMMENT	

Table: TST_AC07_V2_CREEP_COMP_SUM

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
LAYER_NO (PK)		
TEST_NO (PK)	TEST_NO	
CONSTRUCTION_NO (PK)		
FIELD_SET (PK)		
TEST_TEMPERATURE (PK)		
RECORD_STATUS		
LAB_CODE	LAB_CODE	
CREEP_COMP_1_SEC		
CREEP_COMP_2_SEC		
CREEP_COMP_5_SEC		
CREEP_COMP_10_SEC		
CREEP_COMP_20_SEC		

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: TST_AC07_V2_CREEP_COMP_SUM

FIELD NAME*	CODE LIST	PARENT TABLE
CREEP_COMP_50_SEC		
CREEP_COMP_100_SEC		
CREEP_POISSON_CALC		
CREEP_POISSON_USED		
CREEP_DATA_FILE_SPECIMEN_1		
CREEP_DATA_FILE_SPECIMEN_2		
CREEP_DATA_FILE_SPECIMEN_3		

Table: TST_AC07_V2_IDT_SUM

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
LAYER_NO (PK)		
TEST_NO (PK)	TEST_NO	
CONSTRUCTION_NO (PK)		
FIELD_SET (PK)		
TEST_TEMPERATURE (PK)		
RECORD_STATUS		
LAB_CODE	LAB_CODE	
IDT_SPECIMEN_1		
IDT_SPECIMEN_2		
IDT_SPECIMEN_3		
IDT_AVERAGE		
IDT_POISSON_CALC		
IDT_POISSON_USED		
IDT_DATA_FILE_SPECIMEN_1		
IDT_DATA_FILE_SPECIMEN_2		
IDT_DATA_FILE_SPECIMEN_3		

Table: TST_AC07_V2_MR_SUM

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
LAYER_NO (PK)		
TEST_NO (PK)	TEST_NO	
CONSTRUCTION_NO (PK)		
FIELD_SET (PK)		
TEST_TEMPERATURE (PK)		
RECORD_STATUS		
LAB_CODE	LAB_CODE	
INST_MR_CYCLE_1		
INST_MR_POISSON_CALC_CYCLE_1		
INST_MR_POISSON_USED_CYCLE_1		
TOTAL_MR_CYCLE_1		
TOTAL_MR_POISSON_CALC_CYCLE_1		
TOTAL_MR_POISSON_USED_CYCLE_1		
INST_MR_CYCLE_2		
INST_MR_POISSON_CALC_CYCLE_2		
INST_MR_POISSON_USED_CYCLE_2		
TOTAL_MR_CYCLE_2		
TOTAL_MR_POISSON_CALC_CYCLE_2		
TOTAL_MR_POISSON_USED_CYCLE_2		
INST_MR_CYCLE_3		
INST_MR_POISSON_CALC_CYCLE_3		
INST_MR_POISSON_USED_CYCLE_3		
TOTAL_MR_CYCLE_3		
TOTAL_MR_POISSON_CALC_CYCLE_3		
TOTAL_MR_POISSON_USED_CYCLE_3		
INST_MR_AVG		
INST_MR_POISSON_CALC_AVG		

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: TST_AC07_V2_MR_SUM

FIELD NAME*	CODE LIST	PARENT TABLE
INST_MR_POISSON_USED_AVG		
TOTAL_MR_AVG		
TOTAL_MR_POISSON_CALC_AVG		
TOTAL_MR_POISSON_USED_AVG		
MR_DATA_FILE_SPECIMEN_1		
MR_DATA_FILE_SPECIMEN_2		
MR_DATA_FILE_SPECIMEN_3		

Table: TST_AC07_V2_SPECIMEN_INFO

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
SHRP_ID (PK)		TST_L05B
LAYER_NO (PK)		TST_L05B
TEST_NO (PK)	TEST_NO	
CONSTRUCTION_NO (PK)		TST_L05B
FIELD_SET (PK)		
RECORD_STATUS		
LAB_CODE	LAB_CODE	
THICKNESS_SPECIMEN_1		
DIAMETER_SPECIMEN_1		
BSG_AC_SPECIMEN_1		
THICKNESS_SPECIMEN_2		
DIAMETER_SPECIMEN_2		
BSG_AC_SPECIMEN_2		
THICKNESS_SPECIMEN_3		
DIAMETER_SPECIMEN_3		
BSG_AC_SPECIMEN_3		
CREEP_DATA_ANAL_FILE		
MR_DATA_ANAL_FILE		
IDT_DATA_ANAL_FILE_1		
IDT_DATA_ANAL_FILE_2		
IDT_DATA_ANAL_FILE_3		
COMMENT_1	COMMENT	
COMMENT_2	COMMENT	
COMMENT_3	COMMENT	

Table: TST_AC_MOIST_DAMAGE

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
FIELD_SET (PK)		
LOC_NO (PK)		
MOIST_IN_CORE	Y_N	

Table: TST_AE01

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
LOC_NO (PK)		
TEST_NO (PK)	TEST_NO	
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	
COMMENTS_1	COMMENT	
COMMENTS_2	COMMENT	
COMMENTS_3	COMMENT	
COMMENTS_4	COMMENT	
COMMENTS_5	COMMENT	
COMMENTS_6	COMMENT	

Table: TST_AE01S

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: TST_AE01S

FIELD NAME*	CODE LIST	PARENT TABLE
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
LOC_NO (PK)		
TEST_NO (PK)	TEST_NO	
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	
COMMENT_1	COMMENT	
COMMENT_2	COMMENT	
COMMENT_3	COMMENT	
COMMENT_4	COMMENT	
COMMENT_5	COMMENT	
COMMENT_6	COMMENT	

Table: TST_AE02

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
LOC_NO (PK)		
TEST_NO (PK)	TEST_NO	
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	
COMMENTS_1	COMMENT	
COMMENTS_2	COMMENT	
COMMENTS_3	COMMENT	
COMMENTS_4	COMMENT	
COMMENTS_5	COMMENT	
COMMENTS_6	COMMENT	

Table: TST_AE02S

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
LOC_NO (PK)		
TEST_NO (PK)	TEST_NO	
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	
COMMENT_1	COMMENT	
COMMENT_2	COMMENT	
COMMENT_3	COMMENT	
COMMENT_4	COMMENT	
COMMENT_5	COMMENT	
COMMENT_6	COMMENT	

Table: TST_AE03

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
LOC_NO (PK)		
TEST_NO (PK)	TEST_NO	
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	
COMMENTS_1	COMMENT	
COMMENTS_2	COMMENT	
COMMENTS_3	COMMENT	
COMMENTS_4	COMMENT	
COMMENTS_5	COMMENT	
COMMENTS_6	COMMENT	

Table: TST_AE04

***Key fields are marked with (PK) and non-null fields are bolded.**

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
LOC_NO (PK)		
TEST_NO (PK)	TEST_NO	
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	
COMMENTS_1	COMMENT	
COMMENTS_2	COMMENT	
COMMENTS_3	COMMENT	
COMMENTS_4	COMMENT	
COMMENTS_5	COMMENT	
COMMENTS_6	COMMENT	

Table: TST_AE05

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
LOC_NO (PK)		
TEST_NO (PK)	TEST_NO	
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	
COMMENTS_1	COMMENT	
COMMENTS_2	COMMENT	
COMMENTS_3	COMMENT	
COMMENTS_4	COMMENT	
COMMENTS_5	COMMENT	
COMMENTS_6	COMMENT	

Table: TST_AE06S

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
LOC_NO (PK)		
TEST_NO (PK)	TEST_NO	
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	
COMMENT_1	COMMENT	
COMMENT_2	COMMENT	
COMMENT_3	COMMENT	
COMMENT_4	COMMENT	
COMMENT_5	COMMENT	
COMMENT_6	COMMENT	

Table: TST_AE07_DATA

FIELD NAME*	CODE LIST	PARENT TABLE
TST_ID (PK)		TST_AE07_MASTER
AGING_TYPE (PK)	BINDER_AGE_TYPE	TST_AE07_MASTER
TEST_TEMP (PK)		
COMPLEX_MOD		
PHASE_ANGLE		
TEST_RUN (PK)		TST_AE07_MASTER

Table: TST_AE07_MASTER

FIELD NAME*	CODE LIST	PARENT TABLE
TST_ID (PK)		TST_LINK_SAMPLE
AGING_TYPE (PK)	BINDER_AGE_TYPE	
LAB_CODE	LAB_CODE	
TEST_DATE		
TEST_CONTROL	DSR_TEST_CONTROL	
PLATE_DIAMETER		

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: TST_AE07_MASTER

FIELD NAME*	CODE LIST	PARENT TABLE
PG_HIGH_TEMP		
PG_LOW_TEMP		
COMMENT_1	COMMENT	
COMMENT_2	COMMENT	
COMMENT_3	COMMENT	
COMMENT_4	COMMENT	
COMMENT_5	COMMENT	
COMMENT_6	COMMENT	
TEST_RUN (PK)		

Table: TST_AE08_DATA

FIELD NAME*	CODE LIST	PARENT TABLE
TST_ID (PK)		TST_AE08_MASTER
AGING_TYPE (PK)	BINDER_AGE_TYPE	TST_AE08_MASTER
TEST_TEMP (PK)		TST_AE08_MASTER
TEST_TIME (PK)		
STIFF_MEASURE		
SOAK_TIME (PK)		TST_AE08_MASTER
TEST_RUN (PK)		TST_AE08_MASTER

Table: TST_AE08_MASTER

FIELD NAME*	CODE LIST	PARENT TABLE
TST_ID (PK)		TST_LINK_SAMPLE
AGING_TYPE (PK)	BINDER_AGE_TYPE	
TEST_TEMP (PK)		
LAB_CODE	LAB_CODE	
TEST_DATE		
SOAK_TIME (PK)		
PG_HIGH_TEMP		
PG_LOW_TEMP		
COMMENT_1	COMMENT	
COMMENT_2	COMMENT	
COMMENT_3	COMMENT	
COMMENT_4	COMMENT	
COMMENT_5	COMMENT	
COMMENT_6	COMMENT	
TEST_RUN (PK)		

Table: TST_AE09_DATA

FIELD NAME*	CODE LIST	PARENT TABLE
TST_ID (PK)		TST_AE09_MASTER
AGING_TYPE (PK)	BINDER_AGE_TYPE	TST_AE09_MASTER
REPEAT_NO (PK)		
PEAK_LOAD		
FAIL_STRESS		
FAIL_ELONG		
FAIL_STRAIN		
TEST_TEMP (PK)		TST_AE09_MASTER

Table: TST_AE09_MASTER

FIELD NAME*	CODE LIST	PARENT TABLE
TST_ID (PK)		TST_LINK_SAMPLE
AGING_TYPE (PK)	BINDER_AGE_TYPE	
LAB_CODE	LAB_CODE	
TEST_DATE		
TEST_TEMP (PK)		
FRACTURE_TYPE	DT_FRACTURE_TYPE	
COMMENT_1	COMMENT	
COMMENT_2	COMMENT	
COMMENT_3	COMMENT	
COMMENT_4	COMMENT	
COMMENT_5	COMMENT	
COMMENT_6	COMMENT	

Table: TST_AG01

***Key fields are marked with (PK) and non-null fields are bolded.**

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
LOC_NO (PK)		
TEST_NO (PK)	TEST_NO	
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	
COMMENTS_1	COMMENT	
COMMENTS_2	COMMENT	
COMMENTS_3	COMMENT	
COMMENTS_4	COMMENT	
COMMENTS_5	COMMENT	
COMMENTS_6	COMMENT	

Table: TST_AG02

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
LOC_NO (PK)		
TEST_NO (PK)	TEST_NO	
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	
COMMENTS_1	COMMENT	
COMMENTS_2	COMMENT	
COMMENTS_3	COMMENT	
COMMENTS_4	COMMENT	
COMMENTS_5	COMMENT	
COMMENTS_6	COMMENT	

Table: TST_AG04

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
TEST_NO (PK)	TEST_NO	
LOC_NO (PK)		
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	
COMMENTS_1	COMMENT	
COMMENTS_2	COMMENT	
COMMENTS_3	COMMENT	
COMMENTS_4	COMMENT	
COMMENTS_5	COMMENT	
COMMENTS_6	COMMENT	
SOIL_GEOL	GEOL_CLASS	
GEOL_CODE_A	GEOL_CLASS	
GEOL_CODE_B	GEOL_CLASS	

Table: TST_AG05

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
TEST_NO (PK)	TEST_NO	
LOC_NO (PK)		
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	
COMMENTS_1	COMMENT	
COMMENTS_2	COMMENT	
COMMENTS_3	COMMENT	
COMMENTS_4	COMMENT	

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: TST_AG05

FIELD NAME*	CODE LIST	PARENT TABLE
COMMENTS_5	COMMENT	
COMMENTS_6	COMMENT	

Table: TST_ASPHALT_CEMENT

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
FIELD_SET (PK)		
LOC_NO (PK)		
PLANT_TYPE	PLANT_TYPE	
CONSTRUCTION_NO		

Table: TST_CS01

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
TEST_NO (PK)	TEST_NO	
LOC_NO (PK)		
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	
BOND_INIT	PASS_FAIL	
ASPHALT_COMPATIBILITY_INIT	PASS_FAIL	
BOND_HEAT	PASS_FAIL	
ASPHALT_COMPATIBILITY_HEAT	PASS_FAIL	

Table: TST_CS02

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
TEST_NO (PK)	TEST_NO	
LOC_NO (PK)		
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	
MOVEMENT_CAPABILITY	UN_SATISFACTORY	
OZONE_AND_UV_RESISTANCE	UN_SATISFACTORY	

Table: TST_FRESH_PCC

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
FIELD_SET (PK)		
LOC_NO (PK)		
SAMPLE_LOC	SAMPLE_LOC_PCC	
LAB_CODE	LAB_CODE	
CONSTRUCTION_NO		

Table: TST_HOLE_LOG

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
FIELD_SET (PK)		
LOC_NO (PK)		
CONSTRUCTION_NO		
RECOVERED	Y_N	
REFUSAL	Y_N	

Table: TST_ISD_MOIST

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	

Table: TST_ISD_MOIST

FIELD NAME*	CODE LIST	PARENT TABLE
FIELD_SET (PK)		
LOC_NO (PK)		
DEPTH_TOP_STRATA (PK)		
CONSTRUCTION_NO		
MATERIAL_TYPE	ISD_MOIST_MATL_TYPE	

Table: TST_L05

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
PROJECT_LAYER_CODE (PK)		
MATL_CODE	MATERIAL	

Table: TST_L05A

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO (PK)		
LAYER_NO (PK)		
DESCRIPTION	DESCRIPTION	
LAYER_TYPE	LAYER_TYPE	
MATL_CODE_STATION0	MATERIAL	
MEASURE_TYPE_1_STATION0	MEASURE_TYPE	
MEASURE_TYPE_2_STATION0	MEASURE_TYPE	
MEASURE_TYPE_3_STATION0	MEASURE_TYPE	
MATL_CODE_WITHIN	MATERIAL	
MEASURE_TYPE_1_WITHIN	MEASURE_TYPE	
MEASURE_TYPE_2_WITHIN	MEASURE_TYPE	
MEASURE_TYPE_3_WITHIN	MEASURE_TYPE	
MATL_CODE_STATION5	MATERIAL	
MEASURE_TYPE_1_STATION5	MEASURE_TYPE	
MEASURE_TYPE_2_STATION5	MEASURE_TYPE	
MEASURE_TYPE_3_STATION5	MEASURE_TYPE	

Table: TST_L05B

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
CONSTRUCTION_NO (PK)		
LAYER_NO (PK)		
DESCRIPTION	DESCRIPTION	
LAYER_TYPE	LAYER_TYPE	
MATL_CODE	MATERIAL	
LAYER_COMMENT1	L05B_COMMENT_CODES	
LAYER_COMMENT2	L05B_COMMENT_CODES	
LAYER_COMMENT3	L05B_COMMENT_CODES	

Table: TST_LINK_LAYER

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
SHRP_ID (PK)		TST_L05B
LAYER_NO (PK)		TST_L05B
CONSTRUCTION_NO (PK)		TST_L05B
TST_ID (PK)		TST_LINK_SAMPLE

Table: TST_LINK_SAMPLE

FIELD NAME*	CODE LIST	PARENT TABLE
TST_ID (PK)		
STATE_CODE	STATE_PROVINCE	TST_L05B
SHRP_ID		TST_L05B
LAYER_NO		TST_L05B
FIELD_SET		
SAMPLE_NO		
CONSTRUCTION_NO		TST_L05B

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: TST_PC01

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
TEST_NO (PK)	TEST_NO	
LOC_NO (PK)		
CONSTRUCTION_NO		TST_L05B
SAMPLE_NO (PK)		
LAB_CODE	LAB_CODE	
COMP_STRENGTH_FRAC	FRACTURE	
COMMENTS_1	COMMENT	
COMMENTS_2	COMMENT	
COMMENTS_3	COMMENT	
COMMENTS_4	COMMENT	
COMMENTS_5	COMMENT	
COMMENTS_6	COMMENT	

Table: TST_PC02

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
TEST_NO (PK)	TEST_NO	
LOC_NO (PK)		
CONSTRUCTION_NO		TST_L05B
SAMPLE_NO (PK)		
LAB_CODE	LAB_CODE	
TENSILE_STRENGTH_FRAC	FRACTURE	
COMMENTS_1	COMMENT	
COMMENTS_2	COMMENT	
COMMENTS_3	COMMENT	
COMMENTS_4	COMMENT	
COMMENTS_5	COMMENT	
COMMENTS_6	COMMENT	

Table: TST_PC03

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
SHRP_ID (PK)		TST_L05B
LAYER_NO (PK)		TST_L05B
TEST_SEQUENCE (PK)		
FIELD_SET (PK)		
LOC_NO (PK)		
SAMPLE_NO (PK)		
CONSTRUCTION_NO		TST_L05B
RECORD_STATUS		
LAB_CODE	LAB_CODE	
COEF_THERMAL_EXPANSION		
EQUIP_MANUFACTURER	EQUIP_MANUFACTURER	
PRIMARY_AGG_CLASS	AGG_CLASS	
SECONDARY_AGG_CLASS	AGG_CLASS	
TEST_DATE		
COMMENT_OTHER	COMMENTS	

Table: TST_PC04

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
TEST_NO (PK)	TEST_NO	
LOC_NO (PK)		
CONSTRUCTION_NO		TST_L05B

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: TST_PC04

FIELD NAME*	CODE LIST	PARENT TABLE
LAB_CODE	LAB_CODE	
COMMENTS_1	COMMENT	
COMMENTS_2	COMMENT	
COMMENTS_3	COMMENT	
COMMENTS_4	COMMENT	
COMMENTS_5	COMMENT	
COMMENTS_6	COMMENT	

Table: TST_PC05

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
TEST_NO (PK)	TEST_NO	
LOC_NO (PK)		
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	
COMMENTS_1	COMMENT	
COMMENTS_2	COMMENT	
COMMENTS_3	COMMENT	
COMMENTS_4	COMMENT	
COMMENTS_5	COMMENT	
COMMENTS_6	COMMENT	

Table: TST_PC06

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
TEST_NO (PK)	TEST_NO	
LOC_NO (PK)		
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	
VISUAL_EXAM_1	VISUAL_ACPC	
VISUAL_EXAM_2	VISUAL_ACPC	
VISUAL_EXAM_3	VISUAL_ACPC	
VISUAL_EXAM_4	VISUAL_ACPC	
VISUAL_EXAM_5	VISUAL_ACPC	
VISUAL_EXAM_6	VISUAL_ACPC	
COMMENTS_1	COMMENT	
COMMENTS_2	COMMENT	
COMMENTS_3	COMMENT	
COMMENTS_4	COMMENT	
COMMENTS_5	COMMENT	
COMMENTS_6	COMMENT	

Table: TST_PC07

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
TEST_NO (PK)	TEST_NO	
LOC_NO (PK)		
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	
COMMENTS_1	COMMENT	
COMMENTS_2	COMMENT	
COMMENTS_3	COMMENT	
COMMENTS_4	COMMENT	
COMMENTS_5	COMMENT	
COMMENTS_6	COMMENT	

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: TST_PC08

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
TEST_NO (PK)	TEST_NO	
LOC_NO (PK)		
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	
COMMENT_1	COMMENT	
COMMENT_2	COMMENT	
COMMENT_3	COMMENT	
COMMENT_4	COMMENT	
COMMENT_5	COMMENT	
COMMENT_6	COMMENT	

Table: TST_PC09

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
TEST_NO (PK)	TEST_NO	
LOC_NO (PK)		
SAMPLE_NO (PK)		
LAB_CODE	LAB_CODE	
CONSTRUCTION_NO		TST_L05B
COMMENTS_1	COMMENT	
COMMENTS_2	COMMENT	
COMMENTS_3	COMMENT	
COMMENTS_4	COMMENT	
COMMENTS_5	COMMENT	
COMMENTS_6	COMMENT	

Table: TST_SAMPLE_BASIC_INFO

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE	STATE_PROVINCE	

Table: TST_SAMPLE_BULK_AC_AGG

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
FIELD_SET (PK)		
SAMPLE_NO (PK)		
RECORD_STATUS		
LOC_NO		
PLANT_TYPE	PLANT_TYPE	
SAMPLE_LOC	SAMPLE_LOC_UNCOMP	
REPR_GRADATION	REPR_GRADATION	
CONSTRUCTION_NO		

Table: TST_SAMPLE_COMBINE

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
FIELD_SET (PK)		
SAMPLE_NO (PK)		
SAMPLE_NO_ORIG (PK)		
RECORD_STATUS		
LOC_NO		
LOC_NO_ORIG		

Table: TST_SAMPLE_LAB_AC_MIX

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: TST_SAMPLE_LAB_AC_MIX

FIELD NAME*	CODE LIST	PARENT TABLE
FIELD_SET (PK)		
SAMPLE_NO (PK)		
RECORD_STATUS		
LOC_NO		
SAMPLE_NO_AGG		
SAMPLE_NO_BINDER		
LAB_CODE	LAB_CODE	
AGG_REGRADE	AGG_REGRADE	

Table: TST_SAMPLE_LOG

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
FIELD_SET (PK)		
LOC_NO (PK)		
STRATA_LEVEL (PK)		
MATERIAL_CODE	MATERIAL	
REFUSAL	Y_N	

Table: TST_SAMPLE_LOG_LAB

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
FIELD_SET (PK)		
LOC_NO (PK)		
SAMPLE_NO (PK)		
LAB_SAMPLE_NO (PK)		

Table: TST_SAMPLE_LOG_SPS_3_4

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
FIELD_SET (PK)		
LOC_NO (PK)		
SAMPLE_NO (PK)		
CONSTRUCTION_NO		

Table: TST_SC01

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
LOC_NO (PK)		
TEST_NO (PK)	TEST_NO	
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	
PARTICLE_CHARGE	PARTICLE_CHARGE	
COATED_LESS_THAN_UNCOATED	Y_N	
COATING_OF_STONE	G_F_P	
FREE_WATER_PRESENT	Y_N	
COAGULATION_OF_AC	Y_N	

Table: TST_SC02

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
LOC_NO (PK)		
TEST_NO (PK)	TEST_NO	
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: TST_SC03

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
LOC_NO (PK)		
TEST_NO (PK)	TEST_NO	
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	

Table: TST_SC04

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
LOC_NO (PK)		
TEST_NO (PK)	TEST_NO	
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	

Table: TST_SC05

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
LOC_NO (PK)		
TEST_NO (PK)	TEST_NO	
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	

Table: TST_SC06

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
LOC_NO (PK)		
TEST_NO (PK)	TEST_NO	
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	

Table: TST_SC07

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
LOC_NO (PK)		
TEST_NO (PK)	TEST_NO	
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	

Table: TST_SC08

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
LOC_NO (PK)		
TEST_NO (PK)	TEST_NO	
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	
CONSISTENCY	CONSISTENCY	
ASPHALT_AGG_DISTRIBUTION	UNIFORMITY	

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: TST_SC08

FIELD NAME*	CODE LIST	PARENT TABLE
SURFACE_OF_SPECIMEN	CONSISTENCY	

Table: TST_SC09

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
LOC_NO (PK)		
TEST_NO (PK)	TEST_NO	
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	
PAPER_TOWEL_STAINED	Y_N	
WATER_DISCOLORATION	WATER_DISCOLORATION	

Table: TST_SC10A

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
LOC_NO (PK)		
TEST_NO (PK)	TEST_NO	
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	

Table: TST_SC10B

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
LOC_NO (PK)		
TEST_NO (PK)	TEST_NO	
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	

Table: TST_SC11

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
LOC_NO (PK)		
TEST_NO (PK)	TEST_NO	
LAB_CODE	LAB_CODE	
CONSTRUCTION_NO		TST_L05B

Table: TST_SC12

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
LOC_NO (PK)		
TEST_NO (PK)	TEST_NO	
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	

Table: TST_SC13

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B

Table: TST_SC13

FIELD NAME*	CODE LIST	PARENT TABLE
FIELD_SET (PK)		
LOC_NO (PK)		
TEST_NO (PK)	TEST_NO	
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	

Table: TST_SP01_DATA

FIELD NAME*	CODE LIST	PARENT TABLE
TST_ID (PK)		TST_SP01_MASTER
GYRATE_NO (PK)		
SPECIMEN_NO (PK)		
BULK_SPEC_GRAV_COR		
REL_DENSITY_COR		

Table: TST_SP01_MASTER

FIELD NAME*	CODE LIST	PARENT TABLE
TST_ID (PK)		TST_LINK_SAMPLE
LAB_CODE	LAB_CODE	
TEST_DATE		
PG_HIGH_TEMP		
PG_LOW_TEMP		
AGGR_NOM_SIZE		
TRAFFIC_LEVEL		
ASPHALT_CONTENT		
AGG_BULK_SPEC_GRAV		
GYRATE_N_INI		
GYRATE_N_MAX		
AVG_REL_DENS_N_INI		
AVG_REL_DENS_N_MAX		
BULK_SPEC_GRAV_1		
COMMENT_1	COMMENT	
COMMENT_2	COMMENT	
COMMENT_3	COMMENT	
COMMENT_4	COMMENT	
COMMENT_5	COMMENT	
COMMENT_6	COMMENT	

Table: TST_SP02

FIELD NAME*	CODE LIST	PARENT TABLE
TST_ID (PK)		TST_LINK_SAMPLE
LAB_CODE	LAB_CODE	
TEST_DATE		
BINDER_SPEC_GRAV		
BINDER_PCT		
AGG_COMB_SPEC_GRAV		
AGG_EFF_SPEC_GRAV		
MIX_MAX_SPEC_GRAV		
MIX_BULK_SPEC_GRAV		
BINDER_ABS_PCT		
BINDER_EFF_PCT		
VMA		
AIR_VOIDS		
VFA		
COMMENT_1	COMMENT	
COMMENT_2	COMMENT	
COMMENT_3	COMMENT	
COMMENT_4	COMMENT	
COMMENT_5	COMMENT	
COMMENT_6	COMMENT	

Table: TST_SS01_UG01_UG02

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: TST_SS01_UG01_UG02

FIELD NAME*	CODE LIST	PARENT TABLE
FIELD_SET (PK)		
TEST_NO (PK)	TEST_NO	
SHRP_TEST (PK)	SHRP_TEST	
LOC_NO (PK)		
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	
COMMENTS_1	COMMENT	
COMMENTS_2	COMMENT	
COMMENTS_3	COMMENT	
COMMENTS_4	COMMENT	
COMMENTS_5	COMMENT	
COMMENTS_6	COMMENT	

Table: TST_SS02_UG03

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
TEST_NO (PK)	TEST_NO	
LOC_NO (PK)		
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	
COMMENTS_1	COMMENT	
COMMENTS_2	COMMENT	
COMMENTS_3	COMMENT	
COMMENTS_4	COMMENT	
COMMENTS_5	COMMENT	
COMMENTS_6	COMMENT	

Table: TST_SS04_UG08

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
TEST_NO (PK)	TEST_NO	
LOC_NO (PK)		
SAMPLE_NO (PK)		
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	
DESC_CODE_1	SOIL_CRITERIA	
DESC_CODE_2	SOIL_CRITERIA	
DESC_CODE_3	SOIL_CRITERIA	
DESC_CODE_4	SOIL_CRITERIA	
DESC_CODE_5	SOIL_CRITERIA	
DESC_CODE_6	SOIL_CRITERIA	
DESC_CODE_7	SOIL_CRITERIA	
DESC_CODE_8	SOIL_CRITERIA	
DESC_CODE_9	SOIL_CRITERIA	
DESC_CODE_10	SOIL_CRITERIA	
VISUAL_CLASS	MATERIAL	
AASHTO_SOIL_CLASS	S_CLASS	
COMMENTS_1	COMMENT	
COMMENTS_2	COMMENT	
COMMENTS_3	COMMENT	
COMMENTS_4	COMMENT	
COMMENTS_5	COMMENT	
COMMENTS_6	COMMENT	

Table: TST_SS06

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
SHRP_ID (PK)		TST_L05B
LAYER_NO (PK)		TST_L05B

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: TST_SS06

FIELD NAME*	CODE LIST	PARENT TABLE
FIELD_SET (PK)		
LOC_NO (PK)		
CONSTRUCTION_NO		TST_L05B
COMMENT_1	COMMENT	
COMMENT_2	COMMENT	
COMMENT_3	COMMENT	
COMMENT_4	COMMENT	
COMMENT_5	COMMENT	
COMMENT_6	COMMENT	

Table: TST_SS08

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
TEST_NO (PK)	TEST_NO	
LOC_NO (PK)		
SAMPLE_NO (PK)		
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	
COMMENTS_1	COMMENT	
COMMENTS_2	COMMENT	
COMMENTS_3	COMMENT	
COMMENTS_4	COMMENT	
COMMENTS_5	COMMENT	
COMMENTS_6	COMMENT	

Table: TST_SS10

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
SHRP_ID (PK)		TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
TEST_NO (PK)	TEST_NO	
LOC_NO (PK)		
SAMPLE_NO (PK)		
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	
COMMENTS_1	COMMENT	
COMMENTS_2	COMMENT	
COMMENTS_3	COMMENT	
COMMENTS_4	COMMENT	
COMMENTS_5	COMMENT	
COMMENTS_6	COMMENT	

Table: TST_SS11

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
TEST_NO (PK)	TEST_NO	
LOC_NO (PK)		
SAMPLE_NO (PK)		
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	
COMMENTS_1	COMMENT	
COMMENTS_2	COMMENT	
COMMENTS_3	COMMENT	
COMMENTS_4	COMMENT	
COMMENTS_5	COMMENT	
COMMENTS_6	COMMENT	

Table: TST_SS12

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
LAYER_NO (PK)		
FIELD_SET (PK)		
LOC_NO (PK)		
LAB_CODE	LAB_CODE	
COMMENTS_1	COMMENT	
COMMENTS_2	COMMENT	
COMMENTS_3	COMMENT	
COMMENTS_4	COMMENT	
COMMENTS_5	COMMENT	
COMMENTS_6	COMMENT	
CONSTRUCTION_NO		

Table: TST_SS14_UG14_COMMENT

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	TST_SS14_UG14_MASTER
SHRP_ID (PK)		TST_SS14_UG14_MASTER
LOC_NO (PK)		TST_SS14_UG14_MASTER
TEST_DATE (PK)		TST_SS14_UG14_MASTER
COMMENT_NO (PK)		
RECORD_STATUS		
COMMENT_CODE	COMMENT	

Table: TST_SS14_UG14_DATA

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	TST_SS14_UG14_MASTER
SHRP_ID (PK)		TST_SS14_UG14_MASTER
LOC_NO (PK)		TST_SS14_UG14_MASTER
TEST_DATE (PK)		TST_SS14_UG14_MASTER
READING_NO (PK)		
CONSTRUCTION_NO		
RECORD_STATUS		
NO_BLOWS		
PEN_CUMULATIVE		
PEN_BTWN_RDGS		
PEN_PER_BLOW		
DCP_INDEX		
CBR		

Table: TST_SS14_UG14_MASTER

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	
SHRP_ID (PK)		
LOC_NO (PK)		
TEST_DATE (PK)		
CONSTRUCTION_NO		
RECORD_STATUS		
FIELD_SET		
DCP_HAMMER	DCP_HAMMER	
ZERO_POINT_DEPTH		

Table: TST_TB01

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
TEST_NO (PK)	TEST_NO	
LOC_NO (PK)		
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	
SOIL_GEOL	GEOL_CLASS	
THICKNESS_CODE	THICKNESS_CODE	
PRELIM_TREAT_MATL	TREAT_TYPE	
PRELIM_TREAT_TYPE	TREAT_TYPE	

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: TST_TB01

FIELD NAME*	CODE LIST	PARENT TABLE
DETAIL_TREAT_MATL	TREAT_TYPE	
DETAIL_TREAT_TYPE	TREAT_TYPE	
VISUAL_EXAM_1	VISUAL_ACPC	
VISUAL_EXAM_2	VISUAL_ACPC	
VISUAL_EXAM_3	VISUAL_ACPC	
VISUAL_EXAM_4	VISUAL_ACPC	
VISUAL_EXAM_5	VISUAL_ACPC	
VISUAL_EXAM_6	VISUAL_ACPC	
AGGR_TYPE	AGGR_TYPE	
COMMENTS_1	COMMENT	
COMMENTS_2	COMMENT	
COMMENTS_3	COMMENT	
COMMENTS_4	COMMENT	
COMMENTS_5	COMMENT	
COMMENTS_6	COMMENT	
DESC_CODE_1	SOIL_CRITERIA	
DESC_CODE_2	SOIL_CRITERIA	
DESC_CODE_3	SOIL_CRITERIA	
DESC_CODE_4	SOIL_CRITERIA	
DESC_CODE_5	SOIL_CRITERIA	
DESC_CODE_6	SOIL_CRITERIA	
DESC_CODE_7	SOIL_CRITERIA	
DESC_CODE_8	SOIL_CRITERIA	
DESC_CODE_9	SOIL_CRITERIA	
DESC_CODE_10	SOIL_CRITERIA	

