



Completion of the LTPP Materials Action Plan (MAP) for Specific Pavement Study (SPS) Sites

An important element to understand why pavements perform as they do is the availability of accurate and reliable data to properly characterize the as-constructed pavement structure and engineering properties of its materials. Field materials sampling and tests, along with laboratory test plan guidelines were developed by the Long-Term Pavement Performance (LTPP) program for each of the nine SPS experiments. Although many highway agencies performed the sampling and testing as they could, a 1996 mid-course program assessment found that there were still major gaps in the SPS materials data.

In 1997, LTPP undertook a campaign to determine the status of these database shortages and whether they could be filled. Although progress was made, significant materials data gaps still remained. Forty-eight percent of the requested SPS materials test data were still missing, clearly limiting the use of data from the SPS experiments in some important research investigations.

Since 1997, LTPP continued to do what it could to fill in these missing data gaps. However, in 2002, the LTPP program became more aggressive in its effort to address the SPS materials data gaps. This effort led to further pursuit of missing materials data, reconciliation of all materials data submitted to the LTPP program, and acceleration of hot-mix asphalt (HMA) and unbound granular resilient modulus testing. While this effort provided some positive results, significant data needs still existed. In 2004, the LTPP program developed the Materials Action Plan (MAP), which was designed to address priority materials data needs on SPS project sites. The details of the final MAP were contained in an internal LTPP document *LTPP SPS Materials Data Resolution: Update and Final Action Plan, August 2004*.

The MAP addressed three major areas of need:

- Resolution of materials data gaps.
- Aging and new material testing.
- Collection of material samples for the Materials Reference Library (MRL).

To optimize the use of available LTPP program funds, the MAP focused on the following SPS project sites:

- SPS-1: Strategic Study of Structural Factors for Flexible Pavements.
- SPS-2: Strategic Study of Structural Factors for Rigid Pavements.
- SPS-5: Rehabilitation of Asphalt Concrete Pavements.
- SPS-6: Rehabilitation of Jointed Portland Cement Concrete Pavements.
- SPS-8: Study of Environmental Effects in the Absence of Heavy Loads.

These sites were designed to extend the findings from the LTPP General Pavement Study (GPS) sites with the addition of controlled pavement design factors and/or environmental load factors.

Materials data on SPS -1, -2, -5, -6, and -8 increased by 24 percent as a result of this effort. Between 2004 and 2009 (the time period in which the MAP was implemented), more than 21,000 material test result data sets were collected—a 90th percentile level of achievement. This level represents the practical maximum of additional material testing possible due to the ability to obtain adequate quantity of materials from thin layers and suitability of material for anticipated tests.

In addition to filling data gaps, new material tests were obtained to extend previous material characterizations on these important test sections. For transparency purposes, the LTPP program is reporting nine percent missing materials data characterization on the SPS projects included in the MAP. The reality is that the MAP has successfully addressed all of the data shortfalls as much as possible through a field data collection and laboratory testing effort. The new data will expand the usefulness of these prime SPS projects in future pavement analysis and development efforts related to mechanistic-empirical pavement design and performance models.

A final report on the MAP is scheduled for publication later this year, and will be available at the LTPP Web site:

<http://www.fhwa.dot.gov/pavement/ltp/index.cfm>.

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The Importance of Equipment Calibration and Maintenance: Lessons from LTPP

The LTPP program has worked diligently to make sure that the data entered into the LTPP Information Management System is of the highest quality. An important aspect of LTPP quality assurance procedures is the calibration and maintenance of the data collection equipment.

Procedures are in place for maintenance and calibration of the falling weight deflectometer (FWD), profiler, Dipstick®, Faultmeter, elevation measurement levels, weather and seasonal monitoring sensors, and other equipment. Monthly and annual maintenance schedules were established for testing equipment used by the LTPP program. This article focuses on FWDs and profilers.

