LONG TERM PAVEMENT PERFORMANCE
PROGRAM DIRECTIVE

For the Technical Direction of the LTPP Program

Program Area:	**General Operations**	**Directive Number**:	**GO-19**
Date:	**March 17, 1999**	**Supersedes**:	**NA**
Subject:	**LTPP Data Completeness Assessment and Monitoring Adjustment Process**		

Introduction

This directive contains guidelines on assessment of data completeness and procedures to be followed in the monitoring adjustment process for Long-Term Pavement Performance (LTPP) test sections.

Adjustments to the test section monitoring scheme are one of the intended results of the work that began with the data resolution exercise. The objective of the data resolution exercise was to make a final determination of what data we will and will not obtain for each LTPP test section. This was done so that an assessment of the completeness of data for each test section could be made. The results of this assessment will be used as the basis for changes to the final monitoring plan for each test section and project site. Since highway agencies play a primary role in the collection of critical LTPP data, their agreement to support the final monitoring plan is required.

The following acronyms are used in this document:

FHWA	Federal Highway Administration
FHWA LTPP Team	The FHWA staff assigned to the LTPP Team working within the Pavement Performance Division, HNR-30. (Note that the name of this division may change in the near future.)
RCOC	Regional Coordination Office Contractors
TSSC	Technical Support Services Contractor
GPS	General Pavement Studies

SPS	Specific Pavement Studies
SMP	Seasonal Monitoring Program
IMS	Information Management System
FWD	Falling Weight Deflectometer
AC	Asphaltic Concrete (also includes hot mixed asphalt materials)
PCC	Portland Cement Concrete
JPCP	Jointed Plain Concrete Pavement
JRCP	Jointed Reinforced Concrete Pavement
CRCP	Continuously Reinforced Concrete Pavement
WIM	Weigh-in-Motion (traffic monitoring device)
AVC	Automated Vehicle Classifier (traffic monitoring device)
ATR	Automatic Traffic Recorder (traffic monitoring device)
GVW	Gross Vehicle Weight
ESAL	Equivalent Single Axle Load

In the directive, the following convention is used for specifying table names and field names in the IMS:

TABLE_NAME.FIELD_NAME

where FIELD_NAME is the name of the field in the specified **TABLE**. In some cases, a wild card character * is used to specify a series of tables either starting or ending with a specified set of characters.

Data Completeness Assessment and Monitoring Adjustments Procedures and Schedule

The following procedure and schedule will be followed:

April 1, 1999 - April 29, 1999	**Draft Data Completeness and Monitoring Adjustment Reports.** RCOCs will prepare Data Completeness and Monitoring Adjustment Report following the guidelines in this directive.

April 30, 1999	**Submit Reports.** RCOCs will submit draft Data Completeness and Monitoring Adjustment Reports to the FHWA LTPP team in both paper and electronic form. Copies of the electronic files containing the reports will be sent to the TSSC.
May 1, 1999 to May 31, 1999	**Report Reviews.** The FHWA LTPP Team and TSSC will review the draft Data Completeness and Monitoring Adjustment Reports. Questions regarding the data completeness assessment ratings and recommended monitoring adjustments will be directed to the RCOCs. The FHWA LTPP Team will prepare the final Data Completeness and Monitoring Adjustment Reports.
June 1, 1999	**Distribute Final Reports.** The FHWA LTPP Team will distribute the final Data Completeness and Monitoring Adjustment Reports to highway agencies, FHWA division offices, RCOCs, and TSSC.
June 7, 1999 to July 30, 1999	**FHWA Division Office Follow-up.** FHWA division office staff in each state, with assistance from RCOCs, will follow-up with each highway agency to complete and sign the Data Completeness and Monitoring Adjustment Reports.
August 2, 1999	**Highway Agencies Return Completed Reports.** Final date for highway agencies to return the completed and signed reports to the FHWA LTPP Team.
August 3, 1999 to August 31, 1999	**Report Review and Development of Final Monitoring Plan.** The FHWA LTPP Team will review the completed Data Completeness and Monitoring Adjustment Reports and develop an approved monitoring plan for all LTPP test sections and projects.
September 1, 1999	**Implementation of Monitoring Adjustments.** The final monitoring plan is distributed by the FHWA LTPP Team for implementation.
August 1, 2000	**Completion Date for Corrective Data Actions**. Action to correct known data deficiencies must be completed by this date. Corrective activities whose completion date is expected to occur after this date should be discussed with the FHWA LTPP Team on a case-by-case basis.

Data Completeness and Monitoring Adjustment Report

For uniformity, the Data Completeness and Monitoring Adjustment Reports described in this document will be prepared for all active GPS test sections and SPS projects contained in the

EXPERIMENT_SECTION table in the LTPP IMS whose STATUS field is **not** equal to R (Rejected) or O (Out-of-Study).