Table: TST_TB02

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
TEST_NO (PK)	TEST_NO	
LOC_NO (PK)		
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	
P32_METHOD	P32_METHOD	
GRAPH	Y_N	
VISUAL_EXAM_1	VISUAL_ACPC	
VISUAL_EXAM_2	VISUAL_ACPC	
VISUAL_EXAM_3	VISUAL_ACPC	
VISUAL_EXAM_4	VISUAL_ACPC	
VISUAL_EXAM_5	VISUAL_ACPC	
VISUAL_EXAM_6	VISUAL_ACPC	
COMMENTS_1	COMMENT	
COMMENTS_2	COMMENT	
COMMENTS_3	COMMENT	
COMMENTS_4	COMMENT	
COMMENTS_5	COMMENT	
COMMENTS_6	COMMENT	

Table: TST_UG04_SS03

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
TEST_NO (PK)	TEST_NO	
LOC_NO (PK)		
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	
COMMENTS_1	COMMENT	
COMMENTS_2	COMMENT	
COMMENTS_3	COMMENT	
COMMENTS_4	COMMENT	
COMMENTS_5	COMMENT	

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: TST_UG04_SS03

FIELD NAME*	CODE LIST	PARENT TABLE
COMMENTS_6	COMMENT	
SAMPLE_NO (PK)		

Table: TST_UG05_SS05

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
TEST_NO (PK)	TEST_NO	
LOC_NO (PK)		
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	
MAX_LAB_DRY_DENSITY_TEST	MAX_LAB_DRY_DENSITY_TEST_METHOD	
COMMENTS_1	COMMENT	
COMMENTS_2	COMMENT	
COMMENTS_3	COMMENT	
COMMENTS_4	COMMENT	
COMMENTS_5	COMMENT	
COMMENTS_6	COMMENT	
SAMPLE_NO (PK)		

Table: TST_UG07_SS07_A

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
TEST_NO (PK)	TEST_NO	
FIELD_SET (PK)		
LOC_NO (PK)		
SAMPLE_NO (PK)		
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	
LAYER_TYPE	LAYER_TYPE_RES_MOD	
MR_MATL_TYPE	MR_MATL_TYPE	
PRE_GREATER_5_PERCENT_STRAIN	Y_N	
TEST_GREATER_5_PERCENT_STRAIN	Y_N	
SPEC_FAIL	Y_N	
COMMENT_1	COMMENT	
COMMENT_2	COMMENT	
COMMENT_3	COMMENT	
COMMENT_4	COMMENT	
COMMENT_5	COMMENT	
COMMENT_6	COMMENT	

Table: TST_UG07_SS07_B

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
TEST_NO (PK)	TEST_NO	
FIELD_SET (PK)		
SAMPLE_NO (PK)		
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	
LAYER_TYPE	LAYER_TYPE_RES_MOD	
LOC_NO (PK)		
MR_MATL_TYPE	MR_MATL_TYPE	
PRE_GREATER_5_PERCENT_STRAIN	Y_N	
TEST_GREATER_5_PERCENT_STRAIN	Y_N	
SPEC_FAIL	Y_N	
COMMENT_1	COMMENT	
COMMENT_2	COMMENT	
COMMENT_3	COMMENT	

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: TST_UG07_SS07_B

FIELD NAME*	CODE LIST	PARENT TABLE
COMMENT_4	COMMENT	
COMMENT_5	COMMENT	
COMMENT_6	COMMENT	

Table: TST_UG07_SS07_WKSHT_CYCLES

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
TEST_NO (PK)	TEST_NO	
FIELD_SET (PK)		
CON_PRESSURE (PK)		
LOC_NO (PK)		
SAMPLE_NO (PK)		
NOM_MAX_AXIAL_STRESS (PK)		
CYCLE_NO (PK)		
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	
LAYER_TYPE	LAYER_TYPE_RES_MOD	
MR_MATL_TYPE	MR_MATL_TYPE	

Table: TST_UG07_SS07_WKSHT_SUM

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
TEST_NO (PK)	TEST_NO	
FIELD_SET (PK)		
LOC_NO (PK)		
SAMPLE_NO (PK)		
CON_PRESSURE (PK)		
NOM_MAX_AXIAL_STRESS (PK)		
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	
LAYER_TYPE	LAYER_TYPE_RES_MOD	
MR_MATL_TYPE	MR_MATL_TYPE	

Table: TST_UG09

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
TEST_NO (PK)	TEST_NO	
LOC_NO (PK)		
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	
COMMENTS_1	COMMENT	
COMMENTS_2	COMMENT	
COMMENTS_3	COMMENT	
COMMENTS_4	COMMENT	
COMMENTS_5	COMMENT	
COMMENTS_6	COMMENT	

Table: TST_UG10_SS09

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		TST_L05B
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
LAYER_NO (PK)		TST_L05B
FIELD_SET (PK)		
LOC_NO (PK)		
TEST_NO (PK)	TEST_NO	
SAMPLE_NO (PK)		
CONSTRUCTION_NO		TST_L05B
LAB_CODE	LAB_CODE	

***Key fields are marked with (PK) and non-null fields are bolded.**

Table: TST_UG10_SS09

FIELD NAME*	CODE LIST	PARENT TABLE
COMMENTS_1	COMMENT	
COMMENTS_2	COMMENT	
COMMENTS_3	COMMENT	
COMMENTS_4	COMMENT	
COMMENTS_5	COMMENT	
COMMENTS_6	COMMENT	

Table: TST_UNBOUND_SPEC_GRAV

FIELD NAME*	CODE LIST	PARENT TABLE
STATE_CODE (PK)	STATE_PROVINCE	TST_L05B
SHRP_ID (PK)		TST_L05B
SAMPLE_NO (PK)		
LAYER_NO (PK)		TST_L05B
TEST_NO (PK)		
RECORD_STATUS		
CONSTRUCTION_NO		TST_L05B
FIELD_SET		
SPEC_GRAVITY		
LAB_CODE	LAB_CODE	
COMMENT_1	COMMENT	
COMMENT_2	COMMENT	
COMMENT_3	COMMENT	
COMMENT_4	COMMENT	
COMMENT_5	COMMENT	
COMMENT_6	COMMENT	

Table: TST_UNCOMP_BITUMINOUS

FIELD NAME*	CODE LIST	PARENT TABLE
SHRP_ID (PK)		
STATE_CODE (PK)	STATE_PROVINCE	
FIELD_SET (PK)		
LOC_NO (PK)		
PLANT_TYPE	PLANT_TYPE	
SAMPLE_LOC	SAMPLE_LOC_UNCOMP	
MIX_TYPE	MIX_TYPE	
LAYER_TYPE	LAYER_TYPE_UNCOMP	
CONSTRUCTION_NO		

Appendix D

DATABASE CODE DEFINITIONS

Many fields in the LTPP database are populated with coded values. In other words, a number or a letter will represent a value in a standard list. This appendix lists each code and definition, organized by the Code Type. Where available, the source of the code is included with the Code Type.

AASHTO_SOIL_CLASS - Code for AASHTO soil classification for subgrade material.

CODE	DEFINITION
1	A-1a
2	A-1-b
3	A-3
4	A-2-4
5	A-2-5
6	A-2-6
7	A-2-7
8	A-4
9	A-5
10	A-6
11	A-7-5
12	A-7-6

ACCEPT_FLAG - Point parameter acceptance flag (MON_DEFL_RGD_BAKCAL_POINT table specification)

CODE	DEFINITION
1	Point parameter was included in section statistics.
2	ERROR - Backcalculation process did not converge.
3	ERROR - Deflection basin type is not decreasing.
4	ERROR - Mean absolute relative basin fit error is greater than 2 percent.
5	ERROR - Point location is not within section limits.
6	ERROR - Backcalculated value is out of allowable range.
7	OUTLIER - Point parameter is more than 2 standard deviations from section mean.
8	NUMBER - The number of acceptable basins is less than 30 percent or less or equal to 3.
9	PCC OVERLAY - PCC and base moduli will not be reported.

AC_MATERIAL_TYPE - Code for type of AC materials used.

CODE	DEFINITION
1	New
2	Hot Recycled
3	Cold Recycled
4	Other

AGGR_DUR - Codes for aggregate durability (INVENTORY DCG, Table A.13)

CODE	DEFINITION
1	AASHTO T96 ASTM C131
2	AASHTO T103 ASTM --
3	AASHTO T104 ASTM C88
4	AASHTO -- ASTM C535

AGGR_DUR - Codes for aggregate durability (INVENTORY DCG, Table A.13)

5	AASHTO -- ASTM C342
6	AASHTO -- ASTM C682
7	AASHTO -- ASTM C227
8	AASHTO -- ASTM C289
9	AASHTO T112 ASTM C142
11	AASHTO -- ASTM C586

AGGR_SOURCE - Code indicating source of aggregate.

CODE	DEFINITION
1	Reclaimed Base
2	Pit

AGGR_TYPE - Codes for aggregate type validation checking. (Field Materials Sampling, Testing, ...)

CODE	DEFINITION
401	Gravel
402	Crushed stone
403	Crushed gravel
404	Crushed slag
405	Blend (several sizes of coarse aggregates)
406	Manufactured
407	Light weight
408	Other (specify)
409	Natural sand
410	Manufactured sand
411	Blend (different sized fine aggregates)
412	Other (specify)

AGG_CLASS - Code indicating the type of coarse aggregate in PCC test specimen.

CODE	DEFINITION
112	Crushed Gravel, Igneous Extrusive, Basalt
121	Crushed Gravel, Igneous Plutonic, Diabase
122	Crushed Gravel, Igneous Plutonic, Granite
133	Crushed Gravel, Metamorphic, Schist
141	Crushed Gravel, Sedimentary, Chert
142	Crushed Gravel, Sedimentary, Dolomite
143	Crushed Gravel, Sedimentary, Limestone
144	Crushed Gravel, Sedimentary, Quartzite
145	Crushed Gravel, Sedimentary, Sandstone
211	Crushed Stone, Igneous Extrusive, Andesite
212	Crushed Stone, Igneous Extrusive, Basalt
213	Crushed Stone, Igneous Extrusive, Vglass
214	Crushed Stone, Igneous Extrusive, Rhyolite
221	Crushed Stone, Igneous Plutonic, Diabase
222	Crushed Stone, Igneous Plutonic, Gabbro
223	Crushed Stone, Igneous Plutonic, Granite
231	Crushed Stone, Metamorphic, Gneiss
232	Crushed Stone, Metamorphic, Marble

AGG_CLASS - Code indicating the type of coarse aggregate in PCC test specimen.

233	Crushed Stone, Metamorphic, Schist
241	Crushed Stone, Sedimentary, Chert
242	Crushed Stone, Sedimentary, Dolomite
243	Crushed Stone, Sedimentary, Limestone
244	Crushed Stone, Sedimentary, Quartzite
245	Crushed Stone, Sedimentary, Sandstone
311	Gravel, Igneous Extrusive, Andesite
312	Gravel, Igneous Extrusive, Basalt
314	Gravel, Igneous Extrusive, Rhyolite
321	Gravel, Igneous Plutonic, Diabase
322	Gravel, Igneous Plutonic, Gabbro
323	Gravel, Igneous Plutonic, Granite
333	Gravel, Igneous Metamorphic, Schist
341	Gravel, Igneous Sedimentary, Chert
342	Gravel, Igneous Sedimentary, Dolomite
343	Gravel, Igneous Sedimentary, Limestone
344	Gravel, Igneous Sedimentary, Quartzite
345	Gravel, Igneous Sedimentary, Sandstone
346	Gravel, Igneous Sedimentary, Siltstone

AGG_COND_MOIST - Code indicating the moisture condition prior to use.

CODE	DEFINITION
1	Very Dry
2	Dry
3	Only Slightly Damp
4	Somewhat Damp
5	Slightly Wet
6	Wet

AGG_REGRADE - Code indicating whether sample was re-graded prior to mix. (Sampling Data Sheet 22)

CODE	DEFINITION
1	Gradation of aggregate was not altered by the lab prior to mix
2	Gradation of aggregate was altered by the lab prior to mix

ANTISTRIP - Anti-Stripping Agent Type Codes (Table A.21 from the DCG)

CODE	DEFINITION
0	No Antistripping Agent Used.
1	Permatac
2	Permatac Plus
3	Betascan Roads
4	Pavebond
5	Pavebond Special
6	Pavebond Plus
7	BA 2000
8	BA 2001
9	Unichem "A"
10	Unichem "B"
11	Unichem "C"
12	AquaShield AS4115
13	AquaShield AS4112
14	AquaShield AS4113
15	Portland Cement
16	Hydrated Lime: Mixed Dry with Asphalt Cement
17	Hydrated Lime: Mixed Dry with Dry Aggregate
18	Hydrated Lime: Mixed Dry with Wet Aggregate
19	Hydrated Lime: Slurried Lime Mixed with Aggregate
20	Hot Lime Slurry (Quick Lime Slaked and Slurried at Job Site)

ANTISTRIP - Anti-Stripping Agent Type Codes (Table A.21 from the DCG)

21	No Strip Chemicals A-500
22	No Strip Chemical Works ACRA RP-A
23	No Strip Chemical Works ACRA Super Conc
24	No Strip Chemical Works ACRA 200
25	No Strip Chemical Works ACRA 300
26	No Strip Chemical Works ACRA 400
27	No Strip Chemical Works ACRA 500
28	No Strip Chemical Works ACRA 512
29	No Strip Chemical Works ACRA 600
30	Darakote
31	De Hydro H86C
32	Emery 17065
33	Emery 17319
34	Emery 17319 - 6880
35	Emery 17320
36	Emery 17321
37	Emery 17322
38	Emery 17339
39	Emery 1765-6860
40	Emery 6886B
41	Husky Anti-Strip
42	Indulin AS-Special
43	Indulin AS-1
44	Jetco AD-8
45	Kling
46	Kling Beta ZP-251
47	Kling Beta L-75
48	Kling Beta LV
49	Kling Beta 1000
50	Kling Beta 20
51	Nacco Anti Strip
52	No Strip
53	No Strip Concentrate
54	Redi-Coat 80-S
55	Redi-Coat 82-S
56	Silicone
57	Super AD-50
58	Tap Co 206
59	Techni H1B7175
60	Techni H1B7173
61	Techni H1B7176
62	Techni H1B7177
63	Tretolite DH-8
64	Tretolite H-86
65	Tretolite H-86C
66	Tyfo A-45
67	Tyfo A-65
68	Tyfo A-40
69	Edoco 7003
70	Other

APPL_METHOD - Code indicating application method of silicone sealant.

CODE	DEFINITION
1	Hand
2	Pressure

AREA_DETERMINATION - Code indicating the means for determining the required area extent of the undersealing efforts.

CODE	DEFINITION
1	Blanket
2	Deflection Data
3	Visual signs of pumping

AREA_DETERMINATION - Code indicating the means for determining the required area extent of the undersealing efforts.

4	Other

ASPHALT - Grades of Asphalt, Emulsified Asphalt, and Cutback Asphalt Codes (Table A.16 from the DCG)

CODE	DEFINITION
1	Asphalt Cements AC-2.5
2	Asphalt Cements AC-5
3	Asphalt Cements AC-10
4	Asphalt Cements AC-20
5	Asphalt Cements AC-30
6	Asphalt Cements AC-40
7	Asphalt Cements AR-1000 (AR-10 by AASHTO Designation)
8	Asphalt Cements AR-2000 (AR-20 by AASHTO Designation)
9	Asphalt Cements AR-4000 (AR_40 by AASHTO Designation)
10	Asphalt Cements AR-8000 (AR-80 by AASHTO Designation)
11	Asphalt Cements AR-16000 (AR-160 by AASHTO Designation)
12	Asphalt Cements 200-300 pen
13	Asphalt Cements 120-150 pen
14	Asphalt Cements 85-100 pen
15	Asphalt Cements 60-70 pen
16	Asphalt Cements 40-50 pen
17	Other Asphalt Cement Grade
18	Emulsified Asphalts RS-1
19	Emulsified Asphalts RS-2
20	Emulsified Asphalts MS-1
21	Emulsified Asphalts MS-2
22	Emulsified Asphalts MS-2h
23	Emulsified Asphalts HFMS-1
24	Emulsified Asphalts HFMS-2
25	Emulsified Asphalts HFMS-2h
26	Emulsified Asphalts HFMS-2s
27	Emulsified Asphalts SS-1
28	Emulsified Asphalts SS-1h
29	Emulsified Asphalts CRS-1
30	Emulsified Asphalts CRS-2
31	Emulsified Asphalts CMS-2
32	Emulsified Asphalts CMS-2h
33	Emulsified Asphalts CSS-1
34	Emulsified Asphalts CSS-1h
35	Other Emulsified Asphalt Grade
36	Cutback Asphalts (RC, MC, SC) 30 (MC only)
37	Cutback Asphalts (RC, MC, SC) 70
38	Cutback Asphalts (RC, MC, SC) 250
39	Cutback Asphalts (RC, MC, SC) 800
40	Cutback Asphalts (RC, MC, SC) 3000
99	Other Cutback Asphalt Grade

AVC_METH_COUNT_LENGTH - Code indicating method for basis of AVC comparison (Traffic Data Sheet 16)

CODE	DEFINITION
1	Time
2	Number of trucks

AVC_METH_VOL_MEASURE - Code indicating method for collecting independent volume measurements to check classifier (Traffic Data Sheet 16)

CODE	DEFINITION
1	Video

AVC_METH_VOL_MEASURE - Code indicating method for collecting independent volume measurements to check classifier (Traffic Data Sheet 16)

2	Manual
3	Parallel classifiers

AXLE_GROUP - Code indicating number of axles in a group (TRF_MONITOR_AXLE_DISTRIB)

CODE	DEFINITION
1	Single axle
2	Tandem axle
3	Tridem axle
4	Quad axle and 5+ axle groups

BACKFILL_MATERIAL - Code identifying the type of material used to backfill around the load transfer restoration device.

CODE	DEFINITION
1	Cement Based Grout
2	Polymer
3	Epoxy Resin
4	Other

BASE_MAT - Base and Subbase Material Type Codes (Table A.6 from the DCG)

CODE	DEFINITION
21	No Base (Pavement Placed Directly on Subgrade)
22	Gravel (Uncrushed)
23	Crushed Stone, Gravel or Slag
24	Sand
25	Soil-Aggregate Mixture (Predominantly Fine-Grained Soil)
26	Soil-Aggregate Mixture (Predominantly Coarse-Grained Soil)
27	Soil Cement
28	Dense Graded, Hot Laid, Central Plant Mix
29	Dense Graded, Cold Laid, Central Plant Mix
30	Dense Graded, Cold Laid, Mixed In-Place
31	Open Graded, Hot Laid, Central Plant Mix
32	Open Graded, Cold Laid, Central Plant Mix
33	Open Graded, Cold Laid, Mixed In-Place
34	Recycled Asphalt Concrete, Plant Mix, Hot Laid
35	Recycled Asphalt Concrete, Plant Mix, Cold Laid
36	Recycled Asphalt Concrete, Mixed In-Place
37	Cement-Aggregate Mixture
38	Lean Concrete (<3 sacks cement/cy)
39	Recycled Portland Cement Concrete
40	Sand-Shell Mixture
41	Limerock, Caliche (Soft Carbonate Rock)
42	Lime-Treated Subgrade Soil
43	Cement-Treated Subgrade Soil
44	Pozzolanic-Aggregate Mixture
45	Cracked and Seated PCC Layer
46	Sand Asphalt
47	Open graded, Untreated Aggregate Drainage Layer
49	Other

BEFORE_AFTER - Code indicating if undersealing was performed before or after regrouting.

CODE	DEFINITION
1	Before
2	After

BINDER_AGE_TYPE - Code indicating type of accelerated aging, if any, used in sample preparation. (Test Data Sheet T27)

CODE	DEFINITION
1	Original
2	Rolling Thin Film Oven (RTFO)
3	Pressure Aging Vessel (PAV)
4	Field Aged

BOND - Interface bond condition flag (MON_DEFL_RDG_BAKCAL_SECT table specification)

CODE	DEFINITION
1	Full bond between the layers.
2	Full slip between the layers.
3	Bond was not identified.

BOND_AGENT - Code identifying the material used to bond the patch material to the existing PCC pavement.

CODE	DEFINITION
1	None
2	Cement Grout
3	Epoxy Resin
4	Cutback Asphalt
5	Other

BOND_AGENT_BACKFILL - Code identifying the material used to bond the backfill material to the existing PCC pavement.

CODE	DEFINITION
1	None
2	Epoxy
3	Cement/Water
4	Other

BOND_BREAK - Code indicating backer material under sealant.

CODE	DEFINITION
1	None
2	Nonreactive adhesive backed tape
3	Backer Rod
4	Other

BOND_CONDITION - Code indicating bonding condition of the overlay.

CODE	DEFINITION
1	Unbonded
2	Partially Bonded
3	Fully Bonded

BOND_PREVENT - Code for material used to prevent bonding for unbonded overlays.

CODE	DEFINITION
1	AC
2	Polypropylene Sheeting
3	Other

BOUNDARY_METHOD - Code identifying method of full depth patch boundary determination.

CODE	DEFINITION
1	Visual
2	Coring
3	Deflection
4	State Standard
5	Other

BOUNDARY_METHOD_PART - Method used for partial depth patch boundary determination (Data Collection Sheets)

CODE	DEFINITION
1	Visual
2	Ball peen hammer, steel rod, chain or equivalent
3	Delam-tech
4	Other

BREAKER_TYPE - Code indicating the type of pavement breaker used.

CODE	DEFINITION
2	Pile driver hammer
4	Guillotine drop hammer
7	Other

BREAKUP_EQUIPMENT - Equipment used to breakup PCC pavement (REHAB sheet 50.)

CODE	DEFINITION
1	Surface Milling
2	Vibratory Chisel or Hammer
3	Hydraulic Chisel or Hammer
4	Pneumatic Chisel or Hammer
5	Diesel Chisel or Hammer
6	Resonant Breaker
7	Other

BREAKUP_METHOD - Code for method used to breakup and/or remove asphalt pavement.

CODE	DEFINITION
1	Scarifying
2	Grid Rolling
3	Ripping
4	Cold Milling
5	Other

BREAK_METHOD - Code for method used to break up and/or remove deteriorated concrete.

CODE	DEFINITION
1	Jackhammer
2	Cold milling
3	Other

BUBBLES_PRESENT - Code indicating the amount of bubbles in the surface of the joint sealer.

CODE	DEFINITION
1	Significant bubbles
2	Few bubbles
3	No bubbles
4	N/A

BUFFER_SHAPE - FWD buffer shape used on given test date (LTPP FWD Documentation)

CODE	DEFINITION
1	Flat - 100 mm diameter, flat (90 deg) buffers
2	Fully Rounded - 100 mm diameter, "knife" cut var. cone shaped (45 deg) buffers
3	Semi-Rounded - 100 mm diameter, tapered (60 deg) buffers
4	Semi-Rounded - 110mm diameter buffers
9	Unknown - buffer shape is unknown

CLASS - Functional Class Codes (Table A.2 from the DCG)

CODE	DEFINITION
1	Rural Principal Arterial - Interstate
2	Rural Principal Arterial - Other
6	Rural Minor Arterial
7	Rural Major Collector
8	Rural Minor Collector
9	Rural Local Collector
11	Urban Principal Arterial - Interstate
12	Urban Principal Arterial - Other Freeways or Expressways
14	Urban Other Principal Arterial
16	Urban Minor Arterial
17	Urban Collector
19	Urban Local

CLASS_COUNT_TYPE - Codes for type of classification count (Traffic Data Sheet 5)

CODE	DEFINITION
1	Manual
2	Automated
3	Unknown

CLASS_EQUIPMENT_TYPE - Codes for type of equipment used for classification count (Traffic Sheet 5)

CODE	DEFINITION
1	AVC Permanent
2	AVC Portable
3	WIM Permanent
4	WIM Portable
5	Manual Counter
6	Unknown

CLEAN_METHOD_PATCH - Code for method of final clearing of patch area. (Data Collection Sheets)

CODE	DEFINITION
1	None
2	Sandblasting
3	Water blasting
4	Other

CLEAN_METHOD_SEAL - Code for method used to clean crack prior to crack sealing. (Data Collection Sheets)

CODE	DEFINITION
1	None
2	Compressed Air
3	Routing
4	Steel Wire Brush
5	Brooming
6	Hot Air Lance
7	Other

COARSE_AGG_COMP - Composition of coarse aggregate (RHB_03)

CODE	DEFINITION
1	Crushed Stone
2	Gravel
3	Crushed Gravel
4	Crushed Slag
5	Manufactured Lightweight
6	Other

COATING_ABILITY - Code indicating coating ability and water test for aggregate.

COATING_ABILITY - Code indicating coating ability and water test for aggregate.

CODE	DEFINITION
1	Good
2	Fair
3	Poor

COMMENT - SHRP Standard Comments for Laboratory Material Testing (Laboratory Material Testing Guide)

CODE	DEFINITION
1	Insufficient size sample
2	Specimen is flawed, not ideal
3	Procedural mistake by lab or some parts not in strict conformance to protocol
4	Test results do not seem reasonable; no explanation
5	Test results do not seem reasonable; explanation provided
6	Test is suspect, sample was misnumbered.
7	Test is suspect, sample was not correctly identified
8	Equipment was not in calibration
9	L/D ratio is not according to the requirement for layer thickness
10	L/D ratio is not according to the requirement for maximum size aggregate.
11	Technician's results are not consistent with the previous technician's results
12	This test is a replacement for the previous test.
13	SHRP has directed a deviation in the test procedure
14	Substantial update in the SHRP protocol.
15	Very thin, untestable, layer.
16	Layer thickness was measured in lab prior to sawing from other bonded layers.
17	Layer thickness not measured in the lab prior to sawing from other bonded layers
18	Insufficient material to perform test. Test was not performed.
19	Insufficient material to perform moisture content test. Test was not performed.
20	Not enough AC for H03L/H04L on separate samp. H03L samp. reused for H04l test.
21	L/D ratio was < 1.0 because layer thickness was < the diameter of the specimen.
22	L/D ratio was = or < 1.0 because specimen was sawed to remove embedded steel.
23	Embedded steel was noted in the specimen near the middle of the diametral plane.
24	Embedded steel was noted at or near the side of the test specimen.
25	Specimen was skewed (see P61).
26	Mr determinations generally done within four minutes
27	Mr determinations were generally not done within four minutes
28	Test performed in a temperature controlled cabinet.
29	Dummy specimen used to monitor temperature.
30	Specimen damaged and not tested. Replacement was used.
31	L/D ratio was = or < 1.0 because layer thickness was < the diameter of specimen.
32	The specimen was trimmed only at the bottom end.
33	The specimen was trimmed only at the top end.
34	The specimen was trimmed at the bottom and top ends.

COMMENT - SHRP Standard Comments for Laboratory Material Testing (Laboratory Material Testing Guide)

35	Line of contact was straight & free (see P62).
36	The line of contact described in code 35 was made possible by grinding.
37	Line of contact (see code 35) made possible by capping or by grinding & capping.
38	Line of contact had >0.01 inch tolerance (see code 35) but < 0.1 inch (see P62).
39	The projections/depressions on test surface higher or deeper than .1 (see P62).
40	Core did not have any arrow or "T" to show direction of traffic (see P62).
41	L/D ratio < 1.5 because layer was = or < the diameter of the specimen.
42	L/D ratio was = or < 1.5 because specimen was sawed to remove embedded steel.
43	Embedded steel was noted in the specimen near the middle of the diametral plane.
44	Embedded steel was noted at or near the side of the test specimen.
45	The specimen was trimmed only at the bottom end.
46	The specimen was trimmed only at the top end.
47	The specimen was trimmed at the top and bottom ends.
48	Pct. < 0.001 mm could not be determined in 1440 minutes. (24 hrs)
50	Specimen capped
51	Specimen ground
52	Leather shims used
53	Irregular interface between existing and overlay concrete.
54	Failure plane in overlay concrete.
55	Failure plane in existing concrete.
56	Failure plane in interface between existing and overlay concrete.
61	Insufficient size of test sample because of insufficient quantity of bulk sample
62	Roots & other organic material present in bulk sample retrieved from the field.
63	Presence of mica in the bulk sample retrieved from the field.
64	Bulk sample contained cobbles or aggregates passing 12" & retained on 3" sieve.
65	Test sample included shale, claystone, mudstone, siltstone, sandstone (see PP51)
67	PI is reported as "NP" because LL and/or PL cannot be determined.
68	PI is reported as "NP" because PL is = or > LL.
69	Test specimen slipped in the cup of the LL device.
70	Test not completed within 5 addition increments. Additional increments made.
71	Degradation of test sample observed during the moisture-density test.
72	Material taken from other sources in order to complete moisture density test.
73	Free water appeared at the bottom of the mold (i.e., seeped onto the plate).
74	Moisture density test included material passing 1.5" & retained on #4 (see P55)
75	Coarse fraction > 5%. Method D used to perform moisture density test (see P55).
76	Coarse material > 1.5" sieve was removed for the moisture density test (see P55)
77	Moisture density test included material passing 1.5" & retained on .75"(see P55)
78	Coarse fraction > 5%. Sample was sieved with .75" sieve before testing (see P55)

COMMENT - SHRP Standard Comments for Laboratory Material Testing (Laboratory Material Testing Guide)

79	A segmental rammer face was used to prepare specimens in the laboratory.
80	Insufficient bulk sample size, sample from P46 was saved for possible future use
81	Separate test sample used for classification and description tests
82	Insufficient bulk sample size, sample from P41 or P51 used to complete test
83	Insufficient bulk sample size, sample from P44 or P55 was reused for P46
84	Sample for moisture density test obtained from gradation sample. (see P55).
85	Insufficient bulk sample size, sample was saved & reused for Mr testing.
86	Insufficient size of bulk sample, test sample reused for other tests.
87	The undisturbed thin-walled tube sample was used for the Mr testing (P46).
88	Thin-walled tube sample not suitable; a reconstituted sample used for Mr testing
89	Thin-wall sample not available; sample for Mr test reconstituted from bulk samp.
90	Excess proportion of thin-walled tube sample saved & stored for future use.
91	No compressive strength or Mr tests performed, thickness < 3 inches
92	Compressive strength & resilient modulus tests not performed, no intact cores.
93	Core intact & thickness > 3 inches, tests from either P32 or P33 to be performed
94	Test not performed due to oversize aggs; sample stored until further instruction
95	L/D < 1.0 inch. Correction factor of 0.87 applied to get compressive strength.
99	Other comment

COMPACTION - Code indicating type of compaction equipment used.

CODE	DEFINITION
1	None
2	Pneumatic Roller
3	Vibratory Plate Comp
4	Vibratory Roller
5	Steel Wheel Roller
6	Truck Tire
7	Hand Tools
8	Other

COMPACTION_EQUIP_TYPE - Code indicating type of compaction equipment used.

CODE	DEFINITION
1	Sheepsfoot
2	Pneumatic Tired
3	Steel Wheel Tandem
4	Single Drum Vibr
5	Double Drum Vibr
6	Other

COMPACTION_TYPE - Code indicating type of compaction equipment used.

CODE	DEFINITION
1	Pneumatic-Tired
2	Steel Wheel Tandem
3	Single Drum Vibr
4	Double Drum Vibr

COMPACTION_TYPE - Code indicating type of compaction equipment used.

5	Other

COMP_TEST_TYPE - Code indicating type of compression test.

CODE	DEFINITION
1	T167/D1074
2	T24/D1633
3	T220
4	T234
5	Other

CONCRETE_CURE - Concrete Cure methods. (Data Collection Sheets)

CODE	DEFINITION
1	Membrane Curing Compound
2	Burlap Curing Blankets
3	Waterproof Paper Blankets
4	White Polyethylene Sheeting
5	Burlap-Polyethylene Blanket
6	Cotton Mat Curing
7	Hay
8	Other

CONCRETE_TEXTURE_METHOD - Code for method used to texture concrete.

CODE	DEFINITION
1	Tine
2	Broom
3	Burlap Drag
4	Grooved Float
5	Astro Turf
6	Other

CONC_BREAK_METHOD - Code indicating the method of breaking up the existing concrete to be removed.

CODE	DEFINITION
1	None
2	Air Hammer
3	Gravity Drop Hammer
4	Sawing
5	Other

CONC_REMOVAL - Code indicating the method of concrete removal.

CODE	DEFINITION
1	Concrete breakup and cleanout
2	Lift out intact slab section
3	Other

CONDITION - Code indicating general cleanliness.