Calibration of FWDs and Profilers

Annual calibration of data collection equipment is necessary to ensure the collection of reliable and consistent data. Since the winter period reduces the opportunity for field data collection, maintenance and calibration is often conducted during the winter months or prior to the equipment returning to service during the spring period.

For FWDs, conduct an annual reference calibration at a regional calibration center. Service the FWD prior to conducting the reference calibration to ensure the equipment is in top operating order and that all sensors are working and producing repeatable results.

Prior to returning profile units to service, perform the Accelerometer Signal Conditioning Electronics test, monthly laser/accelerometer calibration, photocell-offset determination check, distance measuring instrument (DMI) calibration, and profiler repeatability checks from benchmark sections that were selected for long-term comparisons. These benchmark sections also have Dipstick® profile data for comparison. If more than one profiler is used in the profile runs over the reference section, compare the profilers to ensure the units are comparable.

LTPP profile rodeos are held to ensure the profilers from the different LTPP regions meet the profiler comparison requirements and there are no “region-to-region” discrepancies in procedures, data, or data quality. The rodeos also provide an opportunity for interaction between operators and the exchange of experiences.

Maintenance or Long-Term Storage of FWDs and Profilers

To extend the service life of various vehicle components and ensure the safe and reliable operation of profiler vans, FWD tow vehicles and trailers, the following are found to be essential for maintenance or preparation for long-term storage.

- Remove moisture and trapped particles, which may cause internal rusting, to avoid damage during a long-term storage period.
- Check the antifreeze coolant strength and acidity level. If the coolant has been in use for an extended period (2 years for green coolant and 5 years for long-life coolant) do a flush and fill. For diesel engines operating with the green coolant, consider using an acid stabilizer supplement depending on the acidity level of the coolant.
- Fill tires to the maximum pressure as indicated on the sidewall, which may in fact be higher than the manufacturer’s recommended tire pressure. If stored outside, cover the tires to prevent damage due to ultraviolet lighting.
- If the vehicle will not be started during the storage period, fully charge and disconnect the batteries. If a vehicle is stored outside in a cold climate, remove the batteries and store them inside.
- Spray the under components of the chassis and engine with a light oil to minimize rust during outside storage in damp climates in order to preserve the components.
- Top up the gas tank and add fuel stabilizer prior to storage. This will minimize rust forming in the tank and fuel line components while ensuring the fuel will be usable when the vehicle returns to use.
- If the vehicle is started during long-term storage, a sufficient warm-up period is necessary to remove the vapors that develop in the engine, transmission, and exhaust system.
- Relocate indoors electrical components such as computers, printers, and processors if the unit will not be periodically operated during the outside storage period. Prior to putting the unit back into service, clean all contact components and connectors. For example, the removal and reinsertion of the printer circuit boards in the profiler processor chassis has been found to be a good method to ensure a clean contact between the chassis and the boards, eliminating many of the start-up problems associated with this equipment.

- Clean FWD trailers and lubricate all moving components of the unit prior to storage. Prepare tires and batteries for storage as previously discussed. Top up all fluid levels. Periodic operation of the FWD will reduce start-up problems when the unit returns to service. In addition, a monthly operation using LTPP's 'buffer warm-up' sequence will assist in keeping everything operational. This is particularly helpful for the hydraulic system, which can be problematic after long-term storage.
- Check and/or change all fluid levels (depending on the length of inactivity) upon resuming normal data collection activities. Thereafter, run the unit for a period of time before returning to full-time operation to catch and repair any leaks, bad hoses, or poor connections that may have developed during storage.

The above recommendations are not all-inclusive, but highlight areas that were problematic after storage of LTPP's equipment.

Equipment Downtime is Necessary

It is essential to incorporate downtime into the data collection schedule for calibration and maintenance of the equipment. Both the vehicle and non-vehicle maintenance follows the manufacturer's guidelines with additional procedures added by LTPP based on the program's 20 years of experience operating the various types of equipment.