The Data Completeness and Monitoring Adjustment Report consists of the two forms shown in Tables 1 and 2. The Data Completeness and Monitoring Adjustment Form shown in Table 1 is intended to provide a summary of the data completeness assessment and monitoring category adjustments. The Data Completeness and Monitoring Adjustment Comments Form shown in Table 2 is used to record comments concerning entries made on the Data Completeness and Monitoring Adjustment Form. The formats shown in Tables 1 and 2 will be used for all Data Completeness and Monitoring Adjustment Reports. In order to provide a common mechanism for compilation and evaluation of these reports from the LTPP regions, the RCOCs are required to submit these reports in Microsoft Excel 97 electronic format.

A separate file will be created for each agency. Each file will contain both the completed Data Completeness and Monitoring Adjustment and Comment forms. Each form will be prepared on separate worksheets within the file. The following file naming convention will be used for the electronically submitted files:

D C s c r r _ a . x l s

where,

DC - The letters DC to indicate that these files are related to Data Completeness.

sc - The two digit state agency code as specified in table A.1 of the LTPP Data Collection Guide. Leading zero's should be included.

rr - LTPP region two digit abbreviation as follows:
NA - North Atlantic,
NC - North Central,
SR - Southern Region,
WR - Western Region.

_ - The underscore character.

a - Data completeness report revision sequence letter as follows:
A - first submission,
B - first revision,
C - second revision, etc.

xls - Constant file extension characters (default Excel file extension).

For example, the file DC04WR_A.xls corresponds to the first submission of the Data Completeness and Monitoring Adjustment Report file for Arizona from the Western Region. Similarly the file DC51NA_B.xls would be the file name for the first revision of the data status report for Virginia from the North Atlantic region.

Data Completeness and Monitoring Adjustment Form

The following guidelines will be followed in completion of the Data Completeness and Monitoring Adjustment Form.

State / Province

Enter the name of the state or province in which the test sections and projects are located. The full name of the state or province as shown in Table A.1 of the LTPP Data Collection Guide will be used.

Date

Enter the date the form was completed or last updated.

Test Section or Project ID

Entries will be made on this form for those sections which are currently active (have not been taken out-of-study), SPS projects on which at least one test section is still active, and SPS projects which have not been constructed. In general, test sections on SPS projects are treated as groups of sections collocated at the same site; a separate record is completed for core test sections (those designated in the LTPP experiment design) and supplemental test sections located on the project. The exception to this general rule may occur when one or more test sections on a project have a data completeness deficiency not common to the other test sections in the group or have changed experimental designation due to the application of a rehabilitation treatment. In this circumstance, entries for individual SPS test sections should be made, in addition to the general entry for the core and supplements groups. The test section or project ID is the traditional six digit LTPP Identification Code (ID), which consists of the combined two digit STATE_CODE and four digit SHRP_ID. This ID should be used, except as noted below:

GPS test sections	Individual LTPP ID for the test section.
SPS core test sections	The assigned project level SHRP_ID (the last four digits of the LTPP ID) ending with 00 should be used. For example, the SHRP_ID for core test sections on a SPS 2 project should be 0200.
SPS supplemental test sections	A 0S should be used for the last two digits of the SHRP_ID. For example, on a SPS-2 project, the SHRP_ID for supplemental sections should be 020S.

Current Experiment

Indicate the current experimental designation for the project, using a G for GPS and S for SPS. Suffixes for GPS rehabilitation experiment designation should also be included as appropriate. Thus, if a test section started as a GPS-1, but was subsequently overlaid and is currently in the GPS 6B experiment, a G-6B should be entered. For SPS project groups, the initial SPS project experimental designation should be used.

SMP Site

This cell is used to indicate if a test section(s) at the site was previously included in the Seasonal Monitoring Program (SMP). The following entries should be made in this cell:

- Y Yes, a test section at the site was included or is planned to be included in the SMP.
- N No, there are no test sections at the site which have been a part of or are planned for inclusion into the SMP.

Highest Potential Monitoring Category

Enter the monitoring code designation which corresponds to the current LTPP experimental designation previous indicated on the form.

- S1 SPS 1 and 2
- S2 SPS 5, 6, and 8
- G SPS 9, GPS 1, 2, 3, 4, 5, 6B, 6C, 6D, 6S, 7B, 7C, 7D, 7F, 7R, 7S, and 9
- C SPS 3, 4, 7, GPS 6A, and 7A

Minimum Data Completeness Adequacy

Changes to the LTPP recommended monitoring category are based upon assessment of the minimum data completeness adequacy. The minimum requirements for each category are discussed below. For each category, only one of the following entries is permitted, unless otherwise instructed in the discussion for that category:

Y	All required minimum data are available and stored in the IMS. (Black font color with no fill (no color))
Y	Some of the required minimum data are **not** presently available in the IMS but a plan exists to obtain these missing data within one year. (Black font color with light gray fill)
N	Some of the required minimum data are **not** available and it has been confirmed that the missing data will **not** be obtained. (White font color with black fill)
NA	Not Applicable, this entry can only be used for SPS projects which have not been constructed. (Black font color with no fill (no color))

Pavement Structure

The minimum data requirements for the pavement structure category are those items related to layer thicknesses, material classification from tests, geometry, shoulder, and reinforcement details as follows:

Layer thickness

Layer thicknesses for all pavement layers, based upon field and/or laboratory measurements must be available in the IMS. This includes alterations to the layer structure caused by the application of maintenance and rehabilitation treatments. The appropriate **TST_L05** tables must be up-to-date for all known construction activities.