CODE	DEFINITION
1	Clean
2	Mostly clean
3	Somewhat clean
4	Dirty

CONSISTENCY - Code describing the consistency of the specimen

CODE	DEFINITION
S	Satisfactory
T	Tacky

CONSOLIDATE_METHOD_FULL - Consolidation of materials (Data Collection Sheets)

CODE	DEFINITION
1	Internal vibrators
2	Vibrating screeds
3	Troweling
4	Rolling
5	Tamping
6	Other

CONSOLIDATE_METHOD_PART - Method of consolidating materials in partial depth patching (Data Collection Sheets)

CODE	DEFINITION
1	Vibrators
2	Vibrating screeds
3	Troweling
4	Rodding/Tamping
5	Rolling
6	Other

COORD_DETERMINE - Method used to determine location coordinates. (Inventory Data Sheet 1C)

CODE	DEFINITION
1	Direct field measurement
2	Estimated

COUNTY - County codes from FIPS (FIPS)
1 - Alabama

CODE	DEFINITION
1	AUTAUGA
3	BALDWIN
5	BARBOUR
7	BIBB
9	BLOUNT
11	BULLOCK
13	BUTLER
15	CALHOUN
17	CHAMBERS
19	CHEROKEE
21	CHILTON
23	CHOCTAW
25	CLARKE
27	CLAY
29	CLEBURNE
31	COFFEE
33	COLBERT
35	CONECUH
37	COOSA
39	COVINGTON
41	CRENSHAW
43	CULLMAN
45	DALE
47	DALLAS
49	DE KALB
51	ELMORE
53	ESCAMBIA
55	ETOWAH
57	FAYETTE
59	FRANKLIN
61	GENEVA
63	GREENE
65	HALE
67	HENRY
69	HOUSTON
71	JACKSON

COUNTY - County codes from FIPS (FIPS)
1 - Alabama

73	JEFFERSON
75	LAMAR
77	LAUDERDALE
79	LAWRENCE
81	LEE
83	LIMESTONE
85	LOWNDES
87	MACON
89	MADISON
91	MARENGO
93	MARION
95	MARSHALL
97	MOBILE
99	MONROE
101	MONTGOMERY
103	MORGAN
105	PERRY
107	PICKENS
109	PIKE
111	RANDOLPH
113	RUSSELL
115	ST CLAIR
117	SHELBY
119	SUMTER
121	TALLADEGA
123	TALLAPOOSA
125	TUSCALOOSA
127	WALKER
129	WASHINGTON
131	WILCOX
133	WINSTON

COUNTY - County codes from FIPS (FIPS)
2 - Alaska

CODE	DEFINITION
10	ALEUTIAN ISLANDS
20	ANCHORAGE
30	ANGOON
40	BARROW
50	BETHEL
60	BRISTOL BAY BOROUGH
70	BRISTOL BAY DIVISION
80	CORDOVA-MC CARTHY
90	FAIRBANKS NORTH STAR
100	HAINES
110	JUNEAU
120	KENAI-COOK INLET
122	KENAI PENINSULA
130	KETCHIKAN
140	KOBUK
150	KODIAK
160	KUSKOKWIM
170	MATANUSKA-SUSITNA
180	NOME
190	OUTER KETCHIKAN
200	PRINCE OF WALES
210	SEWARD
220	SITKA
230	SKAGWAY-YAKUTAT
240	SOUTHEAST FAIRBANKS
250	UPPER YUKON
260	VALDEZ-CHITINA-WHITTIER
270	WADE HAMPTON
280	WRANGELL-PETERSBURG

COUNTY - County codes from FIPS (FIPS)
2 - Alaska

290	YUKON-KOYUKUK

COUNTY - County codes from FIPS (FIPS)
4 - Arizona

CODE	DEFINITION
1	APACHE
3	COCHISE
5	COCONINO
7	GILA
9	GRAHAM
11	GREENLEE
12	LA PAZ
13	MARICOPA
15	MOHAVE
17	NAVAJO
19	PIMA
21	PINAL
23	SANTA CRUZ
25	YAVAPAI
27	YUMA

COUNTY - County codes from FIPS (FIPS)
5 - Arkansas

CODE	DEFINITION
1	ARKANSAS
3	ASHLEY
5	BAXTER
7	BENTON
9	BOONE
11	BRADLEY
13	CALHOUN
15	CARROLL
17	CHICOT
19	CLARK
21	CLAY
23	CLEBURNE
25	CLEVELAND
27	COLUMBIA
29	CONWAY
31	CRAIGHEAD
33	CRAWFORD
35	CRITTENDEN
37	CROSS
39	DALLAS
41	DESHA
43	DREW
45	FAULKNER
47	FRANKLIN
49	FULTON
51	GARLAND
53	GRANT
55	GREENE
57	HEMPSTEAD
59	HOT SPRING
61	HOWARD
63	INDEPENDENCE
65	IZARD
67	JACKSON
69	JEFFERSON
71	JOHNSON
73	LAFAYETTE
75	LAWRENCE
77	LEE
79	LINCOLN

COUNTY - County codes from FIPS (FIPS)
5 - Arkansas

81	LITTLE RIVER
83	LOGAN
85	LONOKE
87	MADISON
89	MARION
91	MILLER
93	MISSISSIPPI
95	MONROE
97	MONTGOMERY
99	NEVADA
101	NEWTON
103	OUACHITA
105	PERRY
107	PHILLIPS
109	PIKE
111	POINSETT
113	POLK
115	POPE
117	PRAIRIE
119	PULASKI
121	RANDOLPH
123	ST FRANCIS
125	SALINE
127	SCOTT
129	SEARCY
131	SEBASTIAN
133	SEVIER
135	SHARP
137	STONE
139	UNION
141	VAN BUREN
143	WASHINGTON
145	WHITE
147	WOODRUFF
149	YELL

COUNTY - County codes from FIPS (FIPS)
6 - California

CODE	DEFINITION
1	ALAMEDA
3	ALPINE
5	AMADOR
7	BUTTE
9	CALAVERAS
11	COLUSA
13	CONTRA COSTA
15	DEL NORTE
17	EL DORADO
19	FRESNO
21	GLENN
23	HUMBOLDT
25	IMPERIAL
27	INYO
29	KERN
31	KINGS
33	LAKE
35	LASSEN
37	LOS ANGELES
39	MADERA
41	MARIN
43	MARIPOSA
45	MENDOCINO
47	MERCED
49	MODOC

COUNTY - County codes from FIPS (FIPS)
6 - California

51	MONO
53	MONTEREY
55	NAPA
57	NEVADA
59	ORANGE
61	PLACER
63	PLUMAS
65	RIVERSIDE
67	SACRAMENTO
69	SAN BENITO
71	SAN BERNARDINO
73	SAN DIEGO
75	SAN FRANCISCO
77	SAN JOAQUIN
79	SAN LUIS OBISPO
81	SAN MATEO
83	SANTA BARBARA
85	SANTA CLARA
87	SANTA CRUZ
89	SHASTA
91	SIERRA
93	SISKIYOU
95	SOLANO
97	SONOMA
99	STANISLAUS
101	SUTTER
103	TEHAMA
105	TRINITY
107	TULARE
109	TUOLUMNE
111	VENTURA
113	YOLO
115	YUBA

COUNTY - County codes from FIPS (FIPS)
8 - Colorado

CODE	DEFINITION
1	ADAMS
3	ALAMOSA
5	ARAPAHOE
7	ARCHULETA
9	BACA
11	BENT
13	BOULDER
15	CHAFFEE
17	CHEYENNE
19	CLEAR CREEK
21	CONEJOS
23	COSTILLA
25	CROWLEY
27	CUSTER
29	DELTA
31	DENVER
33	DOLORES
35	DOUGLAS
37	EAGLE
39	ELBERT
41	EL PASO
43	FREMONT
45	GARFIELD
47	GILPIN
49	GRAND
51	GUNNISON
53	HINSDALE

COUNTY - County codes from FIPS (FIPS)
8 - Colorado

55	HUERFANO
57	JACKSON
59	JEFFERSON
61	KIOWA
63	KIT CARSON
65	LAKE
67	LA PLATA
69	LARIMER
71	LAS ANIMAS
73	LINCOLN
75	LOGAN
77	MESA
79	MINERAL
81	MOFFAT
83	MONTEZUMA
85	MONTROSE
87	MORGAN
89	OTERO
91	OURAY
93	PARK
95	PHILLIPS
97	PITKIN
99	PROWERS
101	PUEBLO
103	RIO BLANCO
105	RIO GRANDE
107	ROUTT
109	SAGUACHE
111	SAN JUAN
113	SAN MIGUEL
115	SEDGWICK
117	SUMMIT
119	TELLER
121	WASHINGTON
123	WELD
125	YUMA

COUNTY - County codes from FIPS (FIPS)
9 - Connecticut

CODE	DEFINITION
1	FAIRFIELD
3	HARTFORD
5	LITCHFIELD
7	MIDDLESEX
9	NEW HAVEN
11	NEW LONDON
13	TOLLAND
15	WINDHAM

COUNTY - County codes from FIPS (FIPS)
10 - Delaware

CODE	DEFINITION
1	KENT
3	NEW CASTLE
5	SUSSEX

COUNTY - County codes from FIPS (FIPS)
11 - District of Columbia

CODE	DEFINITION
1	DISTRICT OF COLUMBIA

COUNTY - County codes from FIPS (FIPS)
12 - Florida

COUNTY - County codes from FIPS (FIPS)
12 - Florida

CODE	DEFINITION
1	ALACHUA
3	BAKER
5	BAY
7	BRADFORD
9	BREVARD
11	BROWARD
13	CALHOUN
15	CHARLOTTE
17	CITRUS
19	CLAY
21	COLLIER
23	COLUMBIA
25	DADE
27	DE SOTO
29	DIXIE
31	DUVAL
33	ESCAMBIA
35	FLAGLER
37	FRANKLIN
39	GADSDEN
41	GILCHRIST
43	GLADES
45	GULF
47	HAMILTON
49	HARDEE
51	HENDRY
53	HERNANDO
55	HIGHLANDS
57	HILLSBOROUGH
59	HOLMES
61	INDIAN RIVER
63	JACKSON
65	JEFFERSON
67	LAFAYETTE
69	LAKE
71	LEE
73	LEON
75	LEVY
77	LIBERTY
79	MADISON
81	MANATEE
83	MARION
85	MARTIN
87	MONROE
89	NASSAU
91	OKALOOSA
93	OKEECHOBEE
95	ORANGE
97	OSCEOLA
99	PALM BEACH
101	PASCO
103	PINELLAS
105	POLK
107	PUTNAM
109	ST JOHNS
111	ST LUCIE
113	SANTA ROSA
115	SARASOTA
117	SEMINOLE
119	SUMTER
121	SUWANNEE
123	TAYLOR
125	UNION

COUNTY - County codes from FIPS (FIPS)
12 - Florida

127	VOLUSIA
129	WAKULLA
131	WALTON
133	WASHINGTON

COUNTY - County codes from FIPS (FIPS)
13 - Georgia

CODE	DEFINITION
1	APPLING
3	ATKINSON
5	BACON
7	BAKER
9	BALDWIN
11	BANKS
13	BARROW
15	BARTOW
17	BEN HILL
19	BERRIEN
21	BIBB
23	BLECKLEY
25	BRANTLEY
27	BROOKS
29	BRYAN
31	BULLOCH
33	BURKE
35	BUTTS
37	CALHOUN
39	CAMDEN
43	CANDLER
45	CARROLL
47	CATOOSA
49	CHARLTON
51	CHATHAM
53	CHATTAHOOCHEE
55	CHATTOOGA
57	CHEROKEE
59	CLARKE
61	CLAY
63	CLAYTON
65	CLINCH
67	COBB
69	COFFEE
71	COLQUITT
73	COLUMBIA
75	COOK
77	COWETA
79	CRAWFORD
81	CRISP
83	DADE
85	DAWSON
87	DECATUR
89	DE KALB
91	DODGE
93	DOOLY
95	DOUGHERTY
97	DOUGLAS
99	EARLY
101	ECHOLS
103	EFFINGHAM
105	ELBERT
107	EMANUEL
109	EVANS
111	FANNIN
113	FAYETTE

COUNTY - County codes from FIPS (FIPS)
13 - Georgia

115	FLOYD
117	FORSYTH
119	FRANKLIN
121	FULTON
123	GILMER
125	GLASCOCK
127	GLYNN
129	GORDON
131	GRADY
133	GREENE
135	GWINNETT
137	HABERSHAM
139	HALL
141	HANCOCK
143	HARALSON
145	HARRIS
147	HART
149	HEARD
151	HENRY
153	HOUSTON
155	IRWIN
157	JACKSON
159	JASPER
161	JEFF DAVIS
163	JEFFERSON
165	JENKINS
167	JOHNSON
169	JONES
171	LAMAR
173	LANIER
175	LAURENS
177	LEE
179	LIBERTY
181	LINCOLN
183	LONG
185	LOWNDES
187	LUMPKIN
189	MC DUFFIE
191	MC INTOSH
193	MACON
195	MADISON
197	MARION
199	MERIWETHER
201	MILLER
205	MITCHELL
207	MONROE
209	MONTGOMERY
211	MORGAN
213	MURRAY
215	MUSCOGEE
217	NEWTON
219	OCONEE
221	OGLETHORPE
223	PAULDING
225	PEACH
227	PICKENS
229	PIERCE
231	PIKE
233	POLK
235	PULASKI
237	PUTNAM
239	QUITMAN
241	RABUN
243	RANDOLPH

COUNTY - County codes from FIPS (FIPS)
13 - Georgia

245	RICHMOND
247	ROCKDALE
249	SCHLEY
251	SCREVEN
253	SEMINOLE
255	SPALDING
257	STEPHENS
259	STEWART
261	SUMTER
263	TALBOT
265	TALIAFERRO
267	TATTNALL
269	TAYLOR
271	TELFAIR
273	TERRELL
275	THOMAS
277	TIFT
279	TOOMBS
281	TOWNS
283	TREUTLEN
285	TROUP
287	TURNER
289	TWIGGS
291	UNION
293	UPSON
295	WALKER
297	WALTON
299	WARE
301	WARREN
303	WASHINGTON
305	WAYNE
307	WEBSTER
309	WHEELER
311	WHITE
313	WHITFIELD
315	WILCOX
317	WILKES
319	WILKINSON
321	WORTH

COUNTY - County codes from FIPS (FIPS)
15 - Hawaii

CODE	DEFINITION
1	HAWAII
3	HONOLULU
5	KALAWAO
7	KAUAI
9	MAUI

COUNTY - County codes from FIPS (FIPS)
16 - Idaho

CODE	DEFINITION
1	ADA
3	ADAMS
5	BANNOCK
7	BEAR LAKE
9	BENEWAH
11	BINGHAM
13	BLAINE
15	BOISE
17	BONNER
19	BONNEVILLE
21	BOUNDARY
23	BUTTE

COUNTY - County codes from FIPS (FIPS)
16 - Idaho

25	CAMAS
27	CANYON
29	CARIBOU
31	CASSIA
33	CLARK
35	CLEARWATER
37	CUSTER
39	ELMORE
41	FRANKLIN
43	FREMONT
45	GEM
47	GOODING
49	IDAHO
51	JEFFERSON
53	JEROME
55	KOOTENAI
57	LATAH
59	LEMHI
61	LEWIS
63	LINCOLN
65	MADISON
67	MINIDOKA
69	NEZ PERCE
71	ONEIDA
73	OWYHEE
75	PAYETTE
77	POWER
79	SHOSHONE
81	TETON
83	TWIN FALLS
85	VALLEY
87	WASHINGTON

COUNTY - County codes from FIPS (FIPS)
17 - Illinois

CODE	DEFINITION
1	ADAMS
3	ALEXANDER
5	BOND
7	BOONE
9	BROWN
11	BUREAU
13	CALHOUN
15	CARROLL
17	CASS
19	CHAMPAIGN
21	CHRISTIAN
23	CLARK
25	CLAY
27	CLINTON
29	COLES
31	COOK
33	CRAWFORD
35	CUMBERLAND
37	DE KALB
39	DE WITT
41	DOUGLAS
43	DU PAGE
45	EDGAR
47	EDWARDS
49	EFFINGHAM
51	FAYETTE
53	FORD
55	FRANKLIN

COUNTY - County codes from FIPS (FIPS)
17 - Illinois

57	FULTON
59	GALLATIN
61	GREENE
63	GRUNDY
65	HAMILTON
67	HANCOCK
69	HARDIN
71	HENDERSON
73	HENRY
75	IROQUOIS
77	JACKSON
79	JASPER
81	JEFFERSON
83	JERSEY
85	JO DAVIESS
87	JOHNSON
89	KANE
91	KANKAKEE
93	KENDALL
95	KNOX
97	LAKE
99	LA SALLE
101	LAWRENCE
103	LEE
105	LIVINGSTON
107	LOGAN
109	MC DONOUGH
111	MC HENRY
113	MC LEAN
115	MACON
117	MACOUPIN
119	MADISON
121	MARION
123	MARSHALL
125	MASON
127	MASSAC
129	MENARD
131	MERCER
133	MONROE
135	MONTGOMERY
137	MORGAN
139	MOULTRIE
141	OGLE
143	PEORIA
145	PERRY
147	PIATT
149	PIKE
151	POPE
153	PULASKI
155	PUTNAM
157	RANDOLPH
159	RICHLAND
161	ROCK ISLAND
163	ST CLAIR
165	SALINE
167	SANGAMON
169	SCHUYLER
171	SCOTT
173	SHELBY
175	STARK
177	STEPHENSON
179	TAZEWELL
181	UNION
183	VERMILION

COUNTY - County codes from FIPS (FIPS)
17 - Illinois

185	WABASH
187	WARREN
189	WASHINGTON
191	WAYNE
193	WHITE
195	WHITESIDE
197	WILL
199	WILLIAMSON
201	WINNEBAGO
203	WOODFORD

COUNTY - County codes from FIPS (FIPS)
18 - Indiana

CODE	DEFINITION
1	ADAMS
3	ALLEN
5	BARTHOLOMEW
7	BENTON
9	BLACKFORD
11	BOONE
13	BROWN
15	CARROLL
17	CASS
19	CLARK
21	CLAY
23	CLINTON
25	CRAWFORD
27	DAVIESS
29	DEARBORN
31	DECATUR
33	DE KALB
35	DELAWARE
37	DUBOIS
39	ELKHART
41	FAYETTE
43	FLOYD
45	FOUNTAIN
47	FRANKLIN
49	FULTON
51	GIBSON
53	GRANT
55	GREENE
57	HAMILTON
59	HANCOCK
61	HARRISON
63	HENDRICKS
65	HENRY
67	HOWARD
69	HUNTINGTON
71	JACKSON
73	JASPER
75	JAY
77	JEFFERSON
79	JENNINGS
81	JOHNSON
83	KNOX
85	KOSCIUSKO
87	LAGRANGE
89	LAKE
91	LA PORTE
93	LAWRENCE
95	MADISON
97	MARION
99	MARSHALL

COUNTY - County codes from FIPS (FIPS)
18 - Indiana

101	MARTIN
103	MIAMI
105	MONROE
107	MONTGOMERY
109	MORGAN
111	NEWTON
113	NOBLE
115	OHIO
117	ORANGE
119	OWEN
121	PARKE
123	PERRY
125	PIKE
127	PORTER
129	POSEY
131	PULASKI
133	PUTNAM
135	RANDOLPH
137	RIPLEY
139	RUSH
141	ST JOSEPH
143	SCOTT
145	SHELBY
147	SPENCER
149	STARKE
151	STEUBEN
153	SULLIVAN
155	SWITZERLAND
157	TIPPECANOE
159	TIPTON
161	UNION
163	VANDERBURGH
165	VERMILLION
167	VIGO
169	WABASH
171	WARREN
173	WARRICK
175	WASHINGTON
177	WAYNE
179	WELLS
181	WHITE
183	WHITLEY

COUNTY - County codes from FIPS (FIPS)
19 - Iowa

CODE	DEFINITION
1	ADAIR
3	ADAMS
5	ALLAMAKEE
7	APPANOOSE
9	AUDUBON
11	BENTON
13	BLACK HAWK
15	BOONE
17	BREMER
19	BUCHANAN
21	BUENA VISTA
23	BUTLER
25	CALHOUN
27	CARROLL
29	CASS
31	CEDAR
33	CERRO GORDO
35	CHEROKEE

COUNTY - County codes from FIPS (FIPS)
19 - Iowa

37	CHICKASAW
39	CLARKE
41	CLAY
43	CLAYTON
45	CLINTON
47	CRAWFORD
49	DALLAS
51	DAVIS
53	DECATUR
55	DELAWARE
57	DES MOINES
59	DICKINSON
61	DUBUQUE
63	EMMET
65	FAYETTE
67	FLOYD
69	FRANKLIN
71	FREMONT
73	GREENE
75	GRUNDY
77	GUTHRIE
79	HAMILTON
81	HANCOCK
83	HARDIN
85	HARRISON
87	HENRY
89	HOWARD
91	HUMBOLDT
93	IDA
95	IOWA
97	JACKSON
99	JASPER
101	JEFFERSON
103	JOHNSON
105	JONES
107	KEOKUK
109	KOSSUTH
111	LEE
113	LINN
115	LOUISA
117	LUCAS
119	LYON
121	MADISON
123	MAHASKA
125	MARION
127	MARSHALL
129	MILLS
131	MITCHELL
133	MONONA
135	MONROE
137	MONTGOMERY
139	MUSCATINE
141	O BRIEN
143	OSCEOLA
145	PAGE
147	PALO ALTO
149	PLYMOUTH
151	POCAHONTAS
153	POLK
155	POTTAWATTAMIE
157	POWESHIEK
159	RINGGOLD
161	SAC
163	SCOTT

COUNTY - County codes from FIPS (FIPS)
19 - Iowa

165	SHELBY
167	SIOUX
169	STORY
171	TAMA
173	TAYLOR
175	UNION
177	VAN BUREN
179	WAPELLO
181	WARREN
183	WASHINGTON
185	WAYNE
187	WEBSTER
189	WINNEBAGO
191	WINNESHIEK
193	WOODBURY
195	WORTH
197	WRIGHT

COUNTY - County codes from FIPS (FIPS)
20 - Kansas

CODE	DEFINITION
1	ALLEN
3	ANDERSON
5	ATCHISON
7	BARBER
9	BARTON
11	BOURBON
13	BROWN
15	BUTLER
17	CHASE
19	CHAUTAUQUA
21	CHEROKEE
23	CHEYENNE
25	CLARK
27	CLAY
29	CLOUD
31	COFFEY
33	COMANCHE
35	COWLEY
37	CRAWFORD
39	DECATUR
41	DICKINSON
43	DONIPHAN
45	DOUGLAS
47	EDWARDS
49	ELK
51	ELLIS
53	ELLSWORTH
55	FINNEY
57	FORD
59	FRANKLIN
61	GEARY
63	GOVE
65	GRAHAM
67	GRANT
69	GRAY
71	GREELEY
73	GREENWOOD
75	HAMILTON
77	HARPER
79	HARVEY
81	HASKELL
83	HODGEMAN
85	JACKSON

COUNTY - County codes from FIPS (FIPS)
20 - Kansas

87	JEFFERSON
89	JEWELL
91	JOHNSON
93	KEARNY
95	KINGMAN
97	KIOWA
99	LABETTE
101	LANE
103	LEAVENWORTH
105	LINCOLN
107	LINN
109	LOGAN
111	LYON
113	MC PHERSON
115	MARION
117	MARSHALL
119	MEADE
121	MIAMI
123	MITCHELL
125	MONTGOMERY
127	MORRIS
129	MORTON
131	NEMAHA
133	NEOSHO
135	NESS
137	NORTON
139	OSAGE
141	OSBORNE
143	OTTAWA
145	PAWNEE
147	PHILLIPS
149	POTTAWATOMIE
151	PRATT
153	RAWLINS
155	RENO
157	REPUBLIC
159	RICE
161	RILEY
163	ROOKS
165	RUSH
167	RUSSELL
169	SALINE
171	SCOTT
173	SEDGWICK
175	SEWARD
177	SHAWNEE
179	SHERIDAN
181	SHERMAN
183	SMITH
185	STAFFORD
187	STANTON
189	STEVENS
191	SUMNER
193	THOMAS
195	TREGO
197	WABAUNSEE
199	WALLACE
201	WASHINGTON
203	WICHITA
205	WILSON
207	WOODSON
209	WYANDOTTE

COUNTY - County codes from FIPS (FIPS)
21 - Kentucky

CODE	DEFINITION
1	ADAIR
3	ALLEN
5	ANDERSON
7	BALLARD
9	BARREN
11	BATH
13	BELL
15	BOONE
17	BOURBON
19	BOYD
21	BOYLE
23	BRACKEN
25	BREATHITT
27	BRECKINRIDGE
29	BULLITT
31	BUTLER
33	CALDWELL
35	CALLOWAY
37	CAMPBELL
39	CARLISLE
41	CARROLL
43	CARTER
45	CASEY
47	CHRISTIAN
49	CLARK
51	CLAY
53	CLINTON
55	CRITTENDEN
57	CUMBERLAND
59	DAVIESS
61	EDMONSON
63	ELLIOTT
65	ESTILL
67	FAYETTE
69	FLEMING
71	FLOYD
73	FRANKLIN
75	FULTON
77	GALLATIN
79	GARRARD
81	GRANT
83	GRAVES
85	GRAYSON
87	GREEN
89	GREENUP
91	HANCOCK
93	HARDIN
95	HARLAN
97	HARRISON
99	HART
101	HENDERSON
103	HENRY
105	HICKMAN
107	HOPKINS
109	JACKSON
111	JEFFERSON
113	JESSAMINE
115	JOHNSON
117	KENTON
119	KNOTT
121	KNOX
123	LARUE
125	LAUREL

COUNTY - County codes from FIPS (FIPS)
21 - Kentucky

127	LAWRENCE
129	LEE
131	LESLIE
133	LETCHER
135	LEWIS
137	LINCOLN
139	LIVINGSTON
141	LOGAN
143	LYON
145	MC CRACKEN
147	MC CREARY
149	MC LEAN
151	MADISON
153	MAGOFFIN
155	MARION
157	MARSHALL
159	MARTIN
161	MASON
163	MEADE
165	MENIFEE
167	MERCER
169	METCALFE
171	MONROE
173	MONTGOMERY
175	MORGAN
177	MUHLENBERG
179	NELSON
181	NICHOLAS
183	OHIO
185	OLDHAM
187	OWEN
189	OWSLEY
191	PENDLETON
193	PERRY
195	PIKE
197	POWELL
199	PULASKI
201	ROBERTSON
203	ROCKCASTLE
205	ROWAN
207	RUSSELL
209	SCOTT
211	SHELBY
213	SIMPSON
215	SPENCER
217	TAYLOR
219	TODD
221	TRIGG
223	TRIMBLE
225	UNION
227	WARREN
229	WASHINGTON
231	WAYNE
233	WEBSTER
235	WHITLEY
237	WOLFE
239	WOODFORD

COUNTY - County codes from FIPS (FIPS)
22 - Louisiana

CODE	DEFINITION
1	ACADIA
3	ALLEN
5	ASCENSION

COUNTY - County codes from FIPS (FIPS)
22 - Louisiana

7	ASSUMPTION
9	AVOYELLES
11	BEAUREGARD
13	BIENVILLE
15	BOSSIER
17	CADDO
19	CALCASIEU
21	CALDWELL
23	CAMERON
25	CATAHOULA
27	CLAIBORNE
29	CONCORDIA
31	DE SOTO
33	EAST BATON ROUGE
35	EAST CARROLL
37	EAST FELICIANA
39	EVANGELINE
41	FRANKLIN
43	GRANT
45	IBERIA
47	IBERVILLE
49	JACKSON
51	JEFFERSON
53	JEFFERSON DAVIS
55	LAFAYETTE
57	LAFOURCHE
59	LA SALLE
61	LINCOLN
63	LIVINGSTON
65	MADISON
67	MOREHOUSE
69	NATCHITOCHES
71	ORLEANS
73	OUACHITA
75	PLAQUEMINES
77	POINTE COUPEE
79	RAPIDES
81	RED RIVER
83	RICHLAND
85	SABINE
87	ST BERNARD
89	ST CHARLES
91	ST HELENA
93	ST JAMES
95	ST JOHN THE BAPTIST
97	ST LANDRY
99	ST MARTIN
101	ST MARY
103	ST TAMMANY
105	TANGIPAHOA
107	TENSAS
109	TERREBONNE
111	UNION
113	VERMILION
115	VERNON
117	WASHINGTON
119	WEBSTER
121	WEST BATON ROUGE
123	WEST CARROLL
125	WEST FELICIANA
127	WINN

COUNTY - County codes from FIPS (FIPS)
23 - Maine

COUNTY - County codes from FIPS (FIPS)
23 - Maine

CODE	DEFINITION
1	ANDROSCOGGIN
3	AROOSTOOK
5	CUMBERLAND
7	FRANKLIN
9	HANCOCK
11	KENNEBEC
13	KNOX
15	LINCOLN
17	OXFORD
19	PENOBSCOT
21	PISCATAQUIS
23	SAGADAHOC
25	SOMERSET
27	WALDO
29	WASHINGTON
31	YORK

COUNTY - County codes from FIPS (FIPS)
24 - Maryland

CODE	DEFINITION
1	ALLEGANY
3	ANNE ARUNDEL
5	BALTIMORE
9	CALVERT
11	CAROLINE
13	CARROLL
15	CECIL
17	CHARLES
19	DORCHESTER
21	FREDERICK
23	GARRETT
25	HARFORD
27	HOWARD
29	KENT
31	MONTGOMERY
33	PRINCE GEORGES
35	QUEEN ANNES
37	ST MARYS
39	SOMERSET
41	TALBOT
43	WASHINGTON
45	WICOMICO
47	WORCESTER
510	BALTIMORE CITY

COUNTY - County codes from FIPS (FIPS)
25 - Massachusetts

CODE	DEFINITION
1	BARNSTABLE
3	BERKSHIRE
5	BRISTOL
7	DUKES
9	ESSEX
11	FRANKLIN
13	HAMPDEN
15	HAMPSHIRE
17	MIDDLESEX
19	NANTUCKET
21	NORFOLK
23	PLYMOUTH
25	SUFFOLK
27	WORCESTER

COUNTY - County codes from FIPS (FIPS)
26 - Michigan

CODE	DEFINITION
1	ALCONA
3	ALGER
5	ALLEGAN
7	ALPENA
9	ANTRIM
11	ARENAC
13	BARAGA
15	BARRY
17	BAY
19	BENZIE
21	BERRIEN
23	BRANCH
25	CALHOUN
27	CASS
29	CHARLEVOIX
31	CHEBOYGAN
33	CHIPPEWA
35	CLARE
37	CLINTON
39	CRAWFORD
41	DELTA
43	DICKINSON
45	EATON
47	EMMET
49	GENESEE
51	GLADWIN
53	GOGEBIC
55	GRAND TRAVERSE
57	GRATIOT
59	HILLSDALE
61	HOUGHTON
63	HURON
65	INGHAM
67	IONIA
69	IOSCO
71	IRON
73	ISABELLA
75	JACKSON
77	KALAMAZOO
79	KALKASKA
81	KENT
83	KEWEENAW
85	LAKE
87	LAPEER
89	LEELANAU
91	LENAWEE
93	LIVINGSTON
95	LUCE
97	MACKINAC
99	MACOMB
101	MANISTEE
103	MARQUETTE
105	MASON
107	MECOSTA
109	MENOMINEE
111	MIDLAND
113	MISSAUKEE
115	MONROE
117	MONTCALM
119	MONTMORENCY
121	MUSKEGON
123	NEWAYGO

COUNTY - County codes from FIPS (FIPS)
26 - Michigan

125	OAKLAND
127	OCEANA
129	OGEMAW
131	ONTONAGON
133	OSCEOLA
135	OSCODA
137	OTSEGO
139	OTTAWA
141	PRESQUE ISLE
143	ROSCOMMON
145	SAGINAW
147	ST CLAIR
149	ST JOSEPH
151	SANILAC
153	SCHOOLCRAFT
155	SHIAWASSEE
157	TUSCOLA
159	VAN BUREN
161	WASHTENAW
163	WAYNE
165	WEXFORD

COUNTY - County codes from FIPS (FIPS)
27 - Minnesota

CODE	DEFINITION
1	AITKIN
3	ANOKA
5	BECKER
7	BELTRAMI
9	BENTON
11	BIG STONE
13	BLUE EARTH
15	BROWN
17	CARLTON
19	CARVER
21	CASS
23	CHIPPEWA
25	CHISAGO
27	CLAY
29	CLEARWATER
31	COOK
33	COTTONWOOD
35	CROW WING
37	DAKOTA
39	DODGE
41	DOUGLAS
43	FARIBAULT
45	FILLMORE
47	FREEBORN
49	GOODHUE
51	GRANT
53	HENNEPIN
55	HOUSTON
57	HUBBARD
59	ISANTI
61	ITASCA
63	JACKSON
65	KANABEC
67	KANDIYOHI
69	KITTSON
71	KOOCHICHING
73	LAC QUI PARLE
75	LAKE
77	LAKE OF THE WOODS

COUNTY - County codes from FIPS (FIPS)
27 - Minnesota

79	LE SUEUR
81	LINCOLN
83	LYON
85	MC LEOD
87	MAHNOMEN
89	MARSHALL
91	MARTIN
93	MEEKER
95	MILLE LACS
97	MORRISON
99	MOWER
101	MURRAY
103	NICOLLET
105	NOBLES
107	NORMAN
109	OLMSTED
111	OTTER TAIL
113	PENNINGTON
115	PINE
117	PIPESTONE
119	POLK
121	POPE
123	RAMSEY
125	RED LAKE
127	REDWOOD
129	RENVILLE
131	RICE
133	ROCK
135	ROSEAU
137	ST LOUIS
139	SCOTT
141	SHERBURNE
143	SIBLEY
145	STEARNS
147	STEELE
149	STEVENS
151	SWIFT
153	TODD
155	TRAVERSE
157	WABASHA
159	WADENA
161	WASECA
163	WASHINGTON
165	WATONWAN
167	WILKIN
169	WINONA
171	WRIGHT
173	YELLOW MEDICINE