In summary, un-calibrated or poorly maintained equipment will result in low quality data that will be of little use to the pavement community. This is one of the reasons why the LTPP program invests so much effort in making sure the data collection equipment, as well as those operating the equipment, passes LTPP's protocol for collecting high quality pavement performance data.

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In Brief

LTPP Pavement Analysis Forum

LTPP and the Transportation Research Board (TRB) are jointly planning an LTPP pavement analysis forum that will be held this summer in Irvine, CA from August 31 to September 2. The attendees of this invitation-only forum will conduct a comprehensive review of the Strategic Plan for LTPP Data Analysis, and develop new problem statements and project descriptions that will be considered by the TRB LTPP Committee at its next meeting in November.

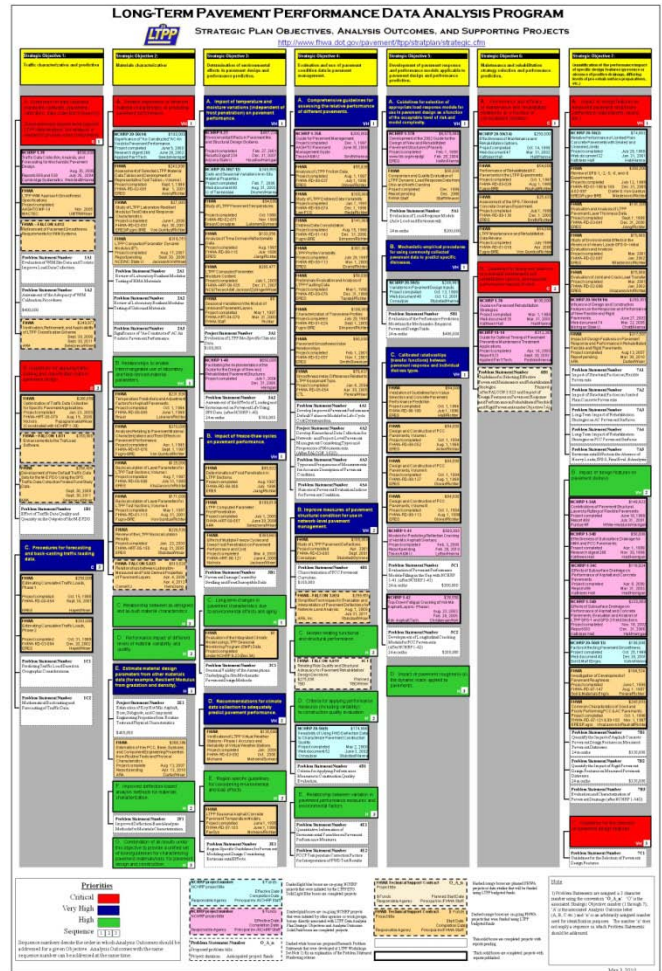


Figure 1. Strategic Plan for LTPP Data Analysis

Since 1999, data analyses performed within the LTPP program have been guided by this plan. The plan was originally developed by the TRB Expert Task Group on LTPP Data Analysis, recommended by the TRB LTPP Committee, and adopted by the Federal Highway Administration as the basis for selecting LTPP data analysis projects. The plan has also been used to measure LTPP's progress in data collection and analysis. The plan defines seven strategic objectives that support LTPP's goal "to develop knowledge, relationships, and models to facilitate improved pavement design and reliable performance predictions." The plan identifies both ongoing and anticipated near-term LTPP data analysis projects, as well as closely related National Cooperative Highway Research Program projects.

For more information, visit the LTPP Analysis Web site - <http://www.fhwa.dot.gov/pavement/ltpp/analysis.cfm> or contact Larry Wiser at larry.wiser@dot.gov or (202) 493-3079.

To learn more about the LTPP program and products, visit: www.fhwa.dot.gov/pavement/ltpp/index.cfm or contact the LTPP Customer Support Service Center (CSSC) at ltpinfo@dot.gov or (202) 493-3035.