Guide to LTPP Traffic Data Collection and Processing

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Long-Term Pavement Performance
Serving your need for durable pavements

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1. INTRODUCTION

This document supersedes Chapter 4: Traffic Data Collection of the Data Collection Guide[1] developed by the Strategic Highway Research Program (SHRP). Data sheets and instructions for submitting traffic data for test sections, as well as the protocols for calibrating traffic data collection equipment, are included in this document. These guidelines reflect the revised traffic data collection plan developed for the Long Term Pavement Performance (LTPP) project, as well as other minor changes that have occurred since Chapter 4 was last produced in 1993.

Traffic data is required within the LTPP study in order to provide an independent measure of the loads that are applied to the individual pavement sections being studied. The basic goal of the data collection effort is to provide researchers with axle load distributions that represent the loading history for each test section. This means actively measuring loads being applied to test section pavements, while also providing the best possible estimates of loads that these pavements experienced prior to the start of the LTPP traffic monitoring efforts.

The goal of this report is to document the process and procedures used by LTPP to collect and store the traffic data used to estimate pavement loadings. This first section of this report provides introductory material on the traffic data collection process, including an outline of how data flows through the system and an introduction to terms used throughout this report. Section 2 covers the principles of traffic data collection regarding data manipulation, site-specific data, and codes for data availability and site location. The traffic data collection plan is presented in Section 3. Section 4 presents LTPP's instructions for the selection, location, installation and calibration of traffic data collection equipment. Section 5 details the submittal formats for traffic monitoring data. Section 6 presents the forms and instructions for submitting monitored traffic data. Appendix A discusses the submittal of historical traffic data.

1.1 FLOW OF TRAFFIC DATA WITHIN THE LTPP PROCESS

In the LTPP program, state and provincial highway agencies are tasked with collecting and submitting all requested traffic data. Their responsibilities include the selection of the data collection equipment (including both automatic vehicle classification and weigh-in-motion equipment), and the placement, calibration, and operation of that equipment. The Agency is also responsible for the initial quality control effort regarding the collected data. (The highway agency should examine the data to make sure the equipment worked as intended.) The highway agency is also responsible for formatting the data as defined in later sections of this report, and then transmitting that data to the appropriate Regional LTPP office.

Once the data are received at the Regional LTPP office, the required back up copies are created, and the data are then entered into the regional traffic database. At this point the initial LTPP quality control

[1] Data Collection Guide for Long-Term Pavement Performance Studies, Operational Guide Number SHRP-LTPP-OG-001, Strategic Highway research Program (SHRP), Washington, D.C. January 1990. (Revised October 1993, Federal Highway Administration, LTPP Division.)

process is performed. The end product of this process is a written report that is sent by the Regional Office to the Agency describing potential problems in the submitted data. The report consists of a memo, the list of irregular data (the flag list), the QC results and any other material that would assist the agency in reviewing the processed data submission. In addition, the questionable data records are identified to prevent their possible use in LTPP estimations and aggregations.

The highway agency is responsible for responding to this written report. Based on the Agency's responses, the Regional Office reviews the flagged data records. The flags are either left in place, (questionable data are removed from further processing because they are in fact bad data points), or the flags are removed (the Agency indicates that the data are correct measures of the traffic experienced at that location.)

Once the traffic data have passed through the QC process, the Regional Office is responsible for the remainder of the traffic data processing. This includes the aggregation of the data into daily estimates of traffic volume and load (by class of vehicle), and the creation of two forms of annual loading table (a loading table by vehicle class and a table for all classes combined.) All data submitted to the Regional Offices are stored in the LTPP Central Traffic Database (CTDB). In addition, the annual axle load table for all classes combined and the summary volume data are uploaded from the CTDB to the LTPP Information Management System (IMS.)

1.2 TRAFFIC DATA AVAILABLE TO RESEARCHERS

Researchers can access LTPP traffic data contained in both the CTDB and the IMS. In general, the CTDB contains all traffic data submitted by the agencies, including all levels of aggregation created as part of the annual load estimation process. The IMS contains the annual load tables, and specific computed parameter tables for specific experimental sections. A more complete explanation of the data available to researchers through the IMS and the best methods for obtaining that data can be found in the LTPP Researcher's Guide[2]. Access to the disaggregated and more voluminous data in the CTDB can be obtained by contacting the FHWA LTPP staff or the Customer Support Services Center of LTPP at ltppinfo@fhwa.dot.gov.

It is important to recognize that all traffic estimates in the CTDB and the IMS are not equivalent. In particular, there is a significant difference in the reliability of loading estimates made from data collected at the site of an LTPP test section, and estimates made based on data collected elsewhere in the state or province. To help researchers differentiate between loading estimates made from these different sources, two separate steps have been taken. The first differentiates between estimates made prior to the start of LTPP monitoring (Historical Data) when little site specific data is available and those made after the start of those monitoring efforts (Monitoring Data). The second separates the monitoring period estimates into those years when data was actually collected versus those years when estimates made by extrapolating from previously collected LTPP data.

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[3] SAIC, "Researcher's Guide to the Long-Term Pavement Performance Traffic Data", DRAFT, Federal Highway Administration, Pavement Performance Division, LTPP Team, June 1997.

1.2.1 Historical Traffic Data

For LTPP purposes, historical traffic data are defined to cover the period from the dates the pavement sections were initially opened to traffic (or from the date of the most recent overlay or rehabilitation project) until traffic monitoring activities began. The historical data include both estimates and actual measurements of traffic volumes, vehicle classification, and axle loadings. To submit historical data, nine data sheets are submitted for each site to the Regional office. Historical traffic data reporting guidelines can be found in Appendix A.

1.2.2 Traffic Monitoring Data

Data collection for traffic monitoring purposes for SHRP began in 1990. Only traffic data collected after 1989 are considered "traffic monitoring data" for LTPP purposes. Traffic monitoring data are site-specific and are intended to include actual measures of traffic over each 152 meter (500 foot) long LTPP test section. They are intended to be collected from equipment placed immediately up- or down-stream from the LTPP site. The formats and instructions for submitting these site-specific measurements of vehicle volume, vehicle classification, and truck axle weight data are provided in this guide. The majority of this report describes the collection and reporting of the traffic monitoring data.

1.3 LTPP TERMS

The following terms are commonly used with the LTPP program. Understanding their meaning within the LTPP process is important for individuals working with LTPP traffic data.

Additional Traffic Loading Information - All data regarding traffic loading that is submitted by Agencies but is not recorded within the Submitted Traffic Loading Records (see below) is maintained in the Regional Offices as part of the Central Traffic Database. These miscellaneous pieces of information include transmittal correspondence and "meta data" that effect how traffic loading records should be used and interpreted and were originally referred to as Sheet 5 data.

Annual Loads By Vehicle Class Records - This is the second highest level of data aggregation in the Central Traffic Database (CTDB). Formerly called Level 2 it contains an estimated, annual, axle load distribution table by vehicle classification (i.e., one axle load distribution table for each class of vehicles weighed by Agencies) for each year and site for which traffic monitoring data are collected.

Annual Load/Count Summary Records - The highest level of data aggregation in the Central Traffic Database (CTDB). A record exists in the CTDB for each LTPP test site for each year during which monitoring data was submitted to the LTPP Regional Offices. These records contain the total estimated number of axle loads by axle type and load range for the test lane. Also contained on these records are the total estimated vehicle volume, by classification of vehicle. These were previously referred to as Level 1 records.

Computed Quantities - A number of measures stored in the IMS for use as independent variables in the evaluation of pavement performance are not directly measured, nor are they simple aggregations of measured quantities. Instead these variables are the result of analytical procedures that transform one or more other measurements into a new "computed quantity." For example the creation of ESALs reflects a computed quantity.

CTDB - Central Traffic Database. The database system maintained by LTPP in order to store all submitted traffic records for the LTPP experiment. Summaries of the CTDB are uploaded to the IMS. The CTDB contains data at a variety of different levels of aggregation. These different levels of aggregation, ranging from individual vehicle weight records to annual summaries of axle load distributions. The term RTDB (Regional Traffic Database) is occasionally used to identify the portion of the CTDB located at each regional office.

Daily Summary Traffic Records - A middle level of data aggregation within the CTDB. This group of records, formerly called Level 3, contains three types of records. It contains daily total volumes by class of vehicle, daily total volumes for each class, and a daily total axle load distribution table for each vehicle class. Data are present at this level of the CTDB whenever a complete day of data of the relevant type has been submitted by an Agency. No data are interpolated at this level of the database.

Historical Traffic Data - Independent traffic loading estimates that are the "best possible" estimate of annual loads on a test section that took place prior to the start of LTPP traffic monitoring. These loading estimates are based on whatever data were available to the Agency.

IMS - The LTPP Information Management System. The primary LTPP database. It contains both traffic and non-traffic variables.

Level 1 - In the CTDB, this set of records includes annual summary load information. It has been renamed "Annual Load/Count Summary Records." It includes both total vehicles in the LTPP test lane, and the axle load distributions estimated to occur in the test lane during a given year. The axle load distributions are by weight range and axle type (i.e., single, tandem, tridem, and quad). This information is also transferred to, and stored in, the IMS.

Level 2 - In the CTDB, this set of records provides annual axle load distributions by vehicle type. This level of the CTDB has been renamed "Annual Loads By Vehicle Class." It is similar in structure to the Level 1 record, except that a set of axle load distributions is presented for each of the 10 FHWA truck types. (FHWA vehicle classes 4 through 13.)

Level 3 - In the CTDB, this set of records (now called Daily Summary Traffic Records) contains daily summaries of loading information. Level 3 consists of three different types of records; daily volume totals, daily volume totals by vehicle class, and daily axle load distributions by vehicle class if the relevant type of raw data was submitted by the region.

Level 4 - In the CTDB, this set of records (now called "Submitted Traffic Loading Records") contains the "raw" data submitted by the Agencies, but stored in a common format. There are three different types of records at this level of aggregation; individual vehicle weight records, hourly volume records, and hourly volume records by vehicle classification.

Level 5 - In the CTDB, this set of records includes all traffic information submitted by an Agency, but that is not incorporated in Level 4 of the CTDB. This includes all data incorporated on the transmittal sheets and transmittal letters sent by Agencies to their respective RCOCs. This portion of the CTDB is now called "Additional Traffic Loading Information."

Location - A general reference to a place on a roadway. This term is often used in place of "section" or "site."

LTPP Region - A group of states for which an LTPP contractor charged with data collection is responsible. Data collection activities include agency coordination for field work done by the LTPP contractor and processing of data collected by individual highway agencies. There are four LTPP Regions, North Atlantic, North Central, Southern and Western.

Monitored Traffic Data - Independent variables of traffic loading that are the direct result of field measurements performed in accordance with LTPP data collection instructions. Monitored traffic data includes aggregations of these field measurements. The aggregation procedures include steps that account for missing data.

Project - A group of SPS test sections located contiguously on a roadway. (Many SPS projects are designed with several different pavement structures. In general, these test sections are placed sequentially on the roadway, separated by short buffer zones to ensure that distress caused in one test section does not effect the following test section.)

RCOC - Regional Contractor's Office Coordinator. The principal investigator in the Regional office responsible for direct state contact and liaison on data collection for LTPP.

Regional Office - A contractor working directly for the LTPP program to collect data, review it and load the information into the IMS. Pavement performance monitoring data are collected by personnel form the regional offices. Regional office processing of traffic data begins after its field collection and submission by an SHA.

Section - See Test Section

SHA - State and Provincial Highway Agency. Those (non-federal) agencies in the United States and Canada that are participating in the LTPP experiment by supplying roadway test sections for either the GPS or SPS experiments.

Sheet - A form used to submit data. There are currently 16 sheets used to transmit data related to traffic from the SHAs to the Regional Offices.

Sheet 10 Data - Annual ESAL estimates provided by a highway agency for years in the monitoring period in which no weight data was collected. Also included is an annual truck volume which may or may not be based on classification data obtained during the year for which an ESAL estimate is being provided.

SHRP - The Strategic Highway Research Program. The precursor to LTPP.

SHRP ID - The ID code used by LTPP to reference a specific test section within a state.

Site - A term used as a general location reference. It often is used to mean "a test section." However, for SPS experiments with more than one test section, the term "site" usually refers to all test sections within that project.

Submitted Traffic Loading Records - This is the lowest level of data aggregation in the CTDB. The CTDB contains three types of record at this level of the database; hourly traffic volume records, hourly traffic volume records by vehicle classification, and individual vehicle weight records. All traffic data submitted by Agencies are retained by the LTPP in this level of the CTDB, formerly called Level 4. When Agencies submit data in S.I. units both the original data set and the data in U.S. customary units (and associated format) is stored in the database.

Test Section - Refers to the 152-meter (500-foot) long piece of pavement that is physically being monitored for deterioration as part of the LTPP project. For SPS experiments, where multiple test sections are placed in series (one following another), each separate experimental pavement is considered a test section, and there can be as many as 20 "sections" within a given project (see "Project"). In most cases for these SPS experiments, traffic data is collected in one location and that loading rate is assumed to apply to all test sections within that SPS project.

Traffic Site - The specific location at which traffic load data is being collected. This may or may not correspond directly to an LTPP test section. Ideally, it is located either immediately up- or down-stream of the LTPP test section. For most SPS experiments, data from one traffic site is applicable to more than one test section.

1.4 INFORMATION SOURCES ON TRAFFIC DATA COLLECTION

Additional background information on the traffic data collection process for LTPP pavement performance test sections can be obtained through the documents listed below. Each of these reports can be obtained from the Customer Support Services Center of LTPP (ltppinfo@fhwa.dot.gov).

SAIC, "Researcher's Guide to the Long-Term Pavement Performance Traffic Data", DRAFT, Federal Highway Administration, Pavement Performance Division, LTPP Team, June 1997.

Hallenbeck, Mark, "An Overview of Traffic Data Requirements and Options for the General Pavement Studies Test Sections," Strategic Highway Research Program, April 1990.

Hallenbeck, Mark, "Procedures for Manipulating SHRP LTPP Traffic Data," Strategic Highway Research Program, April 1990.

Hallenbeck, Mark, "SHRP LTPP Traffic Database Design," Strategic Highway Research Program, April 1990.

Hallenbeck, Mark, "SHRP National Traffic Database, Description of the Required Computer System," Strategic Highway Research Program, August 1990.

"Traffic Data Summary Statistics in the SHRP CTDB," TRDF Technical Memorandum EC-43, May 1990.

Hallenbeck, Mark, "Directive TDP-10: Revised Traffic Monitoring Protocol For LTPP Test Sites," April 30, 1998.

Cornell-Martinez, Cindy, "Directive TDP-15: Basic Steps for Processing Monitored Traffic Data," November 30, 1998.

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2. PRINCIPLES OF TRAFFIC DATA COLLECTION

SHRP adopted a set of principles that govern traffic data collection, electronic processing, and summarization for the LTPP Information Management System (IMS). These principles are presented here as a reference to people who are participating in any aspect of LTPP research involving traffic data. They remain in force as part of the ongoing LTPP experiment.

2.1 WHAT TRAFFIC DATA LTPP WANTS AND WHY

To estimate traffic loading LTPP (based on initial recommendations by the SHRP Expert Task Group on Traffic Data Collection) requires the collection of vehicle volumes by classification and axle weights for vehicles. The specifics of the LTPP traffic data requirements are discussed later in this chapter. In general terms, the LTPP approach is to use vehicle volume by classification data to determine the number of heavy and light vehicles using a roadway, as well as the variability in those volumes during different time periods (time-of-day, day-of-week, and time-of-year.) Individual vehicle weight data is summarized to determine the distribution of axle weights by class of vehicle. When combined, these data sets provide all of the necessary information to estimate vehicle loads at LTPP test sites.

2.2 TRUTH IN DATA

A guiding principle of the traffic data collection program is the AASHTO adopted concept of “truth-in-data.” That is, a complete audit trail of all data collected and submitted to the LTPP program will be maintained. Consequently, traffic data collected will never be destroyed, discarded, or changed. In some agencies, these types of changes are referred to as "smoothing" the data. LTPP does not want any traffic data to be altered, revised, or smoothed. LTPP wants the actual traffic data collected in the field. If editing demonstrates that machine errors or failures have occurred, (and subsequently, that invalid data have been removed from the submittal), that fact should be noted when the data are transmitted to the Regional office. No changes should be made at any time to the data, other than the removal of invalid data. However, if known calibration errors occur (that is, if the data collected are biased by a known amount), this information should be submitted along with the monitoring data, and this information will be incorporated when annual load estimates are computed in the IMS.

The Regional office is required to summarize and aggregate traffic monitoring data to determine the estimated number of equivalent 18,000-pound single axle loads (ESALs) per year in the test lane and other summary statistics. The manipulation of traffic data is accomplished on the basis of a report prepared by Mark Hallenbeck, and upon operational manuals developed by SHRP. The procedures used for this task can be found in the LTPP document, “Procedures for Manipulating SHRP LTPP Traffic Data,” by Mark Hallenbeck, April 1990, as refined to conform to the *AASHTO Guidelines for Traffic Data Programs.*

2.3 SITE-SPECIFIC DATA

LTPP requires that traffic data be collected at or near the LTPP test section, in the same direction of travel. Wherever possible, historical data should also be derived from volume counts or classification and weight studies conducted at or near the test section.

