LTPP Pavement Performance Database
Release Notes
Data Release 21
January 2007

Introduction

The Long-Term Pavement Performance (LTPP) program has collected a large quantity of data and information on the performance of selected in-service pavement test sections in North America. These data are designed to serve a broad range of research needs related to pavement performance in the areas of pavement engineering, pavement materials engineering, and pavement management. A primary mission of LTPP is to provide access to this data and related information to researchers, highway agency personnel, and others interested in pavement performance related research.

Standard Data Release

To serve this mission, LTPP developed a Standard Data Release (SDR) that provides access to its data in a convenient format, free of charge. The LTPP SDR is delivered in Microsoft® Access 2000 format on multiple CD-ROMs or a single DVD. As the LTPP program is an on-going operation, new releases contain data from previous releases, additional data collected since the last release, new data elements still being populated, changes made in response to errors in previously released data, and updates. SDR data is extracted from the production Pavement Performance Database (PPDB) and is divided by data module into multiple relational databases due to limitation on the size of Access databases. FWD and profile data tables are further subdivided by highway agency, and Seasonal Monitoring Program (SMP) tables and Climate tables are separated into multiple databases for the same reason. The database modules are delivered in a compressed zip format.

Starting with data release 20, a **LTPP Reference Library** is distributed with the SDR on 2 CDs or 1 DVD. The reference library contains the following:

- **Pavement Performance Database User Reference Guide** updated for this data release. The user reference guide provides data users with information on the contents of each SDR data module, an explanation of the relational structure of data tables, tips and examples for using LTPP data, and a listing of other reports that document the design of the LTPP experiments, data collection protocols, testing protocols, quality control checks, construction reports, and other items related to data quality. Data users are urged to review the information contained in this document.

- **LTPP Information Management System, IMS Quality Control Checks.** This document contains a listing of all of the automated data quality control checks performed on data after entry into the PPDB.
- **Table Navigator Software** updated for this data release. The Table Navigator software is a stand alone program that provides a point and click user interface to descriptions of all tables included in the data release, descriptions of all fields included in all table, and meaning of codes stored in code fields.
- **ESALCalc Software.** The ESALCalc software provides a tool for a data user to compute 18-kip (80-kN) Equivalent Single Axle Load applications on an annual basis based on the AASHTO86 formulation. In order to run the program, a user must assemble the input database from tables contained in the SDR. Instructions are contained in the ESALCalc user guide on how to prepare this database.
- **LTPP Data Analysis Reports**. LTPP data analysis reports published by FHWA are included in the reference library. Some of these reports document algorithms used to populate tables containing computed parameters such as rut depth.
- **LTPP Data Collection Guides**. LTPP is in the process of updating its data collection guidelines to reflect changes that have occurred over time. The most current versions of the data collection guides are included.
- **SHRP LTPP Documents**. The LTPP documents developed under the Strategic Highway Research Program that document many of the early planning efforts and analyses are contained in this portion of the library.
- **Data Analysis/Operations Feedback Report (DAOFR).** A Data feedback report form is included that a user can use to report errors in the data. A user is encouraged to contact LTPP customer service before submitting such a DAOFR to ascertain if the issue is truly an error or a data misunderstanding.
- **LTPP Products Information**
- **Other LTPP documents**

Data users can also find updated information about the LTPP program at the LTPP web site at http://www.fhwa.dot.gov/pavement/ltpp/. A DAOFR and satisfaction questionnaire can also be accessed on this web site.

Data users can contact the LTPP Customer Support Service Center with questions, comments, and requests for more copies of the SDR or other LTPP information by phone at (202) 493-3035 or at the email address ltppinfo@fhwa.dot.gov. Written inquires can be sent to:

LTPP Customer Support
c/o Larry Wiser
Long Term Pavement Performance
Federal Highway Administration, HRDI-13
6300 Georgetown Pike
McLean, Virginia 22101-2296

Data Usage

While the LTPP program has taken due diligence and reasonable care in providing quality data, data users assume responsibility for conclusions based on interpretation of data collected by the LTPP program. If a published report, paper, or technical document is generated using results from LTPP data, a statement **must** be included indicating that LTPP data were used, date of the data release used, and references to non-LTPP data sources used.

LTPP data and information are distributed under the sponsorship of the United States Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its content or use thereof.

The U.S. Government does not endorse products or manufacturers. Trade and manufacturers' names appear in the database and documentation only because they are considered to be essential.

Data Release Notes

The following portion of this document contains notes on the contents, changes, and updates made to each version of the SDR. This is followed by more specific information on other data user aids, data quality checks, reference tables common to all data modules, and traffic data. Notes on prior data releases are maintained in this document for historical purposes.

Release 21

This is the 21st national release of data from the LTPP program. Some of the notable updates, additions, deletions, and changes made to the data since the November 2005 data release include the following:

Tables Added

TST_SS14_UG14_MASTER, TST_SS14_UG14_DATA, and TST_SS14_UG14_COMMENTS. These three tables contain the results from Dynamic Cone Penetrometer tests performed on SPS test sections as part of the SPS Materials Action Plan. This data release contains measurements from several sections. More data is expected to become available in the next data release.