For GPS test sections, for all layers where **TST_L05B**.DESCRIPTION…7 (Subgrade), TST_L05B.REPR_THICKNESS must not be null and not contain a value of either 999 or 999.9. Matching records must also exist in **TST_L05A** for each record in **TST_L05B**.

For SPS test sections for all layers where **TST_L05B**.DESCRIPTION…7 (Subgrade), TST_L05B.REPR_THICKNESS must not be null and not contain a value of either 999 or 999.9. Matching records must also exist in **TST_L05A** for each record in **TST_L05B**. A matching record must exist in **TST_L05** for all SPS projects.

Material class

Materials classification must be available for all pavement layers, including embankments and subgrade. For unbound materials, the classification must be based upon laboratory tests or field observations of material samples obtained from the project site.

For unbound layers on GPS and SPS test sections, **TST_SS04_UG08**.VISUAL_CLASS, **TST_SS04_UG08**.AASHTO_SOIL_CLASS, or **TST_SAMPLE_LOG**.MATERIAL_CODE must be non-null and contain a valid material code for each unbound layer defined in **TST_L05B**. For SPS test sections, if the criteria for unbound materials on GPS test sections are not met, then **TST_L05B**.LAYER_COMMENT1, **TST_L05B**.LAYER_COMMENT2, or **TST_L05B**.LAYER_COMMENT3 must contain a code P and **TST_L05B**.MATL_CODE must be non-null and contain a valid materials code.

For bound material layers on all test sections, **TST_L05B.**MATL_CODE must be non-null and a valid code.

Geometry

Data related to lane geometry, must be available for all test sections, including lane width and number of lanes.

GPS test sections and SPS 5, 6, 7 and 9 (overlay) projects, **INV_GENERAL**.LANE_WIDTH and **INV_GENERAL**.NO_OF_LANES must be non-null and contain a valid entry.

For SPS 1, 2, 8 and 9 (non-overlay) projects, **SPS_GENERAL**.LANE_WIDTH and **SPS_ID**.NO_OF_LANES must be non-null and contain a valid entry.

For jointed PCC pavement layers, data on the joint spacing, joint skewness, and joint locations are required. For original PCC surface layers which are jointed pavement types on GPS-3, GPS-4, GPS-7, GPS-9, SPS-6 and SPS-7 test sections, and overlay surface layer on GPS-9, at least one of the following fields must be populated **INV_PCC_JOINT**.AVG_CONTRACTION_SPACING, **INV_PCC_JOINT.**RANDOM_SPACING, or **INV_PCC_JOINT**.BUILT_IN_EXPANSION_SPACING. If the jointed PCC pavement layer has skewed joints, as determined from the manual distress maps, then **INV_PCC_JOINT**.JOINT_SKEWNESS must be populated.

All PCC pavements must have at least one manual distress survey map available in the RCOC office which shows the project station of each joint and transverse crack.

Shoulder

Data on the surface type of the outside shoulder must be available in the IMS.

For GPS test sections and SPS 5, 6, 7 and 9 (overlay) projects, for records in **INV_SHOULDER** where **INV_SHOULDER**.SHOULDER_TYPE=O, **INV_SHOUDLER.**SH_SURFACE_TYPE must be non-null and contain a valid code. If **INV_SHOULDER**.SH_SURFACE_TYPE=6, then **INV_SHOULDER**.SH_SURFACE_TYPE_OTHER must be non-null and contain a description of the surface type.

For SPS 1, 2, 8 and 9 (non-overlay) projects **SPS_GENERAL.**O_SH_SURFACE_TYPE, must be non-null and contain a valid code.

Reinforcement For PCC pavements, data on reinforcing type, longitudinal reinforcing bar diameter, percent longitudinal reinforcement, and load transfer device must be available in the IMS.

For the reinforced PCC layers on GPS 4, 5, and 9 (JRCP and CRCP layers) test sections **INV_PCC_STEEL**.REINFORCING_TYPE, **INV_PCC_STEEL**.LONG_BAR_DIAMETER, and **INV_PCC_STEEL**.DESIGN_PERCENT_LONG_STEEL must be non-null and contain a valid entry.

For all jointed PCC layers on GPS 3, 4, 7, and 9 test sections, and SPS 6 projects, **INV_PCC_JOINT**.TRANS_CONT_JLTS must be non-null and contain a valid code. If **INV_PCC_JOINT**.TRANS_CONT_JLTS=5, then **INV_PCC_JOINT**.TRANS_CONT_JLTS_OTHER must be non-null and contain a description of the joint load transfer device.

Inventory Inventory refers to general project information including location, and key dates. (This information should not be confused with the broad range of data stored in the INV module in the IMS.)