Although an exact definition of "near the test section" cannot be written, the intent is to measure the same traffic (the exact same vehicles) that cross over the test section. "Near" could be several miles on an interstate highway with widely spaced interchanges in remote areas of a state or province. On the other hand, it may be less than 1,000 feet on an arterial highway in a highly populated urban area. Each state or province must make a judgment for each test section. The selection of a count location for a particular test section is reviewed by LTPP as part of the Traffic Data Collection Plan submitted by each state or province for each LTPP test site.

Data from parallel roadways or from roadways with similar volumes and similar functional classification is useful to the highway agency for estimating the AADT and ESALs per year for historical purposes, but such data do not meet the traffic data requirements during the monitoring phase of LTPP.

2.4 DATA AVAILABILITY CODE AND SITE LOCATION CODES

SHRP developed a Data Availability Code to be assigned to traffic summary statistics derived from each test section. The code is still used by LTPP, and is initially assigned by the Regional office on an annual basis to denote the completeness of data supporting the summary statistics for that site for the year. This measure is descriptive of the type of data collection equipment in place at each site, the amount of data expected (measured in days), and the type of data collected (WIM/AVC/ATR). Recent LTPP research allows the development of a crude estimate of the reliability (e.g., bias and confidence interval) of annual ESAL estimates included in the IMS database. The reliability estimate is based on the amount of classification and weight data that pass the LTPP Quality Control procedures for a given year.

The Data Availability Code defines the level of data collected on the basis of these specific factors:

- The type of weighing, classification, or counting equipment used to collect the data, and the type of WIM sensor used.
- The frequency of data acquisition.
- The number and duration of portable WIM measurements
- The availability of seasonal data for weight and classification data.
- Whether both weekday and weekend weight studies are made.

The Data Availability Code has three digits. The first two digits describe the location of the automatic vehicle classification (AVC) equipment and the weigh-in-motion (WIM) equipment used to collect the data for that site. These digits are determined from the relative location of the traffic data collection device and the LTPP test section. If the traffic data equipment is installed at or near the test section so that no change in traffic occurs between the traffic data collection point (measured by lane) and the LTPP test section, the data collection is considered 'Site Specific' and given a value of 'S.' If the traffic data collection equipment is on the same highway but some distance upstream or downstream of the test site such that some minor change in truck volumes may occur between the traffic data collection point and the LTPP test section, the code is set to 'R' for 'Site Related.' Finally, if the traffic data collection equipment is located at a point where it is not measuring the same traffic stream (i.e., it is at a non-related site), the code is set to 'O' for Other. Because of the code letters, this site location code is also known as the S, R, O code. The third digit of the code describes the type of equipment being used and whether that equipment is permanently installed and operated.

As stated earlier, the Regional office is responsible for entering these codes into the traffic database for each site. The Data Availability Code is written in this order (see Table 1 for the list of Data Availability Codes):

S, R, O Code for AVC

S, R, O Code for WIM

Data Availability Code

For example, if a permanent, continuously operating AVC device is located at the site, but the portable WIM device is set up at a location downstream of the GPS test location, the code would be S-R-7 and would be defined as follows:

S - Site Specific AVC

R - Site Related WIM

7 - Continuous operating, permanent AVC with portable WIM for all seasons and weekday/weekend time periods

Table 1. Data Availability Index Codes

0 to 9 Code (Amount of Data Collected)	
9	Continuous WIM meeting the ASTM standard.
8	Continuous WIM that does not meet the ASTM standard (or hasn't been tested against the ASTM standard).
7	Permanent classifier operating continuously, with portable WIM for all seasons and weekday/weekend time periods.
6	Continuous vehicle classification with some seasonal WIM.
5	Continuous vehicle classification with limited WIM.
4	Continuous AVC with no WIM data.
3	Continuous ATR volume station, with limited vehicle classification and truck weight data, and a measurement of truck seasonality.
2	Vehicle classification and WIM data with some measure of seasonality.
1	Limited data (only short duration counts) for either vehicle classification or truck weights.
0	Data collected on a different roadway that the LTPP site, including system level estimates.
S/R/O Code (Location of Class and Weight)	
S	Site specific data collection (data collected immediately up- or down-stream from the LTPP site).
R	Site related data collection (data collected on the same road as the LTPP test section, but separated from the test site by some traffic generator).
O	Other (data collected on another highway, or at a location which does not experience the same traffic stream as the LTPP test section.)

3. REVISED TRAFFIC DATA COLLECTION PLAN

The revised traffic monitoring proposal for LTPP test sites contained in this Section was originally published as LTPP Program Directive TDP-10. The intent of the revised plan is to improve the overall quality of the LTPP traffic loading estimates by shifting emphasis from collecting many days of data to collecting higher quality data. The new data collection plan prescribes the collection of large amounts of traffic data only at those sites at which other detailed data (on pavement deterioration, environmental issues, materials, etc.) needed for model development and validation have been collected. Larger amounts (more days) of traffic data are needed at these sites in order to provide a higher level of accuracy and precision in the available traffic load estimates. At other LTPP test sites, less accuracy and detail are required from traffic load estimates, and therefore, the number of days of traffic data requested is significantly smaller than that requested by the original traffic monitoring plan.

3.1 BACKGROUND

Analysis of the traffic load data that have already been submitted to LTPP has allowed LTPP to better understand the effects of different sampling plans on the accuracy of annual load statistics. The recommended plan resulted from that analysis and is intended to provide LTPP with the best possible analytical results from the least costly data collection effort. The analysis results show that reasonably accurate estimates of annual loadings can be computed from fairly small samples of data (see Table 2), given two provisions:

- The data accurately measure the traffic using the roadway at the time of the data collection effort (that is, accurate results can be obtained if the equipment is well calibrated and operating properly) and

- The road in question does not experience unusually high levels of traffic or loading variation.

Because of these findings, the new traffic data collection plan differs from the initial LTPP plan in that it requires considerably fewer days of monitored traffic data from most sites, but places more emphasis on the quality of those data. Particular emphasis is placed on the calibration of the equipment, including manual review of equipment performance at the data collection site. Section 4 of this document provides more specific guidance on the installation, calibration, and use of automatic vehicle classification and weigh-in-motion equipment.

The data collection plans described below are to be followed at each LTPP site until those sites stop being monitored as part of the LTPP tests or until permanent data collection equipment at the site fails. If the equipment installed at the site fails, discussions with the appropriate LTPP representative will be necessary to determine whether, for that particular site, the cost of repairing or re-installing traffic data collection equipment is warranted. This decision will vary from site to site, depending on the importance of a site to the overall LTPP experiment, the

availability of other experimental data at that site, and the cost of replacing the equipment, including any needed pavement rehabilitation.

Table 2. Summary of Expected Errors for Selected Sampling Plans

Sampling Plan		Expected Bias to the Annual Estimate	Expected Error (percent)	95 Percent Confidence Interval
Classification	WIM			
1 weekday	1 weekday	+20	45	200
1 weekend day	1 weekend day	-50	55	50
2 weekdays	2 weekdays	20	45	100
1 week	1 week	0	30	50
1 week during each of 4 seasons	1 week during each of 4 seasons	0	30	50
1 weekday and 1 weekend day per season for 4 seasons	1 weekday and 1 weekend day per season for 4 seasons	0	35	80
Continuous	1 weekday	0	30	50
Continuous	2 weekdays	0	25	50
Continuous	1 weekday and 1 weekend day	0	25	50
Continuous	1 week	0	25	40
Continuous	1 weekday during each of 4 seasons	0	12	30
Continuous	2 weekdays during each of 4 seasons	0	10	25
Continuous	1 week during each of 4 seasons	0	8	20

All values expressed as a percentage of annual load.
Source: Results of the Empirical Analysis of Alternative Data Collection Sampling Plans For Estimating Annual Vehicle Loads at LTPP Test Sites, July 1997

3.2 REVISED DATA COLLECTION PLAN

Table 3 shows the current data collection plan. Participating agencies have some flexibility in modifying these data collection plans at individual sites if they can show that the data collection plan they propose for a given site meets the desired level of accuracy. This flexibility is intended to allow agencies to tailor

the data collection plan to their own equipment and staffing resources/limitations. At the same time, the plan should maintain the accuracy and precision of the database and allow agencies with sites that have proven to have stable, repeatable, traffic patterns to reduce their data collection efforts because of the effect that repeatability has on the accuracy of annual load estimation.

At the vast majority of sites, these data collection plans should be viewed as the minimum data collection effort required to meet the stated levels of precision. Participating agencies may wish to collect more traffic information than is required under this plan, both because they are interested in obtaining more accurate traffic loading estimates at those sites for their own research and analysis and because in some cases more extensive data collection efforts may cost the same as the required LTPP effort. Participating agencies are encouraged to collect more than the minimum requested data, particularly where permanent data collection equipment have already been installed or where equipment will be installed as part of the agency's own traffic data collection program.

Table 3. Summary of Recommended Minimum Data Collection Plans

Required Data Accuracy and Precision	Recommended Data Collection Plan	Apply Plan To These Sites
Measured loads (not sample based estimates)	Continuous WIM	SPS-1, SPS-2
±25 percent 95 percent confidence the load estimate is +50 percent	Continuous Vehicle Classification Data 2 Days of WIM / year	SPS-5, SPS-6, SPS-8, SPS-9 Most GPS experiments (1, 2, 3, 4, 5, 6B, 6C, 6S, 7B, 7C, 7F, 7R, 7S and 9)
±45 percent with 95 percent confidence the load estimate is within ±200 percent	1 Week of Vehicle Class / 2 years 1 Day of WIM / 2 years	SPS-3, 4, 7 GPS 6A, 7A

In some cases (where traffic is particularly variable[3]), agencies are requested to collect additional days of traffic data to meet the required data collection accuracy. Additional traffic data will improve the loading estimates computed for a site and thus will improve the quality of research performed with the LTPP database.

Participating agencies are also encouraged to install and operate permanent equipment and sensors at LTPP test sites, even when such equipment is not specifically required by the LTPP data collection plans. Tests have shown that permanently installed WIM equipment often operates more reliably than

2 The term "variable" is not strictly defined. In general, any change in heavy truck volume or of total loading per day of greater than 25 percent can be considered significant, and worthy of monitoring.

portable equipment, even when not operated continuously (particularly for WIM sensors, where flush mounting of the sensors can only be accomplished in "permanent" installations). Permanently installed equipment also allows participating agencies to more easily observe traffic variations over time and, if necessary, to collect additional data at modest expense to account for that variation in both the LTPP loading estimates and the agency's own data collection and reporting system.

3.3 LTPP TEST SITE CLASSIFICATION

As shown in Table 3, the LTPP test sites are grouped into four monitoring categories. These categories correlate with the amount of data being collected (in all LTPP categories) and the types of analyses that will be performed. The new monitoring categories of for LTPP test sites are:

S1 - SPS-1 and -2,

S2 - SPS-5, -6, and -8,

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

C - Close-Out sections, including SPS-3, -4,- 7, and GPS-6A and -7A.

Traffic data collection resources will be most heavily focused on SPS sites that will provide the basic inputs for the development of mechanistic models for pavement design and rehabilitation. LTPP tests that are ending and/or test sections that are being removed from further pavement performance data collection (for example, that are being reconstructed in a manner that does not fit within one of the LTPP experiments) will not require continued traffic monitoring. However, all valid data previously collected will remain available through the LTPP IMS.

3.3.1 S1 Sites (SPS-1 and -2)

For SPS-1 and 2 sites, a continuously operating WIM device is required. This level of data collection is needed for two reasons: (1) to provide the accurate traffic loading measurements required to develop mechanistic and mechanistic/empirical design models and (2) to provide the base data necessary to understand the intricacies of the interactions among pavement, traffic load, and environment.

In addition to continuous WIM data collection, the participating agency should perform on-site scale calibration checks at least twice each year. (See Section 4 for the LTPP protocol for calibrating traffic data collection equipment in the absence of a documented, routinely used agency protocol to calibrate and check automated traffic data collection equipment). The agency should also monitor the output of the WIM equipment to determine whether additional calibration is needed. If the scale fails or experiences calibration drift, the agency should plan to repair the equipment within two months, with shorter repair times whenever possible. WIM data should not be submitted to LTPP for times during which the scale is not calibrated.

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 RCOC the need for continued operation of that site and the maintenance and repair activities necessary 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.

3.3.2 S2 Sites (SPS-5, -6)

For SPS-5 and -6 sites the minimum recommended data collection effort is two days of vehicle weight data per year plus the data from a continuously operating automatic vehicle classifier. At least twice a year, the operation of the AVC should be validated and any necessary adjustments made to ensure the accuracy of the classification counts. The WIM data collection device should also be calibrated immediately before its use. (See Section 4 for the LTPP protocol for calibrating traffic data collection equipment.)

Thus, for these sites, the minimum recommended data collection effort is two days of vehicle weight data per year plus the data from a continuously operating automatic vehicle classifier (AVC). This data collection plan yields an expected error in the estimate of annual load of roughly 25 percent[4], with 95 percent confidence that the annual load estimate is within ±50 percent.

At least twice a year, the operation of the AVC should 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 should be performed using documented and routinely used agency procedures or the methods discussed in Section 4 of this document.

As with the earlier data collection requirements, 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.

The review of available LTPP load data showed that at a majority of sites these conditions are not a problem. However, for the 20 percent of sites where significant variations in the traffic stream occur, a small increase in traffic data collection can significantly improve the accuracy of annual and seasonal loading estimates.

Since these sites are significant for improving rehabilitation designs, continuous WIM is highly desirable when funding is available. When continuous WIM is installed, the guidelines that apply to SPS-1 and -2

[4] This statistic is based on ESALs.

sites should apply to these projects as well. SPS-5 and -6 sites are nearing the end of their useful lives. If continuous WIM has been installed and it is determined that the pavement will be rehabilitated within 2 years of WIM equipment failure, consideration should be given to monitoring with continuous AVC and sampled WIM as discussed in section 3.3.4.

3.3.3 S2 Sites (SPS-8)

For SPS-8 sites the minimum recommended data collection effort is two days of vehicle weight data per year plus the data from a continuously operating automatic vehicle classifier. At least twice a year, the operation of the AVC should be validated and any necessary adjustments made to ensure the accuracy of the classification counts. The WIM data collection device should also be calibrated immediately before its use. (See Section 4 for the LTPP protocol for calibrating traffic data collection equipment.)

Thus, for these sites, the minimum recommended data collection effort is two days of vehicle weight data per year plus the data from a continuously operating automatic vehicle classifier (AVC). This data collection plan yields an expected error in the estimate of annual load of roughly 25 percent[5], with 95 percent confidence that the annual load estimate is within ±50 percent.

At least twice a year, the operation of the AVC should 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 should be performed using documented and routinely used agency procedures or the methods discussed in Section 4 of this document.

As with the earlier data collection requirements, 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, it is expected that since these projects were located in areas with minimal truck traffic that the variation of concern will be truck volume rather than truck weight.

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 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.

In the event that a state can certify that there is essentially no loading on the section, the monitoring requirement may be reduced to samples of both class and weight. Information supporting the certification could include previously collected monitoring data, location or truck restrictions on the facility .

[5] This statistic is based on ESALs.

3.3.4 G Sites (SPS-9 and GPS except -6A and -7A)

For most GPS experiments (1, 2, 3, 4, 5, 6B, 6C, 6D, 6S, 7B, 7C, 7D, 7F, 7R, 7S, 9) and SPS-9 sites, the minimum recommended data collection effort is two days of vehicle weight data per year plus the data from a continuously operating automatic vehicle classifier. At least twice a year, the operation of the AVC should be validated and any necessary adjustments made to ensure the accuracy of the classification counts. The WIM data collection device should also be calibrated immediately before its use. (See Section 4 for the LTPP protocol for calibrating traffic data collection equipment.)

Thus, for these sites, the minimum recommended data collection effort is two days of vehicle weight data per year plus the data from a continuously operating automatic vehicle classifier (AVC). This data collection plan yields an expected error in the estimate of annual load of roughly 25 percent[6], with 95 percent confidence that the annual load estimate is within ±50 percent.

At least twice a year, the operation of the AVC should 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 should be performed using documented and routinely used agency procedures or the methods discussed in Section 4 of this document.

As with the earlier data collection requirements, 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.

The review of available LTPP load data showed that at a majority of sites these conditions are not a problem. However, for the 20 percent of sites where significant variations in the traffic stream occur, a small increase in traffic data collection can significantly improve the accuracy of annual and seasonal loading estimates.

The primary difference in traffic data collection for this category of LTPP test sites and the SPS -1, -2, -5 and -6 sets is in the response time to repair permanent data collection equipment at each site. For these sites, LTPP has relaxed the two month repair criterion. 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. This decision will be made on a case by case basis, given the needs of LTPP, those of the agency, and the cost and difficulty of replacing the data collection equipment. If a WIM scale is replaced by an AVC,

[6] This statistic is based on ESALs.

the LTPP will provide additional instructions (on a case by case basis) regarding whether to collect additional WIM data at that site.

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

3.3.5 C Sites (SPS-3, 4, 7 and GPS 6A and 7A)

At these sites, traffic monitoring is still required. 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 shall 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 any permanently installed traffic sensors, one last suite of measurements (AVC and WIM) shall be performed prior to their destruction. If measurements are being performed with portable sensors, then one last suite of measurements shall be performed within three months of the close-out distress survey.