TST_SAMPLE_COMBINE. The purpose of this table is to document the multiple locations used when a sample is combined in order to have enough material to perform a laboratory test. For example, it is often necessary to combine samples of unbound material from different core/borehole locations since the layer is not thick enough to provide enough material to be obtained from one hole. A new sample numbering convention code is being used, which uses an X in the SAMPLE_NO field to indicate the sample is a combined sample. This new convention will be used for materials from the SPS Materials Action Plan. If resources permit, attempts will be made in the future to add entries to this table for previously combined samples which currently use the * or ** convention in the SAMPLE_NO field.

TST_SAMPLE_BASIC_INFO. This table is a view that combines basic sampling information from all the other sampling tables to make certain internal automated quality control checks operations easier, and to provide the user with a single source for sampling information. Information contained in this table comes from TST_ASPHALT_CEMENT, TST_FRESH_PCC, TST_SAMPLE_BULK_AC_AGG, TST_SAMPLE_COMBINE, TST_SAMPLE_LAB_AC_MIX, TST_SAMPLE_LOG, TST_SAMPLE_LOG_LAB, TST_SAMPLE_LOG_SPS_3_4, and TST_UNCOMP_BITUMINOUS.

Tables Removed:

The results of the backcalculation analysis performed on Falling Weight Deflectometer (FWD) data extracted from the database in 1997 have been removed from the SDR because the results of the analysis were valid for a fixed point in time and the rest of the database is dynamic. If users are interested in obtaining this data they should request a copy of SDR 20 from LTPP customer services. The following tables containing the results of the backcalculation analysis removed are:

MON_DEFL_FLX_BAKCAL_BASIN
MON_DEFL_FLX_BAKCAL_LAYER
MON_DEFL_FLX_BAKCAL_POINT
MON_DEFL_FLX_BAKCAL_SECT
MON_DEFL_FLX_NMODEL_POINT
MON_DEFL_FLX_NMODEL_SECT
MON_DEFL_RGD_BAKCAL_BASIN
MON_DEFL_RGD_BAKCAL_LAYER
MON_DEFL_RGD_BAKCAL_POINT
MON_DEFL_RGD_BAKCAL_SECT

MON_CATEGORY. This table is being discontinued due to changes to monitoring frequencies in response to the LTPP budget under the SAFETEA-LU legislation. The new monitoring frequencies are contained in LTPP Directive GO-38 available from the WWW.LTPP.ORG web site.

Other Notes:

Data from the SPS Materials Action Plan

The SPS Materials Action Plan (MAP) was initiated to address the issue of missing materials test data from test sections in the Specific Pavement Study (SPS) experiments. This data release contains the first material test results from this activity. A partial set of data updates are contained in this data release since material sampling and testing are still being performed. This data release contains more material sampling data than material property test results since testing always lags behind field sampling.

Data from the SPS Traffic Pooled Fund Study

The traffic pooled fund study is designed to address deficiencies and improve the quality and quantity of monitored traffic data from the SPS 1, 2, 5, 6, and 8 projects. This five-year study consists of two phases. Phase I consists of assessing, evaluating, and calibrating the current Weigh-In-Motion (WIM) and Vehicle Classification (VC) systems used to collect traffic data at the SPS sites across the country. Phase II consists of installing and maintaining new WIM equipment as necessary to ensure high-quality data collection. This is the first release of data from Phase II of the study for the Colorado SPS-2, Maryland SPS-5, and Illinois SPS-6 project sites. The data release also contains traffic data from sites validated as part of Phase I from Florida SPS-1 and 5, Ohio SPS-1 and 2, Texas SPS-1, and Michigan SPS-1.

Photographic Distress and Transverse Profile Data Reconciliation

After SDR 20, a major effort was made to reconcile pavement distress and transverse profile measurements performed using photographic based technology. The objective of this reconciliation was to resolve discrepancies between field measurements and data contained in the database. This effort has resulted in the addition of approximately 600 distress surveys stored in the MON_PADIAS42_* tables and 1,400 transverse profile measurements stored in the MON_T_PROF_* tables. Some of these data date back to the start of pavement test sectioning monitoring in1990.

NOTICE: The remaining portion of these release notes are a copy of the notes that accompanied previous releases. These are included for continuity and historical reference. Any data issues reported in these notes may no longer be valid, or may have since been resolved. Users should refer to the LTPP website to view the current list of Data

Analysis/Operations Feedback Reports (DAOFR) and their status to determine known data issues that may affect their research. http://www.fhwa.dot.gov/pavement/ltpp.

Release 20.0

This was the 20th national release of data from the LTPP program. This release contains some revisions to data included in the January 2005 Data Release. In addition, several tables have been added to this release as noted below:

Tables Added:

TST_SAMPLE_BULK_AC_AGG: This new table in the Material Testing module contains information on bulk aggregate sampled at asphalt concrete plants for test sections included in the SPS-9 Superpave experiment.

TST_SAMPLE_LAB_AC_MIX: This new table in the Material Testing module contains information on laboratory mixed AC samples for test sections included in the SPS-9 Superpave experiment.

Tables Removed:

RHB_ACO_SP_PROP: This table was added in SDR 19 and has no data in it yet. It will be included in future releases if data becomes available.