COUNTY - County codes from FIPS (FIPS)
28 - Mississippi

CODE	DEFINITION
1	ADAMS
3	ALCORN
5	AMITE
7	ATTALA
9	BENTON
11	BOLIVAR
13	CALHOUN
15	CARROLL
17	CHICKASAW
19	CHOCTAW
21	CLAIBORNE
23	CLARKE

COUNTY - County codes from FIPS (FIPS)
28 - Mississippi

25	CLAY
27	COAHOMA
29	COPIAH
31	COVINGTON
33	DE SOTO
35	FORREST
37	FRANKLIN
39	GEORGE
41	GREENE
43	GRENADA
45	HANCOCK
47	HARRISON
49	HINDS
51	HOLMES
53	HUMPHREYS
55	ISSAQUENA
57	ITAWAMBA
59	JACKSON
61	JASPER
63	JEFFERSON
65	JEFFERSON DAVIS
67	JONES
69	KEMPER
71	LAFAYETTE
73	LAMAR
75	LAUDERDALE
77	LAWRENCE
79	LEAKE
81	LEE
83	LEFLORE
85	LINCOLN
87	LOWNDES
89	MADISON
91	MARION
93	MARSHALL
95	MONROE
97	MONTGOMERY
99	NESHOBA
101	NEWTON
103	NOXUBEE
105	OKTIBBEHA
107	PANOLA
109	PEARL RIVER
111	PERRY
113	PIKE
115	PONTOTOC
117	PRENTISS
119	QUITMAN
121	RANKIN
123	SCOTT
125	SHARKEY
127	SIMPSON
129	SMITH
131	STONE
133	SUNFLOWER
135	TALLAHATCHIE
137	TATE
139	TIPPAH
141	TISHOMINGO
143	TUNICA
145	UNION
147	WALTHALL
149	WARREN
151	WASHINGTON

COUNTY - County codes from FIPS (FIPS)
28 - Mississippi

153	WAYNE
155	WEBSTER
157	WILKINSON
159	WINSTON
161	YALOBUSHA
163	YAZOO

COUNTY - County codes from FIPS (FIPS)
29 - Missouri

CODE	DEFINITION
1	ADAIR
3	ANDREW
5	ATCHISON
7	AUDRAIN
9	BARRY
11	BARTON
13	BATES
15	BENTON
17	BOLLINGER
19	BOONE
21	BUCHANAN
23	BUTLER
25	CALDWELL
27	CALLAWAY
29	CAMDEN
31	CAPE GIRARDEAU
33	CARROLL
35	CARTER
37	CASS
39	CEDAR
41	CHARITON
43	CHRISTIAN
45	CLARK
47	CLAY
49	CLINTON
51	COLE
53	COOPER
55	CRAWFORD
57	DADE
59	DALLAS
61	DAVIESS
63	DE KALB
65	DENT
67	DOUGLAS
69	DUNKLIN
71	FRANKLIN
73	GASCONADE
75	GENTRY
77	GREENE
79	GRUNDY
81	HARRISON
83	HENRY
85	HICKORY
87	HOLT
89	HOWARD
91	HOWELL
93	IRON
95	JACKSON
97	JASPER
99	JEFFERSON
101	JOHNSON
103	KNOX
105	LACLEDE
107	LAFAYETTE

COUNTY - County codes from FIPS (FIPS)
29 - Missouri

109	LAWRENCE
111	LEWIS
113	LINCOLN
115	LINN
117	LIVINGSTON
119	MC DONALD
121	MACON
123	MADISON
125	MARIES
127	MARION
129	MERCER
131	MILLER
133	MISSISSIPPI
135	MONITEAU
137	MONROE
139	MONTGOMERY
141	MORGAN
143	NEW MADRID
145	NEWTON
147	NODAWAY
149	OREGON
151	OSAGE
153	OZARK
155	PEMISCOT
157	PERRY
159	PETTIS
161	PHELPS
163	PIKE
165	PLATTE
167	POLK
169	PULASKI
171	PUTNAM
173	RALLS
175	RANDOLPH
177	RAY
179	REYNOLDS
181	RIPLEY
183	ST CHARLES
185	ST CLAIR
186	STE GENEVIEVE
187	ST FRANCOIS
189	ST LOUIS
195	SALINE
197	SCHUYLER
199	SCOTLAND
201	SCOTT
203	SHANNON
205	SHELBY
207	STODDARD
209	STONE
211	SULLIVAN
213	TANEY
215	TEXAS
217	VERNON
219	WARREN
221	WASHINGTON
223	WAYNE
225	WEBSTER
227	WORTH
229	WRIGHT
510	ST LOUIS CITY

COUNTY - County codes from FIPS (FIPS)
30 - Montana

COUNTY - County codes from FIPS (FIPS)
30 - Montana

CODE	DEFINITION
1	BEAVERHEAD
3	BIG HORN
5	BLAINE
7	BROADWATER
9	CARBON
11	CARTER
13	CASCADE
15	CHOUTEAU
17	CUSTER
19	DANIELS
21	DAWSON
23	DEER LODGE
25	FALLON
27	FERGUS
29	FLATHEAD
31	GALLATIN
33	GARFIELD
35	GLACIER
37	GOLDEN VALLEY
39	GRANITE
41	HILL
43	JEFFERSON
45	JUDITH BASIN
47	LAKE
49	LEWIS AND CLARK
51	LIBERTY
53	LINCOLN
55	MC CONE
57	MADISON
59	MEAGHER
61	MINERAL
63	MISSOULA
65	MUSSELSHELL
67	PARK
69	PETROLEUM
71	PHILLIPS
73	PONDERA
75	POWDER RIVER
77	POWELL
79	PRAIRIE
81	RAVALLI
83	RICHLAND
85	ROOSEVELT
87	ROSEBUD
89	SANDERS
91	SHERIDAN
93	SILVER BOW
95	STILLWATER
97	SWEET GRASS
99	TETON
101	TOOLE
103	TREASURE
105	VALLEY
107	WHEATLAND
109	WIBAUX
111	YELLOWSTONE
113	YELLOWSTONE NATIONAL PAR

COUNTY - County codes from FIPS (FIPS)
31 - Nebraska

CODE	DEFINITION
1	ADAMS
3	ANTELOPE

COUNTY - County codes from FIPS (FIPS)
31 - Nebraska

5	ARTHUR
7	BANNER
9	BLAINE
11	BOONE
13	BOX BUTTE
15	BOYD
17	BROWN
19	BUFFALO
21	BURT
23	BUTLER
25	CASS
27	CEDAR
29	CHASE
31	CHERRY
33	CHEYENNE
35	CLAY
37	COLFAX
39	CUMING
41	CUSTER
43	DAKOTA
45	DAWES
47	DAWSON
49	DEUEL
51	DIXON
53	DODGE
55	DOUGLAS
57	DUNDY
59	FILLMORE
61	FRANKLIN
63	FRONTIER
65	FURNAS
67	GAGE
69	GARDEN
71	GARFIELD
73	GOSPER
75	GRANT
77	GREELEY
79	HALL
81	HAMILTON
83	HARLAN
85	HAYES
87	HITCHCOCK
89	HOLT
91	HOOKER
93	HOWARD
95	JEFFERSON
97	JOHNSON
99	KEARNEY
101	KEITH
103	KEYA PAHA
105	KIMBALL
107	KNOX
109	LANCASTER
111	LINCOLN
113	LOGAN
115	LOUP
117	MC PHERSON
119	MADISON
121	MERRICK
123	MORRILL
125	NANCE
127	NEMAHA
129	NUCKOLLS
131	OTOE

COUNTY - County codes from FIPS (FIPS)
31 - Nebraska

133	PAWNEE
135	PERKINS
137	PHELPS
139	PIERCE
141	PLATTE
143	POLK
145	RED WILLOW
147	RICHARDSON
149	ROCK
151	SALINE
153	SARPY
155	SAUNDERS
157	SCOTTS BLUFF
159	SEWARD
161	SHERIDAN
163	SHERMAN
165	SIOUX
167	STANTON
169	THAYER
171	THOMAS
173	THURSTON
175	VALLEY
177	WASHINGTON
179	WAYNE
181	WEBSTER
183	WHEELER
185	YORK

COUNTY - County codes from FIPS (FIPS)
32 - Nevada

CODE	DEFINITION
1	CHURCHILL
3	CLARK
5	DOUGLAS
7	ELKO
9	ESMERALDA
11	EUREKA
13	HUMBOLDT
15	LANDER
17	LINCOLN
19	LYON
21	MINERAL
23	NYE
27	PERSHING
29	STOREY
31	WASHOE
33	WHITE PINE
510	CARSON CITY

COUNTY - County codes from FIPS (FIPS)
33 - New Hampshire

CODE	DEFINITION
1	BELKNAP
3	CARROLL
5	CHESHIRE
7	COOS
9	GRAFTON
11	HILLSBOROUGH
13	MERRIMACK
15	ROCKINGHAM
17	STRAFFORD
19	SULLIVAN

COUNTY - County codes from FIPS (FIPS)
34 - New Jersey

CODE	DEFINITION
1	ATLANTIC
3	BERGEN
5	BURLINGTON
7	CAMDEN
9	CAPE MAY
11	CUMBERLAND
13	ESSEX
15	GLOUCESTER
17	HUDSON
19	HUNTERDON
21	MERCER
23	MIDDLESEX
25	MONMOUTH
27	MORRIS
29	OCEAN
31	PASSAIC
33	SALEM
35	SOMERSET
37	SUSSEX
39	UNION
41	WARREN

COUNTY - County codes from FIPS (FIPS)
35 - New Mexico

CODE	DEFINITION
1	BERNALILLO
3	CATRON
5	CHAVES
6	CIBOLA
7	COLFAX
9	CURRY
11	DE BACA
13	DONA ANA
15	EDDY
17	GRANT
19	GUADALUPE
21	HARDING
23	HIDALGO
25	LEA
27	LINCOLN
28	LOS ALAMOS
29	LUNA
31	MC KINLEY
33	MORA
35	OTERO
37	QUAY
39	RIO ARRIBA
41	ROOSEVELT
43	SANDOVAL
45	SAN JUAN
47	SAN MIGUEL
49	SANTA FE
51	SIERRA
53	SOCORRO
55	TAOS
57	TORRANCE
59	UNION
61	VALENCIA

COUNTY - County codes from FIPS (FIPS)
36 - New York

CODE	DEFINITION
1	ALBANY

COUNTY - County codes from FIPS (FIPS)
36 - New York

3	ALLEGANY
5	BRONX
7	BROOME
9	CATTARAUGUS
11	CAYUGA
13	CHAUTAUQUA
15	CHEMUNG
17	CHENANGO
19	CLINTON
21	COLUMBIA
23	CORTLAND
25	DELAWARE
27	DUTCHESS
29	ERIE
31	ESSEX
33	FRANKLIN
35	FULTON
37	GENESEE
39	GREENE
41	HAMILTON
43	HERKIMER
45	JEFFERSON
47	KINGS
49	LEWIS
51	LIVINGSTON
53	MADISON
55	MONROE
57	MONTGOMERY
59	NASSAU
61	NEW YORK
63	NIAGARA
65	ONEIDA
67	ONONDAGA
69	ONTARIO
71	ORANGE
73	ORLEANS
75	OSWEGO
77	OTSEGO
79	PUTNAM
81	QUEENS
83	RENSSELAER
85	RICHMOND
87	ROCKLAND
89	ST LAWRENCE
91	SARATOGA
93	SCHENECTADY
95	SCHOHARIE
97	SCHUYLER
99	SENECA
101	STEUBEN
103	SUFFOLK
105	SULLIVAN
107	TIOGA
109	TOMPKINS
111	ULSTER
113	WARREN
115	WASHINGTON
117	WAYNE
119	WESTCHESTER
121	WYOMING
123	YATES

COUNTY - County codes from FIPS (FIPS)
37 - North Carolina

CODE	DEFINITION
1	ALAMANCE
3	ALEXANDER
5	ALLEGHANY
7	ANSON
9	ASHE
11	AVERY
13	BEAUFORT
15	BERTIE
17	BLADEN
19	BRUNSWICK
21	BUNCOMBE
23	BURKE
25	CABARRUS
27	CALDWELL
29	CAMDEN
31	CARTERET
33	CASWELL
35	CATAWBA
37	CHATHAM
39	CHEROKEE
41	CHOWAN
43	CLAY
45	CLEVELAND
47	COLUMBUS
49	CRAVEN
51	CUMBERLAND
53	CURRITUCK
55	DARE
57	DAVIDSON
59	DAVIE
61	DUPLIN
63	DURHAM
65	EDGECOMBE
67	FORSYTH
69	FRANKLIN
71	GASTON
73	GATES
75	GRAHAM
77	GRANVILLE
79	GREENE
81	GUILFORD
83	HALIFAX
85	HARNETT
87	HAYWOOD
89	HENDERSON
91	HERTFORD
93	HOKE
95	HYDE
97	IREDELL
99	JACKSON
101	JOHNSTON
103	JONES
105	LEE
107	LENOIR
109	LINCOLN
111	MC DOWELL
113	MACON
115	MADISON
117	MARTIN
119	MECKLENBURG
121	MITCHELL
123	MONTGOMERY
125	MOORE

COUNTY - County codes from FIPS (FIPS)
37 - North Carolina

COUNTY - County codes from FIPS (FIPS)
37 - North Carolina

127	NASH
129	NEW HANOVER
131	NORTHAMPTON
133	ONSLOW
135	ORANGE
137	PAMLICO
139	PASQUOTANK
141	PENDER
143	PERQUIMANS
145	PERSON
147	PITT
149	POLK
151	RANDOLPH
153	RICHMOND
155	ROBESON
157	ROCKINGHAM
159	ROWAN
161	RUTHERFORD
163	SAMPSON
165	SCOTLAND
167	STANLY
169	STOKES
171	SURRY
173	SWAIN
175	TRANSYLVANIA
177	TYRRELL
179	UNION
181	VANCE
183	WAKE
185	WARREN
187	WASHINGTON
189	WATAUGA
191	WAYNE
193	WILKES
195	WILSON
197	YADKIN
199	YANCEY

COUNTY - County codes from FIPS (FIPS)
38 - North Dakota

CODE	DEFINITION
1	ADAMS
3	BARNES
5	BENSON
7	BILLINGS
9	BOTTINEAU
11	BOWMAN
13	BURKE
15	BURLEIGH
17	CASS
19	CAVALIER
21	DICKEY
23	DIVIDE
25	DUNN
27	EDDY
29	EMMONS
31	FOSTER
33	GOLDEN VALLEY
35	GRAND FORKS
37	GRANT
39	GRIGGS
41	HETTINGER
43	KIDDER
45	LA MOURE

COUNTY - County codes from FIPS (FIPS)
38 - North Dakota

47	LOGAN
49	MC HENRY
51	MC INTOSH
53	MC KENZIE
55	MC LEAN
57	MERCER
59	MORTON
61	MOUNTRAIL
63	NELSON
65	OLIVER
67	PEMBINA
69	PIERCE
71	RAMSEY
73	RANSOM
75	RENVILLE
77	RICHLAND
79	ROLETTE
81	SARGENT
83	SHERIDAN
85	SIOUX
87	SLOPE
89	STARK
91	STEELE
93	STUTSMAN
95	TOWNER
97	TRAILL
99	WALSH
101	WARD
103	WELLS
105	WILLIAMS

COUNTY - County codes from FIPS (FIPS)
39 - Ohio

CODE	DEFINITION
1	ADAMS
3	ALLEN
5	ASHLAND
7	ASHTABULA
9	ATHENS
11	AUGLAIZE
13	BELMONT
15	BROWN
17	BUTLER
19	CARROLL
21	CHAMPAIGN
23	CLARK
25	CLERMONT
27	CLINTON
29	COLUMBIANA
31	COSHOCTON
33	CRAWFORD
35	CUYAHOGA
37	DARKE
39	DEFIANCE
41	DELAWARE
43	ERIE
45	FAIRFIELD
47	FAYETTE
49	FRANKLIN
51	FULTON
53	GALLIA
55	GEAUGA
57	GREENE
59	GUERNSEY

COUNTY - County codes from FIPS (FIPS)
39 - Ohio

61	HAMILTON
63	HANCOCK
65	HARDIN
67	HARRISON
69	HENRY
71	HIGHLAND
73	HOCKING
75	HOLMES
77	HURON
79	JACKSON
81	JEFFERSON
83	KNOX
85	LAKE
87	LAWRENCE
89	LICKING
91	LOGAN
93	LORAIN
95	LUCAS
97	MADISON
99	MAHONING
101	MARION
103	MEDINA
105	MEIGS
107	MERCER
109	MIAMI
111	MONROE
113	MONTGOMERY
115	MORGAN
117	MORROW
119	MUSKINGUM
121	NOBLE
123	OTTAWA
125	PAULDING
127	PERRY
129	PICKAWAY
131	PIKE
133	PORTAGE
135	PREBLE
137	PUTNAM
139	RICHLAND
141	ROSS
143	SANDUSKY
145	SCIOTO
147	SENECA
149	SHELBY
151	STARK
153	SUMMIT
155	TRUMBULL
157	TUSCARAWAS
159	UNION
161	VAN WERT
163	VINTON
165	WARREN
167	WASHINGTON
169	WAYNE
171	WILLIAMS
173	WOOD
175	WYANDOT

COUNTY - County codes from FIPS (FIPS)
40 - Oklahoma

CODE	DEFINITION
1	ADAIR
3	ALFALFA

COUNTY - County codes from FIPS (FIPS)
40 - Oklahoma

5	ATOKA
7	BEAVER
9	BECKHAM
11	BLAINE
13	BRYAN
15	CADDO
17	CANADIAN
19	CARTER
21	CHEROKEE
23	CHOCTAW
25	CIMARRON
27	CLEVELAND
29	COAL
31	COMANCHE
33	COTTON
35	CRAIG
37	CREEK
39	CUSTER
41	DELAWARE
43	DEWEY
45	ELLIS
47	GARFIELD
49	GARVIN
51	GRADY
53	GRANT
55	GREER
57	HARMON
59	HARPER
61	HASKELL
63	HUGHES
65	JACKSON
67	JEFFERSON
69	JOHNSTON
71	KAY
73	KINGFISHER
75	KIOWA
77	LATIMER
79	LE FLORE
81	LINCOLN
83	LOGAN
85	LOVE
87	MC CLAIN
89	MC CURTAIN
91	MC INTOSH
93	MAJOR
95	MARSHALL
97	MAYES
99	MURRAY
101	MUSKOGEE
103	NOBLE
105	NOWATA
107	OKFUSKEE
109	OKLAHOMA
111	OKMULGEE
113	OSAGE
115	OTTAWA
117	PAWNEE
119	PAYNE
121	PITTSBURG
123	PONTOTOC
125	POTTAWATOMIE
127	PUSHMATAHA
129	ROGER MILLS
131	ROGERS

COUNTY - County codes from FIPS (FIPS)
40 - Oklahoma

133	SEMINOLE
135	SEQUOYAH
137	STEPHENS
139	TEXAS
141	TILLMAN
143	TULSA
145	WAGONER
147	WASHINGTON
149	WASHITA
151	WOODS
153	WOODWARD

COUNTY - County codes from FIPS (FIPS)
41 - Oregon

CODE	DEFINITION
1	BAKER
3	BENTON
5	CLACKAMAS
7	CLATSOP
9	COLUMBIA
11	COOS
13	CROOK
15	CURRY
17	DESCHUTES
19	DOUGLAS
21	GILLIAM
23	GRANT
25	HARNEY
27	HOOD RIVER
29	JACKSON
31	JEFFERSON
33	JOSEPHINE
35	KLAMATH
37	LAKE
39	LANE
41	LINCOLN
43	LINN
45	MALHEUR
47	MARION
49	MORROW
51	MULTNOMAH
53	POLK
55	SHERMAN
57	TILLAMOOK
59	UMATILLA
61	UNION
63	WALLOWA
65	WASCO
67	WASHINGTON
69	WHEELER
71	YAMHILL

COUNTY - County codes from FIPS (FIPS)
42 - Pennsylvania

CODE	DEFINITION
1	ADAMS
3	ALLEGHENY
5	ARMSTRONG
7	BEAVER
9	BEDFORD
11	BERKS
13	BLAIR
15	BRADFORD
17	BUCKS

COUNTY - County codes from FIPS (FIPS)
42 - Pennsylvania

19	BUTLER
21	CAMBRIA
23	CAMERON
25	CARBON
27	CENTRE
29	CHESTER
31	CLARION
33	CLEARFIELD
35	CLINTON
37	COLUMBIA
39	CRAWFORD
41	CUMBERLAND
43	DAUPHIN
45	DELAWARE
47	ELK
49	ERIE
51	FAYETTE
53	FOREST
55	FRANKLIN
57	FULTON
59	GREENE
61	HUNTINGDON
63	INDIANA
65	JEFFERSON
67	JUNIATA
69	LACKAWANNA
71	LANCASTER
73	LAWRENCE
75	LEBANON
77	LEHIGH
79	LUZERNE
81	LYCOMING
83	MC KEAN
85	MERCER
87	MIFFLIN
89	MONROE
91	MONTGOMERY
93	MONTOUR
95	NORTHAMPTON
97	NORTHUMBERLAND
99	PERRY
101	PHILADELPHIA
103	PIKE
105	POTTER
107	SCHUYLKILL
109	SNYDER
111	SOMERSET
113	SULLIVAN
115	SUSQUEHANNA
117	TIOGA
119	UNION
121	VENANGO
123	WARREN
125	WASHINGTON
127	WAYNE
129	WESTMORELAND
131	WYOMING
133	YORK

COUNTY - County codes from FIPS (FIPS)
44 - Rhode Island

CODE	DEFINITION
1	BRISTOL
3	KENT

COUNTY - County codes from FIPS (FIPS)
44 - Rhode Island

5	NEWPORT
7	PROVIDENCE
9	WASHINGTON

COUNTY - County codes from FIPS (FIPS)
45 - South Carolina

CODE	DEFINITION
1	ABBEVILLE
3	AIKEN
5	ALLENDALE
7	ANDERSON
9	BAMBERG
11	BARNWELL
13	BEAUFORT
15	BERKELEY
17	CALHOUN
19	CHARLESTON
21	CHEROKEE
23	CHESTER
25	CHESTERFIELD
27	CLARENDON
29	COLLETON
31	DARLINGTON
33	DILLON
35	DORCHESTER
37	EDGEFIELD
39	FAIRFIELD
41	FLORENCE
43	GEORGETOWN
45	GREENVILLE
47	GREENWOOD
49	HAMPTON
51	HORRY
53	JASPER
55	KERSHAW
57	LANCASTER
59	LAURENS
61	LEE
63	LEXINGTON
65	MC CORMICK
67	MARION
69	MARLBORO
71	NEWBERRY
73	OCONEE
75	ORANGEBURG
77	PICKENS
79	RICHLAND
81	SALUDA
83	SPARTANBURG
85	SUMTER
87	UNION
89	WILLIAMSBURG
91	YORK

COUNTY - County codes from FIPS (FIPS)
46 - South Dakota

CODE	DEFINITION
3	AURORA
5	BEADLE
7	BENNETT
9	BON HOMME
11	BROOKINGS
13	BROWN
15	BRULE

COUNTY - County codes from FIPS (FIPS)
46 - South Dakota

17	BUFFALO
19	BUTTE
21	CAMPBELL
23	CHARLES MIX
25	CLARK
27	CLAY
29	CODINGTON
31	CORSON
33	CUSTER
35	DAVISON
37	DAY
39	DEUEL
41	DEWEY
43	DOUGLAS
45	EDMUNDS
47	FALL RIVER
49	FAULK
51	GRANT
53	GREGORY
55	HAAKON
57	HAMLIN
59	HAND
61	HANSON
63	HARDING
65	HUGHES
67	HUTCHINSON
69	HYDE
71	JACKSON
73	JERAULD
75	JONES
77	KINGSBURY
79	LAKE
81	LAWRENCE
83	LINCOLN
85	LYMAN
87	MC COOK
89	MC PHERSON
91	MARSHALL
93	MEADE
95	MELLETTE
97	MINER
99	MINNEHAHA
101	MOODY
103	PENNINGTON
105	PERKINS
107	POTTER
109	ROBERTS
111	SANBORN
113	SHANNON
115	SPINK
117	STANLEY
119	SULLY
121	TODD
123	TRIPP
125	TURNER
127	UNION
129	WALWORTH
135	YANKTON
137	ZIEBACH

COUNTY - County codes from FIPS (FIPS)
47 - Tennessee

CODE	DEFINITION
1	ANDERSON

COUNTY - County codes from FIPS (FIPS)
47 - Tennessee

3	BEDFORD
5	BENTON
7	BLEDSOE
9	BLOUNT
11	BRADLEY
13	CAMPBELL
15	CANNON
17	CARROLL
19	CARTER
21	CHEATHAM
23	CHESTER
25	CLAIBORNE
27	CLAY
29	COCKE
31	COFFEE
33	CROCKETT
35	CUMBERLAND
37	DAVIDSON
39	DECATUR
41	DE KALB
43	DICKSON
45	DYER
47	FAYETTE
49	FENTRESS
51	FRANKLIN
53	GIBSON
55	GILES
57	GRAINGER
59	GREENE
61	GRUNDY
63	HAMBLEN
65	HAMILTON
67	HANCOCK
69	HARDEMAN
71	HARDIN
73	HAWKINS
75	HAYWOOD
77	HENDERSON
79	HENRY
81	HICKMAN
83	HOUSTON
85	HUMPHREYS
87	JACKSON
89	JEFFERSON
91	JOHNSON
93	KNOX
95	LAKE
97	LAUDERDALE
99	LAWRENCE
101	LEWIS
103	LINCOLN
105	LOUDON
107	MC MINN
109	MC NAIRY
111	MACON
113	MADISON
115	MARION
117	MARSHALL
119	MAURY
121	MEIGS
123	MONROE
125	MONTGOMERY
127	MOORE
129	MORGAN

COUNTY - County codes from FIPS (FIPS)
47 - Tennessee

131	OBION
133	OVERTON
135	PERRY
137	PICKETT
139	POLK
141	PUTNAM
143	RHEA
145	ROANE
147	ROBERTSON
149	RUTHERFORD
151	SCOTT
153	SEQUATCHIE
155	SEVIER
157	SHELBY
159	SMITH
161	STEWART
163	SULLIVAN
165	SUMNER
167	TIPTON
169	TROUSDALE
171	UNICOI
173	UNION
175	VAN BUREN
177	WARREN
179	WASHINGTON
181	WAYNE
183	WEAKLEY
185	WHITE
187	WILLIAMSON
189	WILSON

COUNTY - County codes from FIPS (FIPS)
48 - Texas

CODE	DEFINITION
1	ANDERSON
3	ANDREWS
5	ANGELINA
7	ARANSAS
9	ARCHER
11	ARMSTRONG
13	ATASCOSA
15	AUSTIN
17	BAILEY
19	BANDERA
21	BASTROP
23	BAYLOR
25	BEE
27	BELL
29	BEXAR
31	BLANCO
33	BORDEN
35	BOSQUE
37	BOWIE
39	BRAZORIA
41	BRAZOS
43	BREWSTER
45	BRISCOE
47	BROOKS
49	BROWN
51	BURLESON
53	BURNET
55	CALDWELL
57	CALHOUN
59	CALLAHAN

COUNTY - County codes from FIPS (FIPS)
48 - Texas

61	CAMERON
63	CAMP
65	CARSON
67	CASS
69	CASTRO
71	CHAMBERS
73	CHEROKEE
75	CHILDRESS
77	CLAY
79	COCHRAN
81	COKE
83	COLEMAN
85	COLLIN
87	COLLINGSWORTH
89	COLORADO
91	COMAL
93	COMANCHE
95	CONCHO
97	COOKE
99	CORYELL
101	COTTLE
103	CRANE
105	CROCKETT
107	CROSBY
109	CULBERSON
111	DALLAM
113	DALLAS
115	DAWSON
117	DEAF SMITH
119	DELTA
121	DENTON
123	DE WITT
125	DICKENS
127	DIMMIT
129	DONLEY
131	DUVAL
133	EASTLAND
135	ECTOR
137	EDWARDS
139	ELLIS
141	EL PASO
143	ERATH
145	FALLS
147	FANNIN
149	FAYETTE
151	FISHER
153	FLOYD
155	FOARD
157	FORT BEND
159	FRANKLIN
161	FREESTONE
163	FRIO
165	GAINES
167	GALVESTON
169	GARZA
171	GILLESPIE
173	GLASSCOCK
175	GOLIAD
177	GONZALES
179	GRAY
181	GRAYSON
183	GREGG
185	GRIMES
187	GUADALUPE

COUNTY - County codes from FIPS (FIPS)
48 - Texas

189	HALE
191	HALL
193	HAMILTON
195	HANSFORD
197	HARDEMAN
199	HARDIN
201	HARRIS
203	HARRISON
205	HARTLEY
207	HASKELL
209	HAYS
211	HEMPHILL
213	HENDERSON
215	HIDALGO
217	HILL
219	HOCKLEY
221	HOOD
223	HOPKINS
225	HOUSTON
227	HOWARD
229	HUDSPETH
231	HUNT
233	HUTCHINSON
235	IRION
237	JACK
239	JACKSON
241	JASPER
243	JEFF DAVIS
245	JEFFERSON
247	JIM HOGG
249	JIM WELLS
251	JOHNSON
253	JONES
255	KARNES
257	KAUFMAN
259	KENDALL
261	KENEDY
263	KENT
265	KERR
267	KIMBLE
269	KING
271	KINNEY
273	KLEBERG
275	KNOX
277	LAMAR
279	LAMB
281	LAMPASAS
283	LA SALLE
285	LAVACA
287	LEE
289	LEON
291	LIBERTY
293	LIMESTONE
295	LIPSCOMB
297	LIVE OAK
299	LLANO
301	LOVING
303	LUBBOCK
305	LYNN
307	MC CULLOCH
309	MC LENNAN
311	MC MULLEN
313	MADISON
315	MARION

COUNTY - County codes from FIPS (FIPS)
48 - Texas

317	MARTIN
319	MASON
321	MATAGORDA
323	MAVERICK
325	MEDINA
327	MENARD
329	MIDLAND
331	MILAM
333	MILLS
335	MITCHELL
337	MONTAGUE
339	MONTGOMERY
341	MOORE
343	MORRIS
345	MOTLEY
347	NACOGDOCHES
349	NAVARRO
351	NEWTON
353	NOLAN
355	NUECES
357	OCHILTREE
359	OLDHAM
361	ORANGE
363	PALO PINTO
365	PANOLA
367	PARKER
369	PARMER
371	PECOS
373	POLK
375	POTTER
377	PRESIDIO
379	RAINS
381	RANDALL
383	REAGAN
385	REAL
387	RED RIVER
389	REEVES
391	REFUGIO
393	ROBERTS
395	ROBERTSON
397	ROCKWALL
399	RUNNELS
401	RUSK
403	SABINE
405	SAN AUGUSTINE
407	SAN JACINTO
409	SAN PATRICIO
411	SAN SABA
413	SCHLEICHER
415	SCURRY
417	SHACKELFORD
419	SHELBY
421	SHERMAN
423	SMITH
425	SOMERVELL
427	STARR
429	STEPHENS
431	STERLING
433	STONEWALL
435	SUTTON
437	SWISHER
439	TARRANT
441	TAYLOR
443	TERRELL

COUNTY - County codes from FIPS (FIPS)
48 - Texas

445	TERRY
447	THROCKMORTON
449	TITUS
451	TOM GREEN
453	TRAVIS
455	TRINITY
457	TYLER
459	UPSHUR
461	UPTON
463	UVALDE
465	VAL VERDE
467	VAN ZANDT
469	VICTORIA
471	WALKER
473	WALLER
475	WARD
477	WASHINGTON
479	WEBB
481	WHARTON
483	WHEELER
485	WICHITA
487	WILBARGER
489	WILLACY
491	WILLIAMSON
493	WILSON
495	WINKLER
497	WISE
499	WOOD
501	YOAKUM
503	YOUNG
505	ZAPATA
507	ZAVALA

COUNTY - County codes from FIPS (FIPS)
49 - Utah

CODE	DEFINITION
1	BEAVER
3	BOX ELDER
5	CACHE
7	CARBON
9	DAGGETT
11	DAVIS
13	DUCHESNE
15	EMERY
17	GARFIELD
19	GRAND
21	IRON
23	JUAB
25	KANE
27	MILLARD
29	MORGAN
31	PIUTE
33	RICH
35	SALT LAKE
37	SAN JUAN
39	SANPETE
41	SEVIER
43	SUMMIT
45	TOOELE
47	UINTAH
49	UTAH
51	WASATCH
53	WASHINGTON
55	WAYNE

COUNTY - County codes from FIPS (FIPS)
49 - Utah

57	WEBER

COUNTY - County codes from FIPS (FIPS)
50 - Vermont

CODE	DEFINITION
1	ADDISON
3	BENNINGTON
5	CALEDONIA
7	CHITTENDEN
9	ESSEX
11	FRANKLIN
13	GRAND ISLE
15	LAMOILLE
17	ORANGE
19	ORLEANS
21	RUTLAND
23	WASHINGTON
25	WINDHAM
27	WINDSOR