4. TRAFFIC DATA COLLECTION EQUIPMENT

As mentioned previously, the new data collection plan emphasizes the quality of data rather than the quantity of data. Data accuracy depends on equipment that is well calibrated and properly operated, regardless of the type of equipment used to collect the data. Hence, the LTPP protocol for calibrating traffic data collection equipment is designed to improve the quality of the data collected by the states, with a reasonable amount of flexibility in how the equipment is calibrated. Information regarding the protocol for calibrating traffic data collection equipment was originally contained in the LTPP Program Directive TDP-11. That information forms the basis of this chapter.

This section of the Traffic Guide replaces the LTPP program directive. It provides the reader with specific instructions regarding the selection, placement, and operation of traffic data collection equipment. It is intended to provide the reader with the background necessary to assist new state highway agency engineers in the selection, placement, and operation of traffic data collection equipment for LTPP purposes.

4.1 EQUIPMENT SELECTION: PERMANENT VERSUS PORTABLE

It is up to the individual highway agency to determine which type of sensor it will use for any given data collection effort at each LTPP test site. Both permanent and portable sensors have strengths and weaknesses when used to collect weight and classification data. However, the TRB LTPP Expert Task Group on Traffic Data Collection and Analysis (LTPP ETG) strongly recommends the use of permanently mounted sensors whenever possible, even when only short duration counts are being taken. While compliance with this recommendation requires a fairly substantial up-front capital investment for each LTPP test site, the LTPP ETG believes that in most cases correctly operating permanent equipment yields more reliable results, particularly for weigh-in-motion data. Permanent equipment also reduces the cost of repeated equipment set-up, allows longer data collection efforts, uses less staff time per data collection session, and reduces the exposure of data collection personnel to hazardous situations (e.g., the need to provide traffic control during portable sensor placement or the placement of data collection sensors in the roadway without traffic control).

Still, there are times when use of portable equipment is more cost effective and reliable than permanent equipment. Consequently, LTPP accepts data from both types of equipment, but it requires that the accurate performance of that equipment ***at each LTPP test site***, for each LTPP data collection session, be assured through the application of calibration/validation plans. These plans ensure the quality of data provided to LTPP regardless of the type of equipment being used.

4.2 EQUIPMENT LOCATION

The data collection site should be in the LTPP test lane and located directly upstream or downstream of the LTPP test section. Where it is not possible to place equipment in such a location, the participating agency should work with the RCOC to select the best potential location to ensure that the traffic being measured can be directly related to the loads the test section is experiencing.

For best results, select a location that is as smooth and flat as possible, with no ruts or potholes. Ruts and potholes will cause both axles and road tubes to bounce, which can create erroneous (or missed) axle hits, suggesting an inaccurate number of axles per vehicle. These errors would prevent an automatic vehicle classifier (AVC) from correctly categorizing vehicles. Similarly, WIM accuracy is adversely affected by the dynamics of bouncing axles, and the more the axles bounce, the more difficult it is to provide accurate weights.

If the pavement immediately upstream or downstream of the test section is not suitable for placing traffic data collection sensors, it is permissible to move the sensors farther away from the test section. However, the benefits of moving the sensors to a section of pavement that is more conducive to traffic counting must be balanced against the possibility that traffic conditions in the test lane will change between the test site and a remote location. Sites should be chosen both to minimize these differences and to permit effective sensor operation. The overall intent of the data collection effort is to provide the best possible measurement of traffic crossing the test section. Therefore, participating agencies are discouraged from moving the data collection site to a location that is separated from the test site by an intersection or road junction because such a junction can significantly change the traffic stream. These changes may include differences in total traffic volume, vehicle mix, and lane distribution.

When in doubt, discuss the advantages and disadvantages of potential data collection locations with the appropriate Regional office staff.

4.3 EQUIPMENT INSTALLATION INFORMATION

As the state and provincial highway agencies install traffic data collection equipment at each test location, the details about the equipment type, brand name, and serial number for each unit installed must be recorded. These data are recorded on Sheet 14, the LTPP Traffic Data Equipment Installation Log. A copy of Sheet 14 should be filed with the Regional office immediately following the completion of the installation work. Copies should also be filed at the Agency offices and kept at the site with the WIM/AVC equipment, preferably in the cabinet housing the control equipment, along with Sheet 15, which describes the changes that occur at the site over time.

Instructions to complete Sheet 14 are provided in Chapter 6 along with the actual form. Information must be recorded about control units, sensors, loops, software, and the axle spacing algorithm. The type of equipment should be listed along with the brand name and unit serial number, if available.

The completed forms become part of the auxiliary data for each LTPP test location. These data are part of the LTPP Traffic Database. They are retained in hard copy format at the Regional offices. Additional information is attached to Sheet 14 to further describe items such as the vehicle classification algorithm.

All changes in the equipment at the site over time should be recorded on Sheet 15.

4.4 EQUIPMENT CALIBRATION

Section 3 specifies the accuracy of traffic data required for each classification of LTPP test site, as well as one recommended data collection plan for meeting those accuracy requirements. Any data collection plan designed to meet those levels of accuracy requires that data be collected from properly calibrated and correctly functioning traffic monitoring equipment. The following describes the procedures that LTPP recommends for ensuring that traffic data collection equipment used for LTPP traffic monitoring efforts operate correctly and collect valid data.

Recommendations are made for the following subject areas:

- steps for checking equipment calibration,
- quality control steps to be taken in the field, and
- quality control steps to be taken in the office.

The LTPP program acknowledges that WIM and AVC are not mature technologies, and consequently, participating agency and site specific conditions may legitimately warrant the use of procedures other than those presented below. In addition, LTPP recognizes that participating agencies use a variety of traffic data collection equipment and have different levels of available labor. Consequently, different participating agencies may prefer to use different methods for checking calibration and performing quality assurance checks on their data.

As a result, while LTPP strongly recommends the use of the following procedures, agencies may request to substitute alternative, equivalent procedures. When a participating agency desires to use an alternative technique, it should discuss the recommended alternative with its Regional office (its RCOC). As long as the participating agency can achieve the desired levels of accuracy and data reliability, the RCOC should allow use of those alternatives when

- the LTPP procedures are unreasonable, given the specific equipment or staffing available to a participating agency
- site conditions at a given LTPP test section dictate changes to these procedures or
- where the participating agency can show that an alternative procedure will yield better, more accurate traffic monitoring estimates at a test site.

This flexibility is intended to take advantage of professional experience within the participating agencies and to further encourage the collection of accurate, reliable traffic data at a cost that is acceptable to the participating agencies. Agencies are requested to inform their respective RCOCs of the methods they will use to check the calibration and operation of the WIM and AVC equipment they use for LTPP traffic monitoring.

Additional information on calibration techniques can be found in the following references:

ASTM Standard E1318-94, Highway Weigh-in-Motion (WIM) Systems With User Requirements and Test Method, Annual Book of ASTM Standards.

Davis, Peter and Fraser Sommerville, "Calibration and Accuracy Testing of Weigh-In-Motion Systems", Transportation Research Record 1123, *Pavement Management and Weigh-In-Motion*, 1987, pp 122-126.

Izadmehr, Bahman and Clyde Lee, "On-Site Calibration of Weigh-in-Motion Systems", Transportation Research Record 1123, *Pavement Management and Weigh-In-Motion*, 1987, pp 136-144.

McCall, Bill and Walter Vodrazka Jr., *State's Successful Practices Weigh-in-Motion Handbook*, by Bill McCall and Walter Vodrazka Jr., December 15, 1997.

On-Site Evaluation and Calibration Procedures for Weigh-in-Motion Systems, NCHRP Research Results Digest #214, 1996.

4.4.1 Steps For Checking Equipment Calibration

Automatic Vehicle Classification

WIM and AVC equipment use a series of inputs (usually including some combination of vehicle presence, the number of axles, the spacings between axles, and the weight of those axles) to categorize vehicles into vehicle classes. The calibration review process tests to ensure that the algorithm using these inputs correctly classifies the vehicles. Adjustments are then made to the algorithm until the output (vehicle volumes by classification) meets the acceptance criteria.

As with WIM equipment, each new set of automatic classification equipment ***must*** be field tested (i.e., at least one device from each order, not each device) to ensure that the algorithm accurately classifies the state's vehicles. This is both because different devices use different classification algorithms and because several cases have been documented in which manufacturers accidentally shipped equipment with the wrong classification algorithm to a state.

Calibration checking involves collecting samples of classified vehicle counts and comparing them with independent measurements of those same classified vehicle counts. In most cases, the independent counts are performed either by hand or by collecting videotape and converting that tape to vehicle classification information. However, once calibrated, a correctly functioning classification counter can be used to calibrate a second type or model of classifier. In fact, one very useful calibration test is to compare the output of AVC and WIM equipment with each other.

Two basic types of checks need to be performed to test a classifier's functioning; a review of the equipment's ability to classify specific types of vehicles, and a comparison of aggregated classification device output with known control totals. The first of these checks allows the state to test whether the device correctly handles vehicles that have traditionally caused problems for classifiers. The second test reveals errors that are apparent only over a longer term data collection effort.

Many automatic vehicle classification counters have problems correctly differentiating specific vehicle types because the axle spacing characteristics of these vehicle types are similar. Therefore, the calibration effort needs to review how well specific types of vehicles are classified. These vehicles include the following:

- recreational vehicles,
- passenger vehicles (and pick-ups) pulling light trailers, and
- long tractor semi-trailer combinations.

Other vehicle classifications can also be tested, given a state's experience with automatic vehicle classification equipment. These tests are accomplished by placing the counter on a roadway and observing the results of the classification process for individual vehicles crossing the test sensors. The location for this test must often be selected carefully to ensure that all relevant vehicle types are present so that the counter's ability to correctly classify those vehicles can be observed.

The second portion of the calibration test involves comparing a minimum of 24 hours of vehicle classification output from the device with records known to correctly measure those same 24 hours. (These records are normally collected from a series of manual counts, but they can also be obtained through other means.) Two analyses are then performed with the output of the classifier.

The first comparison examines the number of "unclassified" vehicles produced by the device. If this percentage is greater than 5 percent of the traffic stream, there is a strong possibility that either the time-out or length threshold is set inappropriately. If either of these values is too large, it will allow multiple vehicles to be included in the same vehicle record, often creating an axle pattern for that "vehicle" that falls outside of established parameters.

The second analysis compares the individual volume estimates for different vehicle classes for a given time period from the test equipment with the known "true" value. The "true" value is the independent measurement. (Note that the clocks for the two devices must be set precisely for this comparison to be valid.) Significant differences in these two measurements mean that the classification algorithm parameters need to be adjusted and the equipment retested.

Results that should be investigated include the following:

- the presence of a large number of motorcycles (Class 1) when few motorcycles were present.

- overly large numbers of Class 8 vehicles.

- significant differences in other vehicle classes.

A large number of invalid motorcycle counts usually means that the time-out and/or the vehicle length thresholds are set too low. This causes the last set of tandem axles on a semi-trailer to be treated as a separate vehicle. The short spacing between the tandem axles viewed by themselves tend to be classified as motorcycles. (Note that this error should also result in an under-counting of tractor semi-trailer trucks and an over-counting of single unit trucks.)

An overly large value for Class 8 trucks usually means one of three things:

- closely following pairs of cars are being recorded as trucks

- passenger vehicles pulling trailers are being classified as tractors pulling trailers

- the axle sensors are routinely missing one of the tandem axles on conventional 5-axle tractor semi-trailer trucks

Significant differences in other classes usually mean that either the axle sensors are not set as described in the classification algorithm's parameter file, or that the algorithm itself is not accurately tuned to the axle characteristics of the state's vehicle fleet. Remeasuring the sensor spacings and checking the parameter file will allow the user to determine whether the problems are due to equipment set up or whether a different processing algorithm is needed.

Not all classification errors are significant. Differences in Class 2 (cars) and Class 3 (light duty trucks) counts are not significant for LTPP purposes. (These differences may be important for other state analyses.) To be acceptable to LTPP, the differences in the manual (or "true") counts and equipment counts for vehicle classes 8, 9, and any other heavy truck category that exceeds 20 percent of the total truck volume at this site should not exceed 10 percent for any of those truck categories. In addition, during the calibration tests, the counter should not list more than 5 percent unclassified vehicles.

Weigh-in-Motion

Each time a WIM scale will be used to collect data for the LTPP program, its calibration should be checked and revised if necessary. In addition, permanent WIM scales should have their calibration settings field validated (and updated as necessary) at least twice per year, and their data should be monitored on a monthly basis to ensure that the scales remain calibrated. This calibration check must include both the weight and vehicle classification data produced by the equipment. In addition, the participating agency should monitor the performance of the equipment to determine that the equipment is operating correctly throughout the data collection effort. Data from an improperly functioning WIM device should not be sent to LTPP.

The LTPP specifies the use of one of two scale calibration confirmation methods. (Participating agencies may request the use of alternative methods from their RCOCs to account for unique site conditions.) To be accepted by LTPP, any alternative method must

- have a proven track record (i.e., its use must be backed up by documented evidence that it works effectively)

- be actively employed (i.e., it must be routinely used at non-LTPP WIM sites as well as LTPP sites)

- include site specific characteristics for each LTPP test site (for example, before an average front axle weight can be used as part of a calibration check, an independent check of the front axle weights of the subject trucks at that site must be undertaken)

- be performed multiple times per year, and always before the start of any short duration data collection at a test site.

Where a weigh station is located upstream or downstream from the WIM site, the required LTPP calibration confirmation technique is as follows:

- Use the static scale at the weigh station to measure trucks randomly selected from the traffic stream and then compare the various weights from those trucks with the WIM system measurements (a minimum of 150 trucks must be matched).

- Where a weigh station is not located up- or downstream of a test site, the following calibration confirmation mechanism is desired by LTPP:

    - Use a minimum of two legally loaded test trucks, one of which must be a 3S2 vehicle. The two vehicles must be either different configurations or at least different suspension types. The 3S2 vehicle must be loaded to approximately 80,000 pounds GVW and preferably have an air suspension system. A minimum of 40 passes must be made (20 for each vehicle—more runs are preferred). All test runs must be made at highway speeds. (If more loaded test vehicles are used, the number of passes each vehicle makes can be reduced.) Three- or four-axle single unit dump trucks should not be used for calibration checking.

    - ***The participating agency must make sure the trucks' tires have a conventional highway tread pattern, not an off-road pattern, as the "knobby" tread can cause unusual sensor readings from some WIM systems.***

WIM scales that will be used at LTPP test sites must be capable of estimating static weights within the tolerances listed in Table 4.

These values can be computed by calculating the percentage difference in the static and dynamic weights of the vehicles used for the calibration check (either test trucks or trucks weighed at a nearby scale that meets law enforcement standards) and converting that error into percentage form. The standard deviation of that error can then be used to determine the 95 percent confidence limits.

Note that some WIM systems require separate calibration factors for different vehicle speed ranges, different temperatures, and/or different gross vehicle weights. For systems that require multiple calibration constants, the calibration check must be repeated for each calibration step. The scale will not be accepted by FHWA-LTPP until it is capable of operating correctly during all times of the year and under all environmental and traffic conditions that can reasonably be expected to occur during data collection operations. In addition, note that these calibration confirmation steps are minimums, which must be exceeded whenever a manufacturer's calibration instructions require additional effort.

When the system calibration has been confirmed, the data collected during the time that scale is certain to be within calibration tolerances will be used to create an "expected loading pattern" for five-axle tractor semi-trailer gross vehicle weights (that is, GVWs for 3S2s) at that site. At least 100 trucks are needed to determine this pattern, which can be calculated with the LTPP QC software.

Changes in this pattern, specifically, movement in the location of the loaded or unloaded peaks in the GVW distribution, are a sign that scale calibration may have shifted (See Figure 1). These observed changes are a preliminary indicator that the calibration at that site may be improper and that the site calibration factor requires confirmation or changing. A scale's calibration must be validated (and potentially changed) whenever one of the following happens:

- the unloaded peak in the QC graph of the 3S2 GVW distribution shifts more than 4,000 pounds

- the location of the loaded peak shifts 4,000 pounds or more or

- the location of the loaded peak exceeds the legal weight limit for 3S2 vehicles (unless previous calibration review efforts have shown that at this site, this result legitimately occurs).

Table 4. WIM System Calibration Tolerances

SPS-1 and SPS-2 Sites	**95 Percent Confidence Limit***
Loaded single axles	±20 percent
Loaded tandem axles	±15 percent
Gross vehicle weights	±10 percent
All other Test Sites	
Loaded single axles	±30 percent
Loaded tandem axles	±20 percent
Gross vehicle weights	±15 percent

*Source: ASTM Standard E1318-94.

If the field review of the current scale calibration setting shows that the scale is performing correctly (i.e., the GVW pattern for 3S2 trucks has in fact changed), then this new pattern can also be used in conjunction with the original GVW pattern to describe legitimate truck weight patterns that exist at the test site. If the participating agency has firm evidence (i.e., data collected immediately after successful calibration efforts have been completed) that a measured pattern is expected and is the result of normal traffic conditions at that site (for example, the pattern represents an expected seasonal pattern), the scale does not have to be re-calibrated, even when that pattern is different than the pattern most recently observed at that site.

The second part of the calibration review process is the examination of the effectiveness of the vehicle classification algorithm used by the WIM equipment. The procedures for this effort are the same as those described below for examining the operation of automatic vehicle classification equipment. Each WIM system's classification algorithm needs to be field checked only once. This calibration review involves extensive testing of the algorithm itself. However, the algorithm of each new shipment of WIM systems must be tested, since even minor changes in classification algorithms from one model of a manufacturer's WIM scale to another have been known to cause significantly different classification results. In addition, it is important to test the classification results of the WIM system against those produced by the state's automatic vehicle classification equipment to ensure that the results from these alternative devices are compatible.