Other Additions to Release 20.0:

CONSTRUCTION_NO added to tables:

The field CONSTRUCTION_NO field was added to the following Material Testing tables: TST_ASPHALT_CEMENT, TST_FRESH_PCC, TST_SAMPLE_BULK_AC_AGG, TST_SAMPLE_LOG_SPS_3_4, TST_UNCOMP_BITIMINOUS.

Other Notes:

Backcalculation Tables:

This is the last release of the FWD backcalculation tables in the SDR. This data was calculated from FWD data that was available in 1997. It has become cost prohibitive to continue updates and support these data elements in response to changes and corrections are made to the baseline FWD data. An update was made to these tables to remove records which could no longer be traced to the source FWD data, and to correct these tables with changes made to the source data tables.

MON_T_PROF_CROSS_SLOPE table

Population of this table for manual transverse profile measurements for all previous measurements was completed for this data release. From this data, a data user now has the capability of determining if ruts can hold water from a transverse cross slope perspective.

Known Data Issues Not Yet Reported

The mechanism for reporting LTPP data problems is currently called the Data Analysis/Operations Feedback Report (DAOFR). LTPP data users can view resolved and unresolved DAOFR at the LTPP web site: http://www.fhwa.dot.gov/pavement/ltpp.
The following unresolved data issues reported in the release notes for data release 19, have not yet been fully addressed. DAOFR will be prepared in the near future to better document these previously identified problems. Unresolved data problems previously identified in this data upload have already been submitted as DAOFRs to FHWA.

Table	Problem
AWS_HOURLY_DATA	For site 350101, the pyranometer readings are suspect.
MON_DIS_JPCC_FAULT	For certain sections, the faulting values are very inconsistent over time.
MON_DIS_JPCC_FAULT	The POINT_LOC value assigned to a given crack or joint varies slightly over time on some sections
MON_DIS_JPCC_FAULT	For certain POINT_LOC's on given section, there are large spikes in the measured faulting value.
MON_DIS_JPCC_FAULT	For a given POINT_LOC, the CRACK_OR_JOINT designation changes over time for some sections.
MON_DIS_*_REV	Many null values should in fact be recorded as zero.
MON_DIS_AC_REV	The fatigue cracking values on 010102 are suspect.
MON_DIS_CRCP_REV	For 185518, OTHER indicates multiple patches, while the patching fields indicate only one.
MON_DIS_AC_REV	For a number of sites, BEFORE_TEMP and AFTER_TEMP are zero during summer months, indicating that the values should probably be null instead.
MON_DIS_JPCC_REV	Inconsistent rating of transverse cracking on sections 290704, 290705
MON_DIS_JPCC_REV	inconsistent rating of map cracking on section 100210
MON_DIS_JPCC_REV	On section 124000, 7/21/99, OTHER indicate presence of map cracking, though map cracking field contain zeroes.
MON_DIS_JPCC_REV	For the 8/7/91 survey on the 2906** sections, OTHER indicates pumping, while the pumping fields indicate none.
MON_DIS_JPCC_REV	For 18A430, 5/1/91and 370201, 9/19/02, OTHER indicates polished aggregate, but POLISH_AGG_A = 0.
MON_DIS_JPCC_FAULT	EDGE and WHEELPATH measurements differ by > 12mm
SMP_ATEMP_RAIN_HOUR	Temperatures very low for certain dates on sections 131031(-42) and 351112 (-49)
SMP_ATEMP_RAIN_DAY	hourly average in HOUR outside min and max values in DAY
SMP_ELEV_PCC_DATA	Sections 274040(9/22/93), 484143(9/25/97), and 833802(various dates) have questionable elevation data.
SMP_ELEV_AC_DATA	Questionable elevation data on 310114, 390901, 460804,

Table	Problem
	469187, 501002, 831801, and 906405.
SMP_MRCTEMP_AUTO_DAY_STATS	483739, THERM_NO =18(after 5/6/00) and 11(after6/6/00) have very high values - looks like bad sensor.
SPS9_PMA_PROFILE	180901, 0902, 0904, and 0905 have zero PROFILE_INDEX, which is not a reasonable value.
TRF_EQUIPMENT_MASTER	Where sensor type is null, it should be N.
TST_AC01_LAYER	Sections/layers: 04_1021 layers 6,7; 18_5518 layers 9,10; 18_6012, layer 11; 19_3006 layers 5,6; 19_3055 layers 5,6; and section 27_1085 layer 5, do not have matching layers in TST_L05B
Various	In many TST tables, there are SAMPLE_NO entries that do no have a match in one of the sampling tables.
Various	In many TST tables, there are LOC_NO entries that do no have a match in one of the sampling tables.
TST_AC02	For many sections, the LAYER_NO reported does not have a match in TST_L05B.
TST_AC04	comments indicate multiple samples, but LOC_NO or SAMPLE_NO are for a single sample.
TST_AE01	There are many ASH_CONTENT values over 2, which may indicate the test was not performed properly.
TST_HOLE_LOG	Many section have holes with locations far outside section boundaries (+/1 200').
TST_HOLE_LOG	Ther are many records with negative TRANS_POS, but a LOC_NO not indicative of shoulder testing.
TST_HOLE_LOG	Many of the values in REPL_LOC_NO are not in LOC_NO for that section.
TST_HOLE_LOG	For many SPS testing locations, POINT_LOC is within another section according to SPS_PROJECT_STATIONS.

