

LTPP Pavement Performance Database Release Notes

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 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 5-CDROMs. Currently, the SDR is distributed every six months. As the LTPP program is still an on-going operation, new releases contain new data collected since the last release, new data elements currently under development, changes to data in previous release made in response to discovered problems or errors in previously release data, and updates. The SDR contains all data from the tables included in the release. SDR data extracted from the production Pavement Performance Database is divided into multiple relational databases by data module. FWD and profile data modules are further subdivided by highway agency. The database modules are delivered in a compressed format.

An updated copy of the **Pavement Performance Database User Reference Guide** is included on the Primary Data Set CD (CD-1). This document provides data users with information on the contents of each SDR data module, 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.

Data users can find information on the LTPP program at the LTPP web site on the Internet at www.tfhr.gov/pavement/ltp/ltp.htm. A data problem feedback form and satisfaction questionnaire can be found on this web site. Alternatively, users can contact LTPP Customer Support Service Center at the email address ltpinfo@fhwa.dot.gov, by calling (865) 481-2967, or by faxing (865) 481-8555. Written inquires can be sent to:

LTPP Customer Support
c/o Miriam Pitz
P.O. Box 2501
Oak Ridge, TN 37831

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 the 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 this document 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 Standard Data Release. 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.

Release 18.0

The July 2004 Data Release 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 in this release for the first time 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.

SDR Table Name	Contents
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.

Unbound Specific Gravity Table

This new 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 were removed from this release that were included in previous releases. 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 of the SDR. 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 contents 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. Names of key variables used in the relational database to link records are aligned with the left margin. All other variable names are indented.

Data Dictionary: The Data Dictionary contains variable names, their definitions, units, and datasheet used to record the data. Coded values have the name of the code list used to validate entries. The Data Dictionary is being updated whenever a table or variable is changed. However, the database is still in flux, and although most of the data in the dictionary is accurate, there may be both missing and outdated items.

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.

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 on the quality checks.

Pavement Performance Database User's 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.

Reference Data Tables

Several reference tables are contained in each Access database in the Standard Data Release. 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. In addition, each Access database has field descriptions in the Design view of the table.

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 checks 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 and B levels are 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.

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.