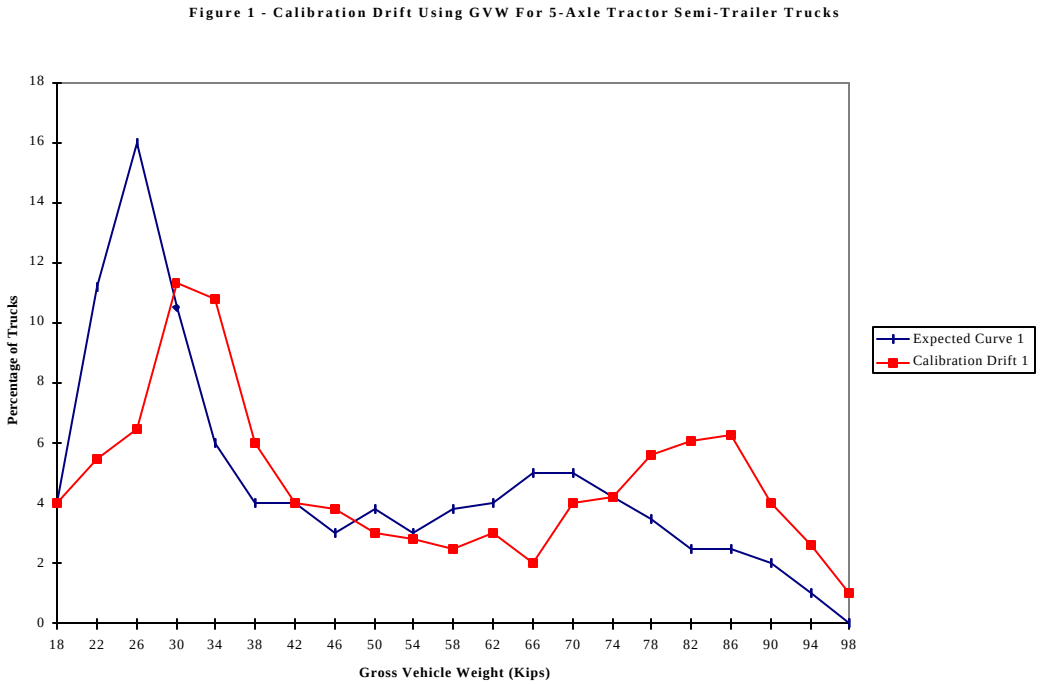

Figure 1. Example of Calibration Drift

Finally, for each LTPP WIM installation, the quality control checks described later in this section must be completed. These will confirm that the various algorithm parameters and sensor measurements are set correctly for each equipment installation. (That is, the AVC algorithm can be calibrated once for an entire state/piece of equipment, but the operation of that calibrated algorithm must be confirmed at each site through the quality control process described later in this section.)

4.4.2 Quality Control Steps to be Taken in the Field

Quality control checks are similar to, but should not be confused with, calibration tests. Both require the comparison of a set of system outputs with independent measurements of "truth." Both are intended to allow a user to set, check, or refine parameters that allow a data collection device to operate correctly. However, whereas calibration efforts are comprehensive, quality control checks allow the application of simple rules of thumb to quickly confirm that a data collection device is working as expected. Quality control is meant to ensure only that a properly calibrated piece of equipment is working as intended in a given field installation. Therefore, the quality control steps described below should be followed for all LTPP traffic data collection.

Provided below are step-by-step instructions that can be used by field personnel to check the performance of equipment in the field.

The field quality control check should be performed at least twice for each portable data collection effort: once when the counter is set out and once when the counter is picked up. In addition, for longer "short duration" counts (e.g., a week or longer), these steps should be undertaken at least once during the middle of the count.

Using a lap-top computer:

Set the recorder to record vehicle by vehicle or in raw mode, and observe the category assigned and the number of axles on each vehicle.

Check the axle spacing on category 9 vehicles (three-axle tractor pulling a two-axle semi-trailer). The drive axles should be greater than 4.1 ft and less than 4.9 ft, and the trailer tandem axle's spacing should be greater than 3.8 ft and less than 4.9 ft unless the trailer tandem is a spread tandem. In this case, the tandem spacing could be up to approximately 8 feet apart (depending on state laws). If the spacing is consistently larger or smaller than the above, re-measure the road tube spacing, then check the road tube spacing setting in the recorder.

Manually checking the AVC unit:

If the AVC counter can collect data on an individual truck's characteristics, perform the following checks. Observe the passing vehicles and how they are recorded by the AVC unit. Look for the unit's ability to correctly count the number of axles and measure the axle spacing of the vehicle. If the number of axles is correct and the axle spacing looks reasonable (e.g., a small car's axle spacing is near 9 feet; a 3S2's front axle spacing can vary from 9.9 ft to 13.0 ft, depending on the cab), then the equipment can be considered to be functioning correctly.

Record any unusual events and describe how the counter handles them. For example, note if there are unusual truck configurations, if no motorcycles are in the traffic stream, or if a large number of light passenger vehicles pulling trailers are being classified as heavy trucks.

After 20 to 30 vehicles have been checked and you are certain that the number of axles being recorded and the axle spacings are accurate, then the device can be considered to be working properly. Reset the recorder to record vehicles by the 13[7] categories in 1-hour intervals.

Regardless of whether the counter can collect detailed data on specific trucks, perform the following. Obtain either a 3-hour manual count or record 100 trucks (whichever comes ***later*** if you are placing a device that will operate for more than 72 hours; whichever comes ***first*** if you are placing a portable

[7] Note that some states and provinces use more or fewer than 13 vehicle categories. This is acceptable to LTPP, so long as the Agency can convert their classification scheme into the FHWA 13-category scheme.

device being used for a count of 72 hours or less). In no circumstances count for less than one full hour. Record vehicle volumes in hourly intervals. **It is critical that your watch is synchronized with the counter**. **It is very important that you start your manual count on the hour**. Starting your count early or late will produce bias in the comparisons.

For short duration counts, a similar check of one hour's duration should be conducted at the end of the survey period to ensure that the counter is still operating correctly. In addition, any time staff are sent to the site to check on the status and performance of the axle sensors, at least some minimal check of classifier performance is recommended. This manual count effort will provide an analyst with several observation points against which to verify the accuracy of data recorded. Send the manual count in to the office with the field sheet[8] and the collected data.

While observing the operation of the counter, check to see whether category 1 (motorcycles) is significantly greater than the number of motorcycles actually observed (e.g., 5 percent of the traffic). If motorcycles are being over-counted, check the time-out and/or the length threshold value in the electronics. If this value is set too small, trailer tandems can be separated from the trucks and tractors pulling those trailers. Independent trailer tandems are usually assumed to be motorcycles by automatic classifiers with poorly adjusted vehicle length thresholds. This will usually occur with tractors pulling long, 2-axle semi-trailers. The trailer tandem will be recorded in category 1, and the truck or tractor pulling the trailer will be recorded in categories 2, 3, or 6, depending on its length and the number of axles present. Check the manufacturer's installation or set-up manual to determine how (and to what extent) to change the threshold value.

It is also important to examine (where possible) how well the device differentiates between Class 3, 5, and 6 vehicles, as well as how it classifies passenger vehicles towing trailers. The poor selection of vehicle length and axle spacing criteria can lead to significant interchange of vehicles between the various two-axle single unit truck categories and the various passenger vehicle categories. In addition, recreational vehicles (RVs) can cause significant classification difficulties. If these types of vehicles are present, it is important to note whether they are being classified correctly, mis-classified consistently, or not being classified at all (i.e., reported as "unclassified" vehicles). Note that in some cases, it is not possible to accurately classify some vehicle types, given only axle count and axle spacing information. A careful calibration test will illustrate these classification program shortcomings. Where possible, states can then either adjust their classification algorithm, or, if necessary, handle these problems within their normal analytical procedures.

Next, check the number of vehicles being included in the device's "unclassified" category. If this percentage is greater than 5 percent of the traffic stream, there is a strong possibility that the time-out or length threshold is set inappropriately. If this value is too large, it will allow multiple vehicles to be included in the same vehicle record, often creating an axle pattern for that "vehicle" that falls outside of established parameters.

[8] Field sheets for use by agency personnel are those routinely used in that state's traffic data collection process.

For both of the previous types of errors, it is also recommended that you

- re-check the loop setting in the data collection equipment, as well as
- confirm the measurement of the distance between the loops and axle sensors

to make sure these are correctly recorded in the equipment. If the loop distance from leading edge to leading edge or the distance between the axle sensors is wrong, then the axle spacings and speed estimated by the equipment will be wrong. This can cause vehicles to be either mis-classified or placed in the "unclassified" category.

If more than 5 percent of the vehicles are unclassified, it is also possible that the road tubes may not be tight, a hole may have developed in a road tube, or the road surface may be too rutted. If one of the road tubes crosses a shallow rut or hole, bouncing of the sensor may produce the appearance of an extra axle for that one tube. If this occurs, it may be necessary to reset the counter in either a different location or with different axle sensors.

Should the errors (the difference between the hourly manual counts and the AVC data) be greater than +/- 5 percent for each of the primary vehicle categories, the road sensors and counter should be reset. In addition, the equipment should be checked for weak batteries, bad air switches, road tubes with holes in them, road tubes that are not matched in length, and other sensor failures. In addition, the count should be retaken.

Weigh-in-Motion Equipment and Data

Perform the field checks described in the previous section on automatic vehicle classification. Once you are satisfied that the WIM equipment can correctly count axles and classify vehicles, you should perform the following checks. (Note that some of these checks can be performed at the same time as the AVC checks.)

Observe the front axle and the drive tandem weights of category 9 trucks (3S2s). The front axle should be in the range of 10,000 lb. +/- 2,000 lb., regardless of whether the truck is loaded or empty (although the front axle of a loaded 3S2 is normally heavier than that of an unloaded 3S2). The drive tandems of a fully loaded truck and trailer should be around 33,000 lb. +/- 3,000 lb. If the front axles are routinely less than 7,000 lb., then check the calibration value of the WIM scale. It may be set wrong for the WIM system.

4.4.3 Quality Control Steps to be Taken in the Office

Automatic Vehicle Classification Data

Check the field sheet for comments concerning the traffic stream and special road conditions, as well as counter problems encountered while in the field.

Tabulate the manual counts, comparing them with the AVC data for the same time and date, and calculate the absolute difference and percentage difference between the manual count and AVC data for each vehicle type.

Check category 1 (motorcycles) to see if it is greater than 5 percent of the total traffic. (While the field person checked the counter and observed the traffic stream, did he or she observe any motorcycles traveling on the roadway?) Large numbers of motorcycles (unless their presence is noted) usually mean that trailers are being separated from tractors because the threshold for identifying a new vehicle is set too low. When the time or length between axle hits is greater than this preset threshold, the device sees the last axle hits as part of a following vehicle. The last tandem or the truck is then recorded as a motorcycle because of its short spacing.

If the data recorder reports "unclassified" vehicles, no more that 5 percent of the vehicles recorded should be in the "unclassified" categories. Unclassified vehicles are vehicles that do not fit any of the formulas used in determining the vehicle type. They may also be caused by errors in the axle sensing that have prevented the data collection equipment from measuring all of the appropriate axle pulses.

If more than 5 percent of the vehicles are unclassified, the road tubes may not have been tight, a hole may have developed in the road tube, or the road surface may have been rutted. If one of the road tubes crosses a shallow rut or hole, the tube may bounce, producing the appearance of extra axles for that one tube. Piezo cable (and other sensor) devices can also generate extra "ghost signals" for a variety of reasons, including the following: when the sensor is not securely held within the pavement, when extraneous pavement stresses are occurring (e.g., a piezo cable may pick up vibrations from the rocking of a neighboring concrete panel), and when the system electronics are providing feedback that register as additional axle pulses. These ghost axles lead to a variety of classification and weighing errors.

Should the errors (the difference between the hourly manual counts and the AVC data) be greater than +/- 5 percent for each of the primary vehicle categories, the count should be retaken. In addition, the equipment should be checked for weak batteries, bad air switches, road tubes with holes in them, road tubes that are not matched in length, and other sensor failures. These items should be checked and verified at the beginning of a survey.

Finally, if historical values are available, compare current truck percentages (by class) to historical percentages (by class) to determine whether unexpected changes in vehicle mix have occurred. In

particular, look for interchanges of vehicles that commonly occur as equipment begins to fail (for example, a transfer of Class 9 vehicles into Class 8 as axle sensors begin to have problems).

A summary comparing the manual counts and the AVC data should be prepared and sent to the regional LTPP offices.

Weigh-in-Motion Data

This section describes the basic office procedure that LTPP recommends for performing a quick check to determine whether the calibration of a WIM scale is changing. It requires that the participating agency be able to produce a histogram plot of the gross vehicle weights of Class 9 trucks (mostly 3S2 tractor, semi-trailers). LTPP normally uses a 4,000-lb. increment for creating the histogram plot, but the participating agency may use any weight increment that meets its own needs.

The logic underlying the quality assurance process is based on the expectation of finding consistent peaks in the GVW distribution at each site. Most sites have two peaks in the GVW distribution. One represents unloaded tractor semi-trailers and should occur between 28,000 and 36,000 pounds. This weight range has been determined from data collected from static scales around the country and appears to be reasonable for most locations. (Most, but not all, unloaded peaks fall between 28,000 and 32,000 lb.) The second peak in the GVW distribution represents the most common loaded vehicle condition at that site, and it varies somewhat with the type of commodity commonly being carried on a given road and the weight limits for 5-axle trucks. Generally, the loaded peak falls somewhere between 72,000 and 80,000 lb.

For most sites, the location of these peaks within the GVW histogram remains fairly constant, although the height of the two peaks changes somewhat over time as a result of changing volumes and/or percentages (depending on whether the participating agency is plotting volume or percentage on the vertical axis; either will work) of loaded and unloaded vehicles. The reviewer must examine this distribution and decide whether the vehicle weights illustrated represent valid data, or whether the scale either is not correctly calibrated or is malfunctioning. This is easily done when the current graph can be compared with graphs produced from data collected ***at that site*** when the scale was known to have been operating correctly.

Both Peaks Shifted If a plot shows both peaks shifted from their expected location in the same direction (that is, where both peaks are lighter than expected or heavier than expected), the scale is most likely out of calibration. The participating agency should then recalibrate that scale at that site and collect a new sample of data.

One Peak Shifted

If a plot shows one peak correctly located but another peak shifted from its expected location, the site should be reviewed for other potential scale problems (such as a high number of classified but not weighed vehicles or scale failure during the data collection session). Additional information on that site may also need to be obtained to determine whether the scale is operating correctly. Information that can be very useful in this investigation includes the types of commodities carried by Class 9 trucks using that road and the load distribution obtained from that scale when it was last calibrated. (For example, it might be discovered that a cement plant is just down the road from the WIM scale, and the loaded, 5-axle cement trucks are routinely exceeding the 80,000-pound legal weight limit. This might result in acceptance of a loaded peak at that site that exceeds the normal 80,000-pound upper limit for the loaded peak.)

If additional information indicates the presence of scale problems, the data from the malfunctioning scale should be not be submitted to the LTPP. If there is no evidence of scale problems and state personnel believe that the data accurately reflect truck weights at that site, the LTPP will accept the submitted data for use within the LTPP database. The state should submit an explanation of why the data are valid, despite their appearance, so that LTPP researchers can be aware of the unusual truck characteristics at that site.

Number of Vehicles Heavier than 80 Kips

A second check performed with the Class 9 GVW graphic is an examination of the number (and/or percentage) of vehicles that are heavier than 80,000 lb. It is particularly important to look at the number and percentage of Class 9 vehicles that weigh more than 100 kips. If the percentage of overweight vehicles (particularly vehicles over 100,000 lb.) is high, the scale calibration is questionable, although some states routinely allow these weights and thus would not question these results. (Note that this check must be done with knowledge of a specific state's weight and permitting laws, as well as knowledge of the types of commodities carried by trucks operating on that road.)

This check is performed partly because when many piezo-electric scales begin to fail, they generate an almost flat GVW distribution. This results in an extremely large (and inaccurate) ESAL computation for a given number of trucks. It is also

Number of Vehicles Heavier than 80 Kips (cont)

highly unusual for FHWA Class 9 trucks to carry such heavy loads. In most cases, trucks legally carrying these heavy weights are required to use additional axles, and they are thus classified as FHWA Class 10 (or higher) and do not appear in the Class 9 GVW graph. While illegally loaded 5-axle trucks may be operating at the site in question, most illegally loaded trucks do not exceed the legal weight limit by more than several thousand pounds, and the number (or percentage) of these extremely high weights is usually fairly low. Thus, it is assumed that high percentages of extremely heavy Class 9 trucks are a sign of scale calibration or operational problems. (Again, if a participating agency routinely permits much higher loads to be carried on 5-axle trucks, this check may not be useful.)

In either case (scale problems or extreme numbers of overloaded trucks), state personnel should investigate the situation. If the data are valid, they should be submitted to the LTPP database along with an explanation of the investigation findings. Otherwise, the data should be withheld from use by LTPP.