COUNTY - County codes from FIPS (FIPS)
51 - Virginia

CODE	DEFINITION
1	ACCOMACK
3	ALBEMARLE
5	ALLEGHANY
7	AMELIA
9	AMHERST
11	APPOMATTOX
13	ARLINGTON
15	AUGUSTA
17	BATH
19	BEDFORD
21	BLAND
23	BOTETOURT
25	BRUNSWICK
27	BUCHANAN
29	BUCKINGHAM
31	CAMPBELL
33	CAROLINE
35	CARROLL
36	CHARLES CITY
37	CHARLOTTE
41	CHESTERFIELD
43	CLARKE
45	CRAIG
47	CULPEPER
49	CUMBERLAND
51	DICKENSON
53	DINWIDDIE
57	ESSEX
59	FAIRFAX
61	FAUQUIER
63	FLOYD
65	FLUVANNA
67	FRANKLIN
69	FREDERICK
71	GILES
73	GLOUCESTER
75	GOOCHLAND
77	GRAYSON
79	GREENE
81	GREENSVILLE
83	HALIFAX

COUNTY - County codes from FIPS (FIPS)
51 - Virginia

85	HANOVER
87	HENRICO
89	HENRY
91	HIGHLAND
93	ISLE OF WIGHT
95	JAMES CITY
97	KING AND QUEEN
99	KING GEORGE
101	KING WILLIAM
103	LANCASTER
105	LEE
107	LOUDOUN
109	LOUISA
111	LUNENBERG
113	MADISON
115	MATHEWS
117	MECKLENBURG
119	MIDDLESEX
121	MONTGOMERY
125	NELSON
127	NEW KENT
131	NORTHAMPTON
133	NORTHUMBERLAND
135	NOTTOWAY
137	ORANGE
139	PAGE
141	PATRICK
143	PITTSYLVANIA
145	POWHATAN
147	PRINCE EDWARD
149	PRINCE GEORGE
153	PRINCE WILLIAM
155	PULASKI
157	RAPPAHANNOCK
159	RICHMOND
161	ROANOKE
163	ROCKBRIDGE
165	ROCKINGHAM
167	RUSSELL
169	SCOTT
171	SHENANDOAH
173	SMYTH
175	SOUTHAMPTON
177	SPOTSYLVANIA
179	STAFFORD
181	SURRY
183	SUSSEX
185	TAZEWELL
187	WARREN
191	WASHINGTON
193	WESTMORELAND
195	WISE
197	WYTHE
199	YORK
510	ALEXANDRIA CITY
515	BEDFORD CITY
520	BRISTOL CITY
530	BUENA VISTA CITY
540	CHARLOTTESVILLE CITY
550	CHESAPEAKE CITY
560	CLIFTON FORGE CITY
570	COLONIAL HEIGHTS CITY
580	COVINGTON CITY
590	DANVILLE CITY

COUNTY - County codes from FIPS (FIPS)
51 - Virginia

595	EMPORIA CITY
600	FAIRFAX CITY
610	FALLS CHURCH CITY
620	FRANKLIN CITY
630	FREDERICKSBURG CITY
640	GALAX CITY
650	HAMPTON CITY
660	HARRISONBURG CITY
670	HOPEWELL CITY
678	LEXINGTON CITY
680	LYNCHBURG CITY
683	MANASSAS
685	MANASSAS PARK
690	MARTINSVILLE CITY
700	NEWPORT NEWS CITY
710	NORFOLK CITY
720	NORTON CITY
730	PETERSBURG CITY
735	POQUOSON
740	PORTSMOUTH CITY
750	RADFORD CITY
760	RICHMOND CITY
770	ROANOKE CITY
775	SALEM CITY
780	SOUTH BOSTON CITY
790	STAUNTON CITY
800	SUFFOLK CITY
810	VIRGINIA BEACH CITY
820	WAYNESBORO CITY
830	WILLIAMSBURG CITY
840	WINCHESTER CITY

COUNTY - County codes from FIPS (FIPS)
53 - Washington

CODE	DEFINITION
1	ADAMS
3	ASOTIN
5	BENTON
7	CHELAN
9	CLALLAM
11	CLARK
13	COLUMBIA
15	COWLITZ
17	DOUGLAS
19	FERRY
21	FRANKLIN
23	GARFIELD
25	GRANT
27	GRAYS HARBOR
29	ISLAND
31	JEFFERSON
33	KING
35	KITSAP
37	KITTITAS
39	KLICKITAT
41	LEWIS
43	LINCOLN
45	MASON
47	OKANOGAN
49	PACIFIC
51	PEND OREILLE
53	PIERCE
55	SAN JUAN
57	SKAGIT

COUNTY - County codes from FIPS (FIPS)
53 - Washington

59	SKAMANIA
61	SNOHOMISH
63	SPOKANE
65	STEVENS
67	THURSTON
69	WAHKIAKUM
71	WALLA WALLA
73	WHATCOM
75	WHITMAN
77	YAKIMA

COUNTY - County codes from FIPS (FIPS)
54 - West Virginia

CODE	DEFINITION
1	BARBOUR
3	BERKELEY
5	BOONE
7	BRAXTON
9	BROOKE
11	CABELL
13	CALHOUN
15	CLAY
17	DODDRIDGE
19	FAYETTE
21	GILMER
23	GRANT
25	GREENBRIER
27	HAMPSHIRE
29	HANCOCK
31	HARDY
33	HARRISON
35	JACKSON
37	JEFFERSON
39	KANAWHA
41	LEWIS
43	LINCOLN
45	LOGAN
47	MC DOWELL
49	MARION
51	MARSHALL
53	MASON
55	MERCER
57	MINERAL
59	MINGO
61	MONONGALIA
63	MONROE
65	MORGAN
67	NICHOLAS
69	OHIO
71	PENDLETON
73	PLEASANTS
75	POCAHONTAS
77	PRESTON
79	PUTNAM
81	RALEIGH
83	RANDOLPH
85	RITCHIE
87	ROANE
89	SUMMERS
91	TAYLOR
93	TUCKER
95	TYLER
97	UPSHUR
99	WAYNE

COUNTY - County codes from FIPS (FIPS)
54 - West Virginia

101	WEBSTER
103	WETZEL
105	WIRT
107	WOOD
109	WYOMING

COUNTY - County codes from FIPS (FIPS)
55 - Wisconsin

CODE	DEFINITION
1	ADAMS
3	ASHLAND
5	BARRON
7	BAYFIELD
9	BROWN
11	BUFFALO
13	BURNETT
15	CALUMET
17	CHIPPEWA
19	CLARK
21	COLUMBIA
23	CRAWFORD
25	DANE
27	DODGE
29	DOOR
31	DOUGLAS
33	DUNN
35	EAU CLAIRE
37	FLORENCE
39	FOND DU LAC
41	FOREST
43	GRANT
45	GREEN
47	GREEN LAKE
49	IOWA
51	IRON
53	JACKSON
55	JEFFERSON
57	JUNEAU
59	KENOSHA
61	KEWAUNEE
63	LA CROSSE
65	LAFAYETTE
67	LANGLADE
69	LINCOLN
71	MANITOWOC
73	MARATHON
75	MARINETTE
77	MARQUETTE
78	MENOMINEE
79	MILWAUKEE
81	MONROE
83	OCONTO
85	ONEIDA
87	OUTAGAMIE
89	OZAUKEE
91	PEPIN
93	PIERCE
95	POLK
97	PORTAGE
99	PRICE
101	RACINE
103	RICHLAND
105	ROCK
107	RUSK

COUNTY - County codes from FIPS (FIPS)
55 - Wisconsin

109	ST CROIX
111	SAUK
113	SAWYER
115	SHAWANO
117	SHEBOYGAN
119	TAYLOR
121	TREMPEALEAU
123	VERNON
125	VILAS
127	WALWORTH
129	WASHBURN
131	WASHINGTON
133	WAUKESHA
135	WAUPACA
137	WAUSHARA
139	WINNEBAGO
141	WOOD

COUNTY - County codes from FIPS (FIPS)
56 - Wyoming

CODE	DEFINITION
1	ALBANY
3	BIG HORN
5	CAMPBELL
7	CARBON
9	CONVERSE
11	CROOK
13	FREMONT
15	GOSHEN
17	HOT SPRINGS
19	JOHNSON
21	LARAMIE
23	LINCOLN
25	NATRONA
27	NIOBRARA
29	PARK
31	PLATTE
33	SHERIDAN
35	SUBLETTE
37	SWEETWATER
39	TETON
41	UINTA
43	WASHAKIE
45	WESTON

COUNTY - County codes from FIPS (FIPS)
72 - Puerto Rico

CODE	DEFINITION
13	ARECIBO
25	CAGUAS
65	HATILLO

COUNTY - County codes from FIPS (FIPS)
81 - Alberta

CODE	DEFINITION
1	ALBERTA MUN DIST WILLOW CRK
4	Highway District #4
6	Highway District #6
7	Highway District #7
10	Highway District #10
14	Highway District #14

COUNTY - County codes from FIPS (FIPS)
82 - British Columbia

CODE	DEFINITION
14	Highway District #14
15	Highway District #15
25	Highway District #25

COUNTY - County codes from FIPS (FIPS)
83 - Manitoba

CODE	DEFINITION
1	CORNWALLIS
2	RITCHOT
3	BROKENHEAD
5	SPRINGFIELD
6	PROTAGE LA PRAIRIE

COUNTY - County codes from FIPS (FIPS)
84 - New Brunswick

CODE	DEFINITION
3	SUNBURY
6	YORK
9	KENT

COUNTY - County codes from FIPS (FIPS)
85 - Newfoundland

CODE	DEFINITION
1	WESTERN
2	EASTERN

COUNTY - County codes from FIPS (FIPS)
86 - Nova Scotia

CODE	DEFINITION
1	HALIFAX

COUNTY - County codes from FIPS (FIPS)
87 - Ontario

CODE	DEFINITION
1	LAMBTON
2	MIDDLESEX
3	SIMCOE
4	MUSKOKA
5	YORK
7	RENFREW

COUNTY - County codes from FIPS (FIPS)
88 - Prince Edward Island

CODE	DEFINITION
1	PRINCE
2	QUEENS

COUNTY - County codes from FIPS (FIPS)
89 - Quebec

CODE	DEFINITION
1	MAURICE
2	CANTONS-DE-L'EST
3	REGION DE QUEBEC
4	LAVAL
5	CENTRE_DU_QUEBEC
7	MONTEREGIE
9	SAGUENAY-LAC-SAINT-JEAN

COUNTY - County codes from FIPS (FIPS)
90 - Saskatchewan

CODE	DEFINITION
153	MOUSE MOUNTAIN
340	TOUCHWOOD HILLS
344	ALLAN HILLS

COUNT_DURATION_UNIT - Time unit used in measuring count duration (Traffic Data Sheet 4)

CODE	DEFINITION
1	Hour
2	Day
3	Month

COUNT_TYPE - Code indicating type of traffic volume count (Traffic Data Sheet 4)

CODE	DEFINITION
1	Two-way
2	One direction only
3	LTPP test lane only

CRACK_CLEAN - Code specifying the means of cleaning the cracks prior to sealing.

CODE	DEFINITION
1	None
2	Routing
3	Air blast
4	Steel wire brush
5	Brooming
6	Other

CRACK_JOINT - A code indicating whether faulting is at cracks or joints.

CODE	DEFINITION
C	Crack
J	Joint

CRACK_SEVERITY - Code indicating the crack severity level (as determined in the distress identification manual).

CODE	DEFINITION
1	Low
2	Moderate
3	High

CURE_METHOD - Curing method (Data Collection Sheets)

CODE	DEFINITION
1	None
2	Membrane curing compound
3	Burlap curing blankets
4	Waterproof paper blankets
5	White polyethylene sheeting
6	Burlap-polyethylene blankets
7	Insulating layers
8	Cotton mat curing
9	Hay
10	Other

CUTOFF_CRITERIA - Code indicating cutoff criteria.

CODE	DEFINITION
1	Refusal
2	Raised Slab
3	Grout extrusion
4	Other

CUT_FILL_TYPE - Code indicating if subgrade structure is cut, fill, at-grade or unknown. (SPS 1-9 Construction Data Sheets and Cut-Fill Section Locations)

CODE	DEFINITION
1	Cut
2	Fill
3	At-Grade
4	Combination of one or more types within the section
5	Unknown

CUT_METHOD_FULL - Code identifying the instrument used to cut boundaries of area to be patched.

CODE	DEFINITION
1	Diamond Blade
2	Carbon Blade
3	Wheel saw
4	Air Hammer
5	Other

CUT_METHOD_PART - Method used to cut boundaries for partial depth patches (Data Collection Sheets)

CODE	DEFINITION
1	Diamond blade saw
2	Carbide blade saw
3	None
4	Air hammer
5	Cold milling
6	Other

CUT_REMOVE_METHOD - Code for method of cutting and removal of concrete.

CODE	DEFINITION
1	Two diamond saw cuts
2	Two carbide blade cuts
3	Single carbide blade cut
4	Other

DATA_AVAILABILITY - Code for subjective assessment of the amount and type of data available at this site. (DCG Table 4.1)

CODE	DEFINITION
0	Data from other roadways, includes system level estimates
1	Limited data (short duration) for class or weight
2	Vehicle class and WIM with some seasonal measurement
3	Continuous ATR with limited AVC and WIM, some seasonal WIM
4	Continuous AVC with no WIM
5	Continuous AVC with limited WIM
6	Continuous AVC with limited WIM
7	Permanent, continuous AVC with seasonal, weekday/weekend WIM
8	Other continuous WIM
9	Continuous WIM meeting the ASTM standard

DAYS_SPANNED - Code indicating the day of week coverage.

CODE	DEFINITION
15	At least one weekday
16	At least one weekend day
17	At least one weekday and one weekend day
18	All week days
19	Complete Week

DCP_HAMMER - Code indicating the DCP hammer factor and corresponding hammer weight

CODE	DEFINITION
1	DCP hammer weight = 8kg
2	DCP hammer weight = 4.6kg

DEFLECTION_LOCATION - Code indicating the location of the deflection measurement.

CODE	DEFINITION
1	Midslab
2	Same slab, but adjacent to Joint at Outside Corner.
3	Next slab, but adjacent to same joint.
4	Midslab, second slab.

DEFLECTION_MEASURE_DEVICE - Code for deflection measurement device used.

CODE	DEFINITION
1	FWD
2	Benkelman Beam
3	Road Rater
4	Dynaflect
5	Other

DEICE_TYPE - Code indicating the type of deicers.

CODE	DEFINITION
1	NaCL
2	CaCl2
3	NaCl+CaCl2
4	CMA
5	Other

DELAM_DETECTION_METHOD - Code for the method used to detect areas of possible overlay delamination.

CODE	DEFINITION
1	Electromechanical Dev
2	Chain Drag or Tapping

DESCRIPTION - Layer description codes (DCG: Inventory sheet 3)

CODE	DEFINITION
1	Overlay
2	Seal Coat
3	Original Surface Layer
4	AC Layer Below Surface (Binder Course)
5	Base Layer
6	Subbase Layer
7	Subgrade
8	Interlayer
9	Friction Course
10	Surface Treatment
11	Embankment Layer

DEVICE_CODE_PROFILE - Code indicating the type of device used to collect longitudinal profile data.

CODE	DEFINITION
D	Dipstick
P	Profilometer

DEVICE_CODE_RUT - Code indicating type of device used to collect transverse profile data.

CODE	DEFINITION
D	Dipstick
P	Pasco
S	Straightedge

DEVICE_SOURCE - Code indicating source of testing device.

CODE	DEFINITION
1	SHRP
2	Host state or province
3	Other state
4	Other

DIRECTION_OF_TRAVEL - Codes for direction of travel (INVENTORY_DCG)

CODE	DEFINITION
1	East Bound
2	West Bound
3	North Bound
4	South Bound
5	Test sections located in both directions of travel.

DISTRESS_TYPE - Primary & secondary type of cracks (Table A.22)

CODE	DEFINITION
1	Alligator cracking (AC)
2	Block cracking (AC)
3	Edge cracking (AC)
4	Longitudinal cracking (AC)
5	Reflection cracking (AC)
6	Transverse cracking (AC)
7	Patch deterioration (AC)
8	Potholes (AC)
9	Rutting (AC)
10	Shoving (AC)
11	Bleeding (AC)
12	Polished aggregate (AC)
13	Raveling and Weathering (AC)
14	Lane shoulder drop-off (AC)
15	Water Bleeding (AC)
16	Pumping (AC)
17	Other AC
20	Corner breaks (PCC)
21	Durability cracking (PCC)
22	Longitudinal cracking (PCC)
23	Transverse cracking (PCC)
24	Joint seal damage (PCC)
25	Spalling (PCC)
26	Map cracking/scaling (PCC)
27	Polished aggregate (PCC)
28	Pop outs (PCC)
29	Punch outs (PCC)
30	Blowouts (PCC)
31	Faulting (PCC)
32	Lane/shoulder drop-off (PCC)
33	Lane/shoulder separation (PCC)
34	Patch deterioration (PCC)
35	Water bleeding/pumping (PCC)
36	Slab settlement (PCC)
37	Slab upheaval (PCC)
38	Other PCC

DITCH_VEG - Condition of vegetation on embankment (Drainage Information Form DI-2)

CODE	DEFINITION
1	Maintained
2	Not Maintained
3	None
4	Other

DLR_POINT_TYPE - Relative location of point (DLRCheck documentation)

CODE	DEFINITION
P	Peak
V	Valley

DLR_TRIGGER - Event that started or ended testing (DLRCheck documentation)

CODE	DEFINITION
1	CPU Function Key
2	Trigger Value
3	Timer or External Trigger

DOWEL_COAT - Code indicating type of coating used on dowel bars.

CODE	DEFINITION
1	None
2	Paint and/or grease
3	Plastic
4	Monel
5	Stainless steel
6	Epoxy
7	Other

DOWEL_COATING - Code indicating type of material covering the dowel bar surfaces.

CODE	DEFINITION
1	Paint/Grease
2	Plastic
3	Monel
4	Stainless Steel
5	Epoxy
6	Other

DOWEL_PLACE_METHOD - Code indicating method used to place dowel bars

CODE	DEFINITION
1	Dowel Bar Inserter
2	Dowel Baskets

DRAG - Code indicating type of drag system used to provide surface texture.

CODE	DEFINITION
1	None
2	Burlap
3	Other

DRAINAGE_LOCATION - Code indicating continuity of subsurface drainage.

CODE	DEFINITION
1	Continuous
2	Intermittent
3	None

DRAINAGE_PIPE - Type of drainage pipes (Data Collection Sheets)

DRAINAGE_PIPE - Type of drainage pipes (Data Collection Sheets)

CODE	DEFINITION
1	Clay Tile
2	Concrete Tile
3	Vitrified Clay
4	Perforated Plastic Bituminous Fiber
5	Perforated Corrugated Metal
6	Corrugated Plastic Tubing
7	Drainage Mat
8	Other
9	None

DRAINAGE_TYPE - Code indicating type of subsurface drainage.

CODE	DEFINITION
1	No subsurface drainage
2	Longitudinal drains
3	Transverse drains
4	Drainage blanket
5	Well system
6	Drainage blanket with longitudinal drains
7	Other

DROP_HEIGHT - Drop height position setting on FWD corresponding to target load (LTPP manual for FWD testing)

CODE	DEFINITION
1	Drop height position 1, target load 27KN (6kips) - 380kpa for standard LTPP pavement surface tests.
2	Drop height position 2, target load 40KN (9kips) - 570kpa for standard LTPP pavement surface tests.
3	Drop height position 3, target load 53KN (12kips) - 750kpa for standard LTPP pavement surface tests.
4	Drop height position 4, target load 71KN (16kips) - 1000kpa for standard LTPP pavement surface tests.

DRY_DENSITY_ADJUSTMENT - Code indicating type of dry density adjustment performed.

CODE	DEFINITION
1	Adjustment based on vertical variation
2	Adjustment based on vertical variation and air volume

DSR_TEST_CONTROL - Code indicating control method used by DSR test equipment (Test Data Sheet T27)

CODE	DEFINITION
1	Stress Control
2	Strain Control

DT_FRACTURE_TYPE - Code indicating fracture mode exhibited by specimen (Test Data Sheet T29)

CODE	DEFINITION
1	Brittle
2	Brittle-Ductile
3	Ductile

ELASTIC_MODULUS_METHOD - Methods for determination of elastic modulus. (Data Collection Sheets)

CODE	DEFINITION

ELASTIC_MODULUS_METHOD - Methods for determination of elastic modulus. (Data Collection Sheets)

1	Compression Test on Cores
2	Compression Test on Cylinders Molded During Construction
3	Calc. Using ACI Relation Between Elastic Mod & Comp Strength
4	Other

EQUATION_TYPE - Code identifying the constitutive equation used for backcalculation.

CODE	DEFINITION
0	Linear model
1	Bulk stress model
2	Deviator stress model
3	Minor principal stress model
4	Second stress invariant model
5	Octahedral shear stress model
6	Vertical stress model
7	Major principal stress model
8	Cornell constitutive model

EQUIP_MANUFACTURER - Code indicating the name of the manufacturer of the CTE test equipment.

CODE	DEFINITION
1	Pine
2	Instro_Tek
3	Gilson
4	FHWA
5	Unknown

EROSION_CONTROL - Erosion control at lateral opening (Drainage Information Form DI-1)

CODE	DEFINITION
1	Headwall
2	Riprap
3	None
4	Other

ESAL_EST_WGHTSCALE - Codes for the type of weight scale used. (Traffic Data Sheets 3 and 10.)

CODE	DEFINITION
1	WIM scale.
2	Static scale used for enforcement.
3	Static scale not used for enforcement.
4	Other or Unknown.

ESAL_EST_WGHTSRC - Codes for the source of weight data. (Traffic Data Sheets 3 and 10.)

CODE	DEFINITION
1	Weight data collected at LTPP site this year.
2	Weight data collected at LTPP site prior years.
3	Weight data from system averages this year.
4	Weight data from system averages prior years.
5	Weight data from historic W-4 Tables used.
6	Other or Unknown.

EXIT_DEPTH - Depth of lateral (Drainage Information Form DI-1)

CODE	DEFINITION
1	< 1 m below pavement surface
2	1 - 2 m below pavement surface
3	> 2 m below pavement surface
4	Pavement surface is below lateral

EXPERIMENT - LTPP experiment code-combination of EXPERIMENT_NO and GPS_SPS from EXPERIMENT_SECTION
G - General Pavement Studies

CODE	DEFINITION
1	Asphalt Concrete on Un-bound Granular Base
2	Asphalt Concrete on Bound Base
3	Jointed Plain Concrete Pavement (JPCP)
4	Jointed Reinforced Concrete Pavement (JPCP)
5	Continuously Reinforced Concrete Pavement (CRCP)
9	Unbonded PCC Overlay of PCC Pavement
6A	Existing AC Overlay on AC Pavement
6B	AC Overlay with Conventional Asphalt Cement on AC Pavement, No Milling
6C	AC Overlay with Modified Asphalt Cement on AC Pavement, No Milling
6D	Multiple AC Overlays with Conventional Asphalt Cement on AC Pavement, No Milling
6S	AC Overlay on AC Pavement with Milling and/or Fabric Pretreatment
7A	Existing AC Overlay on PCC Pavement
7B	AC Overlay with Conventional Asphalt Cement on PCC Pavement, with CPR or No Pretreatment
7C	AC Overlay with Modified Asphalt Cement on PCC Pavement, with CPR or No Pretreatment
7D	Multiple AC Overlays with Conventional Asphalt Cement on PCC Pavement, with No Pretreatment
7F	AC Overlay on PCC Pavement, with Slab Fracture Pretreatment
7R	Intensive Concrete Pavement Restoration of PCC without Overlay
7S	AC Overlay on PCC Pavement with Pretreatment

EXPERIMENT - LTPP experiment code-combination of EXPERIMENT_NO and GPS_SPS from EXPERIMENT_SECTION
S - Specific Pavement Studies

CODE	DEFINITION
1	Strategic Study of Structural Factors for Flexible Pavements, new/reconstructed AC pavements
2	Strategic Study of Structural Factors for Rigid Pavements, new/reconstructed JPCC pavements
3	Preventive Maintenance of AC Pavement
4	Preventive Maintenance of Jointed Concrete Pavement
5	AC Overlay of AC Pavement
6	Rehabilitation of Jointed PCC Pavement
7	Bonded Concrete Overlay on Portland Cement Concrete Pavement
8	Study of Environmental Effects in the Absence of Heavy Loads
9A	Superpave Asphalt Binder Study (Project Level Designation)
9C	Superpave Asphalt Binder Study, AC Overlay on CRCP)
9J	Superpave Asphalt Binder Study, AC Overlay on JCP)
9N	Superpave Asphalt Binder Study, New AC Pavement Construction)
9O	Superpave Asphalt Binder Study, AC Overlay on AC Pavement)
9P	Pilot Superpave Asphalt Binder Study (Project Level Designation)

FAULT_MEASURE_DEVICE - Code used to identify the fault measuring device.

CODE	DEFINITION
1	Straightedge and Ruler
2	GA Faultmeter 1/32" resolution
3	GA Faultmeter 1/20" resolution
4	GA Faultmeter 1-mm resolution
5	FHWA Mechanical Faultmeter 1-mm resolution

FAULT_STATUS - Code describing the availability of data to compute wheel faulting indices.

CODE	DEFINITION
1	Faulting sect stats calc'd since over 75% of pts have faulting values >= 0
2	Faulting sect stats not calc'd since 25% or more pts have null faulting values
3	Faulting sect stats not calc'd since 25% or more pts have faulting values < -1 mm
4	Faulting sect stats not calc'd since 25% + comb. pts have null or faulting values < -1 mm

FILLER_TYPE - Type of pressure relief joint filler (Rehab sheet 54)

CODE	DEFINITION
1	Preformed cellular plastic joint filler for relieving pressure
2	Preformed expansion joint filler for concrete (Bituminous Type)
3	Preformed expansion joint fillers for concrete paving & construction
4	Preformed sponge rubber and cork expansion joint fillers for concrete paving
5	Hot mix asphalt concrete
6	Other

FILTER_MODE - FWD deflection and load filter code (Dynatest FWD Operations Manual)

CODE	DEFINITION
0	Filter off for both peaks and history data
1	120 Hz filter on for peaks, off for history data
2	60 Hz filter on for peaks, off for history data
3	120 Hz filter on for both peaks and history data
4	60 Hz filter on for both peaks and history data

FILTER_TYPE - Type of primary filters used (Data Collection Sheets)

CODE	DEFINITION
1	Graded Aggregate
2	Uniformly Graded Aggregate (One Size)
3	Woven Fabric
4	Non-Woven Fabric
5	Porous PCC
6	Porous Bituminous Concrete
7	Other

FINE_AGG_COMP - Composition of fine aggregates. (RHB_03)

CODE	DEFINITION
1	Natural Sand
2	Manufactured Sand (from crushed gravel or stone)
3	Recycled Concrete
4	Other

FINISH_METHOD_A - Code indicating method used to finish the concrete.

FINISH_METHOD_A - Code indicating method used to finish the concrete.

CODE	DEFINITION
1	Screeding
2	Hand-troweling
3	Machine-troweling
4	Other

FINISH_SEAL - Code indicating the thickness of the finished sealant.

CODE	DEFINITION
1	Overfilled
2	Recessed
3	Level with surface

FLEXURAL_STRENGTH_TYPE - Code for the type of flexural strength test.

CODE	DEFINITION
1	Third-point loading
2	Center-point loading

FRACTURE - Compressive strength fracture for TST_TB02 (Protocol P32)

CODE	DEFINITION
11	Cone
12	Cone and split
13	Cone and shear
14	Shear
15	Columnar
16	Other type

FREEZE_STATE - Code indicating whether or not the ground was frozen.

CODE	DEFINITION
F	Frozen
N	Not frozen
T	Transitional

FREQUENCY - Code indicating frequency of a given activity.

CODE	DEFINITION
1	Never
2	Sometimes
3	Usually
4	Always

FREQUENCY_DEICE - Code indicating the frequency of snow removal or application of deicing chemicals on the test site.

CODE	DEFINITION
1	<1/yr
2	2-10/yr
3	>10/yr

FRICTION_METHOD - Type of equipment used to collect friction data. (Friction Data Sheet 1)

CODE	DEFINITION
1	Locked wheel
2	Mu-meter
3	Other

FROST_SUSCEPTIBILITY_CODE - Code indicating frost susceptibility classification.

CODE	DEFINITION

FROST_SUSCEPTIBILITY_CODE - Code indicating frost susceptibility classification.

1	Negligible
2	Very Low
3	Low
4	Medium
5	High
6	Very High

FUNC_CLASS - Functional classification of route (Traffic Monitoring Guide, FHWA)

CODE	DEFINITION
1	Rural Principal Arterial - Interstate
2	Rural Principal Arterial - Other
6	Rural Minor Arterial
7	Rural Major Collector
8	Rural Minor Collector
9	Rural Local Collector
11	Urban Principal Arterial - Interstate
12	Urban Principal Arterial - Other Freeways or Expressways
14	Urban Other Principal Arterial
16	Urban Minor Arterial
17	Urban Collector
19	Urban Local

GEN_PAVEMENT_RHB_CAUSE - General pavement related rehabilitation causes (Rehabilitation Form RI-1)

CODE	DEFINITION
1	Pavement distress
2	Roughness
3	Friction
4	Agency condition index
5	Other

GEOL_CLASS - Geologic Classification Codes (Table A.9 from the DCG)

CODE	DEFINITION
1	Granite
2	Syenite
3	Diorite
4	Gabbro
5	Peridotite
6	Felsite
7	Basalt
8	Diabase
9	Limestone
10	Dolomite
11	Shale
12	Sandstone
13	Chert
14	Conglomerate
15	Breccia
16	Gneiss
17	Schist
18	Amphibolite
19	Slate
20	Quartzite
21	Marble
22	Serpentine
30	Other rock type (specify if possible or unknown)
31	Glacial soils
32	Boulder clay
33	Glacial sands and gravels
34	Laminated silts and laminated clays
35	Varved clays

GEOL_CLASS - Geologic Classification Codes (Table A.9 from the DCG)

36	Ground moraine
37	Fluvio-glacial sands and gravels
38	Other glacial soils
40	Plateau gravels
41	River gravels
42	Alluvium
43	Alluvial clays and/or peat
44	Alluvial silt
45	Other alluvial soils
46	Coastal shingle and beach deposits
47	Wind-blown sand
48	Loess (collapsible soil)
49	Shale, siltstone, mudstone, claystone
50	Expansive soils
51	Residual soils
52	Residual soils derived from granites, gneisses, and schists
53	Residual soils developed from limestone, sandstone, and shale
54	Other residual soils
55	Limerock materials
56	Coquina
57	Shell
58	Marl
59	Caliche
60	Other Limerock Materials

GMG_EXTENT - Code for extent of milling, grinding, or grooving.

CODE	DEFINITION
1	Entire Section
2	Individual Joints/Cracks
3	Patches only
4	Other

GPS_SPS - Pavement study type

CODE	DEFINITION
G	General Pavement Studies
S	Specific Pavement Studies

GRINDING_REASON - Code for the reason for milling, grinding, or grooving.

CODE	DEFINITION
1	Elimination of faulting
2	Elimination of slab warping
3	Improve skid resistance
4	Restoration of transverse drainage slope
5	Other
6	Other

GROUT_TYPE - Code for type of grout used on bonded overlay.

CODE	DEFINITION
1	None
2	Water/Cement
3	Water/Cement/Sand
4	Epoxy-Resin
5	Other

G_F_P - Code indicating whether the element is good, fair, or poor.

CODE	DEFINITION
F	Fair

G_F_P - Code indicating whether the element is good, fair, or poor.

G	Good
P	Poor

HEATER_SCARIF_TYPE - Code for type of heater scarification.

CODE	DEFINITION
1	Multiple Unit
2	Single Unit

HMA_MIX_DESIGN_METHOD - Code indicating the mix design method used for the hot mix asphalt. (SPS-9 Construction Datasheet 9 (revised) March 1977.)

CODE	DEFINITION
1	Marshall
2	Hveem
3	Superpave
4	Other - specify

HOLE_INSTALL_UNDERSEAL - Code indicating method of under seal hole installation.

CODE	DEFINITION
1	Coring
2	Impact drill
3	Other

INITIAL_OR_REGROUT - Code indicating if grouting was initial or regrouting operation.

CODE	DEFINITION
I	Initial
R	Regrout

INSTALL_FREQUENCY - Code indicating the frequency of installation.

CODE	DEFINITION
1	Every Joint
2	Every Joint/Working
3	Intermittent Joint/Crack
4	Other

INTERPRETATION_METHOD - Code indicating interpretation method used for profilograph measurements.

CODE	DEFINITION
1	Manual
2	Mechanical
3	Computer

INTERPRET_BASIS - Code indicating the basis for the freeze state determination.

CODE	DEFINITION
1	Freeze state based on temperature data using 0oC freezing isotherm, not forced.
2	Freeze state determined by the analyst after reviewing the temperature, electrical resistivity, and moisture data trends.
3	Temperature data is not available. Freeze state determined by the analyst.