Release 19.0

This is the 19th national release of data from the LTPP program. This release contains some revisions to data included in the July 2004 Data Release. This Data Release also includes a new software program, ESALCalc. In addition, several tables have been added to this release and some deleted, as noted, below:

Tables Added:

MON_T_PROF_CROSS_SLOPE: This new table contains the elevation of the last data point, relative to the begin point, of manual transverse profile measurements made using the Dipstick device. This allows the transverse profile data to be de-normalized so that the true elevation profile, relative to the outside edge of the pavement lane, may be computed. This table is expected to be fully populated in 2006.

SMP_TDR_MANUAL_MOISTURE: This table contains volumetric and gravimetric moisture content computed from dielectric constants interpreted and calculated from manually recorded TDR traces.

CLM_VWS_HUMIDITY_DAILY, CLM_VWS_PRECIP_DAILY, CLM_VWS_TEMP_DAILY, CLM_VWS_WIND_DAILY: These four tables were created to mirror similar monthly and annual climatic tables and to allow more selective analysis of the various daily data elements. These tables replace the table CLM_VWS_DATA_DAILY. In addition, all Climatic tables contain data that were recomputed from Level E data provided by a national weather agency.

RHB_ACO_SP_* Tables

Three new Rehabilitation tables were added to this SDR. These tables are used for non-recycled asphalt pavement overlays using SuperPave properties. The tables and their description are listed in the table below:

SDR Table Name	Contents
RHB_ACO_SP_AGGR_PROP	This table contains Superpave AC overlay aggregate properties
RHB_ACO_SP_MIX PROP	This table contains Superpave AC overlay mixture properties as placed
RHB_ACO_SP_PROP	This table contains Superpave AC overlay asphalt cement properties

Tables Removed:

MON_T_PROF_DEV_CONFIG: This table contains information on equipment configuration settings used to capture, digitize, and interpret transverse profile measurements using the photographic and manual dipstick measurement methods. Note that transverse profile measurements based on the photographic method are obtained at the same time as the photographs for the film-based distress interpretations. Since this table provides little information to the data user, it is no longer included in the SDR.

Rehabilitation Tables

Several Rehabilitation tables were removed from this Data Release since there are no data stored in the tables. Listed below are the tables that have been removed:

RHB_CMRAP_COMBINED_AGG
RHB_CMRAP_LAB_AGED_AC
RHB_CRACK_SEAT_PCC
RHB_PCCO_STEEL
RHB_PRESSURE_RELIEF
RHB_RCYPCC_COMBINED_AGGR
RHB_RCYPCC_CONSTRUCTION
RHB_RCYPCC_JOINT

RHB_RCYPCC_MIXTURE
RHB_RCYPCC_NEW_AGGR
RHB_RCYPCC_STEEL
RHB_RCYPCC_STRENGTH

SPS Tables

Several SPS tables were removed from this Data Release since there are no data stored in the tables. Listed below are the tables that have been removed:

SPS4_TRANSIENT_GENERAL
SPS4_TRANSIENT_MEASURE
SPS6_TRANSFER_EFFICIENCY
SPS7_LOAD_TRANSFER
SPS7_PCC_CRACK_SEAL
SPS7_ TRANSFER_EFFICIENCY
SPS7_UNDERSEALING
SPS8_PCC_FULL_DEPTH
SPS9_AC_PATCHES
SPS9_DIAMOND_GRIND
SPS9_PCC_JOINT_RESEAL
SPS9_RUT_LEVEL_UP
SPS9_UNDERSEALING

TST_SC06: This table was intended to contain measurements of excess asphalt in bituminous mixtures obtained by using a loaded wheel and sand cohesion. Although the table structure exists, no data for this test were ever loaded into the database. Since this table is empty, it is not included in the SDR.

TST_SC13: This table was intended to contain measurements of the polish value of aggregates used in chip seals applied to SPS-3 sections only. Although the table structure exists, no data for this test were ever loaded into the database. Since this table is empty, it is not included in the SDR.

TRF_MONITOR_BASIC_INFO: This table has been replaced by outputs from the ESALCalc software.

Other Additions to Release 19.0:

ESALCalc Software:

A computer program called ESALCalc is included in the January 2005 SDR. This software will compute annual ESAL estimates from traffic monitoring data and pavement structure data. A manual is included with the software.

Restructuring of Data Modules and CD Contents:

Two data modules had to be restructured due to database size limitations in Microsoft® Access 2000. The Climate module was split into three databases: Climate_Daily_Humid_Precip, Climate_Daily_Temp_Wind, and Climate_Summary_Data. The two Climate_Daily_* databases contain daily tables, while the Climate_Summary_Data database contains monthly, annual, and all other Climate tables.

The Seasonal Monitoring Program (SMP) module was divided into two new databases: Seasonal_Monitoring and Seasonal_Monitoring_TDR_Meas. The time-domain reflectometry (TDR) measurement tables are in the Seasonal_Monitoring_TDR_Meas database, while all other SMP tables are in the Seasonal_Monitoring database.