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5. MONITORING DATA SUBMITTAL

Traffic data collected during the monitoring phase of the LTPP project are reported and submitted to the regions in the same format as that stipulated by the FHWA in the Traffic Monitoring Guide. However, to provide specifically for state needs, other data formats may be used for submitting traffic data to the regions. All data formats permitted for LTPP are presented in this document.

The monitoring traffic data submitted to LTPP consist of four types of information:

- volume counts
- volume counts by vehicle class
- truck weights
- various ancillary data related to the three categories above.

All monitoring data except the ancillary data are submitted on electronic media. The following media may be used for submittal:

- computer diskette (3 ½" or 5 1/4")
- Zip™ disk
- Jaz™ disk
- CD-ROM
- optical disk

Record formats for these submittals are presented in this document. With each separate data file that is submitted by the highway agency to the RCOC, the Agency is asked to identify the file using the file naming convention initially established by SHRP. This file name will allow the region to enter the data, store and retrieve the data, and provide a data tracking mechanism for LTPP regional offices, researchers, and state agencies.

A copy of the data submitted to LTPP should be retained by each Agency. AASHTO recommends that data be retained for 10 years, but in no circumstances should traffic data be discarded by an Agency before the RCOC confirms that the data were successfully loaded into the regional traffic database.

5.1 DATA SUBMITTAL TIME TABLE

There is no formal timetable under which Agency's submit traffic data. In general, if a Agency collects data from permanent counter, that data should be transmitted to the Regions on a monthly basis. Data collected at less frequent intervals is normally transmitted to the Regions either quarterly or annually.

For most LTPP test sites, the QC process should be performed at least quarterly. For SPS-1, SPS-2, SPS-5, and SPS-6 the QC process should be performed within two weeks of receipt of an agencies' data. This allows the agency to quickly learn if there are equipment problems occurring with their data collection equipment, and should result in better quality data for LTPP analyses.

5.2 FILE NAMING CONVENTION

The filename will be provided by the agency for each volume count, classification count, or weight session as it is submitted to the RCOC for entry into the LTPP Central Traffic Data Base (CTDB). Since the initial database processing program was written under DOS 3.3, the filename is limited to eight characters with a three character extension. When the agencies submit data files to the RCOC, the filename is noted on the data transmittal form. The format for the filename is described in the following paragraphs.

The first character refers to the type of data collected. W refers to weight data, Co classification data, and V to traffic volume data. The second through seventh characters of the filename are the six digit SHRP site ID number. The first two digits (2-3) are the State Code and the next four digits (4-7) are the test site ID number. See the discussion later in this chapter on the various file formats and types.

The three characters of the extension are an index to the starting date (Month, Day, Year) of the count, beginning with the month code as the first character of the extension. The second character of the filename extension is an index to the beginning day. The third character of the extension is the code for the year of the count.

Normally, the year code would require two digits to cover the period 1954 to 2025. However, by creating two groupings of the years (1954 to 1989 and 1990 to 2025), and by coding the month depending upon which year grouping it falls into, only one digit is required to cover a period of 72 years. This is generally sufficient to cover the period of interest of the LTPP Program, 1965 to the year 2017. To illustrate how this works, a count made in November 1988 is given the month code "A" because it falls in the first year grouping. On the other hand, November 1991 is given the month code "M" because it falls in the second grouping of years.

The creation of the filename and the use of the one digit year code are illustrated in the following example for a data set from state 2 for site 3456 which starts with data for November 24, 1991.

Table 5. File Naming Convention Example

Example Filename: 7W023456.MN1

Character(s)-Name	File Entry	Explanation
1	W	Weight Data
2-7	023456	SHRP Site ID Number
2-3	12	State Code
4-7	3456	Test Site Number
Extension		
1	M	Month of Count (In this case the month is November in the 1990-2025 period. See Table 7.)
2	N	Day of Count (In this case the day is the 24th. See Table 6.)
3	1	Year of Count (In this case the year is 1991. See Table 7.)

Table 6. Month and Day Code Combinations by Year Group

Month	1954-1989 Month Code	1990-2025 Month Code	Day of Month		
January	1	C	1 - 1st	C - 13th	O - 25th
February	2	D	2 - 2nd	D - 14th	P - 26th
March	3	E	3 - 3rd	E - 15th	Q - 27th
April	4	F	4 - 4th	F - 16th	R - 28th
May	5	G	5 - 5th	G - 17th	S - 29th
June	6	H	6 - 6th	H - 18th	T - 30th
July	7	I	7 - 7th	I - 19th	U - 31st
August	8	J	8 - 8th	J - 20th	
September	9	K	9 - 9th	K - 21st	
October	0	L	0 - 10th	L - 22nd	
November	A	M	A - 11th	M - 23rd	
December	B	N	B - 12th	N - 24th	

Table 7. Month and Year Code Combinations by Month Group

Year Code	Month Code "1 - B"	Month Code "C - N"	Year Code	Month Code "1 - B"	Month Code "C - N"
0	1954	1990	I	1972	2008
1	1955	1991	J	1973	2009
2	1956	1992	K	1974	2010
3	1957	1993	L	1975	2011
4	1958	1994	M	1976	2012
5	1959	1995	N	1977	2013
6	1960	1996	O	1978	2014
7	1961	1997	P	1979	2015
8	1962	1998	Q	1980	2016
9	1963	1999	R	1981	2017
A	1964	2000	S	1982	2018
B	1965	2001	T	1983	2019
C	1966	2002	U	1984	2020
D	1967	2003	V	1985	2021
E	1968	2004	W	1986	2022
F	1969	2005	X	1987	2023
G	1970	2006	Y	1988	2024
H	1971	2007	Z	1989	2025

5.3 ANCILLARY DATA

Ancillary data include such items as seasonal factors that the agency would apply to short duration counts, comments concerning anomalies in the data found during editing routines, and other miscellaneous pieces of information that need to accompany the submittal. Specific items to be submitted are discussed in the remainder of this section.

Data that are submitted to LTPP should not be modified. That is, the agency should not replace data corrupted because of machine error. The agency may delete data that result from obvious machine error, but "questionable" data (i.e., data that are suspected to contain errors but for which specific machine errors cannot be confirmed) are left alone. A description of the data that the agency considers questionable should be included in the transmittal information. If possible, also describe the edits that the agency would perform on the data if the agency were to use them.

An example is as follows. If the road tubes came loose during data collection, simply end the data file when they came loose. Do not replace the missing data. Also include a description of the machine failure in the ancillary information, indicating that a failure took place, and that data were eliminated from the file. Also indicate whether the data remaining in the file may contain inconsistencies caused by the tubes working themselves loose.

LTPP especially wants data taken in the test lane. However, to develop a more complete data set for other uses, the LTPP database was designed to accommodate data from all lanes of a facility. As a result, the agency is encouraged to submit data by lane wherever possible. When data are submitted by lane, the agency may decide to submit the data for all lanes or the test lane only on the basis of the agency's needs. LTPP will edit and maintain all data. These data will be available to the submitting agency through the LTPP CTDB.

If the agency has not collected ***any*** traffic data at a test section during a calendar year since 1989, fill out Traffic Data Sheet 10, Traffic Volume and Load Estimate - No Site Counts, for that calendar year. This form is required when no new data are available by the end of the calendar year, but it should not be submitted if any new weight were collected for that site during the year and passed LTPP reviews. The instructions for completing Sheets 10-13 are summarized in Chapter 6 of this document.

Additional details on how LTPP stores and manipulates these data are found in the reports "SHRP LTPP Traffic Database Design" by Mark Hallenbeck, "Procedures for Manipulating SHRP LTPP Traffic Data" by Mark Hallenbeck, and "SHRP National Traffic Database Description of the Required Computer System." Details on volume counts, vehicle classification counts, truck weight counts, and submitting traffic monitoring data to the RCOCs are described below.

5.4 VOLUME DATA

Traffic volume data are requested annually for each test site during the traffic monitoring period. Volume data may be derived from vehicle classification counts or truck weigh sessions. However, if vehicle classification counts and weight sessions are not conducted in a given year, separate traffic volume counts should be made at each site.

Volume information from either permanent automated traffic recorders (ATRs) or short duration portable counters may be submitted. Volume data should be submitted by lane if possible, although LTPP will accept data for combined lanes. In either case, the volume data are submitted via the FHWA ATR format (the #3 record, see Table 8). This record allows for submission of hourly volumes by lane or hourly volumes for all lanes combined.

Submit to LTPP all volume data collected (aggregated to hourly totals by lane). Submit the data in "raw" form; that is, do not edit the data before submitting them, other than to end a file when a traffic counter fails.

Submit one file for each continuous data collection session. The number of records for each site will depend on the number of lanes reported and the duration of the counting session. The FHWA ATR record provides for each calendar day and/or each lane's data to be placed on separate records. When a counter fails, end the file for that data collection session and begin a new file after the counter has been repaired or replaced. For example, a 24-hour count running from midnight to midnight without lane-specific information would contain one record. The same count from noon to noon (two calendar days) would require two records. A noon-to-noon count with data for one lane in each direction would

contain four records. Two 48-hour (noon-to-noon) counts separated by one day for that same two-lane road would require two separate files of six records each.

Submit the data monthly or in accordance with the data collection plan the agency submitted to LTPP. In addition to the electronic files that are submitted, provide the paper transmittal form Traffic Data Sheet 11, Volume Data Submittal. The Regional office uses this form to confirm that the data that were sent correspond to the data that were intended to be sent. The form also provides a method for the agency to supply data on the factors used to estimate AADT and to provide additional comments (such as suspected errors in the data) that concern the data submitted. One copy of Sheet 11 should be completed for each volume count file submitted.

Questions about Sheet 11 or about specific data collection and submittal formats should be addressed to the RCOC. Otherwise, when in doubt, provide any information that might benefit a researcher attempting to estimate traffic loadings for that site. A copy of Sheet 11 and instructions on completing it are found in Chapter 6.

Table 8. ATR hourly traffic data format (#3 record)

Column	Field Length	Alpha/ Numeric	Description
1	1	N	Record Identification: 3 = ATR data
2-3	2	N	FIPS State Code (TMG pg. 5-4-1)
4-5	2	N	Functional Classification (TMG pg. 5-4-2)
6-11	6	N	Station Identification Number
12	1	N	Direction of Travel (TMG 5-4-2)
13	1	N	Mainline Lane of Travel 0 = combined lanes 1 = outside (rightmost) lane 2 = next to outside lane, ... to 9 = inside lane
14-15	2	N	Year of Data (last 2 digits)
16-17	2	N	Month of Data (01-12)
18-19	2	N	Day of Month of Data (01-31)
20	1	N	Day of Week (1 = Sunday, 2 = Monday, 3 = Tuesday, 4 = Wednesday, 5 = Thursday, 6 = Friday, 7 = Saturday)
21-25	5	N	Traffic Volume Counted, 00:01 – 01:00
26-30	5	N	Traffic Volume Counted, 01:01 – 02:00
...	"	"	(hourly traffic volumes counted)
136-140	5	N	Traffic Volume Counted, 23:01 – 24:00
141	1	N	Footnotes (0 = No restrictions, 1 = Construction or other activity affected traffic flow)

Source: Traffic Monitoring Guide (TMG) -
2nd edition, Federal Highway Administration, FHWA-PL-92-017, 1992, pg. 3-2-4.
3rd edition, Federal Highway Administration, FHWA, February 1995, pg. 6-3-3.

5.5 VEHICLE CLASSIFICATION DATA

LTPP prefers and encourages that the agency use the FHWA 13 category classification format to collect and submit vehicle classification data. However, LTPP can accept up to 20 classes of vehicle categories, as long as the agency provides the same classes consistently and also provides sufficient information to convert those alternative classification schemes to the FHWA 13 categories. (Use Sheet 7 from the historical traffic data collection material in Appendix A to indicate the necessary conversion process.)

If the agency collects vehicle classification data in categories other than the 13 FHWA categories, submit the data in the classifications in which they were collected. As with traffic volume information, the data that were collected should not be adjusted before their submittal to LTPP. If the counter fails during data collection, end the file for that session and start a new file when the malfunction is repaired. Submit the data to the RCOC and explain the potential malfunctions in the transmittal letter. LTPP will decide whether to enter the data (as flagged) in the database.

Like the volume data, vehicle classification information is submitted from both portable and permanently operating devices. In either case, the data submittal format is similar. The basis for the vehicle classification record submittal format is the FHWA Card 4 (see Table 9). This record format supplies one hour of volume information for each of the 13 FHWA classes by lane (or for all lanes) for each record in a file.

This same basic format is also used for non-standard (i.e., non-FHWA 13 class) vehicle classification count submittals. For non-standard counts, simply redefine the vehicle categories represented by each set of columns in the FHWA Card 4 format[9]. Maintain the same column widths and locations for vehicle data and station/date information. For classification schemes that use less than 13 classes, make the automobile classification correspond to FHWA class 2 (columns 20-23) on the Card 4, and then move to the right, using the remaining classification columns as needed. Leave blank any columns that are not needed. For classification systems that require more than 13 classes, use columns 52 through 80 for the required extra data fields. Use two columns per vehicle classification for these extra classes.

If vehicle classification data are submitted in something other than the FHWA's 13 classes, submit the ancillary data that describe how the agency would convert these counts into the FHWA format. If a vehicle classification conversion form (Sheet 7) has already been completed, simply reference this form. Otherwise, submit an additional Sheet 7 along with this transmittal sheet.

All data from a continuous classification count, regardless of its duration, should be submitted as one file to LTPP. If a classifier fails during a count, end the file at the point of failure and start a new file after the counter has been replaced or repaired. For portable vehicle classification counts, use a separate count file for each portable count.

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[9] *The TMG 3rd edition format is preferred over the TMG 2nd edition for non-standard classification data reporting.*

Table 9. Vehicle classification record (Card 4) - TMG 2nd edition

Columns	No. of Columns	Description	TMG page
1	1	Vehicle classification record code (4)	5-4-1
2-3	2	State code	5-4-1
4-5	2	Functional Classification	5-4-2
6-8	3	Station Identification Number	5-4-2
9	1	Direction of Travel	5-4-2
10-11	2	Year of Data	5-4-3
12-13	2	Month of Data	5-4-6
14-15	2	Day of Month	5-4-6
16-17	2	Hour of day	5-4-6
18-19	2	Number of motorcycles (optional)	4-A-1
20-23	4	Number of passenger cars or all 2-axle, 4-tire single unit vehicles	4-A-1
24-26	3	Number of other 2-axle, 4-tire single unit vehicle	4-A-1
27-28	2	Number of buses	4-A-1
29-31	3	Number of 2-axle, 6-tire single unit trucks	4-A-1
32-33	2	Number of 3-axle single unit trucks	4-A-1
34-35	2	Number of 4 or more axle single unit trucks	4-A-1
36-37	2	Number of 4 or less axle single trailer trucks	4-A-1
38-40	3	Number of 5-axle single trailer trucks	4-A-2
41-42	2	Number of 6 or more axle single trailer trucks	4-A-2
43-44	2	Number of 5 or less axle multi- trailer trucks	4-A-2
45-46	2	Number of 6-axle multi- trailer trucks	4-A-2
47-48	2	Number of 7 or more axle multi- trailer trucks	4-A-2
49	1	Motorcycle reporting indicator	5-4-6
50	1	Vehicle class combination indicator	5-4-6
51	1	Lane of travel: 0 = combined lanes, 1 = outside (rightmost) lane, 2 = next lane(s) in order	5-4-6
52-80	31	Blank or optional State data	5-4-6

Source: Traffic Monitoring Guide (TMG), 2nd edition, Federal Highway Administration, FHWA-PL-92-017, 1992, pg. 5-4-5.

As with volume data, submit vehicle class data to RCOC monthly or in accordance with the agency's traffic data collection plan. Vehicle classification information may be contained on the same media that contain volume and/or truck weight information. In addition to the electronic files, provide the paper transmittal form Traffic Data Sheet 12, Classification Data Transmittal. The Regional office uses this form to confirm that the data files which were sent match those which were received. The form also provides a method for the agency to supply data on the factors that are used to estimate average annual conditions for each vehicle class and to provide additional comments (such as suspected errors in the

data) that concern the data submitted. One copy of Sheet 12 is completed for each classification count file submitted. Specific instructions for Sheet 12 are included in Chapter 6.

Address questions about Sheet 12 or about specific data collection and submittal formats to the RCOC. Otherwise, when in doubt, provide any information that might benefit a researcher attempting to estimate traffic loadings for that site.

Table 10. Vehicle classification record ("C-Card") - TMG 3rd edition

Columns	No. of Columns	Description	TMG Ref
1	1	Vehicle classification record code (C)	6-4-1
2-3	2	State code	6-2-1
4-9	6	Station Identification Number	6-2-3
10	1	Direction of Travel	6-2-3
11	1	Lane of Travel	6-2-3
12-13	2	Year of Data	6-2-3
14-15	2	Month of Data	6-3-1
16-17	2	Day of Data	6-3-1
18-19	2	Hour of Data	6-4-1
20-24	5	Total Volume	6-4-3
25-29	5	Class 1 Count	6-4-3
30-34	5	Class 2 Count	6-4-3
35-39	5	Class 3 Count	6-4-3
40-44	5	Class 4 Count	6-4-3
45-49	5	Class 5 Count	6-4-3
50-54	5	Class 6 Count	6-4-3
55-59	5	Class 7 Count	6-4-4
60-64	5	Class 8 Count	6-4-4
65-69	5	Class 9 Count	6-4-4
70-74	5	Class 10 Count	6-4-4
75-79	5	Class 11 Count	6-4-4
80-84	5	Class 12 Count	6-4-4
85-89	5	Class 13 Count	6-4-4
The record may end here if the FHWA 13 class system is being used			
90-94	5	Class 14 Count	6-4-4
95-99	5	Class 15 Count	6-4-4

Source: Traffic Monitoring Guide (TMG) - 3rd Edition, Federal Highway Administration, FHWA, February 1995, pg. 6-4-2.