Location Required location information in the IMS includes latitude, longitude, elevation, route number, route signing, direction of travel and additional location information (significant landmarks).

For GPS test sections and SPS 5, 6, 7 and 9 (overlay) projects, the following fields must be non-null and contain a valid entry:

INV_ID.LATITUDE_DEG
INV_ID.LATITUDE_MIN
INV_ID.LATITUDE_SEC
INV_ID.LONGITUDE_DEG
INV_ID.LONGITUDE_MIN
INV_ID.LONGITUDE_SEC
INV_ID.ELEVATION
INV_ID.ROUTE_NO
INV_ID.ROUTE_SIGNING
INV_ID.DIRECTION_OF_TRAVEL
INV_ID.LOCATION_INFO

For SPS 1, 2, 8 and 9 (non-overlay) projects, project level records must exist with the following fields and be populated with a non-null, valid, entry:

SPS_ID.LATITUDE_DEG
SPS_ID.LATITUDE_MIN
SPS_ID.LATITUDE_SEC
SPS_ID.LONGITUDE_DEG
SPS_ID.LONGITUDE_MIN
SPS_ID.LONGITUDE_SEC
SPS_ID.ELEVATION
SPS_ID.ROUTE_NO
SPS_ID.ROUTE_SIGNING
SPS_ID.DIRECTION_OF_TRAVEL
SPS_ID.LOCATION_INFO

Key Dates

Key dates include construction dates, traffic open dates, and dates that other types of maintenance and rehabilitation activities were performed.

For GPS test sections and SPS 5, 6, 7, and 9 (overlay) projects, **INV_ID**.CONSTRUCTION_DATE, **INV_AGE**.TRAFFIC_OPEN_DATE, and **TRF_BASIC_INFO**.DATE_OPEN must be non-null and contain valid entries. Furthermore, these dates must have a logical relationship between each other:
INV_ID.CONSTRUCTION_DATE # **INV_AGE**.TRAFFIC_OPEN_DATE
INV_ID.CONSTRUCTION_DATE # **TRF_BASIC_INFO**.DATE_OPEN
INV_AGE.TRAFFIC_OPEN_DATE . **TRF_BASIC_INFO**.DATE_OPEN

For SPS 1, 2, 8 and 9 (non-overlay) projects, **SPS_ID**.DATE_COMPLETE, and **SPS_ID**.DATE_OPEN_TRAFFIC must be non-null and contain a valid date. Furthermore, these dates must have a logical relationship:
SPS_ID.DATE_COMPLETE # **SPS_ID.**DATE_OPEN_TRAFFIC

For all SPS test sections, **SPS#_***.DATE_BEGAN and **SPS#_***.DATE_COMPLETE must be non-null and contain a valid date for all records in all tables which contain these fields. These dates must also have a logical relationship:
SPS#_*.DATE_BEGAN # **SPS#_***. DATE_COMPLETE
(Note that the <#> character represents a variable number, while <*> is a wild card character.)

MNT_*.DATE_BEGAN and **MNT_*.**DATE_COMPLETE must be non-null valid dates for all records in the **MNT** tables which contain these fields. These dates must also have a logical relationship: **MNT_*.**DATE_BEGAN # **MNT_*.**DATE_COMPLETE

RHB_*.DATE_COMPLETE must be non-null and contain a valid date for all records in the **RHB** tables which contain this field.

Pavement Monitoring The minimum pavement monitoring requirements are specified for each five year interval that a test section has active monitoring status. Active monitoring status is considered to be the period of time, after a test section has been accepted into the LTPP program, starting when the site is first established in the field or when the first field measurement for the LTPP program is performed and ending when the test section is taken out-of study. For each five year period in active monitoring status, each individual test section (not project site) must have one complete set of FWD measurements including other associated measurements (such as temperature, joint opening's, etc.); one complete set of distress measurements including surface distress and transverse profile (for AC surfaced sections); and one set of longitudinal profile measurements. Qualifying data sets must have been performed in compliance with LTPP guidelines and be available in the IMS.

Climate For climate data, records must exist in the **CLM_VWS_PRECIP_ANNUAL** and **CLM_VWS_TEMP_ANNUAL** tables for each year a test section or project was in active monitoring status. Missing climate records are considered to be correctable, provided notification is provided to the TSSC and a response is received by the RCOC from the TSSC that it is planned to obtain missing data in the next climate update.

Past Traffic Past traffic refers to traffic data for the calender year ending 1998 and earlier years. For all test sections or SPS project sites, as a minimum, LTPP Traffic Data Sheet 10 - Traffic Volume and Load Estimate Update - No Site Count, or some traffic monitoring data for the site, must be available for each year a test section or SPS project has been under active monitoring status in the LTPP program. Active monitoring status is considered to be the period of time, after a test section has been accepted into the LTPP program, starting when the site is first established in the field or when the first field measurement for the LTPP program is performed and ending when the test section is taken out-of-study.