In addition, the data modules had to be rearranged on CDs 1 and 2. The SMP and Backcalculation modules were added to CD 2, which also contains FWD Measurements. This CD has been renamed "Seasonal Monitoring and Deflection". CD 1 remains the same, minus the SMP and Backcalculation modules. CD 1 is referred to as the "Primary Data Set".

Issues Identified Since Release 18.0:

Below is a table that describes data issues found during a review of the July 2004 Data Release. Data analysts should review this list when performing research.

Table	Issue
AWS_HOURLY_DATA	For site 350101, the pyranometer readings are suspect.
EXPERIMENT_SECTION	The TRAFFIC_RS field is not populated correctly for some records.
MON_DIS_JPCC_FAULT	For certain sections, the faulting values are very inconsistent over time.
MON_DIS_JPCC_FAULT	The POINT_LOC value assigned to a given crack or joint varies slightly over time on some sections.
MON_DIS_JPCC_FAULT	For certain POINT_LOC's on given section, there are large spikes in the measured faulting value.
MON_DIS_JPCC_FAULT	For a given POINT_LOC, the CRACK_OR_JOINT designation changes over time for some sections.
MON_DIS_*_REV	Many null values should, in fact, be recorded as zero.
MON_DIS_AC_REV	The fatigue cracking values on 010102 are suspect.
MON_DIS_CRCP_REV	For 185518, OTHER indicates multiple patches, while the patching fields indicate only one.
MON_DIS_AC_REV	For a number of sites, BEFORE_TEMP and AFTER_TEMP are zero during summer months, indicating that the values should probably be null instead.
MON_DIS_CRCP_REV	On section 485328, 1/22/01, PHOTO_VIDEO = P, but

Table	Issue
	comments indicate no pictures obtained.
MON_DIS_CRCP_REV	485274, 2/11/97 has LONG_JOINT_SEAL_NO = 0, LONG_JOIN_SEAL_DAM_L > 0.
MON_DIS_JPCC_REV	Inconsistent rating of transverse cracking on sections 290704, 290705.
MON_DIS_JPCC_REV	For a number of surveys on various sites, the number of map cracking areas is zero, but the area is non-zero.
MON_DIS_JPCC_REV	Inconsistent rating of map cracking on section 100210.
MON_DIS_JPCC_REV	On section 124000, 7/21/99, OTHER indicates presence of map cracking, though map cracking field contains zeroes.
MON_DIS_JPCC_REV	For 313033, 11/16/99 and 290605, 7/20/95, PUMPING_NO = 0 while PUMPING_L > 0.
MON_DIS_JPCC_REV	For the 8/7/91 survey on the 2906** sections, OTHER indicates pumping, while the pumping fields indicate none.
MON_DIS_JPCC_REV	For 18A430, 5/1/91and 370201, 9/19/02, OTHER indicates polished aggregate, but POLISH_AGG_A = 0.
MON_DIS_JPCC_FAULT	EDGE and WHEELPATH measurements differ by > 12mm.
SMP_JOINT_FAULT	Various fault values are entered to 0.1mm, but the device is supposed to read to 1mm only.
SMP_ATEMP_RAIN_HOUR	Temperatures very low for certain dates on sections 131031(-42) and 351112 (-49).
SMP_ATEMP_RAIN_DAY	Hourly average in HOUR outside min and max values in DAY.
SMP_ELEV_PCC_DATA	Sections 274040 (9/22/93), 484143 (9/25/97), and 833802 (various dates) have questionable elevation data.
SMP_ELEV_AC_DATA	Questionable elevation data on 310114, 390901, 460804, 469187, 501002, 831801, and 906405.
SMP_ATEMP_RAIN_DAY	483739 (2/15/97) has null daily values where there is sufficient info in the hourly table (>20 hours) to calculate it.
SMP_MRCTEMP_AUTO_DAY_STATS	483739, THERM_NO =18(after 5/6/00) and 11(after6/6/00) have very high values - looks like bad sensor.
SPS9_PMA_PROFILE	180901, 0902, 0904, and 0905 have zero PROFILE_INDEX, which is not a reasonable value.
TRF_EQUIPMENT_MASTER	Where sensor type is null, it should be N.
TST_HOLE_LOG	460901, FIELD_SET = 1 has multiple construction numbers associated with it - which can cause incorrect CN assignment.
TST_AC01	089020, FIELD_LAYER_NO = 4 has an average thickness of zero.
TST_AC01_LAYER	2606** layers 4, 5, 6, 260902 layers 5, 6, 7, 469197 layer 5, and 511423 layer 6 do not have matching layers in