INTERSECT_TYPE - Type of intersection between lateral and mainline (Drainage Information Form DI-1)

CODE	DEFINITION
1	"T"

INTERSECT_TYPE - Type of intersection between lateral and mainline (Drainage Information Form DI-1)

2	"Sweep"
3	"L"
4	Angle
5	Other

INV_ADMIX_TYPE - Code indicating the type of admixture. (INV sheets 8 and 20)

CODE	DEFINITION
8-1	Water-Reducing (AASHTO M194, Type A)
8-2	Retarding (AASHTO M194, Type B)
8-3	Accelerating (AASHTO M194, Type C)
8-4	Water-Reducing and Retarding (AASHTO M194, Type D)
8-5	Water-Reducing and Accelerating (AASHTO M194, Type D)
8-6	Water-Reducing, High Range (AASHTO M194, Type F)
8-7	Water-Reducing, High Range and Retarding (AASHTO M194, Type G)
8-8	Air-Entraining Admixture (AASHTO M154)
8-9	Natural Pozzolans (AASHTO M295, Class N)
20-1	Calcium chloride
20-2	Sodium chloride
20-3	Magnesium chloride
20-4	Other
8-10	Fly Ash, Class F (ASSHTO M295)
8-11	Fly Ash, Class C (AASHTO M295)
8-12	Other (Chemical)
8-13	Other (Mineral)

INV_AGGR_COMP - Code indicating the composition of the aggregate. (INV sheets 9 and 12)

CODE	DEFINITION
C1	Crushed stones
C2	Gravel
C3	Crushed Gravel
C4	Crushed Slag
C5	Manufactured Lightweight
C6	Recycled Concrete
C7	Other
F1	Natural Sand
F2	Manufactured Sand (from crushed gravel or stone)
F3	Recycled Concrete
F4	Other

INV_TEXTURE - Code indicating aggregate texture.

CODE	DEFINITION
C	Coarse
F	Fine
M	Mixed

ISD_MOIST_MATL_TYPE - Code identifying the treatment type of a layer on which in-situ tests are performed.

CODE	DEFINITION
G	Unbound
T	Other
AT	AC Treated

JOINT_LOC - Code indicating where the longitudinal surface joint is located within the test section.

CODE	DEFINITION
1	Between Lanes
2	Within Lanes

JOINT_METHOD - Joint forming method (Data Collection Sheets)

CODE	DEFINITION
1	None
2	Polyethylene strip insert
3	Styrofoam insert
4	Fiberboard insert
5	Sawing
6	Forms
7	Other

JOINT_OPEN_PROCESS - Code indicating type of process used to open joints.

CODE	DEFINITION
1	Sealant removed
2	Sealant cut
3	Sealant not effective and left in place
4	Sealant somewhat effective and left in place
5	Other

JOINT_SEALANT - Code indicating method used for lane/shoulder joint sealant.

CODE	DEFINITION
1	None
2	Sealed w/o Providing Reservoir
3	Saw Reservoir & seal
4	Other

JOINT_SEAL_BACKER - Code indicating the type of joint sealant backer material.

CODE	DEFINITION
1	Foam Backer Rod
2	Tape
3	Rope
4	None
5	Other

JOINT_SEAL_TYPE_LS - Code indicating type of lane to shoulder joint sealant.

CODE	DEFINITION
1	Poured
2	Preformed

JOINT_TIE_SYSTEM_TYPE - Code for type of joint tie system.

CODE	DEFINITION
1	None
2	Deformed Bars
3	Hook Bolts
4	Other

JOINT_TYPE - Code for type of lane/shoulder joint.

CODE	DEFINITION
1	Tied
2	Butt
3	Keyed
4	Other

L05B_COMMENT_CODES - Code provides a clarification of the selected thickness and material codes selected. (SPS Pavement Layering Methodology, January 1994..)

CODE	DEFINITION
A	FWD data on section agree best with approach

L05B_COMMENT_CODES - Code provides a clarification of the selected thickness and material codes selected. (SPS Pavement Layering Methodology, January 1994..)

	end sample location.
B	FWD data agree best with leave end sample location.
C	Profile and condition data agree best with approach end sample location.
D	Profile and condition data agree best with leave end sample location.
E	Gradations similar at section ends and averaged to determine material code.
F	Gradations different at section ends, material code from approach end used.
G	Gradations different at section ends, material code from leave end used.
H	Atterberg limits similar at both section ends and Avg to determine material code.
I	Atterberg limits different at both section ends. Material code from approach used.
J	Atterberg limits different at both section ends. Material code from leave used.
K	This layer absent at approach end.
L	This layer absent at leave end.
M	Layer inadvertently not sampled during drill & sample, but layer does exist.
N	Info from the state DOT indicates that beginning end is more representative.
O	Info from the state DOT indicates that the leave end is more representative.
P	Material code for layer derived from lab. testing of adjacent test section.
Q	Layer thickness derived by measuring same material from adjacent test section.
R	Layer was partially removed by milling.
S	Layer was completely removed by milling.
T	Sampling only occurred at approach end.
U	Sampling only occurred at leave end.
V	No sampling at either end.
Z	Other (Enter description in COMMENT_NOTE field.)

LAB_AGE_TEST_PROC - Code for procedure used to measure aging effects.

CODE	DEFINITION
1	Thin Film Oven
2	Rolling Thin Film
3	Other

LAB_CODE - Laboratory Identification Code (Laboratory testing forms)

CODE	DEFINITION
0131	Auburn University, Auburn AL.
0411	Western Technology, Inc, Phoenix, AZ
0412	Arizona State University, Tempe, AZ
0413	Law/Crandall Laboratory
0421	Arizona DOT Central Laboratory, Phoenix, AZ
0521	Arkansas State Lab, Little Rock, AR
0621	Central Laboratory, Sacramento, CA
0631	Reed and Graham, San Jose, CA
0632	Geocon Consultants, Inc., Rancho Cordova, CA
0821	FHWA CFLHD, Denver, CO
0822	CDOT Material and Geotechnical Lab, Denver, CO
0831	CTL/Thompson, Denver, CO
0921	Connecticut Department of Transportation, Rocky Hill, CT

LAB_CODE - Laboratory Identification Code (Laboratory testing forms)

1021	Delaware DOT Lab, Dover, DE
1031	Capital Engineering Services (CES), Dover, DE
1032	Materials Testing Inc., Dover, DE
1221	Florida Department of Transportation, Gainesville, FL
1231	PRI Asphalt Technologies, Inc., Tampa, FL
1311	Law Engineering, Atlanta, GA
1321	Georgia DOT Material Testing Lab, GA
1721	Illinois DOT Test Lab, Springfield, IL
1731	CTL Testing Laboratory - Skokie IL
1732	Erlin, Hime Associates, Northbrook, IL
1821	Indiana DOT Test Lab, Lafayette, IN
1831	Purdue University, West Lafayette, IN
1921	Iowa DOT Test Lab, Ames, IA
2021	Kansas DOT, Topeka, KS
2022	Kansas DOT, Salina, KS (Dist. 2)
2023	Kansas DOT, Hutchinson, KS (Dist. 5)
2121	Kentucky Transportation Cabinet, Frankfort, KY
2221	Louisiana DOT, Baton Rouge, LA
2321	Maine DOT Physical Testing Lab, Bangor, ME
2421	MD State Highway Administration Lab - Brooklandville, MD
2422	MD State Highway Administration Lab - Greenbelt, MD
2451	National Aggregate Association Joint Research Lab, College Park, MD
2521	MASS Highway R&M, South Boston, MA
2531	Professional Service Industries, Canton, MA
2621	Michigan DOT Test Lab, Lansing, MI
2631	Soil and Materials Engineers, Plymouth, MI
2632	Professional Service Industries, Detroit, MI
2711	Braun Intertec, Edina, MN
2721	Minnesota DOT Test Lab, Maplewood, MN
2722	Minnesota DOT Test Lab, Bemidji, MN
2723	Minnesota DOT Test Lab, Detroit Lake, MN
2821	Mississippi Department of Transportation, Jackson, MS
2831	Burns Cooley Dennis, Inc., Ridgeland, MS
2921	Missouri Dept. of Hwy Test Lab, Jefferson City, MO
3021	Montana DOT - Helena
3022	Montana DOT - District 2 - Butte, MT
3121	Nebraska Dept. of Roads Lab, Lincoln, NE
3211	Nichols Consulting Engineers, Reno, NV
3221	Nevada Department of Transportation, Carson City, NV
3231	Western Technologies, Las Vegas, NV
3411	Gutierrez-Palmenberg,Inc., Phoenix, AZ
3421	New Jersey DOT, Trenton, NJ
3422	Port Authority Tech Center, Jersey City, NJ
3431	Trap Rock Industries,. Kingston, NJ
3521	NMSHTD, Santa Fe, NM
3611	Stantec, Buffalo, NY
3621	New York State DOT Lab, Albany, NY
3631	Professional Service Industries, Tonawanda, NY
3721	NC DOT Lab, Raleigh, NC
3821	North Dakota DOT, Bismarck, ND
3921	Ohio DOT Test Lab, Columbus, OH
3922	Ohio DOT District Testing Lab
3931	BBC&M Engineering
3932	University of Ohio.
3933	University of Toledo.
3951	CTL Engineering, Inc.
4021	Oklahoma DOT Oklahoma City,OK
4022	Oklahoma DOT - Clinton Construction Residency

LAB_CODE - Laboratory Identification Code (Laboratory testing forms)

	Laboratory,Clinton,OK
4121	Oregon DOT Materials Laboratory, Salem, OR
4211	Professional Service Industries, Pittsburgh, PA
4221	PA DOT Materials Testing Lab, Harrisburg, PA
4231	Valley Forge Laboratories, INC.; Devan PA.
4521	South Carolina DOT, Columbia, SC
4621	South Dakota DOT, Pierre, SD
4631	South Dakota DOT, SD School of Mines, Rapid City, SD
4721	T.D.O.T HQ Material and Tests, TN
4811	Southwestern Laboratories, Houston, TX
4821	Texas DOT, Construction Division, Bituminous Materials, Austin, TX
4822	Texas DOT, San Antonio District Laboratory, San Antonio, TX.
4831	Buchanan/Soil Mechanics, Inc., Bryan, TX
4832	RABA KISTNER, McAllen, TX
4833	Fugro-South, Austin, TX
4834	Young Materials, INC Bryan,TX
4835	Fugro South INC., Houston TX
4836	Fugro South, Inc., Waco, TX
4851	SUPERPAVE Regional Testing Center, Austin, TX
4921	Utah DOT Bituminous Lab, Salt Lake City, UT
5021	Vermont Agency of Transportation Materials and Research Testing Lab, Montpelier, VT
5111	FHWA (TFHRC) Mclean, VA
5121	Virginia DOT Materials Division Lab, Sandston, VA
5122	Virginia Transportation Research Council, Charlottesville, VA
5131	Professional Service Industries, Inc.; Fairfax, VA.
5132	Advanced Asphalt Technologies; Sterling, VA.
5321	Washington DOT - Headquarters, Olympia, WA
5322	FHWA-WFLHD - Vancouver, WA
5323	Washington DOT, Spokane, WA
5331	Pacific Testing, Seattle, WA
5332	Professional Service Industries, Inc., Seattle, WA
5333	Soil Technology, Inc., Bainbridge Island, WA
5421	MCS&T Division WVDOT, Charleston, WV
5521	Wisconsin DOT, Madison, WI
5531	Construction-Geotechnical Consulting Engineering/Testing Inc., Madison, WI
5532	University of Wisconsin-Madison,Structures Materials Labs, Madison, WI
5533	OMNNI Associates Inc., Appleton, WI
5621	Wyoming DOT, Cheyenne, WY
8131	AGRA Earth & Environment, Alberta, Canada
8321	Manitoba Highway Dept., Test Lab, Winnipeg, MB
8631	AMEC, HALIFAX NS.
8721	Ministry of Transportation of Ontario, Toronto, ON
8731	JD Patterson & Assoc., Neapean, Ont
8732	DBA Engineering, Markham, Ont
8733	Peto MacCallum LTD. Barrie, Ont
8921	QE - MTQ Laboratoire Des Chaussees, Quebec City, QE
8922	Secteur Laboratoire De Quebec, Quebec City, PQ
8931	Shermont Laviolette, Trois Rivieres, PQ
9041	Sasketchewan Highways and Transportation Lab, Regina, SK

LANE_POSITION - Code indicating lane position of the GPR measurement. (GPR data files)

CODE	DEFINITION
C	Center of lane
R	Right wheel path

LANE_SPEC - FWD test location lane specification (LTPP FWD Testing Manual)

CODE	DEFINITION
C0	CRCP outer wheel path
C1	CRCP middle lane at mid panel
C2	CRCP lane edge at crack
C3	CRCP lane edge at mid panel
C4	CRCP load transfer in outer wheel path on crack approach
C5	CRCP load transfer in outer wheel path on crack leave
F0	Flexible pavement outer wheel path at test pit
F1	Flexible pavement mid lane
F3	Flexible pavement outer wheel path
F4	SPS-6(0604) load transfer outer wheel path crack approach
F5	SPS-6(0604) load transfer outer wheel path crack leave
F9	Flexible pavement outer wheel path, pre-SMP test outside ends of section
G1	Granular base mid lane
G3	Granular base outer wheel path
J0	JCP outer wheel path at test pit
J1	JCP middle lane at middle panel
J2	JCP pavement edge at corner
J3	JCP pavement edge at mid panel
J4	JCP load transfer outer wheel path at joint approach
J5	JCP load transfer outer wheel path at joint leave
J6	JCP outer wheel path at mid panel (SPS-4)
J7	JCP pavement edge at corner on widen lane SPS-2 sections
J8	JCP pavement edge at mid panel on widen lane SPS-2 sections
J9	JCP outer wheel path, pre-SMP test outside ends of section
L1	Lean concrete has middle lane
L3	Lean concrete base outer wheel path
P1	Permeable asphalt base middle lane
P3	Permeable asphalt base outer wheel path
S1	Prepared subgrade surface middle lane
S3	Prepared subgrade surface outer wheel path

LAP - Code indicating type of spray pattern developed by the spray bar.

CODE	DEFINITION
1	Double Lap
2	Triple Lap

LATERAL_CRUSH - Crushing of lateral opening (Drainage Information Form DI-2)

CODE	DEFINITION
1	Fully Crushed
2	Partially Crushed
3	Intact

LAYER_TYPE - Generic identification of material in layer. (LTPP Materials Sampling and Testing Protocols.)

CODE	DEFINITION
AC	Asphalt concrete layer
EF	Engineering Fabric
GB	Unbound (granular) base
GS	Unbound (granular) subbase
PC	Portland cement concrete layer
RB	Rigid Layer used for backcalculation

LAYER_TYPE - Generic identification of material in layer. (LTPP Materials Sampling and Testing Protocols.)

SS	Subgrade (untreated)
TB	Bound (treated) base
TS	Bound (treated) subbase

LAYER_TYPE_INV - General layer type designation which identifies inventory data requirements. (Inventory Sheet 3.)

CODE	DEFINITION
A	HMAC layer
B	Base/subbase layer
G	Subgrade
P	PCC layer

LAYER_TYPE_RES_MOD - Unbound layer type being tested (P46 Protocol)

CODE	DEFINITION
1	Subgrade
2	Base/subbase

LAYER_TYPE_UNCOMP - Code designating the type of layer.

CODE	DEFINITION
1	Rut Level-Up
2	Mill Replacement
3	Binder Course
4	Surface Course
5	Surface Friction Layer
6	Other

LENGTH_SECTION_COVERED - Code indicating length of test section on which the rut level-up layer was placed.

CODE	DEFINITION
1	Full Length of Test Section
2	Partial Length of Test Section

LEVEL_UP_LAYER_LOC - Code indicating the placement location of rut level-up layer.

CODE	DEFINITION
1	Outside rut
2	Inside rut
3	Both ruts
4	Full lane width

LEVEL_UP_MATL - Code indicating type of level-up material used in ruts.

CODE	DEFINITION
1	Hot Mix Asphalt Concrete
2	Plant Mix with Cutback Asphalt, Cold Laid
3	Plant Mix with Emulsified Asphalt, Cold Laid
4	Road Mix with Cutback Asphalt
5	Road Mix with Emulsified Asphalt
6	Other

LIQUID_SOLID - Code indicating whether the antistripping agent was liquid or solid.

CODE	DEFINITION
1	Liquid
2	Solid

LOAD_TRANS_RESTORATION - Type of load transfer restoration (Rehab sheet 58. Field #2)

CODE	DEFINITION

LOAD_TRANS_RESTORATION - Type of load transfer restoration (Rehab sheet 58. Field #2)

1	Retrofit Dowels (Placed in Slots)
2	Compressed Double-Vee Shear Device
3	Uncompressed Double-Vee Shear Device
4	Plate and Stud Connector Shear Device
5	Other

LOCATION - Location on Pavement Codes (Table A.18 from the DCG)

CODE	DEFINITION
1	Outside Lane (Number 1)
2	Inside Lane (Number 2)
3	Inside Lane (Number 3)
4	Shoulder
5	Curb and Gutter
6	Side Ditch
7	Culvert
8	Other
9	All lanes
10	All lanes plus shoulder.

LOCATION_AT - Code indicating location of test.

CODE	DEFINITION
1	Joint
2	Crack
3	Midpoint of slab/panel

LOCATION_DESC - Code indicating the support conditions at the test location.

CODE	DEFINITION
1	Good concrete/Good support
2	Poor/Distressed concrete
3	Poor support
4	Small void
5	Medium void
6	Large void
7	Void/Poor support

LOCATION_DYNAFLECT - Code indicating the location of the Dynaflect testing.

CODE	DEFINITION
1	Joint
2	Crack
3	Neither

LOCATION_OF_LANE - Code for shoulder restored.

CODE	DEFINITION
1	Outside
2	Inside
3	Both

LOC_SIZE_METHOD - Code indicating primary method used to determine location of patches.

CODE	DEFINITION
1	Deflection
2	Coring
3	Visual
4	Other

LONG_JOINT_FORMED - Code for method used to form the longitudinal joint between the lanes.

CODE	DEFINITION
1	Butt

LONG_JOINT_FORMED - Code for method used to form the longitudinal joint between the lanes.

2	Keyed
3	Sawed Weakened Plane
4	Insert Weakened Plane
5	Other

MACRO_TEXTURE - Code indicating the general roughness of the surface as defined by the macro texture.

CODE	DEFINITION
1	Fine (<= 1/4 inch)
2	Coarse (> 1/4 inch)

MAINT_MAT - Maintenance Materials Type Codes (Table A.19 from the DCG)

CODE	DEFINITION
1	Preformed Joint Fillers
2	Hot-Poured Joint and Crack Sealer
3	Cold-Poured Joint and Crack Sealer
4	Open Graded Asphalt Concrete
5	Hot Mix Asphalt Concrete Laid Hot
6	Hot Mix Asphalt Concrete Laid Cold
7	Sand Asphalt
8	Portland Cement Concrete (overlay or replacement) Jointed Plain (JPCP)
9	Portland Cement Concrete (overlay or replacement) Jointed Reinforced (JRCP)
10	Portland Cement Concrete (overlay or replacement) Continuously Reinforced (CRCP)
11	Portland Cement Concrete (Patches)
12	Hot Liquid Asphalt and Aggregate (Seal Coat)
13	Hot Liquid Asphalt and Mineral Aggregate
14	Hot Liquid Asphalt and Sand
15	Emulsified Asphalt and Aggregate (Seal Coat)
16	Emulsified Asphalt and Mineral Aggregate
17	Emulsified Asphalt and Sand
18	Hot Liquid Asphalt
19	Emulsified Asphalt
20	Sand Cement (Using Portland Cement)
21	Lime Treated or Stabilized Materials
22	Cement Treated or Stabilized Materials
23	Cement Grout
24	Aggregate (Gravel, Crushed Stone or Slag)
25	Sand
26	Mineral Dust
27	Mineral Filler
28	Other

MAINT_WORK - Maintenance and Rehabilitation Work Type Codes (Table A.17 from the DCG)

CODE	DEFINITION
1	Crack Sealing (linear ft.)
2	Transverse Joint Sealing (linear ft.)
3	Lane-Shoulder Longitudinal Joint Sealing (linear ft.)
4	Full Depth Transverse Joint Repair Patch (sq. yards)
5	Full Depth Patching of PCC Pavement Other Than at Joint (sq. yards)
6	Partial Depth Patching of PCC Pavement Other Than at Joint (sq. yards)
7	PCC Slab Replacement (sq. yards)
8	PCC Shoulder Restoration (sq. yards)
9	PCC Shoulder Replacement (sq. yards)
10	AC Shoulder Restoration (sq. yards)

MAINT_WORK - Maintenance and Rehabilitation Work Type Codes (Table A.17 from the DCG)

11	AC Shoulder Replacement (sq. yards)
12	Grinding Surface (sq. yards)
13	Grooving Surface (sq. yards)
14	Pressure Grout Subsealing (no. of holes)
15	Slab Jacking Depressions (no. of depressions)
16	Asphalt Subsealing (no. of holes)
17	Spreading of Sand or Aggregate (sq. yards)
18	Reconstruction (Removal and Replacement) (sq. yards)
19	Asphalt Concrete Overlay (sq. yards)
20	Portland Cement Concrete Overlay (sq. yards)
21	Mechanical Premix Patch (using motor grader and roller) (sq. yards)
22	Manual Premix Spot Patch (hand spreading and compacting with roller) (sq. yards)
23	Machine Premix Patch (placing premix with paver roller) (sq. yards)
24	Full Depth Patch of AC Pavement (removing damaged material, repairing supporting
25	Patch Pot Holes - Hand Spread, Compacted with Truck (no. of holes)
26	Skin Patching (hand tools/hot pot to apply liquid asphalt and aggregate) (sq.yd)
27	Strip Patching (using spreader and distributor to apply hot liquid asphalt and
28	Surface Treatment, Single Layer (sq. yards)
29	Surface Treatment, Double Layer (sq. yards)
30	Surface Treatment, Three or More Layers (sq. yards)
31	Aggregate Seal Coat (sq. yards)
32	Sand Seal Coat (sq. yards)
33	Slurry Seal Coat (sq. yards)
34	Fog Seal Coat (sq. yards)
35	Prime Coat (sq. yards)
36	Tack Coat (sq. yards)
37	Dust Layering (sq. yards)
38	Longitudinal Subdrains (linear feet)
39	Transverse Subdrainage (linear feet)
40	Drainage Blankets (sq. yards)
41	Well System
42	Drainage Blankets with Longitudinal Drains
43	Hot-Mix Recycled Asphalt Concrete (sq. yards)
44	Cold-Mix Recycled Asphalt Concrete (sq. yards)
45	Heater Scarification, Surface Recycled Asphalt Concrete (sq. yards)
46	Fracture Treatment of PCC Pavement as Base for New AC Surface (sq.yards)
47	Fracture Treatment of PCC Pavement as Base for New PCC Surface (sq.yards)
48	Recycled Portland Cement Concrete (sq. yards)
49	Pressure Relief Joints in PCC Pavements (linear feet)
50	Joint Load Transfer Restoration in PCC Pavements (linear feet)
51	Mill Off AC and Overlay with AC (sq. yards)
52	Mill Off AC and Overlay with PCC (sq. yards)
53	Other
54	Partial depth patching of PCC pavements at joints (sq. yards)
55	Mill Existing Pavement and Overlay with Hot-Mix Recycled AC.
56	Mill Existing Pavement and Overlay with Cold-Mix Recycled AC.
57	Saw and Seal

MAN_TRACE_TYPE - Code indicating the manual TDR trace type classification.

CODE	DEFINITION
1	Classic
2	Shorted
3	Open
4	Rounded
5	Irregular

MAP_DATUM - Map datum used for coordinate locations.

CODE	DEFINITION
1	World Geodetic System 1984 (WGS84)
2	World Geodetic system 1972 (WGS72)
3	North American Datum 1972 mean value continental United States (NAD27 CONUS)
4	North American Datum 1927 Canada and Newfoundland (NAD27 Canada)
5	North American Datum 1927 Alaska (NAD27 Alaska)
6	North American Datum 1927 Alaska, Canada, Central America, Continental United States, Mexico (NAD83)
7	Unknown
8	Other

MATERIAL - Pavement Materials and Soils in the Field (Table C.2)

CODE	DEFINITION
1	Hot Mixed, Hot Laid AC, Dense Graded
2	Hot Mixed, Hot Laid AC, Open Graded
3	Sand Asphalt
4	Portland Cement Concrete (JPCP)
5	Portland Cement Concrete (JRCP)
6	Portland Cement Concrete (CRCP)
7	Portland Cement Concrete (Prestressed)
8	Portland Cement Concrete (Fiber Reinforced)
9	Plant Mix (Emulsified Asphalt) Material, Cold Laid
10	Plant Mix (Cutback Asphalt) Material, Cold Laid
11	Single Surface Treatment
12	Double Surface Treatment
13	Recycled AC, Hot Laid, Central Plant Mix
14	Recycled AC, Cold Laid, Central Plant Mix
15	Recycled AC, Cold Laid Mixed-In-Place
16	Recycled AC, Heater Scarification/Recompaction
17	Recycled Portland Cement Concrete, JPCP
18	Recycled Portland Cement Concrete, JRCP
19	Recycled Portland Cement Concrete, CRCP
20	Other
70	Grout
71	Chip Seal
72	Slurry Seal
73	Fog Seal
74	Woven Geotextile
75	Nonwoven Geotextile
77	Stress Absorbing Membrane Interlayer
78	Dense Graded Asphalt Concrete Interlayer
79	Aggregate Interlayer
80	Open Graded Asphalt Concrete Interlayer
81	Chip Seal with Modified Binder (Does not include Crumb Rubber)
82	Sand Seal
83	Asphalt-Rubber Seal Coat
84	Sand Asphalt
85	Other
90	Plain Portland Cement Concrete (Only Used for SPS-7 Overlays of CRCP)

MATERIAL - Pavement Materials and Soils in the Field (Table C.2)

100	Fine-Grained Soils: General
101	Fine-Grained Soils: Clay
102	Fine-Grained Soils: Lean Inorganic Clay
103	Fine-Grained Soils: Fat Inorganic Clay
104	Fine-Grained Soils: Clay with Gravel
105	Fine-Grained Soils: Lean Clay with Gravel
106	Fine-Grained Soils: Fat Clay with Gravel
107	Fine-Grained Soils: Clay with Sand
108	Fine-Grained Soils: Lean Clay with Sand
109	Fine-Grained Soils: Fat Clay with Sand
110	Fine-Grained Soils: Gravelly Clay
111	Fine-Grained Soils: Gravelly Lean Clay
112	Fine-Grained Soils: Gravelly Fat Clay
113	Fine-Grained Soils: Sandy Clay
114	Fine-Grained Soils: Sandy Lean Clay
115	Fine-Grained Soils: Sandy Fat Clay
116	Fine-Grained Soils: Gravelly Clay with Sand
117	Fine-Grained Soils: Gravelly Lean Clay with Sand
118	Fine-Grained Soils: Gravelly Fat Clay with Sand
119	Fine-Grained Soils: Sandy Clay with Gravel
120	Fine-Grained Soils: Sandy Lean Clay with Gravel
121	Fine-Grained Soils: Sandy Fat Clay with Gravel
131	Fine-Grained Soils: Silty Clay
132	Fine-Grained Soils: Silty Clay with Gravel
133	Fine-Grained Soils: Silty Clay with Sand
134	Fine-Grained Soils: Gravelly Silty Clay
135	Fine-Grained Soils: Sandy Silty Clay
136	Fine-Grained Soils: Gravelly Silty Clay with Sand
137	Fine-Grained Soils: Sandy Silty Clay with Gravel
141	Fine-Grained Soils: Silt
142	Fine-Grained Soils: Silt with Gravel
143	Fine-Grained Soils: Silt with Sand
144	Fine-Grained Soils: Gravelly Silt
145	Fine-Grained Soils: Sandy Silt
146	Fine-Grained Soils: Gravelly Silt with Sand
147	Fine-Grained Soils: Sandy Silt with Gravel
148	Fine-Grained Soils: Clayey Silt
151	Fine-Grained Soils: Peat
160	Fine-Grained Soils: Organic Soil
161	Fine-Grained Soils: Organic Soil with Gravel
162	Fine-Grained Soils: Organic Soil with Sand
163	Fine-Grained Soils: Gravelly Organic Soil
164	Fine-Grained Soils: Sandy Organic Soil
165	Fine-Grained Soils: Gravelly Organic Soil with Sand
166	Fine-Grained Soils: Sandy Organic Soil with Gravel
171	Fine-Grained Soils: Organic Clay
172	Fine-Grained Soils: Organic Clay (OL)
173	Fine-Grained Soils: Organic Clay (OH)
176	Fine-Grained Soils: Organic Silt
177	Fine-Grained Soils: Organic Silt (OL)
178	Fine-Grained Soils: Organic Silt (OH)
180	Treated Subgrade Soil
181	Fine-Grained Soils: Lime-Treated Soil
182	Fine-Grained Soils: Cement-Treated Soil
183	Bituminous Treated Subgrade Soil
200	Coarse-Grained Soils: General
201	Coarse-Grained Soils: Sand
202	Coarse-Grained Soils: Poorly Graded Sand
203	Coarse-Grained Soils: Poorly Graded Sand with Gravel
204	Coarse-Grained Soils: Poorly Graded Sand with Silt
205	Coarse-Grained Soils: Poorly Graded Sand with

MATERIAL - Pavement Materials and Soils in the Field (Table C.2)

	Silt and Gravel
206	Coarse-Grained Soils: Poorly Graded Sand with Clay
207	Coarse-Grained Soils: Poorly Graded Sand with Clay and Gravel
208	Coarse-Grained Soils: Well-Graded Sand
209	Coarse-Grained Soils: Well-Graded Sand with Gravel
210	Coarse-Grained Soils: Well-Graded Sand with Silt
211	Coarse-Grained Soils: Well-Graded Sand with Silt and Gravel
212	Coarse-Grained Soils: Well-Graded Sand with Clay
213	Coarse-Grained Soils: Well-Graded Sand with Clay and Gravel
214	Coarse-Grained Soil: Silty Sand
215	Coarse-Grained Soil: Silty Sand with Gravel
216	Coarse-Grained Soil: Clayey Sand
217	Coarse-Grained Soil: Clayey Sand with Gravel
251	Coarse-Grained Soil: Gravel
252	Coarse-Grained Soil: Poorly Graded Gravel
253	Coarse-Grained Soil: Poorly Graded Gravel with Sand
254	Coarse-Grained Soil: Poorly Graded Gravel with Silt
255	Coarse-Grained Soil: Poorly Graded Gravel with Silt and Sand
256	Coarse-Grained Soil: Poorly Graded Gravel with Clay
257	Coarse-Grained Soil: Poorly Graded Gravel with Clay and Sand
258	Coarse-Grained Soil: Well-Graded Gravel
259	Coarse-Grained Soil: Well-Graded Gravel with Sand
260	Coarse-Grained Soil: Well-Graded Gravel with Silt
261	Coarse-Grained Soil: Well-Graded Gravel with Silt and Sand
262	Coarse-Grained Soil: Well-Graded Gravel with Clay
263	Coarse-Grained Soil: Well-Graded Gravel with Clay and Sand
264	Coarse-Grained Soil: Silty Gravel
265	Coarse-Grained Soil: Silty Gravel with Sand
266	Coarse-Grained Soil: Clayey Gravel
267	Coarse-Grained Soil: Clayey Gravel with Sand
280	Rock and Stone
281	Shale
282	Rock
283	Cobbles
284	Boulders
285	Claystone/Mudstone
286	Siltstone
287	Sandstone
288	Slag
289	Shale Chunk
290	Crushed Sandstone
291	Crushed Limestone
292	Crushed Rock
293	Broken Shells
294	Other (Specify, if Possible)
302	Gravel (Uncrushed)
303	Crushed Stone
304	Crushed Gravel
305	Crushed Slag
306	Sand
307	Soil-Aggregate Mixture (Predominantly Fine-Grained)
308	Soil-Aggregate Mixture (Predominantly Coarse-Grained)
309	Fine-Grained Soils
310	Other (Specify, if Possible)
319	HMAC
320	Sand Asphalt
321	Asphalt Treated Mixture
322	Dense Graded, Hot Laid, Central Plant Mix
323	Dense Graded, Cold Laid, Central Plant Mix
324	Dense Graded, Cold Laid, Mixed In-Place
325	Open Graded, Hot Laid, Central Plant Mix
326	Open Graded, Cold Laid, Central Plant Mix
327	Open Graded, Cold Laid, Mixed In-Place
328	Recycled Asphalt Concrete, Plant Mix, Hot Laid
329	Recycled Asphalt Concrete, Plant Mix, Cold Laid
330	Recycled Asphalt Concrete, Mixed In-Place
331	Cement Aggregate Mixture
332	Econocrete
333	Cement-Treated Soil
334	Lean Concrete
335	Recycled Portland Cement Concrete
336	Sand-Shell Mixture
337	Limerock, Caliche
338	Lime-Treated Soil
339	Soil Cement
340	Pozzolanic-Aggregate Mixture
341	Cracked and Seated PCC Layer
350	Other
351	Treatment: Lime, All Classes of Quick Lime and Hydrated Lime
352	Treatment: Lime - Flyash
353	Treatment: Lime and Cement Flyash
354	Treatment: Cement - Portland Cement
355	Treatment: Bitumen - Includes All Classes of Bitumen and Asphalt Treatments
356	Treatment: Calcium Chloride
357	Treatment: Sodium Chloride
358	Treatment: Other Chemical Treatment - Includes Polymer Stabilization
360	Treatment: Other (Specify, if Possible)
700	Asphalt Concrete (AC)
730	Portland Cement Concrete (PCC)
999	Material Discrepancy

MATERIAL_TYPE - Classification code identifying type of material.