For the years in which traffic data estimates were provided on LTPP Traffic Data Sheet 10, the following fields must be non-null and contain valid entries:
TRF_EST_ANL_TOT_LTPP_LN.KESAL_18K_TOTAL
TRF_EST_ANL_TOT_LTPP_LN.AADT_ALL_VEHIC
TRF_EST_ANL_TOT_LTPP_LN.AADT_TRUCK_COMBO

For years during the active monitoring period in which traffic monitoring data were provided and traffic estimate data were not provided, **TRF_MONITOR_BASIC_INFO**.DATA_AVAILABILITY must be non-null, properly computed, and greater than or equal to 1, and **TRF_MONITOR_BASIC_INFO**.AVC_SITE_LOCATION and **TRF_MONITOR_BASIC_INFO**.WIM_SITE_LOCATION must not both equal "O". *(Note that the DATA_AVAILABILITY and *_SITE_LOCATION fields are determined and input by RCOCs; a DATA_AVAILABILITY value of 1 indicates limited data (only short duration counts) for either vehicle class or truck weights, and a *_SITE_LOCATION value of O indicates the monitoring was not performed on the same road as the test section.)*

Present Traffic Monitoring

Based on available information, enter the monitoring category (S1, S2, G, or C) which best corresponds to the present traffic monitoring data collection being performed at the site.

If the highway agency has provided "proof of intent" under data resolution to improve traffic monitoring data collection at the site, indicate the most appropriate monitoring category, corresponding to the improved plan, and shade the cell gray.

In those instances in which on-site traffic monitoring data was previously collected and reported, which passed quality control checks and substantially complies with the revised data **sampling** guidelines by test section monitoring category, but for which the permanently installed pavement sensors have failed and are no-longer operational, and the agency does not plan to repair the equipment, indicate the monitoring category which best corresponds to the prior traffic data collection sampling scheme and shade the cell gray. On the comments form, provide information concerning the cause for monitoring discontinuation, extent and nature of the previously supplied data. (*As noted in LTPP Directive TDP-10, information on continuation of traffic monitoring measurements on sites on which the equipment has failed, must be coordinated with LTPP.*)

It is expected that this entry will serve as a primary determinate for adjustments to the LTPP recommended monitoring category in those cases where traffic data collection is the only data deficiency.

LTPP Recommended Monitoring Category

The LTPP recommended monitoring category is based upon assessment of test section compliance with the minimum data completeness requirements contained in this directive. Table 3 presents a summary of the minimum past and future monitoring requirements for each category. Using the highest potential monitoring category as a starting point, the recommended monitoring category is recorded in this cell.

If a test section fails to meet the minimum data requirements for pavement structure, inventory, pavement monitoring, climate, or past traffic, and "proof of intent" for plans to correct the deficiencies (black cell fill pattern) have not been received, the test section should be placed in the C monitoring category. Exceptions to this rule should be discussed with FHWA.

If the traffic monitoring data collection plan does not meet or exceed the minimum requirements for the site's highest potential monitoring category, the monitoring category should be adjusted, in the following sequence, until the traffic monitoring data collection plan satisfies the minimum requirement for the category.

S1 þ S2 þ G þ C

For example, if a test section in the S1 monitoring category, has traffic monitoring less than S2, but greater than the G monitoring requirements, the recommended monitoring category would be G.

Every effort must be made to maintain test sections at their highest potential category in order to reap the benefits of the investment in LTPP. The monitoring categories were tailored around the level of highway agency investment in the test site and relative utility of the data. The following is a description of the nature of the various monitoring categories.

S1 These are high value flexible and rigid pavement experiments (SPS 1 and 2) which began with a new construction or reconstruction event. It is on these test sections that we have the opportunity to best measure the effects of pavement features such as drainable bases, widened lane, base type, etc. starting from construction within the context of a nationally coordinated experiment. Some agencies have estimated that they have invested up to $500,000 to construct, test and monitor these test sections. In keeping with this level of investment, these test sections have been assigned the highest level and intensity of monitoring. These test sections will be the primary candidates for future special monitoring studies.

S2 This category includes the SPS-8 experiment on environmental effects and the SPS 5 and 6 rehabilitation experiments. The SPS-8 experiment is an adjunct to the SPS-1 and 2 studies; two test sections from the SPS 1 and 2 studies where constructed on lower volume roadways where environmental effects are most likely to cause deterioration. Since these sections are placed on low volume roadways, the intensity of traffic monitoring requirements is a little less than for the S1 category. The SPS 5 and 6 are the high value flexible and rigid rehabilitation experiments that start with construction of a specified series of treatments on contiguous test sections. These test sections are valuable since they are also based on a nationally coordinated experiment with similar test sections constructed in other parts of the country.

G The G category of pavements is mostly comprised of test sections in the General Pavement Study. These test sections are of vital importance to the program since they provide the greatest extent of coverage of environmental factors, paving materials and paving practices. Some of the monitoring requirements are less intensive than the S categories with provisions for performing measurements in response to changes in the pavement condition or other events.