Table 10 shows the format for "C-Card" in the 3rd edition of the Traffic Monitoring Guide. Data may be submitted to the RCOCs in either format depending on state practice although the 3rd edition format is preferred.

5.6 TRUCK WEIGHT DATA

Truck weight data are provided from many types of weigh-in-motion devices. As with the volume and vehicle count information, both short duration portable devices and continuously operating WIM scales produce the data to be submitted. Submit these data either monthly or as specified in the agency's data collection plan. Weight data may be included on the media that contain volume and vehicle classification record files, but be aware that the truck weight records are considerably larger than the volume and vehicle class files and will likely take up a number of diskettes. As a result, use of higher density transmission media (i.e. CD-ROM) is recommended when submitting WIM data.

All truck weight data are submitted in one of three formats. In either case, submit the truck weight information for individual vehicles, not as summary tables. The agency should not adjust any of the weight data before their submission to LTPP. When a WIM device has obviously failed, invalid records are deleted from the LTPP submittal by ending the computer file. Start a new file after the WIM device has been repaired or replaced.

If the routine editing process identifies suspect truck weight data, include comments in the transmittal form that explain

- the location of the suspect data in the files submitted
- the reason the data are suspect
- the ways in which the agency would correct those problems

Again, do not alter the data collected before their submittal to LTPP.

Two common WIM data submittal formats are the FHWA 7-card format in U.S. customary units (see Table 11 and Table 12) and the W-card format in S.I. units (see Table 14). FHWA has used the 7-card format for a number of years, and most equipment can produce it using software already developed by the manufacturer. The 7-card format is discussed in the second edition of the *Traffic Monitoring Guide* (TMG)[10]. However, this data format has a number of limitations.

The FHWA vehicle record from the 2nd edition TMG uses disk space inefficiently because of its 80-column format and the growing number of trucks that contain more than five axles. As a result of these limitations, LTPP has also accepted a modified truck weight record that was developed for the HELP project (see Table 13). The format allows up to 120 columns of data. Up to eight axle spacings and nine axle weights for an individual truck can be recorded on this format.

[10] *Traffic Monitoring Guide*, 2nd edition, Federal Highway Administration, FHWA-PL-92-017, October 1992.

Table 11. Truck weight record (7-Card -- Face record)

Columns	No. of Columns	Description	TMG Ref Page
1	1	Truck weight record code (7)	5-4-8
2-3	2	State code	5-6-2
4-5	2	Functional Classification	5-6-3
6-8	3	Station Identification Number	5-6-3
9	1	Direction of Travel	5-6-3
10-11	2	Year of Data	5-6-4
12-13	2	Month of Data	5-4-8
14-15	2	Day of Month	5-4-8
16-17	2	Hour of day	5-4-8
18-23	6	Vehicle type code	5-4-8
24-25	2	Body type (optional)*	5-4-10
26	1	Engine type (optional)*	5-4-10
27-28	2	(open)	5-4-10
29-31	3	Registered weight (thousands of pounds)	5-4-10
32	1	Basis of registration	5-4-10
33-34	2	(open)	5-4-10
35	1	Lane of travel: 0 = combined lanes 1 = outside (rightmost) lane 2 = next to outside lane, … 3 to 9 = inside lanes	5-4-10
36-40	5	Commodity code (optional)*	5-4-10
41	1	Load status code (optional)*	5-4-10
42-45	4	Total weight of truck or combination	5-4-10
46-48	3	A-axle weight (hundreds of pounds)	5-4-10
49-51	3	B-axle weight (hundreds of pounds)	5-4-10
52-54	3	C-axle weight (hundreds of pounds)	5-4-10
55-57	3	D-axle weight (hundreds of pounds)	5-4-10
58-60	3	E-axle weight (hundreds of pounds)	5-4-10
61-63	3	(A-B) axle spacing (feet and tenths)	5-4-10
64-66	3	(B-C) axle spacing (feet and tenths)	5-4-10
67-69	3	(C-D) axle spacing (feet and tenths)	5-4-10
70-72	3	(D-E) axle spacing (feet and tenths)	5-4-10
73-76	4	Total wheelbase	5-4-10
77-79	3	Record serial number (same for continuation record)	5-4-10
80	1	Continuation indicator: 0 = no continuation record 1 = has a continuation record	5-6-32

*Each of these data items has a default value which must be entered when the data item is not collected.
Source: TMG, 2nd edition, pg. 5-4-7.

Table 12. Truck weight record (7-card -- Continuation record)**

Columns	No. of Columns	Description	TMG Ref Page
1-23	23	Same as columns 1-23 of the face record	
24-28	5	(open)	
29-31	3	F-axle weight (hundreds of pounds)	5-4-10
32-34	3	G-axle weight (hundreds of pounds)	5-4-10
35-37	3	H-axle weight (hundreds of pounds)	5-4-10
38-40	3	I-axle weight (hundreds of pounds)	5-4-10
41-43	3	J-axle weight (hundreds of pounds)	5-4-10
44-46	3	K-axle weight (hundreds of pounds)	5-4-10
47-49	3	L-axle weight (hundreds of pounds)	5-4-10
50-52	3	M-axle weight (hundreds of pounds)	5-4-10
53-55	3	(E-F) axle spacing (feet and tenths)	5-4-10
56-58	3	(F-G) axle spacing (feet and tenths)	5-4-10
59-61	3	(G-H) axle spacing (feet and tenths)	5-4-10
62-64	3	(H-I) axle spacing (feet and tenths)	5-4-10
65-67	3	(I-J) axle spacing (feet and tenths)	5-4-10
68-70	3	(J-K) axle spacing (feet and tenths)	5-4-10
71-73	3	(K-L) axle spacing (feet and tenths)	5-4-10
74-76	3	(L-M) axle spacing (feet and tenths)	5-4-10
77-79	3	Record serial number (same as face record)	5-4-10
80	1	Continuation indicator: 2= first continuation record for a vehicle with more than 13 axles 9=last continuation record	5-4-10

** Used only for truck combinations having six or more axles. Immediately follows the face record.
Source: TMG, 2nd edition, pg. 5-4-7.

For example, the FHWA truck weight record does not allow the inclusion of the vehicle speed as the vehicle passes over the WIM sensor, or the time a vehicle passes the weight sensors to the minute and seconds. The first data item is important for a number of pavement analyses and is also a factor in scale calibration. By providing the time a vehicle crosses the WIM sensor to the minute and second, vehicle headway can be analyzed for the test section, and many other analyses can be made.

One alternative is for states and provinces to use the HELP record format. To produce this format, the agency may need to write a software routine that will create this record from the computer record produced by the agency WIM devices. Although producing this format may require additional work by the agency, the savings in computer time and disk space needed to create and transmit the LTPP truck weight record could provide substantial benefits to the agency in the long term.

Table 13. HELP record format for weight data

Field			Length	Format	Starts in Column
L	=	LANE	1	n	2
LD	=	LANE DIRECTION	2	nn	4
MO	=	MONTH	2	nn	7
DD	=	DAY	2	nn	10
YY	=	YEAR	2	nn	13
HH	=	HOUR	2	nn	16
MN	=	MINUTE	2	nn	19
SS	=	SECOND	2	nn	22
HS	=	HUNDREDTHS OF SECONDS	2	nn	25
VEHNUM	=	VEHICLE NUMBER	6	nnnnnn	28
NA	=	NUMBER OF AXLES	2	nn	35
CL	=	CLASS	2	nn	38
GROS	=	GROSS WEIGHT * 10	4	nnnn	41
LENG	=	OVERALL LENGTH * 10	4	nnnn	46
SPED	=	SPEED * 10	4	nnnn	51
SP1	=	AXLE SPACING 12 * 10	3	nnn	56
SP2	=	AXLE SPACING 23 * 10	3	nnn	60
SP3	=	AXLE SPACING 34 * 10	3	nnn	64
SP4	=	AXLE SPACING 45 * 10	3	nnn	68
SP5	=	AXLE SPACING 56 * 10	3	nnn	72
SP6	=	AXLE SPACING 67 * 10	3	nnn	76
SP7	=	AXLE SPACING 78 * 10	3	nnn	80
SP8	=	AXLE SPACING 89 * 10	3	nnn	84
WT1	=	WEIGHT OF AXLE 1 * 10	3	nnn	88
WT2	=	WEIGHT OF AXLE 2 * 10	3	nnn	92
WT3	=	WEIGHT OF AXLE 3 * 10	3	nnn	96
WT4	=	WEIGHT OF AXLE 4 * 10	3	nnn	100
WT5	=	WEIGHT OF AXLE 5 * 10	3	nnn	104
WT6	=	WEIGHT OF AXLE 6 * 10	3	nnn	108
WT7	=	WEIGHT OF AXLE 7 * 10	3	nnn	112
WT8	=	WEIGHT OF AXLE 8 * 10	3	nnn	116
WT9	=	WEIGHT OF AXLE 9 * 10	3	nnn	120

The HELP record also allows for optional system/state specified fields to be included. Individual states or provinces can specify additional fields which are unique to the particular WIM system being used, starting in column 123. For example, Iowa could specify that columns 123 and on are for the fields: Pavement Temperature, Tire Footprint, ESALs, etc. The "Standard WIM Record" is from columns 1 to 122. All systems will have the fields shown above from columns 1 to 122.

The additional specifications for a HELP record are:

- n = numeric digit
- All numbers shall be right justified within each field.
- Each field shall be comma delimited.
- Each truck record shall start with "<" (ASCII 60) and end with ">" (ASCII 62).
- All weights are in KIPS; all spacings are in feet.
- Values * 10 fields: Values are multiplied by 10 in order to facilitate the use of integers by the WIM and AVI computers.
- Each record shall be fixed length record (i.e., a 3 axle truck record will be the same length (from columns 1 to 122) as a 9 axle truck record. Fields will be padded with spaces (and include commas) as required.)

Table 14. Truck weight record (W-card)

Cols.	No. of Cols.	Description	TMG Page	Cols.	No. of Cols.	Description
1	1	Truck weight record code (W)	6-5-1			
2-3	2	State code	6-2-1			
4-9	6	Station Identification Number	6-2-3			
10	1	Direction of Travel	6-2-3	58-60	3	(E-F) axle spacing **
11	1	Lane of Travel	6-2-3	61-63	3	F-axle weight *
12-13	2	Year of Data	6-2-3	64-66	3	(F-G) axle spacing**
14-15	2	Month of Data	6-3-1	67-69	3	G-axle weight*
16-17	2	Day of Data	6-3-1	70-72	3	(G-H) axle spacing**
18-19	2	Hour of Data		73-75	3	H-axle weight*
20-21	2	Vehicle Class	6-5-3	76-78	3	(H-I) axle spacing**
22-24	3	Open	6-5-3	79-81	3	I-axle weight*
25-28	4	Total Weight of Vehicle	6-5-3	82-84	3	(I-J) axle spacing**
29-30	2	Number of Axles	6-5-3	85-87	3	J-axle weight
31-33	3	A-axle weight*		88-90	3	(J-K) axle spacing**
34-36	3	(A-B) axle spacing**		91-93	3	K-axle weight*
37-39	3	B-axle weight*		94-96	3	(K-L) axle spacing**
40-42	3	(B-C) axle spacing**		97-99	3	L-axle weight*
43-45	3	C-axle weight*		100-102	3	(L-M) axle spacing**
46-48	3	(C-D) axle spacing**		103-105	3	M-axle weight*
49-51	3	D-axle weight*				
52-54	3	(D-E) axle spacing**		Additional fields if needed.		
55-57	3	E-axle weight*				

*Axle weights are to nearest tenth of a metric ton (100 kilograms) without a decimal point.

** Axle spacings are to the nearest tenth of a meter (100 millimeters) without a decimal point.

Source: TMG, 3rd edition, pg 6-5-2.

The legislative direction to perform all highway work in S.I. (metric) units resulted in the W-card format for truck weight records. The W-card format allows the inclusion of some additional information to the LTPP database and should reduce the time required to create the truck record submittal and the disk

space required to contain that submittal. It was first documented in the third edition of the *Traffic Monitoring Guide*[11].

The truck weight records do not need as much ancillary data as the volume and vehicle class file submittals. Complete Traffic Data Sheet 13, Vehicle Weight Data Transmittal Form, for each file of individual truck weight records that are submitted. The instructions for Sheet 13 are included in Chapter 6 of this document.

Questions about Sheet 13 or about specific data collection and submittal formats should be addressed to the RCOC for the agency. Otherwise, when in doubt, provide any information that might benefit a researcher attempting to estimate traffic loadings for that site.

5.7 SUBMISSION DETAILS

The frequency of the agency's data submittal is determined as part of the agency's data collection plan. Most agencies submit data monthly. For each submittal, the agency should provide the RCOC with one package. That package should contain the following information:

- a brief cover letter that includes a list of the sites covered by the submittal package
- information for each site bundled together (that is, Sheets 11, 12, and 13 for one site paper clipped together)
- the name of a person at the agency who the RCOC should contact if it has questions about the submittal
- the diskettes (or other media) used to transmit the data.

Finally, the file naming conventions described earlier in Section 5.1 should be followed, and any additional information that will be valuable to LTPP researchers or others using the LTPP traffic database should be provided to the RCOC.

[11] *Traffic Monitoring Guide*, 3rd edition, Federal Highway Administration, February 1995.

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6. MONITORING TRAFFIC DATA FORMS AND INSTRUCTIONS

The seven forms provided in this section are associated with traffic monitoring data. They are as follows:

Sheet 10 - Traffic Volume and Load Estimate Update - No Site Weights and or Count

Sheet 11 - Volume Data Transmittal Form

Sheet 12 - Classification Data Transmittal Form

Sheet 13 - Vehicle Weight Data Transmittal Form

Sheet 14 - Equipment Installation Log Form

Sheet 15 - Log of Changes at Test Sections with Permanent AVC or WIM

Sheet 16 - Data Collection Equipment Calibration Form

Specific instructions for completing these forms are provided on the following pages. In addition, Sheets 1 and 7, originally designed for submittal of historical estimates and described in Appendix A are also used for collecting information during the monitoring period. Sheet 1 contains the basic location information for traffic site. Sheet 7 is used to track the difference between and agencies' classification scheme and the 13-class system found in the TMG which has been adopted by LTPP.

Throughout the following discussion, disk is used to represent any electronic medium on which data is submitted.

Data Section Common for all Data Sheets

Each of the forms required by the Traffic Data Collection for the test sections requires general information. The general information items are enclosed in boxes in the upper right corner and at the bottom of each page.

Upper Right Corner

STATE ASSIGNED ID

Form Entry: State Assigned ID __ __ __ __

Explanation: Enter the four-digit number that has been assigned by the State or Province for the applicable test section. If the State or Province has not assigned a number, leave this space blank.

STATE CODE

Form Entry: State Code __ __

Explanation: Enter the two-digit number that has been assigned by SHRP for the State or Province. For example, the state code for New York is 3 6.

SHRP ID

Form Entry: SHRP Section ID __ __ __ __

Explanation: Enter the four-digit number that has been assigned by SHRP for each test site. For GPS sections and SPS projects with GPS control sections this is the SHRP_ID assigned to the section. For all other SPS sites the SPS PROJECT_ID is used.

For example, the SHRP ID number for the test site on I-88 at the Ostego/Delaware county line in the state of New York is 4 0 1 8. (Note: Multiple SPS sections use a single traffic data collection effort. Instructions for this are given in the footnote.[12])

Lower Portion of Page

NAME AND PHONE NUMBER OF PREPARER

Enter the name and phone number of the person responsible for the data entered on this form.

DATE PREPARED

Enter the date that the form was completed as follows:

Form Entry: Date ___ - ___ -_____

[12] SPS sections are basically contiguous on the roadway and a single traffic data collection effort can be used to supply loading estimates at all SPS sections within a given pavement roadway location. All traffic data collected is associated with the SPS project and is given the PROJECT_ ID of that location. This location is called the Traffic Site ID, and is referenced in a file called SPS.DAT that is maintained by the LTPP Regional Offices. This file provides the links between the different individual SPS test sections and the single traffic loading table. More information on this subject can be found in the LTPP document "Specifications For Processing SPS Traffic Data."

Explanation: Month Day Year

Example: 02 - 18 - 1989

6.1 TRAFFIC VOLUME AND LOAD ESTIMATE UPDATE - NO SITE COUNT (SHEET 10)

PURPOSE: The purpose of this form is to record AADT and ESAL estimates for LTPP test sections during the monitoring period of the LTPP study when either no other site-specific or site-related traffic volume classification count and weight data were collected, or classification data but no weight data were collected. This is required during the years prior to the installation of site-specific, continuously operated AVC or WIM equipment and after such equipment is removed while the location remains in study in the absence of any traffic data collection activities. For SPS projects, one Sheet 10 submittal is sufficient for each project (i.e., all contiguous SPS test sections.)

GENERAL INFORMATION: General information such as state assigned ID, state code, SHRP ID, and the name of the preparer is recorded on this sheet. The agency turns it in to the LTPP Regional office.