CODE	DEFINITION
1	"Virgin" Asphalt concrete
2	Recycled Asphalt Concrete
3	Other

MATL_EST - Code indicating the estimated percent of loose material remaining after brooming.

CODE	DEFINITION
1	None(<1%)
2	Very Little(1-3%)
3	Some(3-5%)
4	Substantial(>5%)

MAT_TYPE - Material type classification codes (Tables A.5, A.6, A.7, A.8)

CODE	DEFINITION
1	Hot Mixed, Hot Laid Asphalt Concrete, Dense

MAT_TYPE - Material type classification codes (Tables A.5, A.6, A.7, A.8)

	Graded
2	Hot Mixed, Hot Laid Asphalt Concrete, Open Graded (Porous Friction Course)
3	Sand Asphalt
4	Portland Cement Concrete (JPCP)
5	Portland Cement Concrete (JRCP)
6	Portland Cement Concrete (CRCP)
7	Portland Cement Concrete (Prestressed)
8	Portland Cement Concrete (Fiber Reinforced)
9	Plant Mix (Emulsified Asphalt) Material, Cold Laid
10	Plant Mix (Cutback Asphalt) Material, Cold Laid
11	Single Surface Treatment
12	Double Surface Treatment
13	Recycled Asphalt Concrete Hot, Central Plant Mix
14	Recycled Asphalt Concrete Cold Laid Central Plant Mix
15	Recycled Asphalt Concrete Cold Laid Mixed-In-Place
16	Recycled Asphalt Concrete Heater Scarification/Recompaction
17	Recycled Portland Cement Concrete JPCP
18	Recycled Portland Cement Concrete JRCP
19	Recycled Portland Cement Concrete CRCP
20	Other
21	No Base (Pavement Placed Directly on Subgrade)
22	Gravel (Uncrushed)
23	Crushed Stone, Gravel or Slag
24	Sand
25	Soil-Aggregate Mixture (Predominantly Fine-Grained Soil)
26	Soil-Aggregate Mixture (Predominantly Coarse-Grained Soil)
27	Soil Cement
28	Asphalt Bound, Dense Graded, Hot Laid, Central Plant Mix
29	Asphalt Bound, Dense Graded, Cold Laid, Central Plant Mix
30	Asphalt Bound, Dense Graded, Cold Laid, Mixed In-Place
31	Asphalt Bound, Open Graded, Hot Laid, Central Plant Mix
32	Asphalt Bound, Open Graded, Cold Laid, Central Plant Mix
33	Asphalt Bound, Open Graded, Cold Laid, Mixed In-Place
34	Recycled Asphalt Concrete, Plant Mix, Hot Laid
35	Recycled Asphalt Concrete, Plant Mix, Cold Laid
36	Recycled Asphalt Concrete, Mixed In-Place
37	Cement-Aggregate Mixture
38	Lean Concrete (<3 sacks cement/cy)
39	Recycled Portland Cement Concrete
40	Sand-Shell Mixture
41	Limerock, Caliche (Soft Carbonate Rock)
42	Lime-Treated Subgrade Soil
43	Cement-Treated Subgrade Soil
44	Pozzolanic-Aggregate Mixture
45	Cracked and Seated PCC Layer
46	Sand Asphalt
49	Other
51	Clay (Liquid Limit > 50)
52	Sandy Clay
53	Silty Clay
54	Silt
55	Sandy Silt
56	Clayey Silt

MAT_TYPE - Material type classification codes (Tables A.5, A.6, A.7, A.8)

57	Sand
58	Poorly Graded Sand
59	Silty Sand
60	Clayey Sand
61	Gravel
62	Poorly Graded Gravel
63	Clayey Gravel
64	Shale
65	Rock
70	Grout
71	Chip Seal Coat
72	Slurry Seal Coat
73	Fog Seal Coat
74	Woven Geotextile
75	Nonwoven Geotextile
77	Stress Absorbing Membrane Interlayer
78	Dense Graded Asphalt Concrete Interlayer
79	Aggregate Interlayer
80	Open Graded Asphalt Concrete Interlayer
81	Chip Seal with Modified Binder (Does Not Include Crumb Rubber)
82	Sand Seal
83	Asphalt-Rubber Seal Coat (Stress Absorbing Membrane)
84	Sand Asphalt
85	Other
86	Thin Seals and Interlayers
90	Plain Portland Cement Concrete (only used for SPS-7 overlays of CRCP)

MAX_DRY_DENSITY_TEST - Code for test method used to establish the max dry density and optimum moisture content.

CODE	DEFINITION
1	Std T99
2	Mod T180
3	T134
4	D558
5	D4223
6	Other

MAX_LAB_DRY_DENSITY_TEST - Code indicating the AASHTO test method used to determine the maximum dry density.

CODE	DEFINITION
1	T-99
2	T-180
3	Other

MAX_LAB_DRY_DENSITY_TEST_METHOD - Code indicating the test method used to determine the maximum dry density.

CODE	DEFINITION
B	Method B of Protocol P44/P55
D	Method D of Protocol P44/P55

MEASURE - Code indicating the density measurement method.

CODE	DEFINITION
A	Backscatter
B	Direct Termination
C	Air Gap

MEASURE_TYPE - Codes used to enter the measurement type (Testing sheet TST_L05. Reference Layer.)

CODE	DEFINITION
1	Pavement Core (laboratory measurement)
2	Pavement Core (field core logs)
3	Core of Bound Base/Subbase
4	Borehole logs for BA1, BA2, BA3, and A1, A2, type boreholes
5	Shoulder Auger Probe Log
6	Test Pit Log
7	Other
8	No measurements conducted on this layer
9	Ground Penetrating Radar
10	Field Survey Data

MEGADAC_FILTER - Type of filter applied by MEGADAC system (DLRCheck documentation)

CODE	DEFINITION
0	Undefined
1	System Filter Frequency
2	Wide Band

METHOD_GMG_MNT - Code indicating whether grinding, milling, or grooving was used.

CODE	DEFINITION
1	Diamond grinding
2	Milling
3	Grooving

METHOD_GMG_RHB - Code for method used to mill and grind.

CODE	DEFINITION
1	Diamond Grinding
2	Milling
3	Other

METHOD_TRAFFIC_RESTRICTION - Code indicating the method of determining the traffic restriction duration.

CODE	DEFINITION
1	Time of set
2	Minimum cure time
3	Other

METH_EST_AADT_TOT - Method to estimate AADT for all lanes,two way. (Traffic Data Sheets 3 and 10.)

CODE	DEFINITION
1	Factored a single count taken this year at the LTPP site.
2	Averaged multiple counts taken this year at the LTPP site.
3	Estimated based on volume counts at nearby locations.
4	Used computerized network analysis.
5	Average and factored multiple counts taken this year at the LTPP site.
6	Growth factored last year's estimate.
7	Used flow maps.
8	Other or Unknown.

METH_EST_ESAL_VEH - Method for estimating ESAL/Vehicle ratio. (Traffic Data Sheets 3 and 10.)

CODE	DEFINITION
1	ESAL/Truck.
2	ESAL/Truck by vehicle class.
3	ESAL/axle - single, tandem, tridem axles.
4	Other or Unknown.
5	General Project Estimate. Not section specific.

METH_EST_TRK_TOT - Method to estimate truck volume in all lanes,two way. (Traffic Data Sheets 3 and 10.)

CODE	DEFINITION
1	Factored a single count taken this year at the LTPP site.
2	Averaged multiple counts taken this year at the LTPP site.
3	Used count data from nearby sites.
4	Used computerized network analysis.
5	Used a single count taken this year at the LTPP site.
6	Used system averages from counts taken this year.
7	Used count data taken in earlier years at the LTPP site.
8	Used system averages taken in earlier years.
9	Other or Unknown.

METH_EST_VOL_LTPP - Method to estimate AADT and truck volumes for the LTPP lane. (Traffic Data Sheets 3 and 10.)

CODE	DEFINITION
1	Based on actual lane count data.
2	System distribution factors.
3	Other or Unknown.

METH_VEHICLE_CLASS - Codes for method of vehicle classification (Traffic Sheets 1, 8)

CODE	DEFINITION
1	FHWA - 13 bin
2	Other
3	Unknown

MILL_LAYER_MATL - Type of mill replacement layer material (Data Sheet SPS-5, sheet No. 6)

CODE	DEFINITION
1	Virgin Asphalt Concrete
2	Recycled Asphalt Concrete
3	Other

MINERAL_FILLER - Code indicating the type of mineral filler.

CODE	DEFINITION
1	Stone dust
2	Hydrated lime
3	Portland cement
4	Fly ash
5	Other

MIX_PROCEDURE - Code for procedure for mixing in place.

CODE	DEFINITION
1	Blade
2	Rotary
3	Travel Plant
4	Other

MIX_TYPE - Type of AC mixture

CODE	DEFINITION
1	Virgin AC

MIX_TYPE - Type of AC mixture

2	Recycled Asphalt Concrete
3	Asphalt Treated Dense Graded
4	Permeable Asphalt Treated

MLTD_METHOD - Code indicating the method used to install the mechanical load transfer devices.

CODE	DEFINITION
1	Preplaced on Baskets
2	Mechanically Installed
3	Other

MNT_3_4 - Type of seal. (Maintenance data sheet 3.)

CODE	DEFINITION
1	Fog seal
2	Slurry seal
3	Aggregate seal
4	Sand seal
5	Cape seal
6	Other

MNT_4_7 - Final preparation of existing pavement surface. (Maintenance data sheet 4.)

CODE	DEFINITION
1	None
2	Primarily air blast
3	Primarily water blast
4	Primarily sand blast
5	Sand blast and air blast
6	Other

MNT_5_4 - Type of material used to seal cracks. (Maintenance data sheet 5.)

CODE	DEFINITION
1	Asphalt cement
2	Emulsified asphalt cement
3	Cutback asphalt cement
4	Emulsified asphalt cement slurry seal
5	Emulsified asphalt cement with sand
6	Proprietary crack/joint sealant
7	Modified asphalt
8	Other

MNT_6_7 - Method of compaction (Maintenance data sheet 6)

CODE	DEFINITION
1	None
2	Pneumatic roller
3	Vibratory plate compactor
4	Vibratory roller
5	Steel wheel roller
6	Truck tire
7	Other

MNT_SOURCE - Code indicating the data source.

CODE	DEFINITION
1	Actual
2	Plans/Specs
3	Judgment

MODIFIER - Asphalt Cement Modifier Codes (Table A.15 from the DCG)

CODE	DEFINITION
1	Stone Dust

MODIFIER - Asphalt Cement Modifier Codes (Table A.15 from the DCG)

2	Lime
3	Portland Cement
4	Carbon Black
5	Sulfur
6	Lignin
7	Natural Latex
8	Synthetic Latex
9	Block Copolymer
10	Reclaimed Rubber
11	Polyethylene
12	Polypropylene
13	Ethylene-Vinyl Acetate
14	Polyvinyl Chloride
15	Asbestos
16	Rock Wool
17	Polyester
18	Manganese
19	Other Mineral Salts
20	Lead Compounds
21	Carbon
22	Calcium Salts
23	Recycling Agents
24	Rejuvenating Oils
25	Amines
26	Fly Ash
27	Other

MOIST_SUSCEPT_TEST - Code for moisture susceptibility test type.

CODE	DEFINITION
1	AASHTO T165
2	TX Freeze-Thaw
3	TX boiling
4	Rev. Lottman
5	Other

MONITORING_CATEGORY - Code indicating pavement performance monitoring category and frequencies (LTPP Directive GO-21)

CODE	DEFINITION
C	1 ea profile,distress,FWD prior to going out-of-study.
G	Every 2 years profile photographic distress, every 3 years manual distress, every 5 years FWD;responsive photographic distress,FWD.
S1	Core SPS sections: yearly-profile, manual distress; every 2 yrs photographic distress,FWD testing; responsive FWD; monitoring on supplemental sections may differ; continuous WIM required.
S2	Core SPS sections: yearly-profile, manual distress; every 2 yrs photographic distress,FWD testing; responsive FWD;monitoring on supplemental sections may differ; continuous WIM preferred.

MONITORING_CHANGE_REASON - Code indicating why targeted monitoring frequencies were changed. (LTPP Directive GO-27 or SPR)

CODE	DEFINITION
1	Data completeness matches monitoring category; monitoring intensity for past two years is less than required for that category.
2	Data completeness matches monitoring category; monitoring intensity being reduced by agency

MONITORING_CHANGE_REASON - Code indicating why targeted monitoring frequencies were changed. (LTPP Directive GO-27 or SPR)

	request.
3	Core section data fails to meet minimum for pavement structure, inventory, pavement monitoring, climate or past traffic.
4	Traffic monitoring does not meet or exceed that required for category.
5	Change in experiment designation resulting in different monitoring frequency.
6	Failure to meet minimum monitoring for category C.
7	Test section / project out-of-study.
99	Other

MONITORING_OF_LIFT - Code indicating the method used to monitor undersealing work and amount of lift.

CODE	DEFINITION
1	Deflection
2	Max Pumping
3	Appearance of Material
4	Other

MR_MATL_TYPE - Code designating whether the material was coarse or fine grained.

CODE	DEFINITION
1	Course grained material
2	Fine grained material

NON_DEC_DEFL - Non-decreasing deflection flag (MON_DEFL IMS Specifications)

CODE	DEFINITION
1	data set contains non-decreasing deflections from the center of the load

NO_YES - Code indicating if the patched area contains reinforcing steel.

CODE	DEFINITION
1	No
2	Yes

NUMBER_SEALED - Code indicating the extent of joint or crack sealant.

CODE	DEFINITION
1	All sealed
2	Most sealed
3	Few sealed
4	None sealed
5	None present to seal

OFFSET_FLAG - CENTER_OFFSET value anomaly flag

CODE	DEFINITION
1	Incorrect value for CENTER_OFFSET confirmed, actual or estimated value not available
2	Value for CENTER_OFFSET suspect, not confirmed, estimated location not available
3	Value for CENTER_OFFSET suspect, not confirmed, estimated location is available

OUTLIER_FLAG - Outlier flag code (MON_T_PROF_INDEX IMS table specifications)

CODE	DEFINITION
1	Referenced field less than 2 standard deviations from section mean.

OUTLIER_FLAG - Outlier flag code (MON_T_PROF_INDEX IMS table specifications)

2	Referenced field GT or EQ to 2 standard deviations from section mean.

P32_METHOD - Code indicating whether test method T32A or B was used to test the treated sample.

CODE	DEFINITION
A	Test Protocol P32A
B	Test Protocol P32B

PARAMETER_NO - Code indicating the weather type parameter.

CODE	DEFINITION
1	Max Temp
2	Min Temp
3	Mean Temp
4	Max Relative Humidity
5	Min Relative Humidity
6	Avg Wind Speed
11	Snow
12	Precip
24	Gust Speed & Direction
29	%Sun
33	%Sky Cover Midnight/Midnight
34	%Sky Cover Sunrise/Sunset

PARTICLE_CHARGE - Code indicating polarity of emulsified asphalt particle charge

CODE	DEFINITION
N	Negative
P	Positive

PASS_FAIL - Code indicating whether the element passed or failed.

CODE	DEFINITION
F	Fail
P	Pass

PATCHING - Code indicating the extent of patching in the control section.

CODE	DEFINITION
1	No patching
2	Minor patching
3	Moderate patching
4	Major patching

PATCH_BOUNDARY_METHOD - Code indicating type of method used to form the patch boundary.

CODE	DEFINITION
1	None
2	Saw Cut
3	Air Hammer
4	Cold Milling
5	Other

PATCH_MATERIAL - Surface materials used to patch pavement (Data Collection Sheets)

CODE	DEFINITION
1	Hot mix asphalt concrete
2	Plant mix with cutback asphalt, cold laid
3	Plant mix with emulsified asphalt, cold laid
4	Road mix with cutback asphalt
5	Road mix with emulsified asphalt

PATCH_MATERIAL - Surface materials used to patch pavement (Data Collection Sheets)

6	Portland cement concrete (PCC)
7	Other

PATCH_MATL_AC - Code for patch type used if pavement is AC over PCC.

CODE	DEFINITION
1	All AC
2	AC/PCC

PATCH_MATL_PCC - Code for patch material used on PCC.

CODE	DEFINITION
1	PCC
2	Polymer Concrete
3	AC
4	Epoxy Mortar
5	Other

PAVEMENT - Pavement Type Codes (Table A.4 from the DCG)

CODE	DEFINITION
1	AC with Granular Base
2	AC with Bituminous Treated Base
3	AC Overlay on AC Pavement
4	JPCP Overlay on AC Pavement
5	JRCP Overlay on AC Pavement
6	CRCP Overlay on AC Pavement
7	AC with Non-Bituminous Treated Base
10	Other
11	JPCP - Placed Directly on Untreated Subgrade
12	JRCP - Placed Directly on Untreated Subgrade
13	CRCP - Placed Directly on Untreated Subgrade
14	JPCP - Placed Directly on Treated Subgrade
15	JRCP - Placed Directly on Treated Subgrade
16	CRCP - Placed Directly on Treated Subgrade
17	JPCP - Over Unbound Base
18	JRCP - Over Unbound Base
19	CRCP - Over Unbound Base
20	JPCP Over Bituminous Treated Base
21	JRCP Over Bituminous Treated Base
22	CRCP Over Bituminous Treated Base
23	JPCP Over Non-Bituminous Treated Base
24	JRCP Over Non-Bituminous Treated Base
25	CRCP Over Non-Bituminous Treated Base
28	AC Overlay on JPCP Pavement
29	AC Overlay on JRCP Pavement
30	AC Overlay on CRCP Pavement
31	JPCP Overlay on JPCP Pavement
32	JRCP Overlay on JPCP Pavement
33	JPCP Overlay on JRCP Pavement
34	JRCP Overlay on JRCP Pavement
35	JPCP Overlay on CRCP Pavement
36	JRCP Overlay on CRCP Pavement
37	CRCP Overlay on CRCP Pavement
38	CRCP Overlay on JPCP Pavement
39	CRCP Overlay on JRCP Pavement
40	Prestressed Concrete Pavement
49	Other
51	JPCP with Asphalt Concrete Wearing Surface
52	JRCP with Asphalt Concrete Wearing Surface
53	CRCP with Asphalt Concrete Wearing Surface
59	Other

PAVEMENT_BREAKER - Pavement breaker types (Rehab sheet 60. Field #4)

CODE	DEFINITION
1	Roller
2	Pile Driver Hammer
3	Whip Hammer
4	Guillotine Drop Hammer
5	Air Hammer
6	Hydraulic Hammer
7	Other

PAVEMENT_PROCESSING - Code for pavement processing method.

CODE	DEFINITION
1	None
2	Crushed/Screened
3	Pulverized by Hammermill
4	Pulverized by Grid/V-Cleat Roll
5	Other

PAVEMENT_TYPE - Code indicating whether flexible or rigid pavement was used in the ESAL calculations.

CODE	DEFINITION
F	Flexible
R	Rigid

PAVER_TYPE - Code indicating the type of paver used.

CODE	DEFINITION
1	Slip-form
2	Side-form
3	Other

PAVE_TYPE_MNT - Code for pavement surface type.

CODE	DEFINITION
1	AC
2	PCC

PAVE_TYPE_TRF - Pavement structural type (Traffic Sheet 1 revised Sept 1999)

CODE	DEFINITION
1	AC
2	PCC
3	Other (composite pavements - AC/PCC, PCC/AC
4	AC and PCC sections

PCCA - Portland Cement Concrete Admixture Codes (Table A.12 from the DCG)

CODE	DEFINITION
1	Water-Reducing (AASHTO M194, Type A)
2	Retarding (AASHTO M194, Type B)
3	Accelerating (AASHTO M194, Type C)
4	Water-Reducing and Retarding (AASHTO M194, Type D)
5	Water-Reducing and Accelerating (AASHTO M194, Type D)
6	Water-Reducing, High Range (AASHTO M194, Type F)
7	Water-Reducing, High Range and Retarding (AASHTO M194, Type G)
8	Air-Entraining Admixture (AASHTO M154)
9	Natural Pozzolans (AASHTO M295, Class N)
10	Fly Ash, Class F (ASSHTO M295)
11	Fly Ash, Class C (AASHTO M295)
12	Other (Chemical)
13	Other (Mineral)

PCCO_COARSE_AGG - Composition of coarse aggregate (Data Collection Sheets)

CODE	DEFINITION
1	Crushed stones
2	Gravel
3	Crushed Gravel
4	Crushed Slag
5	Manufactured Lightweight
6	Recycled Concrete
7	Other

PC_TYPE - Portland Cement Type Codes (Table A.11 from the DCG)

CODE	DEFINITION
41	Type I
42	Type II
43	Type III
44	Type IV
45	Type V
46	Type IS
47	Type ISA
48	Type IA
49	Type IIA
50	Type IIIA
51	Type IP
52	Type IPA
53	Type N
54	Type NA
55	Other

PHOTO_VIDEO - Code indicating if distress was read from photos and/or video.

CODE	DEFINITION
B	Both
N	None
P	Photo
V	Video

PIPE_TYPE - Material of drainage pipes (Drainage Information Form DI-1)

CODE	DEFINITION
1	Corrugated Steel
2	Bituminous Corrugated Steel
3	PVC
4	Corrugated PVC
5	Clay Pipe
6	Other

PLACE_METHOD - Code indicating the method used to set bars across cracks.

CODE	DEFINITION
1	Placed on top of crack
2	Recessed in pavement
3	Cross stitched
4	Other

PLANT_TYPE - Code indicating type of asphalt concrete mix plant.

CODE	DEFINITION
1	Batch Plant
2	Drum Mix Plant
3	Other

PREDICTIVE_MODEL - Code indicating the predictive model used to generate Estar estimates.

CODE	DEFINITION
1	Resilient modulus ANN
2	Viscosity ANN
3	G* ANN
4	G* ANN with inconsistent aging conditions
5	Viscosity ANN with viscosity from binder grade

PRESSURE_RELIEF_REASON - Code for reason why pressure relief joint was installed.

CODE	DEFINITION
1	Major Blowup Occurred
2	Major Blowup Anticipated
3	Bridge Pushing
4	Policy
5	Other

PRIMARY_REASON_RHB - Reason for rehabilitation (Rehabilitation Form RI-1)

CODE	DEFINITION
1	Test section pavement condition
2	Non-test section pavement condition
3	Non related to pavement condition

PROFILOGRAPH_TYPE - Code indicating type of profilograph used.

CODE	DEFINITION
1	California
2	Rainhart

QA_LEVEL - Quality Assurance Check Status Level

CODE	DEFINITION
*	All data
A	Level A data
B	Level B data
C	Level C data
D	Level D data
E	Level E data

RCO_CODE - Quality assurance code to explain "spikes" or other anomalous features in profile data.

CODE	DEFINITION
1	Actual pavement feature
2	Equipment malfunction. Invalid data neglected in calculation of stats
3	Anomalous data unexplained

REASON_CALIB - Why the traffic monitoring equipment was checked (Traffic Data Sheet 16)

CODE	DEFINITION
0	Auto calibration
1	Regularly scheduled visit
2	Research
3	Equipment replacement
4	Training
5	Data triggered system review
6	New equipment installation
8	Other
10	LTPP Validation
11	LTPP Assessment

RECESSED_SLOT_METHOD - Code indicating the method used to form the recessed slot in the concrete prior to bar placement.

CODE	DEFINITION
1	Saw cut
2	Milled
3	Other

RECORD_TYPE - Code indicating the traffic data type.

CODE	DEFINITION
3	3 card volume
4	4 card vehicle class
7	7 card weight
8	8 card vehicle class
H	HELP weight record

RECYCLE - Recycling Agent Type Codes (Table A.20 from the DCG)

CODE	DEFINITION
42	RA 1
43	RA 5
44	RA 25
45	RA 75
46	RA 250
47	RA 500
48	Other

RECYCLING_TYPE - Code indicating the recycling method used.

CODE	DEFINITION
1	In Place
2	Central

REFACED - Code indicating method used to reface joint sidewalls.

CODE	DEFINITION
1	No
2	1 Blade
3	2 Blade
4	Other

REFINER - Asphalt Refiners and Processors in the United States (Table A.14 from the DCG)

CODE	DEFINITION
1	Hunt Refining Company, Tuscaloosa, AL
2	Chevron USA, Inc., Kenai, AK
3	Mapco Alaska Petroleum, North Pole, AK
4	Intermountain Refining C1., Fredonia, AZ
5	Berry Petroleum Company, Stevens, AR
6	Cross Oil and Refining Co., Smackover, AR
7	Lion Oil Company, El Dorado, AR
8	McMillan Ring - Free Oil Cl., Norphlet, AR
9	Chevron USA, Inc., Richmond, CA
10	Conoco, Inc., Santa Maria, CA
11	Edgington Oil Co., Long Beach, CA
12	Golden Bear Division, Witco Chemical Corp., Oildale, CA
13	Golden West Refining Co., Santa Fe Springs, CA
14	Huntway Refining Co., Benicia, CA
15	Huntway Refining Co., Wilmington, CA
16	Newhall Refining Cl., Newhall, CA
17	Oxnard Refining, Oxnard, CA
18	San Joaquin Refining Cl., Bakersfield, CA
19	Shell Oil Co., Martinez, CA
20	Superior Processing Co., Santa Fe Springs, CA

REFINER - Asphalt Refiners and Processors in the United States (Table A.14 from the DCG)

21	Conoco Inc., Commerce City, CO
22	Amoco Oil Co., Savannah, GA
23	Young Refining Corp., Douglasville, GA
24	Chevron USA, Inc., Barber's Point, HI
25	Clark Oil and Refining Corp., Blue Island, IL
26	Shell Oil Co., Wood River, IL
27	Unacol Corp., Lemont, IL
28	Amoco Oil Co., Whiting, IN
29	Young Refining Corp., Laketon, IN
30	Farmland Industries, Inc., Phillipsburg, KS
31	Total Petroleum, Inc., Arkansas City, KS
32	Ashland Petroleum Co., Catlettsburg, KY
33	Atlas Processing Co., Shreveport, LA
34	Calumet Refining Co., Princeton, LA
35	Exxon Co., Baton Rouge, LA
36	Marathon Petroleum Co., Garyville, LA
37	Marathon Petroleum Co., Detroit, MI
39	Koch Refining Co., Rosemount, MN
40	Chevron USA, Inc., Pascagoula, MS
41	Ergon Refining Inc., Vicksburg, MS
42	Southland Oil Co., Lumberton, MS
43	Southland Oil Co., Sanderson, MS
44	Cenex, Laurel, MT
45	Conoco, Inc., Billings, MT
46	Exxon Co., Billings, MT
47	Chevron USA, Inc., Perth Amboy, NJ
48	Exxon Co., Linden, NJ
49	Navahoe Refining Co., Artesia, NM
50	Ashland Petroleum Co., Canton, OH
51	Standard Oil Co., Toledo, OH
52	Kerr-McGee Refining Co., Wynnewood, OK
53	Sinclair Oil Corp. Tulsa, OK
54	Sun Co., Tulsa, OK
55	Total Petroleum Inc., Ardmore, OK
56	Chevron USA, Inc., Portland, OR
57	Atlantic Refining & Marketing Corp., Philadelphia, PA
58	United Refining Co., Warren, PA
59	Mapco Petroleum Inc., Memphis, TN
60	Charter International Oil Co., Houston, TX
61	Chevron USA, Inc., El Paso, TX
62	Coastal States Petroleum Co., Corpus Christi, TX
63	Diamond Shamrock Corp., Sunray, TX
64	Exxon Co. USA, Baytown, TX
65	Fina Oil & Chemical Co., Big Spring, TX
66	Shell Oil Co., Deer Park, TX
67	Texaco Refining & Marketing Inc., Port Arthur/Port Neches, TX
68	Unocal Corp., Nederland, TX
69	Valero Refining Co., Corpus Christi, TX
70	Phillips 66 Co., Woods Cross, UT
71	Chevron USA Inc., Seattle, WA
72	Sound Refining, Inc., Tacoma, WA
73	US Oil and Refining Co., Tacoma, WA
74	Murphy Oil USA, Inc., Superior, WI
75	Big West Oil Co., Cheyenne, WY
76	Sinclair Oil Corp., Sinclair, WY
77	Other
78	Belcher Refining Co., Mobile Bay, AL
79	Lunday-Thagard Co., South Gate, CA
80	Paramount Petroleum Corp., Paramount, CA
81	Powerline Oil Co., Santa Fe Springs, CA
82	Colorado Refining Co., Commerce City, CO
83	Laketon Refining Corp., Laketon, IN
84	Derby Refining Co., El Dorado, KS

REFINER - Asphalt Refiners and Processors in the United States (Table A.14 from the DCG)

85	Giant Industries, Inc., Gallup, NM
86	Cibro Petroleum Products Co., Albany, NY
87	Sohio Oil Co (BP America), Toledo, OH
88	Coastal Refining & Marketing, Inc., Corpus Christi, TX
89	Fina Oil and Chemical Co., Port Arthur, TX
90	Hill Petroleum Co., Houston, TX
91	Star Enterprise, Port Arthur/Port Neches, TX
92	Trifinery, Corpus Christi, TX
93	Little America Refining Co., Casper, WY

REGION - LTPP Regions

CODE	DEFINITION
1	North Atlantic (Amherst, NY, USA)
2	North Central (Champaign, IL, USA)
3	Southern (Austin, TX, USA)
4	Western (Reno, NV, USA)

REINFORCE_PLACE_METHOD - Code indicating method used to place reinforcement.

CODE	DEFINITION
1	Preset on Chairs
2	Mechanically
3	BTW Layers
4	Other

REINFORCING_TYPE - Code for type of reinforcing.

CODE	DEFINITION
1	Deformed Bars
2	Welded Wire Fabric
3	Other

REMOVAL_CLEAN_METHOD - Code indicating the method used for removal or cleaning of PCC surface.

CODE	DEFINITION
1	Shot blasting
2	Sandblasting
3	Water blasting w/abrasives
4	Water blasting
5	Air blowing
6	Other

REMOVAL_CLEAN_REASON - Code indicating the reason for removal or cleaning of PCC surface.

CODE	DEFINITION
1	Provide rough surface for overlay
2	Secondary cleaning after cold milling
3	Secondary cleaning after shot blasting
4	Final cleaning to remove dust & free particles
5	Other

REMOVAL_METHOD - Method of removing old sealant (Data Collection Sheets)

CODE	DEFINITION
1	Not removed
2	Joint plow -- V-shaped
3	Joint plow -- Rectangular
4	High pressure water blasting
5	Diamond blade saw
6	Carbine blade saw
7	Pull-out of old compression sealant
8	Not previously sealed

REMOVAL_METHOD - Method of removing old sealant (Data Collection Sheets)

9	Other

REPLACE_MATL - Code for material used to replace base.

CODE	DEFINITION
1	Similar
2	AC
3	PCC
4	Other

REPR_GRADATION - Code indicating whether sample gradation is representative of aggregate used in plant-mixed AC. (Sampling Data Sheet 21)

CODE	DEFINITION
1	Gradation of sample is representative of the gradation of aggregate in AC mix
2	Gradation of sample is not representative of the gradation of aggregate in AC mix

RESERVOIR_MOISTURE - Code best indicating the reservoir moisture at time of sealant application.

CODE	DEFINITION
1	Dry
2	Mostly dry
3	Somewhat damp
4	Wet

ROAD_MOISTURE - Code indicating the predominate moisture condition of pavement surface.

CODE	DEFINITION
1	Dry
2	Moist
3	Wet

ROLLER_CODE - Code indicating the type of roller used.

CODE	DEFINITION
A	Steel_wheel Tandem
B	Steel_wheel Tandem
C	Steel_wheel Tandem
D	Steel_whl Tandem
E	Pneumatic-Tired
F	Pneumatic-Tired
G	Pneumatic-Tired
H	Pneumatic-Tired
I	Single-Drum Vibr
J	Single-Drum Vibr
K	Single-Drum Vibr
L	Single-Drum Vibr
M	Double-Drum Vibr
N	Double-Drum Vibr
O	Double-Drum Vibr
P	Double-Drum Vibr
Q	Other

ROLLER_TYPE - Code for proof roller type.

CODE	DEFINITION
1	Steel Wheeled
2	Pneumatic

ROUTE_SIGNING - Code for the type of highway where the project is located. (INVENTORY DCG)

CODE	DEFINITION
1	Interstate
2	U. S.
3	State
4	Other

RUT_PREP - Code indicating preparation treatment prior to application of the level-up material (SPS9 Construction Data Sheet 22)

CODE	DEFINITION
1	None
2	Broomed
3	Broomed + Asphaltic Tack Coat
4	Asphaltic Tack Coat (only)
5	Wheel Path Milling
6	Other

SAMPLE_LOC_PCC - Code identifying the location from which the sample was taken.

CODE	DEFINITION
1	Batch Plant
2	Hauling Truck before Paving
3	Hauling Truck during Paving
4	Paver
5	Other

SAMPLE_LOC_UNCOMP - Code identifying the location from which the sample was taken.

CODE	DEFINITION
1	Conveyer Belt
2	Stockpile
3	Haul Truck
4	Funnel Device
5	Roadway
6	Other
7	Bins

SAMPLE_TYPE - Code indicating how samples were taken.

CODE	DEFINITION
1	Fld Mix, Lab Comp
2	Fld Mix and Compacted

SAMPLE_TYPE_ESTAR - Code indicating the aging condition of the samples used for inputs into the Estar predictive models.