Table	Issue
	TST_L05B.
TST_AC01_LAYER	For 18A959, there are records with FIELD_LAYER_NO = 1 (which would be subgrade).
Various	In many TST tables, there are SAMPLE_NO entries that do not have a match in one of the sampling tables.
Various	In many TST tables, there are LOC_NO entries that do no have a match in one of the sampling tables.
Various	In many TST tables, there are LAYER_NO entries that do no have a match in TST_L05B.
Various	Some records in TST_AE03, PC03, PC06, SS01_UG01_UG02, SS04_UG08, UG04_SS03, and UG05_SS05 have test results reported for layers inappropriate for the test type (bound layers for unbound tests, etc…).
TST_AC04	Comments indicate multiple samples, but LOC_NO or SAMPLE_NO are for a single sample.
TST_AE01	There are many ASH_CONTENT values over 2, which may indicate the test was not done properly.
TST_HOLE_LOG	Many sections have holes with locations far outside section boundaries (+/- 200').
TST_HOLE_LOG	There are many records with negative TRANS_POS, but a LOC_NO not indicative of shoulder testing.
TST_HOLE_LOG	Many of the values in REPL_LOC_NO are not in LOC_NO for that section.
TST_HOLE_LOG	For many SPS testing locations, POINT_LOC is within another section according to SPS_PROJECT_STATIONS.
TST_L05B	Several records have inconsistent LAYER_TYPE and DESCRIPTION.

Release 18.0

This is the 18th national release of data from the LTPP program. This release contains some revisions to data included in the January 2004 Data Release. New tables included for the first time in this release and updates are noted in the following:

Ground Penetrating Radar Module

In 2003, Ground Penetrating Radar (GPR) measurements were performed on a subset of LTPP sections to provide an estimate of layer thickness variations within the monitoring portion of the test section. The measurements were performed on all SPS-1 project sites still in-service at the time. Measurements were also performed on one selected SPS-2, and SPS-5, and SPS-6 project site. The results of the measurements are stored in the GPR data module. Listed below are the tables and a brief description of each:

SDR Table Name	Contents
GPR_MASTER	One record is included in GPR_MASTER for each measurement pass on a test section. Typically there are two measurement passes on a test section.
GPR_THICK_POINT	This table contains the results of the thickness interpretations from the GPR measurements.
GPR_THICK_SECT	This table contains statistics on the thickness and dielectric constant from data contained in the GPR_THICK_POINT table whose stations fall inside the monitoring portion of the test section.
GPR_LINK_LAYER	This table provides a link between pavement layers identified in the GPR measurements and pavement layers identified by other means. It is not possible to identify layers with similar material properties with GPR measurements. To analyze GPR data, multiple layers in the physical pavement structure can be combined into a single layer.

Drainage Inspection Tables

Three new tables were added to the Monitoring module containing data information on the condition of the edge drain systems installed at the SPS-1, and -6 projects. In the future, tables may be added for other drainage feature evaluations. Listed below are the tables and a brief description of each:

SDR Table Name	Contents
MON_DRAIN_MASTER	This table contains information on the permanent features of the edge drain system and the location of the lateral openings.
MON_DRAIN_CONDITION	This table contains information regarding the condition of the lateral openings and the area around the lateral openings at the time of inspection.
MON_DRAIN_INSPECT	This table contains information on the results of the video edge drain inspection.

TST_UNBOUND_SPEC_GRAV: This table contains the specific gravity of unbound base and subgrade materials. Since this test was not specified in the original material test guidelines for LTPP sections, data are only available for a subset of test sections. The current source of this data is from resilient modulus tests performed by one of the LTPP contract laboratories. Although not required, that laboratory contractor included this measurement in their test results. Test data are currently available for test sections in the North Atlantic and Southern Regions. Depending on budget constraints, it is planned to obtain these measurements from SPS project sites in the future. There are no plans to obtain this data from other GPS test sections. This table is currently undergoing population and not all of the available data have been entered.

Climate Data

This release contains a major data update to the Climatic module covering the period from 1997 to 2002. Additions and corrections were made to the CLM_SITE_VWS_LINK table to add links for test sections and SPS projects missing in the previous data releases. The QC on the CLM tables was run with a "no manual upgrade" policy. A very small percentage of records failed one or more checks and were left in the database with a non-level E RECORD_STATUS.

Data Dictionary and Codes

This data release contains a major revision to the data dictionary contained in the LTPPDD table and the codes contained in the CODES table. Some of the revisions included removing fields no longer needed, modifying field descriptions, updating the field indicating the data sheet used to record the data, and adding missing codes.

Tables Removed

Three tables that were included in previous releases were removed from this release. TST_L06 and TST_L07, which contained the sample disposal record for AC and PCC specimens, were removed since they contained information of little use to a data analyst. The table SMP_WATERTAB_DEPTH_AUTO was also excluded since there was no data in the table, and no data is expected in the future.

Release 17.0

Data Release 17.0 was made available in January 2004. This release contains some revisions to data included in the July 2003 Data Release. No changes or updates have been made to data in the climatic and dynamic load response modules.

Superpave Asphalt Binder and Mixture Tests

Data Release 17 contains, for the first time, the data from Superpave-related asphalt binders and mixtures. This data includes test results from the dynamic shear rheometer, bending beam

rheometer, direct tension, gyratory compaction, and volumetric and gravimetric properties of gyratory compacted specimens. This data represents only a partial set of available data. LTPP contractors are still in the process of entering these data and resolving errors. More data are expected to be included in Release 18. Data users are encouraged to contact LTPP Customer Service with questions or problems that they may find in the contents of these new tables.

To store these data, the following eleven tables were added to the material test module (TST).