1. ANNUAL TRAFFIC ESTIMATES:

   For each year during the monitoring period of the LTPP study in which the necessary traffic data are ***not*** collected or do not pass LTPP review processes, enter the AADT and ESAL estimates that the agency would use for that year if it were to estimate such a number under its normal data manipulation activity, including estimated total vehicles AADT (Two-way); estimated total truck AADT (Two-way); estimated AADT in the test lane; estimated total trucks AADT (Test Lane); and estimated ESAL per year (Test Lane). One sheet is submitted for each year.

2-6. METHODOLOGY:

   To complete the form simply check the methodology that most appropriately describes the method used by the agency to estimate each of the summary traffic statistics listed on the top of Sheet 10. If the appropriate method is not listed, mark "Other" and fill in a description of the method used.

7-8. ESAL ESTIMATES AND WEIGHT SCALE TYPE:

Select the source of data used to estimate annual ESAL and the type of weight scale used in that estimation process. If the appropriate source or type of weight scale is not listed, mark "Other" and fill in the appropriate information.

6.2 VOLUME DATA TRANSMITTAL FORM (SHEET 11)

PURPOSE: Sheet 11 is used to transmit traffic volume data. One of these forms should accompany each disk containing volume data submitted by the agency to the LTPP Regional office. If the disk contains volume counts from several test sections or for several counts on varying dates at the same test section, one sheet should be provided for each separate volume count which is included.

GENERAL INFORMATION: The general information such as state assigned ID, state code, SHRP ID, and the name of the preparer is recorded on this sheet. It is turned in by the agency to the LTPP Regional office.

HIGHWAY ROUTE NO. (THIS COUNT) AND MILE POST NO. (THIS COUNT)

Form Entry: Highway Route # (This Count)_____

Mile Post # (This Count)_____

Explanation: Enter the common name or highway numbers used to identify the highway and the mile post number where the traffic volume count was taken. This may be different from the test section. If a mile post system has not been developed, enter "N/A" on the mile post number line.

Example: Highway Route # (This Count) IH 35

Mile Post # (This Count) MP 269

LOCATION (THIS COUNT)

Form Entry: Location (This Count) _____

Explanation: Describe the location of the volume count, especially if a mile post system has not been established for this highway.

Example: Location (This Count) North of Austin near Parmer Lane

FILENAME

Explanation: Enter the filename in accordance with instructions provided to the agency by the Regional office. The filename includes the type of count, the state code, the SHRP ID, and the date of the count, and as described in the previous chapter.

DISK ID

Explanation: Enter the identification number assigned by the highway agency to the disk that contains the above referenced file.

BEGINNING DATE AND ENDING DATE

Explanation: Enter the beginning and ending date (month-day-year) for the counting period.

BEGINNING TIME AND ENDING TIME

Explanation: Enter the beginning time and ending time for the counting period.

TYPE OF COUNT

Explanation: Select the type of count by marking either Two-way (if the count is for both directions), One-way (if one direction is counted), or test lane (if the count was made only in the test lane).

COUNT DURATION

Explanation: Enter the length of time the count covered and select the appropriate units by marking either hours, days, or months. (Use hours for short counts, days for week-long counts, and months for automatic traffic recorders.)

TYPE OF SENSOR

Explanation: Select the method used for collecting the volume data by marking either road tubes, piezo cable, piezo film, loops, or other.

EQUIPMENT MANUFACTURER/MODEL NUMBER

Explanation: Enter the equipment manufacturer or brand name and the model number of the equipment used for the automated traffic volume count. This information is used in conjunction with the axle correction factor to calculate the traffic volume at the site.

AXLE CORRECTION FACTOR AND STANDARD DEVIATION

Explanation: If this count was taken with a single axle sensor (road tube, piezo cable, etc.) indicate the axle correction factor that applies to the raw data to estimate daily traffic. If the agency computes these factors on a regional or statewide basis, also list the standard deviation of that estimate if it is available. If the count was taken with equipment that physically counts vehicles (i.e., uses loops), leave this blank.

MONTHLY/SEASONAL FACTOR AND STANDARD DEVIATION

Explanation: Supply the monthly or seasonal correction factor that the agency would use to convert this series of counts into AADT estimates. If there is no such factor, leave the space blank. If the agency computes the standard deviation of the seasonal factor (i.e., it is based on a number of permanent counters), also provide that estimate. If more than one seasonal factor is used (for multiple day counts), provide additional information in the comment section on the form or on an attached sheet of paper.

DAY-OF-WEEK FACTOR AND STANDARD DEVIATION

Explanation: If the agency computes a separate day-of-week factor for estimating AADT, supply that estimate in this space. If there is no such factor, leave the space blank. If the agency computes the standard deviation of that factor (i.e., it is based on a number of permanent counters), also provide that estimate. If more than one factor is used (for multiple day counts), provide additional information in the comment section on the form or on an attached sheet of paper.

OTHER FACTOR

Explanation: If the agency uses other factors besides day-of-week and seasonal factors to estimate AADT based on a short duration count, place that estimate in this blank. Please define the factor. (If the space provided is insufficient, use the comment field at the bottom of the page or a separate piece of paper to provide the definition.) Also, provide an estimate of the standard deviation of the factor if the agency computes this statistic.

DISTRIBUTION FACTOR FOR LTPP LANE

Explanation: If the data submitted contain volumes by lane, leave this space blank. If the data submitted do not separate the test lane traffic from other traffic, provide an estimate of the percentage of total traffic in the test lane.

SOURCE FOR LTPP LANE DISTRIBUTION FACTOR ESTIMATE

Explanation: If a lane distribution factor is provided, rather than lane specific volumes, list the source for that factor (e.g., averages from the permanent counter, estimates from the agency design manual, etc).

COMMENTS

Explanation: Place any comments on suspected data collection errors in this area. Also include any other comments that might be useful to LTPP researchers or other individuals using the LTPP traffic database.

6.3 CLASSIFICATION DATA TRANSMITTAL FORM (SHEET 12)

PURPOSE: Sheet 12 is used to transmit vehicle classification data that were collected from continuously operating, automatic vehicle classifiers (AVC) or from portable classifiers. One of these forms should accompany each disk containing classification data submitted by the agency to the Regional office. If the disk contains classification counts from several test sections or several counts on varying dates at the same test section, one sheet is submitted for each separate classification count which is included. If two-way counts are taken and LTPP sections are located in both directions on the roadway, a separate file must be submitted for each direction. Note that for LTPP locations which have contiguous sections, either SPS projects or a group of GPS locations which have no intervening intersections one count can be submitted for all contiguous test sections. SPS projects which contain both SPS and GPS sections require only one submission. If a single submission is provided for a group of which consists solely of GPS sections, all GPS sections to which the data applies must be identified.

GENERAL INFORMATION: General information such as state assigned ID, state code, SHRP ID, and the name of the preparer is recorded on this sheet. The agency turns it in to the LTPP Regional office.

HIGHWAY ROUTE NO. (THIS COUNT)

Explanation: Enter the common name or highway numbers used to identify the highway.

Form Entry: Highway Route # (This Count)_____

Example: Highway Route # (This Count) IH 35

MILE POST NO. OR LOCATION (THIS COUNT)

Explanation: Enter a description or the appropriate mile post number where the vehicle classification count was taken. This may be different from the test section. If a mile post system has not been developed, enter significant permanent features to describe the count location.

Form entry: Mile Post No. or Location (This Count)_____

Example: Mile Post No. or Location (This Count) MP 3.9 North of Austin near Parmer Lane

FILENAME

Explanation: Enter the filename in accordance with instructions provided to the agency by the Regional office. The filename includes the type of count, the State and SHRP ID, and the date of the count, as described in the previous chapter.

DISK ID

Explanation: Enter the identification number assigned to the disk by the agency.

BEGINNING DATE AND ENDING DATE

Explanation: Enter the date (month-day-year) that the counting period began and ended.

BEGINNING TIME AND ENDING TIME

Explanation: Enter the time of day that the counting period began and ended.

COUNT DURATION

Explanation: Enter the length of time the count covered and select the appropriate units by marking either hours, days, or months. (Use hours for short counts, days for week-long counts, and months for continuously functioning classifiers.)

VEHICLE CLASSIFICATION METHOD

Explanation: Check the FHWA blank if the data submitted were collected with the FHWA 13-category classification scheme. If something other than the FHWA 13-category scheme is used, check the Other blank and write the name of the system used by the agency in the field marked "Name of Agency Classification

Scheme" (note that a corresponding sheet 7 must be submitted for this scheme). Indicate the number of vehicle classes differentiated by that scheme in the blank marked "No. of Bins."

TYPE OF AVC EQUIPMENT

Explanation: Check whether the equipment used to collect the data in this file was from a portable counter or a permanent installation.

EQUIPMENT MAKE/MODEL NUMBER

Explanation: List the make and model number of the electronics used to collect the vehicle classification data. (Write "Manual" if the count was performed with human observers.) Also indicate the type of axle sensor used.

SENSOR TYPE

Explanation: Enter the type of sensor used to classify vehicles during this count if other than a manual count.

ADJUSTMENT FACTORS - GENERAL FACTORS

Explanation: In this area of the form, list any factors (and corresponding standard deviations if the agency computes them) that are applied to all classes of vehicles to estimate average annual conditions. Also provide a brief explanation of what each of these factors represents. If more space is needed, attach an additional piece of paper.

ADJUSTMENT FACTOR - CLASS SPECIFIC

Explanation: In this area of the form, list any factors (and corresponding standard deviations if the agency computes them) that are applied to individual vehicle classes to estimate average annual conditions. Also provide a brief explanation of what each of these factors represents. If more space is needed attach an additional piece of paper.

COMMENTS

Explanation: Use this space on the form to describe any events that might have impacted the validity of the classification count. These events may include possible errors in the data found during the agency's editing routines or unusual volumes occurring for other reasons.

6.4 VEHICLE WEIGHT DATA TRANSMITTAL FORM (SHEET 13)

PURPOSE: Sheet 13 is used to transmit vehicle weight data that were collected from a continuously operated, weigh-in-motion (WIM) device, or from portable WIM. One of these forms should accompany each disk containing vehicle weight data submitted by the agency to the Regional office. If a disk contains weight data from several test sections or for several weight sessions on varying dates at the same test section, one sheet is provided for each separate weight session included on the disk. If the data from one weight session fill up more than one disk, one sheet is provided for each disk. If two-way counts are taken and LTPP sections are located in both directions on the roadway, a separate file must be submitted for each direction. Note that for LTPP locations which have contiguous sections, either SPS projects or a group of GPS locations which have no intervening intersections, one count can be submitted for all contiguous test sections. SPS projects which contain both SPS and GPS sections require only one submission. If a single submission is provided for a group of which consists solely of GPS sections, all GPS sections to which the data applies must be identified.

GENERAL INFORMATION: General information such as state assigned ID, state code, SHRP ID, and the name of the preparer is recorded on this sheet. The agency turns it in to the LTPP Regional office.

HIGHWAY ROUTE NO. (THIS SESSION) AND MILE POST NO. OR LOCATION (THIS SESSION)

Form Entry: Highway Route # (This Session)_____

Mile Post # or Location (This Session)_____

Explanation: Enter the common name or highway numbers used to identify the highway and the mile post number where the traffic volume count was taken. This may be different from the test section. If a mile post system has not been developed, describe the location of the weight session.

Example: Highway Route # (This Session) IH 35

Mile Post # or Location (This Session) MP 269

FILENAME

Explanation: Enter the filename in accordance with instructions provided to the agency by the Regional office. The filename includes the type of count, the state code, SHRP ID, and the date of the count, as described in the previous chapter.

DISK ID

Explanation: Enter the identification number assigned to the disk by the agency.

BEGINNING DATE AND ENDING DATE

Explanation: Enter the dates (month-day-year) that the counting period began and ended.

BEGINNING TIME AND ENDING TIME

Explanation: Enter the times of day that the counting began and ended.

COUNT DURATION

Explanation: Enter the length of time that the count covered and select the appropriate units by marking either hours, days, or months. (Use hours for short sessions, days for week-long sessions, and months for continuously functioning WIM devices.)

WEIGHT SCALE TYPE

Explanation: Enter the type of weight scale used by marking either portable WIM, permanent WIM, or some other type of static scale.

EQUIPMENT MAKE/MODEL NUMBER

Explanation: Enter the brand name and model number of the weight equipment used to make the automated weight count.

SENSOR TYPE

Explanation: Enter the type of sensor used to collect the data being transmitted. (Piezo cable, Piezo film, bending plate, etc.)

VEHICLE CLASSIFICATION METHOD

Explanation: Check the appropriate blank for the type of scheme and format of data used for this submittal. Check “FHWA 13 bin in cols. 18-19" if a 7-card uses the FHWA 13-bin scheme and the data are left justified in Columns 18 and 19. Check "FHWA 13 bin in cols. 18-23" if a 7-card uses the FHWA 13-bin scheme and the data are right justified in Columns 22 and 23. Check “6-digit Truck Weight Study” if the 7-card classification scheme follows that convention. Check “W-card” if W-card data are submitted. List the identifying name of the agency specific classification code if something other than the FHWA classes is used. Identify the location of the data in columns 18-23 (either right justified or left justified) for the agency classifications.

METHOD OF CALIBRATION AND FREQUENCY

Explanation: Describe the methodology for calibrating the weighing device and the frequency that the calibration is made.

COMMENTS

Explanation: Enter any comments relative to the data provided or describe errors in the data determined from editing at the state level. Also indicate when equipment malfunctions have occurred and provide information about any changes that have occurred at the data collection site. Any other pertinent information is recorded in the Comments section, or attached on separate pages.

6.5 EQUIPMENT INSTALLATION LOG FORM (SHEET 14)

PURPOSE: Sheet 14 is used to provide the Agency and LTPP with a description of the data collection equipment installed at a given location. It is designed to provide the LTPP Regional office with a mechanism to quickly identify what types of equipment are being used by the agencies. This allows the Regional office to help coordinate the data collection programs and equipment problem trouble shooting of the Agencies by allowing the quick identification of other Agencies that have experience with specific types of equipment.

GENERAL INFORMATION: The general information at the top of the page, such as State assigned ID number, State identification code, SHRP ID number, and location and date of installation is recorded on this sheet. It is turned in by the Agency to the LTPP Regional office.

LOCATION	Enter the name of the location of the data collection equipment. Include the route number of the road on which the equipment is located.
DATE OF INSTALLATION	Enter the date (MM-DD-YYYY) when the equipment and sensors at this sight were first installed. (This should be the day the site installation was completed.)
CATEGORY OF EQUIPMENT:	For each category of equipment listed in the left column of Sheet 14, a description of the type of equipment, brand name, and serial number should be provided. Any equipment installed but not specifically listed on Sheet 14 should be described in the blanks under each general category. Other pertinent information is attached to the primary Sheet 14 for each test location.

CONTROL UNIT(S) AND PERIPHERAL EQUIPMENT

Explanation: In this section, list the serial number, brand (e.g., Golden River), and type of equipment (Model 200) for the primary control unit components listed in the left hand column.

SENSOR(S) / PLATFORM(S)

Explanation: In this section, list the serial number, brand (e.g., Vibra-coax), and type of equipment for the sensors listed in the left hand column. Leave blank those entries for items that are not installed at this location. (E.g., if the WIM site does not have an off-scale detector, leave the “off-scale” row blank.)

SOFTWARE

Explanation: In this section, the intent is to provide LTPP with information as to the source of the vehicle classification algorithm being used for this sight. Does the Agency use its own algorithm (programmed by a vendor?) or does it use an algorithm supplied by a vendor? In addition, this section determines whether the Agency is using the central processing system for polling and evaluating the data collected, or whether they are only using the tools supplied by the vendor.

LOOPS

Explanation: In this section, the agency should list the types and makers (brand, number of strands of wire) of the loops installed. They should also list if there are one or two loops at this location. (If only one loop is present and is installed between two axle sensors, describe this as the “downstream” loop.)

TYPE OF EQUIPMENT: For each category of equipment, the specific type is provided. For example, the sensor in the LTPP test lane could be described as a piezo cable, bending plate, or load cell. The appropriate type description for the particular site is listed under the Type column on Sheet 14.

BRAND NAME: For each category of equipment, the specific brand name should be described. For example the control unit may be a Golden River WIM device. This information should be listed under the Brand Name on Sheet 14.

SERIAL NO: The serial number for each category and piece of equipment should be listed. For example, if the modem that was installed had a serial number of AB12345, it would be recorded under the Serial Number column on Sheet 14.

6.6 LOG OF CHANGES AT TEST LOCATIONS WITH PERMANENT AVC OR WIM (SHEET 15)

PURPOSE: Sheet 15 is used to provide the Agency and LTPP with a record of repairs and modifications made at a given site. As with Sheet 14, the primary purpose of this material is to provide the LTPP Regional office with information that it can access quickly in order to help coordinate the transfer of information between states.

EXPLANATION: Changes are recorded whenever equipment changes are made (e.g., replace sensor, change hardware, upgrade software, repair equipment malfunction, calibrate equipment, discontinue operation, power failure, etc.). The pertinent information is recorded on chronological order on forms that are maintained in log form both in the controller cabinet on site and at the Regional office. At least quarterly, the agency forwards copies of the completed forms to the RCOC.