C The C or close-out category of monitoring is still an active monitoring status category. Close-out monitoring means that one more round of pavement performance measurements will be performed on existing test sections, preferably at the end of their current life cycle when a rehabilitation treatment is applied. The objective is to preserve the previous investment in these test sections by obtaining a minimum level of performance information over the current pavement life cycle. Test sections are assigned to this category due to either an uncorrectable or minimum data requirement deficiency which will not be corrected, or because they are part of an experiment with limited national impact, limited product potential or whose study time period has expired.

Monitoring Category Highway Agency Commits to Support

The monitoring category the highway agency pledges to support for the remainder of the time the test section remains "in-test" in the LTPP study is entered in this cell. The highway agency may elect to commit support for a monitoring category with greater intensity and resource requirements than that recommended by LTPP; however, the category should not be greater than that indicated under the highest potential monitoring category. *(It is important to understand that the stated traffic data collection standards for each monitoring category are minimums; data collection efforts which exceed these minimums are still needed to support program research products.*)

Highway Agency Officials Signature

It is required that an official from each participating highway agency, who is in a position of authority to commit agency resources, sign the form to signify commitment of resources required to support the level of monitoring indicated under "Monitoring Category Highway Agency Commits to Support". These agency resources include provision of traffic monitoring data collection, traffic control for pavement monitoring activities, material sampling and testing (as required by the type of test section), and provision of maintenance and rehabilitation data.

Data Completeness and Monitoring Adjustment Comments Form

The Data Completeness and Monitoring Adjustment Comments Form is used to record notes concerning the nature of entries on the Data Completeness and Monitoring Adjustment Form which are questionable or do not meet the minimum guidelines. Comments shall be provided for all cells which have been shaded, either light gray or black, on the Data Completeness and Monitoring Adjustment Form.

State / Province	Enter the name of the state or province that the test section or project is located.
Date	Enter the date the form was completed or last updated.
Responsible Agency	Enter the name of the agency responsible for resolution of the missing or questionable data. If the responsible agency is a member of the LTPP program team, then LTPP should be entered. If the highway agency is responsible, then the full name of the state or province as shown in Table A.1 of the LTPP Data Collection Guide should be used.
Agency Contact	Enter the name of the person in the responsible agency who was contacted regarding the status of data elements listed on this form.
LTPP ID	Enter the matching test section and project IDs that the comments on this portion of the form pertain. Multiple IDs can be shown when the comment applies to multiple test sections and projects.
Data Type	Enter the data type category to which the comments pertain.
Comments	Comments and notes on the nature of why a particular cell shading pattern was assigned on the Data Completeness and Monitoring Adjustment Form shall be entered for all such cells. Within the comment cell, test section location names, commonly used by the highway agency, can be included.

Resource Requirements

Table 3 presents a summary of the minimum data collection requirements and monitoring intervals for LTPP program by type of test section and monitoring category. Typical production rates for pavement performance monitoring testing performed by LTPP and traffic control requirements are shown in Table 4. This information, plus the details on traffic monitoring requirements in the next section, could be used to develop an estimate of agency resource requirements to support the LTPP program. Note that due to differences in specific site conditions and circumstances, these typical site resource estimates can increase or decrease. Past site experience should be used as a guide for planing purposes.

Traffic Monitoring

Since traffic monitoring most often consumes the most significant amount of agency resources for participation in the LTPP program, the following details on the minimum traffic monitoring requirements for each monitoring category are provided for reference. The four general traffic monitoring categories for LTPP are:

S1	Continuous WIM
S2	Continuous AVC + 2-day WIM *f* (AVC)
G	Continuous AVC for equipment life + 2-day WIM/yr; design sample plan

C Close-out measurements

A description of the data collection plan for each of these traffic monitoring categories is presented next. More detailed information on these data collection plans and traffic data collection equipment calibration requirements, which includes a discussion of exceptions and alternatives is provided in LTPP Directive TDP-10, "Revised Traffic Monitoring Protocol for LTPP Test Sites," April 1998 and LTPP Directive TDP-11, "Protocol for Calibrating Traffic Data Collection Equipment," April 1998.

S1 - Continuous WIM

The continuous Weigh-in-Motion (WIM) level of monitoring consists of a permanent WIM device, installed at a location that measures the same traffic stream passing over the test section(s), and is operated continuously[1] as permitted by scale operating condition. On-site calibration shall be performed a minimum of two times per year in accordance with LTPP Directive TDP 11, "Protocol for Calibrating Traffic Data Collection Equipment," April 1998. The scale output must be monitored and calibrations performed at other times when calibration drift or other problems are detected. If a scale fails or exhibits calibration drift, it will be repaired within two months; shorter repair times are desired whenever possible. WIM data should not be submitted to LTPP for periods during which the scale is not in calibration.

The WIM equipment should be kept in operation as long as physical conditions allow. As the physical condition of the roadway begins to cause problems with scale operation, participating agencies should discuss with their Regional Coordination Office Contractor (RCOC) the need for continued operation on the site and the required maintenance and repair activities needed to keep that scale operational. Decisions about the replacement of the WIM equipment and any required pavement rehabilitation will be made by LTPP and the participating agency on the basis of the status of the SPS experiment, the status of other test data for that SPS site, and the cost of the required repair/replacement effort.