SDR Table Name	Contents
TST_LINK_LAYER	Links between TST_ID and layers in TST_L05B
TST_LINK_SAMPLE	Links between TST_ID and samples in TST_SAMPLE_LOG
TST_AE07_MASTER	Sample and configuration information for Dynamic Shear Rheometer (DSR) test
TST_AE07_DATA	Data from Dynamic Shear Rheometer (DSR) test
TST_AE08_MASTER	Sample and configuration information for Bending Beam Rheometer (BBR) test
TST_AE08_DATA	Data from Bending Beam Rheometer (BBR) test
TST_AE09_MASTER	Sample and configuration information for Direct Tension (DT) test
TST_AE09_DATA	Data from Direct Tension (DT) test
TST_SP01_MASTER	Sample and configuration information for gyratory compaction test
TST_SP01_DATA	Data from gyratory compaction test
TST_SP02	Asphalt mix volumetric and gravimetric information

Since some of these tests represent samples of materials used in more than one layer on multiple test sections, a field named TST_ID is used as primary key in these tables to link material test results to test sections and pavement layers. The TST_LINK_LAYER table provides a linkage between TST_ID and test sections and pavement layers in the TST_L05B table, using the fields STATE_CODE, SHRP_ID, CONSTRUCTION_NO, and LAYER_NO. The TST_LINK_SAMPLE table provides linkage between TST_ID and material sampling information contained in TST_SAMPLE_LOG using the fields STATE_CODE, SHRP_ID, FIELD_NO and SAMPLE_NO.

Supplemental Test Section QC

This is the first data release that includes the results of quality checks on data from supplemental test sections constructed on the Specific Pavement Studies sites. The RECORD_STATUS field in records for supplemental test sections should now be populated as it is for other test sections. Although the majority of the new checks worked as expected, data users may find some anomalies that have not been corrected. Please contact LTPP Customer Service with questions or issues related to supplemental section QC.

SPS 9 Construction Data

SPS-9 construction data was first released in the July 2003 data release. Work continues on entering SPS-9 construction data to the SPS module.

Traffic Monitoring Data

Processing of traffic monitoring data collected between 1999 and 2002 has been substantially completed. Work continues on loading and resolving errors in "problem" data sets from this time period. More traffic monitoring data is expected to be available in the next data release.

Distress Data

Distress data processed by version 1.0 of the Padias software is being reprocessed with version 4.2 of the software. Distress survey records that have been migrated to the MON_DIS_PADIAS42 tables over the past several data releases have been removed from the MON_DIS_PADIAS tables.

Release 16.0

Data Release 16.0 was available in July 2003. This release contains some revisions to data included in the January 2003 Data Release and includes new pavement monitoring, construction and materials test data collected through May 2003.

One new table, TRF_MONITOR_LTPP_LN, was added to the Traffic module for this release. Another table, TRF_MONITOR_AXLE_DISTRIB, was restructured. The old TRF_MONITOR_AXLE_DISTRIB table was structured as one record per axle type per weight bin or 160 records per site per year. All bins and all axle types are present for every site (even some without weight data). The new TRF_MONITOR_AXLE_DISTRIB has one record per axle type per vehicle class or a maximum of 40 records per site per year. If an axle type or vehicle class was not weighed, there is no record in the database.

LTPP is in the process of implementing new and improved traffic analysis software and clearing the backlog of unprocessed traffic monitoring data. The two tables noted above contain the output from the new analysis software for pre-1998 data previously processed using the old software and post-1998 data that had not previously been processed and released. It is anticipated that the backlog of un-processed traffic monitoring data will be cleared in 2004. Some of the tables containing data created by the old traffic analysis software have been removed from this release.

This release also contains the first release of data from all of the SPS-9 construction data tables.

A new table, LTPPTD, was added to the administration module. This table contains table descriptions for all of the tables included in the release. The Table Navigator software included in the release automates the database schema, including descriptions of all tables, fields and codes.

Data User Aids

The Table Navigator Software, an electronic copy of the *Pavement Performance Database User Reference Guide*, and the *LTPP Information Management System: IMS Quality Control Checks* are included with in the SDR package. (Note, the Pavement Performance Database was previously referred to as the Information Management System (IMS).)

Table Navigator

The **Table Navigator** software is contained in the "Table Navigator" folder on CD-1 or in the Reference Documents directory of the DVD. Double click on the setup.exe file to install the software. The folder also contains a .pdf file containing the Table Navigator Software Manual. Table Navigator provides information on the structure and content of the database. This software combines information from three reference documents, the Schema, the Data Dictionary, and the Codes Listing, described as follows:

Schema: The schema has variable names, variable types, their location in a flat file, formatting and units.

Data Dictionary: The Data Dictionary contains variable names, descriptions, units, and datasheet used to record the data. Coded values have the name of the code list used to validate entries (CODETYPE).

Codes Listing: The LTPP database contains variables populated with coded values (number or character) that represent an item in a list, such as materials supplier, soil type, or vehicle classification. All of these values are in the codes listing grouped by a codetype identifier. The codetype used for a given variable is in the CODETYPE field in the data dictionary entry for that variable. If any questions arise or the variables and their codes are not clear from the context, please contact the LTPP Customer Support Service Center.