CODE	DEFINITION
1	Original Binder
2	RTFO/TFO Aged Binder
3	PAV Aged Binder
4	Field Aged Binder

SEALANT_BONDED_TO_BOTH - Code indicating the extent of sealant bonding to the sides of the joint.

CODE	DEFINITION
1	Little bonding
2	Mostly bonded
3	All bonded

SEALANT_TYPE - Type of pressure relief joint sealant (Rehab sheet 54)

CODE	DEFINITION
1	ASTM D3405
2	Silicone
3	Other

SEAL_CURE_TIME - Code for time allowed to cure prior to traffic application.

CODE	DEFINITION
1	None
2	54 hrs
3	4-8 hrs
4	8-24 hrs
5	1-3 days
6	3-7 days
7	>7 days

SEAL_REASON - Code indicating primary reason for seal coat.

CODE	DEFINITION
1	Seal cracks
2	Improve skid resistance
3	Bleeding
4	Raveling
5	Unknown
6	Other

SEAL_REMOVAL_METHOD - Code indicating method used to remove old sealant.

CODE	DEFINITION
1	No Sealant
2	Not Removed
3	Joint plow V-shaped
4	Joint plow rectangular
5	High pressure water blasting
6	Diamond blade saw
7	Carbide blade saw
8	Pull-out of old compression sealant
9	Other

SEAL_ROLLER - Code for roller used for seating aggregate.

CODE	DEFINITION
1	None
2	Pneumatic
3	Steel Wheel
4	Unknown

SEAL_TYPE - Type of contraction joint sealant (Data Collection Sheets)

CODE	DEFINITION
1	D1850 (ASTM) Cold application type
2	D1190 (ASTM) - M173(AASHTO) Hot poured elastic type
3	D3406 (ASTM) - M282(AASHTO) Hot poured for PCC
4	D3405 (ASTM) - M301(AASHTO) Hot poured for concrete and AC
5	D3542 (ASTM) Preformed Polychloroprene for bridges
6	D2628 (ASTM) Preformed Polychloroprene for concrete
7	Other

SECTION_STAT_INCLUDE_FLAG - Code indicating whether the record is included in the section statistics.

CODE	DEFINITION
1	Parameters in record were included in section statistics.
2	Parameters in record were excluded from section statistics.

SENSORS_LTPP_PIEZO_CABLE - Code explicitly indicating the type of piezo sensor used (Traffic Data Sheet 16)

CODE	DEFINITION
1	Bare Round
2	Bare Flat
3	Channelized Round
4	Channelized Flat
5	Unknown
6	None

SEPARATE_METHOD - How concrete pieces and reinforced steel were separated (REHAB sheet 50.)

CODE	DEFINITION
1	Reinforcing Steel Ruptured During PCC Breakup
2	Reinforcing Steel Cut By Torches
3	Reinforcing Steel Cut by Vibrators or Shears
4	Reinforcing Steel Removed by "Rhino Bars"
5	Other

SHOULDER_RESTORE - Type of shoulder restorations (Rehab sheet 61. Field #8)

CODE	DEFINITION
1	AC Overlay Without Removal Of Existing AC
2	Cold Milling And AC Overlay
3	Complete Shoulder Removal And Replacement
4	In-place Recycling And Overlay
5	Other

SHOULDER_SURFACE_TYPE - Shoulder Surface Type Codes (SPS-1,2,8 Construction Data Sheet 2)

CODE	DEFINITION
1	Turf
2	Granular
3	Asphalt Concrete
4	Concrete
5	Surface Treatment
6	Other

SHOULDER_SYSTEM_TYPE - Code for type of shoulder system.

CODE	DEFINITION
1	JPCC
2	JRCP
3	CRCP
4	Other

SHOULDER_TYPE - Code indicating whether the shoulder information is from the inside or outside shoulder

CODE	DEFINITION
I	Inside
O	Outside

SHRP_TEST - Code indicating the SHRP test designation.

CODE	DEFINITION
SS01	Sieve Analysis of Subgrade Soils
UG01	Washed Sieve Analysis of Unbound Granular Base and Subbase Materials
UG02	Sieve Analysis of Unbound Granular Base and Subbase Materials

SH_JOINT_FORMED - Code for method used to form joint between the shoulder and the traffic lane.

CODE	DEFINITION
1	Butt
2	Keyed
3	Sawed Weakened Plane
4	Insert Weakened Plane
5	Tied Concrete Curb
6	Other

SH_JOINT_FORMED_SPS - Code for method used to form joint between the shoulder and the traffic lane.

CODE	DEFINITION
1	Butt
2	Sawed Weakened Plane
3	Insert Weakened Plane
4	Other

SH_SURFACE_TYPE - Code list for the field sh_surface_type pertaining to geometric,shoulder and drainage information. (Inventory Sheet 2)

CODE	DEFINITION
1	Turf
2	Granular
3	Asphalt Concrete
4	Concrete
5	Surface Treatment
6	Other (Specify)

SIDEWALL_CLEAN - Code indicating the method of cleaning sidewalls prior to resealing. (Maintenance Data Sheet 10)

CODE	DEFINITION
1	None
2	Sandblasting
3	Water blasting
4	Other

SIDEWALL_CLEAN_SPS6 - Code indicating the method of cleaning sidewalls prior to resealing.

CODE	DEFINITION
1	None
2	Air blast
3	Sand blast
4	Water blast
5	Other

SIDEWALL_CLEAN_SPS7 - Code indicating the method of cleaning sidewalls prior to resealing.

CODE	DEFINITION
1	None
4	Other
5	Rectangular
6	Diamond Saw Blade

SIDE_LOCATION - Code indicating side of joint/crack where measurements were taken.

CODE	DEFINITION
1	Approach
2	Leave
3	Neither

SILT_DEBRIS - Presence of silt and debris in lateral opening (Drainage Information Form DI-2)

CODE	DEFINITION
1	Fully Blocked (Buried)
2	Partially Blocked
3	Free

SITE_LOCATION - Indicates location of device relative to LTPP site.

CODE	DEFINITION
O	Other
R	Related
S	Specific

SOIL_CRITERIA - Codes describing criteria of soil (Materials Testing Field Guide, App D.2)

CODE	DEFINITION
1101	Soil Symbol: ML
1102	Soil Symbol: CL
1103	Soil Symbol: MH
1104	Soil Symbol: CH
1201	Plasticity: nonplastic
1202	Plasticity: low
1203	Plasticity: medium
1204	Plasticity: high
1301	Moisture condition: dry
1302	Moisture condition: moist
1303	Moisture Condition: wet
1401	Consistency: very soft
1402	Consistency: soft
1403	Consistency: firm
1404	Consistency: hard
1405	Consistency: very hard
1501	Cementation: weak
1502	Cementation: moderate
1503	Cementation: strong
1601	Structure: stratified
1602	Structure: Laminated
1603	Structure: Fissured
1604	Structure: slickensided
1605	Structure: blocky
1606	Structure: lensed
1607	Structure: homogenous
1701	Dry strength: none
1702	Dry strength: low
1703	Dry strength: medium
1704	Dry strength: high
1705	Dry strength: very high
1801	Dilatancy: none
1802	Dilatancy: slow
1803	Dilatancy: rapid
1901	Toughness: low
1902	Toughness: medium
1903	Toughness: high
2001	Relative Density: 0 - 20%
2002	Relative Density: 20 - 40%
2003	Relative Density: 40 - 70%
2004	Relative Density: 70 - 90%
2005	Relative Density: 90 - 100%

SOIL_CRITERIA - Codes describing criteria of soil (Materials Testing Field Guide, App D.2)

2101	Coarse-grained particles: angular
2102	Coarse-grained particles: subangular
2103	Coarse-grained particles: subrounded
2104	Coarse-grained particles: rounded
2201	Particle shape: flat
2202	Particle shape: elongated
2203	Particle shape: flat and elongated
2301	Reaction with HCL: none
2302	Reaction with HCL: weak
2303	Reaction with HCL: strong

SOURCE_DRY_DENSITY_TDR - Code indicating source of the dry density values used. (Specifications for SMP AUTO Computed Parameters)

CODE	DEFINITION
1	SMP installation report
2	SMP installation report - I07 form
3	SMP installation report - S04 form
4	SMP installation report - I05 form
5	IMS table SMP_DRY_DENSITY
6	IMS table TST_ISD_MOIST
7	Calculated, 95% lab max dry density from IMS table TST_UG05_SS05
8	IMS table INV_SUBGRADE
9	Base dry density from the same section
10	Subgrade dry density value from the same section
11	Global Avg of all available aggregate base dry densities from all the SMP sites
12	TST_SS08
13	From Appendix C of "Analysis of Time Domain Reflectometry Data From LTPP Seasonal Monitoring Program Test Sections-Final Report" FHWA-RD-99-115

SOURCE_SOIL_TYPE - Code describing the source of the SOIL_TYPE field. (Specifications for SMP AUTO Computed Parameters)

CODE	DEFINITION
1	IMS table TST_L05B
2	SMP installation report

SPALLING_AMOUNT - Code indicating amount of spalling.

CODE	DEFINITION
1	None
2	Very little
3	Some
4	Considerable

SPREAD_MIX_METHOD - Code indicating the method of spreading mixture.

CODE	DEFINITION
1	Motor Grader
2	Asphalt Paver
3	Front_Mounted Spreader
4	Towed Spreader
5	Other

SPS9_MINERAL_FILLER - Code indicating the type of mineral filler. (SPS9 DATA COLLECTION SHEETS)

CODE	DEFINITION
1	Stone dust
2	Hydrated lime

SPS9_MINERAL_FILLER - Code indicating the type of mineral filler. (SPS9 DATA COLLECTION SHEETS)

3	Portland cement
4	Fly ash
5	None
6	Other

STABIL_AGENT_INV - Code indicating the type of stabilizing agent used. (INVENTORY Sheet 20)

CODE	DEFINITION
1	AC
2	Emulsified cement
3	Cutback asphalt
4	Portland cement
5	Lime
6	Fly ash CL C
7	Fly ash CL N
8	Other

STABIL_AGENT_SPS - Code indicating the type of stabilizing agent used. (SPS-1 Sheet 14, SPS-2 Sheet 6, SPS-8 Sheet 14)

CODE	DEFINITION
1	Portland cement
2	Lime
3	Fly ash CL C
4	Fly ash CL N
5	Other

START_STOP_METHOD - Code designating the start or stop method.

CODE	DEFINITION
1	Photocell
2	Pendant
3	Distance

STATE_PROVINCE - Standard Codes for States, D.C., Puerto Rico, American Protectorates, and Canadian Provinces (Table A.1 from the DCG)

CODE	DEFINITION
1	Alabama
2	Alaska
4	Arizona
5	Arkansas
6	California
8	Colorado
9	Connecticut
10	Delaware
11	District of Columbia
12	Florida
13	Georgia
15	Hawaii
16	Idaho
17	Illinois
18	Indiana
19	Iowa
20	Kansas
21	Kentucky
22	Louisiana
23	Maine
24	Maryland
25	Massachusetts
26	Michigan
27	Minnesota
28	Mississippi

STATE_PROVINCE - Standard Codes for States, D.C., Puerto Rico, American Protectorates, and Canadian Provinces (Table A.1 from the DCG)

29	Missouri
30	Montana
31	Nebraska
32	Nevada
33	New Hampshire
34	New Jersey
35	New Mexico
36	New York
37	North Carolina
38	North Dakota
39	Ohio
40	Oklahoma
41	Oregon
42	Pennsylvania
44	Rhode Island
45	South Carolina
46	South Dakota
47	Tennessee
48	Texas
49	Utah
50	Vermont
51	Virginia
53	Washington
54	West Virginia
55	Wisconsin
56	Wyoming
60	American Samoa
66	Guam
67	Belgium
68	Austria
69	France
70	Brazil
71	Italy
72	Puerto Rico
73	Chile
78	Virgin Islands
81	Alberta
82	British Columbia
83	Manitoba
84	New Brunswick
85	Newfoundland
86	Nova Scotia
87	Ontario
88	Prince Edward Island
89	Quebec
90	Saskatchewan
91	Australia
92	Denmark
93	Finland
94	Japan
95	Netherlands
96	Norway
97	Sweden
98	United Kingdom

STATUS - Code indicating the status of a section for a given construction event.

CODE	DEFINITION
O	Out-of-study
R	Rejected

STAT_FLAG - Section statistics inclusion flag (MON_DEFL_RGD_BAKCAL_SECT table specification)

CODE	DEFINITION
1	Section statistics are reported.
2	NUMBER - The number of acceptable basins is less than 30 percent or is less than or equal to 3.
3	PCC OVERLAY - PCC and base moduli will not be reported.

STEEL_PLACE_METHOD - Code indicating means of placing the reinforcing steel.

CODE	DEFINITION
1	Chairs
2	Between Concrete Layers

SUBDRAIN_EXTENT - Code for extent of sub drains.

CODE	DEFINITION
1	Continuous
2	Intermittent
3	Adj to Full Depth Repairs

SUBDRAIN_PURPOSE - Code indicating the primary purpose of subdrainage installation.

CODE	DEFINITION
1	Remove Free Water
2	Cut-off Side Hill
3	Lower Water Table
4	Other

SUBDRAIN_TYPE - Code indicating the type of subdrainage.

CODE	DEFINITION
1	Transverse
2	Longitudinal

SUBSEAL_MIXTURE - Type of mixture used in subsealing. (Data Collection Sheets)

CODE	DEFINITION
1	Cement-Loam Top Soil Slurry
2	Cement-Limestone Dust Slurry
3	Cement-Pozzolan Slurry
4	Cement-Fine Sand Slurry
5	Asphalt Cement
6	Other

SUBSEAL_MIX_TYPE - Code indicating the type of material used for undersealing the pavement.

CODE	DEFINITION
1	Cement-loam top soil slurry
2	Cement-limestone dust slurry
3	Cement-pozzolan slurry
4	Cement-fine sand slurry
5	Other

SUB_DRAINAGE_TYPE - Code for type of subsurface drainage provided.

CODE	DEFINITION
1	None
2	Long
3	Trans
4	Blanket
5	Well
6	Blanket W/Long Drains
7	Other

SUPPLY_UNIT - Code indicating unit of supply for sealant.

CODE	DEFINITION
1	Ounce
2	Quart
3	Gallon
4	Pound
5	Feet

SURFACE_COND - Code indicating the surface condition at time of seal application.

CODE	DEFINITION
1	Badly Oxidized
2	Slightly Oxidized
3	Normal
4	Slightly Flushed
5	Flushed
6	Flushed only in Wheel Paths
7	Other

SURFACE_MAT - Pavement Surface Material Type Codes (Table A.5 from the DCG)

CODE	DEFINITION
1	Hot Mixed, Hot Laid Asphalt Concrete, Dense Graded
2	Hot Mixed, Hot Laid Asphalt Concrete, Open Graded (Porous Friction Course)
3	Sand Asphalt
4	Portland Cement Concrete (JPCP)
5	Portland Cement Concrete (JRCP)
6	Portland Cement Concrete (CRCP)
7	Portland Cement Concrete (Prestressed)
8	Portland Cement Concrete (Fiber Reinforced)
9	Plant Mix (Emulsified Asphalt) Material, Cold Laid
10	Plant Mix (Cutback Asphalt) Material, Cold Laid
11	Single Surface Treatment
12	Double Surface Treatment
13	Recycled Asphalt Concrete Hot, Central Plant Mix
14	Recycled Asphalt Concrete Cold Laid Central Plant Mix
15	Recycled Asphalt Concrete Cold Laid Mixed-In-Place
16	Recycled Asphalt Concrete Heater Scarification/Recompaction
17	Recycled Portland Cement Concrete JPCP
18	Recycled Portland Cement Concrete JRCP
19	Recycled Portland Cement Concrete CRCP
20	Other

SURFACE_MOISTURE - Code indicating pavement surface moisture condition.

CODE	DEFINITION
1	Dry
2	Wet

SURFACE_MOISTURE_SPS34 - Code indicating pavement surface moisture condition.

CODE	DEFINITION
1	Dry
2	Mostly Dry
3	Somewhat Damp
4	Wet

SURFACE_PREP - Pavement surface preparation. (Data Collection Sheets)

CODE	DEFINITION
1	None
2	Sweep clean only
3	Cold mill
4	Shot blast
5	Other

SURFACE_PREP_CRACK_SEAT - Code indicating method of surface preparation.

CODE	DEFINITION
1	None
2	Sweeping
3	Tack coat
4	Leveling course
5	Full depth repair
6	Other

SURFACE_PREP_OVERLAY - Code indicating method of surface preparation.

CODE	DEFINITION
1	None
2	Broomed
3	Broomed and asphaltic tack coat
4	Asphaltic tack coat only

SURFACE_PREP_RHB - Code indicating method of surface preparation.

CODE	DEFINITION
1	None
2	Sweep
3	Air Blast
4	Water blast
5	Sand Blast
6	Cold Mill
7	Shot Blast
8	Other

SURFACE_TEXTURE - Code indicating type of surface texture.

CODE	DEFINITION
1	Rough and Open
2	Somewhat Rough and Open
3	Somewhat Smooth and Tight
4	Smooth and Tight

SURFACE_TREAT_TYPE - Code for surface treatment.

CODE	DEFINITION
1	None
2	Aggregate
3	Fog Seal
4	Slurry Seal
5	Sand Seal
6	HMAC Overlay
7	Other

SWELL_PRESSURE_TEST - Codes for swell pressure tests (Individual Data Sheet)

CODE	DEFINITION
1	AASHTO T190 OR ASTM D2844
2	AASHTO T258, METHOD 1
3	OTHER

S_CLASS - Codes for AASHTO soil classification numbers. (Materials Testing Field Guide, Table D.3)

CODE	DEFINITION
501	A-1
502	A-1-a
503	A-1-b
504	A-3
505	A-2
506	A-2-4
507	A-2-5
508	A-2-6
509	A-2-7
510	A-4
511	A-5
512	A-6
513	A-7
514	A-7-5
515	A-7-6

TACK_COAT_MATL - Code indicating type of asphaltic tack coat material used.

CODE	DEFINITION
1	None
2	SS-1
3	SS-1H
4	CRS-1
5	CRS-2
6	CMS-2
7	CMS-2H
8	CSS-1
9	CSS-1H
10	Other

TDR_COMMENT - Code indicating error in the computation process or explaining why the trace was not interpreted.

CODE	DEFINITION
1	TDR trace uninterruptible due to lack of negative slope
2	Questionable data due to low dry density value
3	Calibration data from installation activities are unavailable
4	Outlier data based on time series analysis
5	Volumetric moisture content was in transition zone and was adjusted

TEMP_SOURCE - Code indicating the source of the temperature data used in the freeze state determination.

CODE	DEFINITION
1	Based on measured
2	Derived using EICM

TEST_NO - Location of sample with respect to section (Test data sheets)

CODE	DEFINITION
1	Material sample obtained from area adjacent to approach end of test section.
2	Material sample obtained from area adjacent to leave end of test section.
3	Material sample obtained within test section limits.
4	Material sample combined from different areas of a test section.
5	Material sample combined from multiple test sections.
6	First additional sample obtained from area adjacent to approach end of test section.

TEST_NO - Location of sample with respect to section (Test data sheets)

7	First additional sample obtained from area adjacent to leave end of test section.
8	First additional sample obtained within test section limits.
9	First additional sample combined from different areas of test section.
10	First additional sample combined from multiple test sections.
11	Second additional sample obtained from area adjacent to approach end of test section.
12	Second additional sample obtained from area adjacent to leave end of test section.
13	Second additional sample obtained within test section limits.
14	Second additional sample combined from different areas of test section.
15	Second additional sample combined from multiple test sections.

TEST_PURPOSE - Code indicating purpose of the test.

CODE	DEFINITION
1	Determine need for undersealing
2	Slab stability after initial grouting
3	Slab stability after regrout
4	Post construction monitoring

TEST_TYPE - Code indicating what type of k-value test was used.

CODE	DEFINITION
1	T221/D1195
2	T222

TEXTURING - Code indicating method used to provide a surface texture on the concrete.

CODE	DEFINITION
1	Tine
2	Broom
3	Burlap Drag
4	Grooved float
5	Astro turf
6	None
7	Other

THERM_PROBE_DESIGN - Code indicating the type of pavement temperature probe design used.

CODE	DEFINITION
1	Standard LTPP temperature probe
2	Other

THICKNESS_CODE - Code describing how the layer thickness was determined.

CODE	DEFINITION
91	Intact cores Protocol P31
92	Avg from field exploration logs
93	Intact cores >= 3"
94	LD ratio 1.0 correction factor of 0.87

TRACE_TYPE - Code indicating the TDR trace type. (Specifications for SMP AUTO Computed Parameters)

CODE	DEFINITION
1	Automatically processed using Method of Tangents (TG)
2	Automatically processed using Method of Peaks

TRACE_TYPE - Code indicating the TDR trace type. (Specifications for SMP AUTO Computed Parameters)

	(PK)
3	Manually identified using Method of Tangents (MT)
4	Manually identified using Method of Peaks (MP)

TRANSFER_DEVICE - Code indicating material used to grout or epoxy load transfer devices into drilled or preformed hole

CODE	DEFINITION
1	None
2	Grout Filler
3	Epoxy Filler
4	Other

TRANSFER_SYS - Code for type of joint load transfer system used.

CODE	DEFINITION
1	None
2	Dowel Bars
3	Tie Bars
4	Undercutting
5	Aggregate Interlock
6	Other

TRANS_CONT_JLTS_INV - Code for transverse contraction joint load transfer system.

CODE	DEFINITION
1	Round dowels
2	Aggregate interlock
3	I-beams
4	Star lugs
5	Other

TRANS_CONT_JLTS_RHB - Code for transverse contraction joint load transfer system.

CODE	DEFINITION
1	Round dowel
2	Aggregate interlock
3	I-Beams
4	Star lugs
5	Keyways
6	Other

TRANS_CONT_JLTS_SPS - Code for transverse contraction joint load transfer system.

CODE	DEFINITION
1	Round dowel
2	Aggregate interlock
3	Other

TRANS_JOINT - Code indicating type of transverse joints.

CODE	DEFINITION
1	None
2	All Expansion
3	All Contraction
4	Mixture

TRANS_METHOD - Code indicating method used to form transverse joints.

CODE	DEFINITION
1	Sawed
2	Plastic insert

TRANS_METHOD - Code indicating method used to form transverse joints.

3	Metal insert
4	Other

TRANS_SEAL_TYPE - Code indicating type of joint sealant used in transverse joints.

CODE	DEFINITION
1	Preformed
2	Asphalt
3	Rubberized asphalt
4	Low-modulus silicone
5	Other

TREAT_TYPE - Base and Subbase Materials Description (Field Material Sampling Guide, Table D.4)

CODE	DEFINITION
180	Treated Subgrade Soil
181	Lime Treated Soil
182	Cement-Treated Subgrade Soil
183	Bituminous Treated Subgrade Soil
302	Gravel (uncrushed)
303	Crushed Stone
304	Crushed Gravel
305	Crushed Slag
306	Sand
307	Soil-Aggregate Mixture (predominantly fine-grained)
308	Soil-Aggregate Mixture (predominantly coarse-grained)
310	Other (Specify if possible)
319	HMAC
320	Sand Asphalt
321	Asphalt Treated Mixture
322	Dense Graded, Hot Laid, Central Plant Mix
323	Dense Graded, Cold Laid, Central Plant Mix
324	Dense Graded, Cold Laid, Mixed In-Place
325	Open Graded, Hot Laid, Central Plant Mix
326	Open Graded, Cold Laid, Central Plant Mix
327	Open Graded, Cold Laid, Mixed In-Place
328	Recycled Asphalt Concrete, Plant Mix, Hot Laid
329	Recycled Asphalt Concrete, Plant Mix, Cold Laid
330	Recycled Asphalt Concrete, Mixed In-Place
331	Cement Aggregate Mixture
332	Econocrete
333	Cement-treated Soil
334	Lean Concrete
335	Recycled Portland Cement Concrete
336	Sand-Shell Mixture
337	Limerock, Caliche
338	Lime-Treated Soil
339	Soil Cement
340	Pozzolanic-Aggregate Mixture
341	Cracked and Seated PCC Layer
350	Other
351	Treatment: Lime, all classes of quick lime and hydrated lime
352	Treatment: Lime-flyash
353	Treatment: Lime - and cement flyash
354	Treatment: Cement - Portland cement
355	Treatment: Bitumen - includes all classes of bitumen and asphalt treatments
356	Treatment: Calcium chloride
357	Treatment: Sodium Chloride
358	Treatment: Other chemical treatment - includes polymer stabilization

TREAT_TYPE - Base and Subbase Materials Description (Field Material Sampling Guide, Table D.4)

360	Treatment: Other (specify if possible or unknown)

TRF_CAL_PROTOCOL - Code indicating originating agency providing validation/calibration protocol (WIM/AVC).

CODE	DEFINITION
0	Auto-calibration
12	Florida calibration protocol
102	COST 323 - no specifics
100B	LTPP SPS WIM
101W1	ASTM E-1318-94
101W2	ASTM E-1318-02
101W3	ASTM E-1318-09

TRF_DATA_TYPE - Type of data used to create value (Software Specifications)

CODE	DEFINITION
0	Classification and Weight
3	Volume
4	Classification
7	Weight

TYPE_EQUIPMENT_CALIB - Code indicating type of equipment calibrated (Traffic Data Sheet 16)

CODE	DEFINITION
1	WIM
2	AVC
3	Both

TYPE_LOC_FILTER - Code indicating the type and location of secondary filter material (if applicable).

CODE	DEFINITION
1	Fabric Encap. Primary Filter
2	Fabric Encap Drain Pipe
3	Other

UNIFORMITY - Code describing the distribution of the asphalt aggregate

CODE	DEFINITION
N	Non-uniform
U	Uniform

UN_SATISFACTORY - Code indicating whether or not the data item is acceptable.

CODE	DEFINITION
S	Satisfactory
U	Un-satisfactory

VEHICLE_CLASS - Codes indicating vehicle class (Traffic Monitoring Guide, Traffic Sheet 5)

CODE	DEFINITION
1	FHWA Class 1 (Motorcycles)
2	FHWA Class 2 (Cars) or Classes 1-3 combined [Traffic Sheet 5]
3	FHWA Class 3 (Vans)
4	FHWA Class 4 (Buses)
5	FHWA Class 5 (Two axle, 6-Tire, Single-unit truck)
6	FHWA Class 6 (Three axle Single-unit truck)
7	FHWA Class 7 (Four or more axle Single-unit truck)
8	FHWA Class 8 (Four or less axle, one trailer truck)
9	FHWA Class 9 (Five axle, one trailer truck)

VEHICLE_CLASS - Codes indicating vehicle class (Traffic Monitoring Guide, Traffic Sheet 5)

10	FHWA Class 10 (Six or more axle, one trailer truck)
11	FHWA Class 11 (Five or less axle, multi trailer truck)
12	FHWA Class 12 (Six axle, multi trailer truck)
13	FHWA Class 13 (Seven or more axle, multi trailer truck)
14	Other vehicles
15	Unknown
A-T	Agency specific vehicle classification as listed on Traffic Sheet 7

VISUAL_ACPC - Combination of visual_ac and visual_pcc

CODE	DEFINITION
1	Intact core; excellent condition
2	Hairline cracks on the surface; no visible vertical crack within 1/3 of length
3	Cracks and/or voids visible along with the side of the core.
4	Badly cracked or damaged core; unsuitable for testing.
5	Ridges on the sides of the cores; condition should be recorded if used.
6	Very rough and uneven bottom surface.
7	Core severely damaged from sampling, handling, etc. Unsuitable for testing.
8	Core was sawed in laboratory for removing it from the underlying bonded layer.
9	Core consisted of 2 or more AC layers. Core to be sawed & assigned layer numbers
10	Visible separation of one or more layers. Layers to be sawed & assigned numbers
11	Visible segregation of coarse & fine aggregates over 25% of surface area of core
12	Voids in the matrix of the AC mixture are observed along the sides of the core.
13	Voids due to loss of coarse & fine aggregate observed along the sides of core.
14	Core missing significant portions, unsuitable for testing.
15	Coarse aggregate along face of core contains 50% or more of crushed materials
16	Coarse aggregate along face of core is mix of uncrushed gravel & crushed stone
17	More than 10% of core surface area contains soft aggregate particles/clay balls.
18	Slight stripping.
19	Severe stripping.
20	Slight bleeding.
21	Severe bleeding.
22	Skewed core.
51	Intact core; excellent condition.
52	Hairline cracks on the surface; suitable for testing.
53	Cracks and/or voids visible along the side of the core; suitable for testing.
54	Badly cracked or damaged core; unsuitable for testing.
55	Ridges on the sides of the cores; condition should be recorded if used for test.
56	Very rough and uneven bottom surface.
57	Core severely damaged during handling; unsuitable for testing.
58	Core was sawed in laboratory for removing it from the underlying bonded layer.
59	Core consisted of 2 or more layer. Core was assigned & assigned layer numbers.

VISUAL_ACPC - Combination of visual_ac and visual_pcc

60	Visible separation of one or more layers; layers separated and assigned numbers.
61	Segregation of coarse & fine aggregates observed over 25% of core surface area.
62	Voids in the matrix are observed along the sides of the core.
63	Voids due to loss of coarse & fine aggregates observed along sides of core.
64	Core is missing significant portions. Unsuitable for testing.
65	Coarse aggregate are generally crushed stone with predominately fractured faces.
66	Coarse aggregate along face of core is mix of uncrushed gravel & crushed stone.
67	The exposed aggregates along face of core are lightweight aggregate concrete.
68	More than 10% of core surface area contains soft aggregate particles/clay balls.
69	Cracks are generally across or through the coarse aggregate.
70	Cracks are generally around the periphery of the coarse aggregate.
71	Cracks are associated with embedded steel.
72	Rims are observed on aggregate.
73	Fine aggregate is natural sand.
74	Fine aggregate is manufactured sand.
75	Fine aggregate is a mixture of natural and manufactured sand.
76	Steel is present in the core.
77	Steel is corroded.
78	Core indicates D-cracking.
79	Core indicates deterioration due to freeze-thaw cycles.
80	Core indicates sulfate attack.
81	Core indicates alkali silica reactivity
82	Skewed core.
99	Other comment

VOLUMETRIC_MOISTURE_MODEL - Code indicating model used to compute volumetric moisture content. (Specifications for SMP AUTO Computed Parameters)

CODE	DEFINITION
1	3rd polynomial model with only Ka as ind var for coarse-grained soil (Coarse-Ka)
2	3rd polynomial model with only Ka as ind var for fine-grained soil (Fine-Ka)
3	3rd polynomial model with only Ka as ind var for all soil types (AllSoil-Ka)
4	Fine-grained soil mdl with ind vars Ka, gradation params, plastic & liquid limit

WATER_DISCOLORATION - Code describing the water discoloration.

CODE	DEFINITION
M	More than slight
N	None
S	Slight

WATER_FLOW - Flow of water in edge drain system (Drainage Information Form DI-2)

CODE	DEFINITION
1	Standing
2	Free Flowing
3	None

WEIGHT_COUNT_LANE - Code describing the lane(s) in which the truck weight measurements were made (Traffic sheet 8; TMG)

CODE	DEFINITION
0	All lanes in the same direction
1	Curb lane or lane adjacent to shoulder or outside edge of pavement
2	Lane adjacent to the curb lane on four lane highway or adjacent to median on divided four lane highway.
3	Lane adjacent to centerline or median on six lane highway.
4-9	Other lane designation if highway has four or more lanes in one direction.

WEIGHT_COUNT_PURPOSE - Purpose of weight count (Traffic sheet 8)

CODE	DEFINITION
1	Data collection
2	Enforcement
3	Other/Unknown

WEIGHT_EQUIPMENT_TYPE - Type of equipment used for weighing (Traffic sheet 8)

CODE	DEFINITION
1	Permanent Scale
2	Permanent WIM
3	Portable Scale
4	Portable WIM
5	Unknown or Other

WIM_AUTO_CALIB - Code indicating the auto-calibration status (Traffic Data Sheet 16)

CODE	DEFINITION
N	Auto-calibration off
U	Auto-calibration status unknown
Y	Auto-calibration on

WIM_CALIB_TECHNIQUE - Code indicating type of calibration technique used for WIM equipement (Traffic Monitoring Guide (TMG), 4th Edition with additions)

CODE	DEFINITION
A	ASTM Standard E-1318
B	Subset of ASTM Standard E1318
C	Combination of test trucks and trucks from the traffic stream (but not ASTM E1318)
D	Other sample of trucks from the traffic stream
I	Instrumented truck
L	LTPP SPS WIM protocol
M	Moving average of the steering axle of 3S2s
S	Static calibration
T	Test trucks only
U	Uncalibrated
Z	Other method

WIM_CALIB_TRUCK_SUSPNSN - Code indicating type of equipment calibrated (Traffic Data Sheet 16)

CODE	DEFINITION
1	Air bag
2	Leaf spring
3	Other

WS_TYPE - Code indicating type of weather station

CODE	DEFINITION
C	Co-operative

WS_TYPE - Code indicating type of weather station

F	First order

YES_NEVER - Code indicating if the answer if yes, no, or never.

CODE	DEFINITION
1	Yes
2	Usually
3	Sometimes
4	Never
5	N/A

YES_NO - Code indicating if the answer if yes or no.

CODE	DEFINITION
1	Yes
2	No
3	N/A

Y_N - Yes (Y) or No (N) code.

CODE	DEFINITION
N	No
Y	Yes