S2 - Continuous AVC + 2-day WIM f(AVC)

For test sections within this traffic monitoring category, the minimum data collection requirement is two days of vehicle weight data from WIM scales plus data from a continuously operated Automatic Vehicle Classifier (AVC). Beyond the basic two-day WIM sample, the participating agency is expected to collect additional site specific weight data if an agency's review of the site's traffic characteristics determines that either:

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[1] LTPP acknowledges that no data collection device collects data at all times during a year. As a result, "continuous" data collection is defined as use of a device that is intended to operate throughout the year and to which the highway agency commits the resources necessary to both monitor the quality of the data being produced and to fix problems quickly upon determination that the equipment is not functioning correctly.

- weekend loads per vehicle (by class) are significantly[2] different than weekday loads, or
- seasonal loads per vehicle change significantly (for example, if a weight restriction is placed on the road during parts of the year).

The agency must use monitoring data collected for LTPP to determine the need for additional WIM data collection. (For example, the agency must have collected some weekend weight data at that site to determine whether weekend and weekday weights per vehicle are similar or are significantly different. Similar criteria are applied to seasonal loads per truck by vehicle classification, so that over time data should be collected at least once during the four different seasons of the year.) For cases in which agencies have previously collected data requested for LTPP test sites, this analysis can be easily performed with existing LTPP data. Where data have not already been collected to detect these differences, agencies are requested to collect these data and submit them as part of the LTPP traffic data submittal.

If either seasonal or weekday/weekend differences exist, the participating agency should commit to collecting data during the periods that are anticipated to be different in addition to the required 48-hour sample (e.g., collecting one weekend of weight data, or two days' worth of data during a different season). Finally, if significant changes[3] are measured from one year to the next, the agency is requested to collect a second 48-hour sample of WIM data (at least 3 months separated from the first sample) to help determine the cause of that change.

Participating agencies should follow the above data collection plans until new guidelines are issued by LTPP or until pavement performance data will no longer be collected at that test site.

Traffic monitoring measurements which exceed these frequencies are still desired.

On-site WIM calibration is required immediately before the start of the WIM data collection effort. Calibration and/or validation of AVC equipment must also be performed twice per year. (The AVC equipment must be initially calibrated, and then its proper operation must be validated at least twice per year. One of these two validation efforts can occur at the same time as the WIM scale calibration.) These calibrations shall be performed in accordance with LTPP Directive TDP-11 “Protocol for Calibrating Traffic Data Collection Equipment,” April 1998.

If the permanently installed AVC equipment at the test site fails, the classifier should be repaired and/or replaced within two months. However, if the site is scheduled for “close-out,” the participating agency, LTPP, and RCOC may decide to not replace the equipment. This decision will be made on a case by case basis, given the needs of LTPP, those of the agency, and the cost

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[2] “Significantly” is defined as a difference of more than 10 percent in the mean GVW for those vehicle classes that make up 75 percent of the ESAL loading at that site.

[3] “Significant changes” are defined as a positive or negative change of 10 percent or more in the mean GVW per vehicle, by vehicle classification, for the three truck classes that make up the highest percentage of loads (defined by an ESAL/day calculation) at a site. This is designed to determine if the loaded/unloaded condition of “important” trucks at that site has changed, or if a commodity shift change has taken place.

and difficulty of replacing the data collection equipment. If a WIM scale is replaced by an AVC, LTPP will provide additional instructions (on a case by case basis) regarding whether to collect additional WIM data at that site.

G - Continuous AVC for equipment life + 2-day WIM/Yr; Design Sample Plan

The minimum data collection effort for this monitoring category is two days of vehicle weight (WIM) data plus data from a continuously operating automatic vehicle classifier. Additional WIM data collection is required if data collection experience shows that truck loading patterns are not consistent throughout the year and/or that there is seasonal or day-of-week variation in truck weights. However, the agency may use data from elsewhere in the state or province in addition to LTPP collected data to make these determinations. If high weekday/weekend or seasonal variations exist, the agency should collect additional WIM data at that site to determine the size of these differences. Traffic monitoring measurements in excess of these frequencies are still desired.

The primary difference in traffic data collection for this category of LTPP test sites and the previous set is in the response to permanent data collection equipment at each site. For these sites, LTPP has relaxed the two month repair criteria. Instead, the agency should notify the RCOC that a specific piece of equipment has failed and should work with the RCOC to determine whether the expected life span of that test pavement, the availability of data for that site, and the needs of the LTPP analysis effort warrant replacement of that equipment, whether a less costly data collection effort can be substituted for that equipment, or whether traffic data collection can be discontinued.

At least twice a year, the operation of the AVC will be validated and any necessary adjustments made to ensure the accuracy of the classification counts. Calibration of the WIM data collection device should also occur immediately before its use. These calibrations will be performed in accordance with LTPP Directive TDP-11, “Protocol for Calibrating Traffic Data Collection Equipment” April 1998.