Pavement Performance Database User Reference Guide

This document was written to aid in understanding and using the LTPP Pavement Performance Database. The document contains an introduction to the structure of the LTPP program, a description of the location of various data elements, contents of the data tables, and other tips and examples. A review of this document will give the user a good overview of LTPP data. The Pavement Performance Database User Reference Guide can be found on CD-1 in the Reference Documents folder.

LTPP Data Quality Checks

A zipped file containing the document *LTPP Information Management System: IMS Quality Control Checks* has been included with this distribution. Quality control involves record-by-record checks of data in the SDR. This document specifies all of the checks applied to the data after it is loaded into the database. It is updated as changes are made in the quality control checks, though updates often lag behind the changes. The document indicates what information the database designers considered critical for analysis and expectations for reasonable values and rational relationships. Data may be provided which has not met one or more of these criteria or for which no such criteria exist. The data quality check document permits the user to see what automated checks have been applied to the data.

See the section on Data Quality Checks at the end of this document for more information.

Reference Tables

Several reference tables are contained in each Access database in the SDR. These tables are listed below:

EXPERIMENT_SECTION

The **EXPERIMENT_SECTION** table is the master table for test sections included in the database. It provides key variables by which other tables may be linked including STATE_CODE, SHRP_ID, and CONSTRUCTION_NO. Its principal use is to identify the experiment to which a section or site belongs and construction-related changes which have occurred over its life.

LTPPDD

The Data Dictionary (LTPPDD) contains the datatype, units, codetype (where applicable), description, and other information about each field in the database.

LTPPTD

The LTPPTD provides a description of the contents of each table.

CODES

The CODES table is a list of coded values used in the database and their definitions.

Data Quality Checks

Large amounts of data are supplied on paper forms from many different agencies. QC checks on this information consist of reviews for completeness and reasonableness of the provided information.

Data in the database undergo several levels of data quality checks. The results of these checks are recorded in the RECORD_STATUS field. All data tables contain a RECORD_STATUS field. There are three major types of QC checks:

- 'C' Level Checks: These are checks to identify critical fields that contain a null value. In some cases, these checks are replaced by non-null restrictions placed on critical fields during the table design that prevent a record from being created if a value for that field is not entered.

- 'D' Level Checks: These are range checks on the reasonableness of values entered in a field. For example, the range check for deflection data from the center sensor on a Falling Weight Deflectometer (FWD) is 5 μm to 2032 μm.

- 'E' Level Checks: These are termed intra-modular and intra-field checks. This category contains a wide range of checks. The common property of these checks is that they compare the value in one field of a table to the value in another field that may or may not be in the same table. For example, an 'E' level check is used to see if pavement layer temperature gradient data exists for each FWD data set. In addition, 'E' level checks are used to enforce referential integrity between parent and child tables.

These QC checks are performed sequentially – 'D' level checks are applied to records passing 'C' level checks, and 'E' level checks are applied to records passing 'D' level checks. A level is the starting point. If a record fails a check, its record status remains at the next lower status. For example, records failing a level 'D' check have a status of 'C'. A procedure exists to manually upgrade record status, if a record failing a check has been examined and found to be acceptable.

A few modules contain level B checks and these are documented in the QC Manual. Most previous level B checks have been incorporated into level E checks. Any records remaining at level A where explicit level B checks are not documented in the QC Manual, most likely do not have a valid test section identification number (i.e., state_code + shrp_id). Records with invalid test section identification numbers will not be processed by any of the QC programs.

Records with a level E status can mean the following:

- Records have passed all of the current data checks.
- Records may have failed some data checks, but were manually upgraded after inspection

and/or correction.
- Records may contain errors that were not detected by the current data review process.

The quality control 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 data quality control checks, level E data included in previous releases may be reclassified.

Records with a status less than E can be interpreted as:

- Not having completed the QC process.
- Having completed the QC process, but left at a lower level of record status.
- Not currently subjected to the QC process by policy.

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 a relative indicator of potential issues that might exist for these data. As the LTPP program continues to evolve, users can expect changes to be made to LTPP data and record status in order to improve their use in analysis.

Traffic DATA

Historical Traffic

As part of their participation in LTPP, State/Provincial Highway Agencies (SHAs) agreed to provide estimates of historical traffic loading for their GPS sites. In most cases, the agencies did not have significant amount of historical traffic volume, vehicle classification or weight information for many of the LTPP test sites. In many cases no data was available for the sites. Regardless of the amount of information available, the agencies were asked to provide the best estimates they could make. The relationship of these estimates to actual traffic at the test sites is not generally known but instances of significant under- and over-estimation have been observed. At some sites, a data user will notice a break in traffic trends in 1989 and 1990 due to inaccurate historical estimates.

Monitored Traffic

Monitored traffic data may be obtained from either the SDR or the Central Traffic Database (CTDB). Monitored traffic data extracted from the SDR has similar types of quality checks as all other information in the database.

Traffic requested in the form of raw data is obtained from the CTDB and has been flagged according to the traffic QC process, which is separate from the SDR database QC. Records submitted to LTPP by SHAs have not been omitted.