C - Close-Out Measurements

The Close-out measurement category is an active monitoring category; the test section is still considered to be “in-study”. The intent is to perform one last round of pavement condition measurements at a site to capture terminal conditions prior to the next rehabilitation construction event. The minimum traffic data requirements for test sections in this category are traffic estimates for each year of active monitoring status; prior to the final round of pavement condition measurements. For test sections within this monitoring category that have continuous traffic monitoring equipment, it is still desired that the equipment continue to be operated up to the time the final close-out distress survey is performed. At that time, uncollected traffic data should be obtained within one month of the close-out distress survey. At those sites where intermittent traffic sampling measurements are performed and the activity causing the test section to be “closed-out” will result in destruction of the traffic sensors, one last suite of measurements (AVC and WIM) should be performed prior to their destruction. If measurements are being performed with portable sensors, then one last suite of measurements should be performed within three months of the close-out distress survey.

Prepared by: TSSC

Approved by

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Aramis Lopez
LTPP Operations Team Leader

Table 1. Data completeness report and monitoring adjustment form.

State		Date	

	Section or Project ID												
Current LTPP Experiment													
SMP Site?													
Highest Potential Monitoring Category													
Minimum Data Completeness Adequacy													
Pavement Structure													
Inventory													
Pavement Monitoring													
Climate													
Past Traffic													
Present Traffic Monitoring													
LTPP Recommended Monitoring Category													
Monitoring Category Highway Agency Commits to Support													

Data Category	Minimum Requirements for Existing Data
Pavement Structure	Layer thicknesses, material classification from tests, geometry and reinforcement
Inventory	Location, key dates
Monitoring	1 FWD, distress, and profile measurement per 5 year period or equivalent
Climate	virtual weather station
Past Traffic	Sheet 10 or WIM/AVC measurements each year

Highway Agency Official's Signature of Commitment to Support Monitoring	
Signature	Name
Date	Agency

Table 2. Data completeness and monitoring adjustment comment form.

State / Province		Date	

Responsible Agency		Agency Contact	

LTPP ID	Data Type	Comments

Table 3. Summary of data collection requirements and monitoring frequencies.

LTPP Experiment	Minimum Traffic Monitoring Data Collection Methods	Minimum Pavement Monitoring Intervals			Climate Data Collection Method	Monitor Category
		Profile	Distress	FWD		
SPS 1 & 2	Continuous WIM	1-year	1- year manual and 2 -year photographic	2-year and responsive testing	On-site weather station	S1
SPS 5 & 6	Continuous AVC + 2-day WIM *f* (AVC)				Off-site weather stations	S2
SPS 8					On-site weather station	
SPS Supplemental	Same as core sections	Same as core sections	3-year manual, 2-year photographic, and responsive	5-year and responsive testing	Same as core sections	
SPS 9 & GPS 1, 2, 3, 4, 5, 6B/C/D/S, 7B/C/D/F/R/S, 9	Continuous AVC for equipment life+2-day WIM/ Yr; design sample plan	2 year			Off-site weather stations	G
GPS 6A & 7A, SPS 3, 4, & 7	Traffic estimates for each year in active status last measurements	One last measurement	One last measurement	One last measurement	Off-site weather stations	C

Table 4. Typical productivity rates and traffic control requirements for LTPP pavement monitoring measurements.

Experiment	Monitor Category	Manual Distress Measurements			FWD Measurements		
		Interval	Rate (1)	Traffic Control (2)	Interval	Rate	Traffic Control (2)
SPS-1	S1	1 year	4 per-day/proj	4 days/proj	2 years	4 day/proj	4 day/proj
SPS-2	S1	1 year	4 per-day/proj	4 days/proj	2 years	5 day/proj	5 day/proj
SPS-5 & 6	S2	1 year	3 per-day/proj	3 day/proj	2 years	3 day/proj	3 day/proj
SPS-8	S2	1 year	1 per-day/proj	1 day/proj	2 years	1 day/proj	1 day/proj
SPS-9	G	3 years	1 per-day/proj	1 day/proj	5 years	1 day/proj	1 day/proj
SPS Supplemental		Responsive	1 per-day/proj	1 day/proj	5 years	1 day/proj	1 day/proj
GPS-1,2,3,4,5,6,7,9	G	3 years	½ per-day/sect	½ day/sect	5 years	½ day/sect	½ day/sect
SPS-7	C	Responsive	3 per-day/proj	3 days/proj	Responsive	4 day/proj	4 day/proj
SPS 3 & 4	C	Responsive	2 per-day/proj	2 days/proj	Responsive	2 day/proj	2 day/proj
GPS 6A and 7A	C	Responsive	½ per-day/sect	½ day/sect	Responsive	½ day/sect	½ day/sect

Notes

(1) Typical productivity rates for LTPP distress raters, expressed in person-days per project or section. Multiple raters on a project can decrease traffic control requirements, depending upon specific site circumstances. A day is considered to be an eight hour work day.

(2) Typical maximum number of traffic control days, site specific circumstances can decrease or increase requirements.