The RCOC classifies these forms as “off-line” data. (That is, it is maintained at the Regional office, but is not stored electronically as part of the primary portion of the CTDB.) The information on the forms is available to the RCOC to review so that any major changes or disruptions in the continuous data collection operation can be better understood while QC functions are performed. The logs are also used once per year to evaluate the status of traffic data collection for the site. As appropriate, the comment field on vehicle classification and weight data record is annotated to indicate changes at the site that could impact the quality of the collected data (e.g., lightning strike, vehicle collisions at the site, equipment out of

service for repairs and maintenance, change of computer).

CHANGES TO BE RECORDED: A list of possible changes that could occur at each site over time follows. This is not intended to be an all-inclusive list of possibilities but to serve as guidance to an operator or repair person who visits the site and needs to record such changes. All changes are recorded on the Log of Changes (Sheet 15) form at the site when the change occurs or is first noticed.

Electronics Replaced	Complete Equipment Package Control Unit Only Interface Only Modem Only Loop Amplifiers Only Other (List)
Software Changed	Complete Package Axle Spacing Algorithm Only Other (List)
Sensor(s)/Platform(s) Replaced with Same Type of Equipment	Sensor Lane 1 Sensor Lane 2 Sensor Lane 3 Sensor Lane 4 Axle Sensor Sensor Other Right Platform Left Platform Right Platform Load Cell(s) Left Platform Load Cell(s) Capacitance Pad Off Scale Detector
Sensor(s) Platform(s) Replaced with Different equipment	Manufacturer Serial Number
Loop(s) Replaced LTPP Test Lane	Upstream Loop Downstream Loop
Site Reestablished	Same Configuration Different Configuration

	Precisely the Same Location Different Location
Method of Data Collection/Transmission Changed	
Roadway Surface Maintenance at the Counting/Weighing Site	Overlay within 300' of the Site Milling or Planing at the Site (Upstream or Downstream) Patching of Potholes or Crack sealing
Other	Profilometer Reading Made Recalibration of Equipment Manual Automatic Equipment Malfunction Reason: _____ Vehicle Collision at Site Weather or Water Damage Connecting Wire and Hardware Replaced Damage by Snow Removal Equipment

The Log of Changes (Sheet 15) is referenced to the Equipment Installation Log (Sheet 14), which is completed when that permanent vehicle classification or weighing equipment is installed at the site. An example of the Equipment Installation Log (Sheet 14) is included in the forms section immediately following this section.

GENERAL INFORMATION:	The general information such as state assigned ID, state code, and the SHRP Section ID is recorded on the sheet. It is turned in by the agency to the LTPP Regional office whenever a piece of data collection equipment is repaired or modified.

LOCATION

Explanation: Enter the name of the location of the data collection equipment. Include the route number of the road on which the equipment is located.

TYPE OF EQUIPMENT

Explanation: Enter the type of equipment being repaired in this field. This is particularly important if there is more than one piece of data collection electronics at this location. (Example: IRD Bending Plate WIM)

MILEPOST NUMBER (MP #)

Explanation: Enter the approximate milepost number of the location of the data collection equipment cabinet.

MODEL NUMBER

Explanation: Enter the model number of the primary electronics being repaired or modified.

DATE OF CHANGE

Explanation: Enter the date on which the equipment modification took place.

TIME OF CHANGE

Explanation: Enter the time of day when the change became effective.

DESCRIPTION OF CHANGE

Explanation: Enter a brief text description of the changes/repairs that took place.

Example: Replaced upstream piezo-electric cable in the test lane.

PERSON MAKING CHANGE

Explanation: Enter the name (first and last names) of the technician or engineer performing the change and/or equipment repair.

PHONE NUMBER

Explanation: Enter a telephone number at which the person making the repair can be contacted.

NEW EQUIPMENT SERIAL NUMBER

Explanation: Enter the serial number of the primary piece of data collection electronics at this site at the end of the repair or change. (Note is the primary piece of electronics is the same as the one listed earlier on this sheet, place the words “same as above” in this field. This would indicate that the primary data collection electronics were not replaced as part of this “change” record.)

6.7 DATA COLLECTION EQUIPMENT CALIBRATION (SHEET 16)

PURPOSE: Sheet 16 is used to record calibration information for WIM and AVC equipment installed at LTPP test sites. These sheets provide information on both the frequency of the calibration effort, and provide insight into the accuracy of the equipment performance at that site. This sheet should be submitted with the first data submittal made after a calibration or calibration check is completed at a site.

GENERAL INFORMATION: The general information such as state assigned ID, state code, and the SHRP ID is recorded in the upper right corner of the sheet. The sheet is turned in by the agency to the LTPP Regional office whenever a piece of data collection equipment is calibrated.

DATE OF CALIBRATION

Explanation: Enter the date (MM/DD/YYYY) on which the calibration effort took place. If the calibration took place over more than one day, enter the day the calibration effort was completed.

TYPE OF EQUIPMENT

Explanation: Enter the type of equipment being calibrated in this field by checking the appropriate box.

REASON FOR CALIBRATION

Explanation: Check the selection that most appropriately describes the reason why this calibration effort was undertaken.

SENSORS INSTALLED IN LTPP LANE AT THIS SITE

Explanation: Check the selections that describe the types of sensors (axle sensors and presence sensors) currently in place in the LTPP test lane. Note that other sensors may also be located at this site, in other lanes. Only sensors used for collecting data in the LTPP test lane should be indicated. More than one sensor type can be checked if more than one sensor is present. (Usually loops and an axle sensor are present for most AVC and WIM devices.)

EQUIPMENT MANUFACTURER

Explanation: List the manufacturer of the data collection electronics being used at this site. If the AVC and WIM data are being collected with more than one set of electronics, and these two devices come from two different manufacturers, list both manufacturers and indicate which device is the AVC and which is the WIM scale.

WIM CALIBRATION TECHNIQUE (Note: if only AVC equipment was calibrated, leave this section blank)

Explanation: Check the selection which indicates the calibration technique being used at this site on this occasion. If trucks from the traffic stream are being weighed at a nearby static scale, also indicate the number of trucks correctly matched between the static and WIM scales. If test trucks are being used, indicate the style of each test truck (e.g., 3S2), and its primary suspension type (e.g., air suspension, leaf springs, etc.)

SUMMARY CALIBRATION RESULTS

Explanation: In the appropriate blank, fill in the mean difference between the matched dynamic and static weights for all runs for gross vehicle weight, single axles and tandem axles. Also compute and enter the standard deviation of those estimates. If calibration runs were made at multiple speeds, combine all data collected into single data set before computing these values.

NUMBER OF SPEEDS AT WHICH CALIBRATION WAS PERFORMED

Explanation: Some WIM scales are speed sensitive. If the scale being calibrated is speed sensitive, the calibration must be performed at each of the speed ranges that can normally be found at this site. List in this field the number of speed intervals (usually spaced 10 kph or 5 mph apart) at which calibration runs were made.

DEFINE THE SPEED RANGES USED

Explanation: In these fields, indicate the speed ranges at which the calibration runs took place. Speed ranges are collected in miles per hour.

Form entry: DEFINE THE SPEED RANGES USED (MPH) ____ _____ ____ ____

Example: DEFINE THE SPEED RANGES USED (MPH) 45 - 50 , 55 - 60

CALIBRATION FACTOR (AT EXPECTED FREE FLOW SPEED)

Explanation: Indicate the calibration factor entered into the WIM scale software at the end of the calibration effort.

IS AUTO-CALIBRATION USED AT THIS SITE? IF YES, LIST AND DEFINE VALUE

Explanation: Indicate if auto-calibration is a function used at this location. If it is, indicate the auto-calibration value selected.

Example: The mean front axle of passing 3S2's is expected to be 10,000 pounds.

CLASSIFIER TEST SPECIFICS (AVC tests should also be performed for WIM scales)

METHOD FOR COLLECTING INDEPENDENT VOLUME MEASUREMENT

Explanation: Check the selection which describes how the independent measure of volume by classification is measured and against which AVC volumes by class are compared.

METHOD TO DETERMINE LENGTH OF COUNT

Explanation: The AVC comparison can be based on either a given length of count (i.e., 3 hours) or a given number of vehicle comparisons (i.e., 100 heavy trucks). Indicate the method by which the duration of this test was determined by writing the appropriate figure in the appropriate field. (For example, write “100" in the field NUMBER OF TRUCKS if 100 truck comparisons were needed in order to make this calibration check.)

MEAN DIFFERENCE IN VOLUMES BY VEHICLE CLASSIFICATION

Explanation: Indicate the mean differences in volumes within FHWA Classes 8 and 9 during the test period. If additional classes are monitored because they are important to the agency, define the classes compared and report those differences as well. Finally, indicate the percentage of vehicles that could not be classified during the test period.

NAME OF PERSON LEADING THE CALIBRATION EFFORT

Explanation: List the first and last names of the person leading the calibration effort.

CONTACT INFORMATION

Explanation: List the contact information (telephone either mail or e-mail address for the person in charge of the calibration effort.)

SHEET 10 **LTPP TRAFFIC DATA** **TRAFFIC VOLUME AND LOAD** **ESTIMATE UPDATE-NO SITE COUNT**	*STATE ASSIGNED ID [__ __ __ __] *STATE CODE [__ __] *SHRP SECTION ID [__ __ __ __]

1. **ANNUAL TRAFFIC ESTIMATES**

***YEAR**	ESTIMATED TOTAL VEHICLES AADT (TWO-WAY)	ESTIMATED TOTAL TRUCK AADT (TWO-WAY)	ESTIMATED TOTAL VEHICLES AADT LTPP LANE	*ESTIMATED TOTAL TRUCKS AADT LTPP LANE	*ESTIMATED ESAL'S/YR LTPP LANE (1000'S)
_____	_____	_____	_____	_____	___ ___ ___ ___

2. **METHOD FOR ESTIMATING TOTAL VEHICLE AADT (TWO-WAY)**

____ Growth factored last year's estimate. (6)
____ Estimated based on volume counts at nearby locations. (3)
____ Used computerized network analyses. (4)
____ Factored a single count taken this year at the LTPP site. (1)
____ Averaged multiple counts taken this year at the LTPP site. (2)
____ Averaged and factored multiple count taken this year at the LTPP site. (5)
____ Used flow maps. (7)
____ Other: (8) _____
_____

3. **METHOD FOR ESTIMATING TOTAL TRUCK AADT (TWO-WAY)**

____ Used system averages from counts taken this year. (6)
____ Used count data from nearby sites. (3)
____ Used count data from previous years at the LTPP site. (7)
____ Used system averages from previous years. (8)
____ Used computerized network analyses. (4)
____ Used a single count taken this year at the LTPP site. (5)
____ Factored a single count taken this year at the LTPP site. (1)
____ Averaged multiple counts taken this year at the LTPP site. (2)
____ Other: (9) _____
_____

4. **METHOD FOR ESTIMATING TOTAL VEHICLES LTPP LANE AADT**

____ System distribution factors. (2)
____ Based on actual lane count data. (1)
____ Other: (3) _____
_____

*5. **METHOD FOR ESTIMATING TOTAL TRUCKS, LTPP LANE, AADT**

____ System distribution factors. (2)
____ Based on actual lane data count. (1)
____ Other: (3) _____

*6. **METHOD FOR ESTIMATING ESAL//YEAR IN LTPP LANE**

____ ESAL/Truck factor (1)
____ ESAL/Vehicle class. (2) (No. of classes)_____
____ ESAL/Axle(3) Sing. ____ Tand. ____ Tri. ____
____ Other: (4) _____

7. **ESAL ESTIMATES - SOURCE OF DATA**

____ Weight data collected at LTPP site prior years. (2)
____ Weight data from system averages this year. (3)
____ Weight data from system averages prior years. (4)
____ Weight data from historic W-4 Tables used. (5)
____ Other: (6) _____
_____

8. **WEIGHT SCALE TYPE**

____ WIM scale. (1)
____ Static scale used for enforcement. (2)
____ Static scale not used for enforcement. (3)
____ Other: (4) _____
_____

NAME OF PREPARER _____ PHONE #_____
DATE PREPARED _____ rev. March 12, 2001

SHEET 11 **LTPP TRAFFIC DATA** **VOLUME DATA** **TRANSMITTAL FORM**	*STATE ASSIGNED ID [__ __ __ __] *STATE CODE [__ __] *SHRP SECTION ID [__ __ __ __]

HIGHWAY RT. NO. (THIS COUNT)_____ MILEPOST NO. (THIS COUNT) _____

LOCATION (THIS COUNT) _____

FILENAME _____ DISK ID _____

BEGINNING DATE _____ BEGINNING TIME _____

ENDING DATE _____ ENDING TIME _____

TYPE OF COUNT: TWO-WAY_____ ONE-WAY_____ LTPP LANE_____

COUNT DURATION _____ [ ] HOURS [ ] DAYS [ ] MONTHS

TYPE OF SENSOR: _____ ROAD TUBES _____ PIEZO CABLE

_____ PIEZO FILM _____ LOOPS _____ OTHER _____

EQUIPMENT MANUFACTURER/MODEL # _____

AXLE CORRECTION FACTOR _____ STANDARD DEV. OF FACTOR _____

MONTHLY/SEASONAL FACTOR _____ STANDARD DEV. OF FACTOR _____

DAY-OF-WEEK FACTOR _____ STANDARD DEV. OF FACTOR _____

OTHER FACTOR _____ STANDARD DEV. OF FACTOR _____

SPECIFY_____

DISTRIBUTION FACTOR FOR LTPP LANE _____
(WHEN NOT AVAILABLE FROM ACTUAL COUNT DATA)

SOURCE OF LTPP LANE DISTRIBUTION FACTOR ESTIMATE _____

COMMENTS: _____
_____
_____

FILL OUT ONE TRANSMITTAL SHEET FOR EACH DATA FILE SUBMITTED.

NAME OF PREPARER _____ PHONE#_____
DATE PREPARED _____ rev. November 9, 1999

SHEET 12 **LTPP TRAFFIC DATA** **CLASSIFICATION DATA** **TRANSMITTAL FORM**	*STATE ASSIGNED ID [__ __ __ __] *STATE CODE [__ __] *SHRP SECTION ID [__ __ __ __]

HIGHWAY RT. NO. (THIS COUNT) _____

MILEPOST NO. OR LOCATION (THIS COUNT) _____

FILENAME _____ DISK ID _____

BEGINNING DATE _____ BEGINNING TIME _____

ENDING DATE _____ ENDING TIME _____

COUNT DURATION_____ [ ] HOURS [ ] DAYS[ ] MONTHS

VEHICLE CLASSIFICATION METHOD: FHWA _____ OTHER _____

NAME OF AGENCY CLASSIFICATION SCHEME: _____ NO. OF BINS _____

NOTE: IF NOT PREVIOUSLY PROVIDED TO SHRP/LTPP, PLEASE ATTACH SHEET 6 DESCRIBING THE VEHICLE CLASSIFICATION CATEGORIES AND ALSO ATTACH SHEET 7 DESCRIBING HOW THE AGENCY WOULD CONVERT ITS CLASSIFICATION SCHEME TO THE FHWA 13 BIN SYSTEM.

TYPE OF AVC EQUIPMENT: PORTABLE _____ PERMANENT _____

EQUIPMENT MAKE/MODEL# _____

SENSOR TYPE _____

ADJUSTMENT FACTORS FOR ESTIMATING AVERAGE ANNUAL VOLUMES BY CLASSIFICATION:

GENERAL FACTORS: _____

_____

CLASS SPECIFIC FACTORS (PROVIDE BY CLASS OF CLASS GROUPS) _____

_____

COMMENTS _____

_____

_____

FILL OUT ONE TRANSMITTAL SHEET FOR EACH DATA FILE SUBMITTED.

NAME OF PREPARER _____ PHONE_____

DATE PREPARED_____ revised November 11, 1999

SHEET 13 **LTPP TRAFFIC DATA** **VEHICLE WEIGHT DATA** **TRANSMITTAL FORM**	*STATE ASSIGNED ID [__ __ __ __] *STATE CODE [__ __] *SHRP SECTION ID [__ __ __ __]

HIGHWAY RT. NO. (THIS SESSION) _____

MILEPOST NO. OR LOCATION (THIS SESSION) _____

FILENAME _____ DISK ID _____

BEGINNING DATE _____ BEGINNING TIME _____

ENDING DATE _____ ENDING TIME _____

COUNT DURATION_____ [ ] HOURS [ ] DAYS [ ] MONTHS

WEIGHT SCALE TYPE: PORT. WIM_____ PERM. WIM_____ OTHER_____

EQUIPMENT MAKE/MODEL# _____

SENSOR TYPE _____

VEHICLE CLASSIFICATION METHOD:

7-card FHWA 13 bin in cols. 18-19 _____ 7-card FHWA 13 bin in cols. 22-23 _____
7-card 6 digit Truck Weight study _____ W-card _____ OTHER _____

NAME OF AGENCY CLASSIFICATION SCHEME: _____ NO. OF BINS _____

NOTE: IF NOT PREVIOUSLY PROVIDED TO SHRP/LTPP, PLEASE ATTACH SHEET 6 DESCRIBING THE VEHICLE CLASSIFICATION CATEGORIES AND ALSO ATTACH SHEET 7 DESCRIBING HOW THE AGENCY WOULD CONVERT ITS CLASSIFICATION SCHEME TO THE FHWA 13 CLASS SYSTEM.

METHOD OF CALIBRATION AND FREQUENCY: _____

COMMENTS _____

FILL OUT ONE TRANSMITTAL SHEET FOR EACH DATA FILE SUBMITTED.

NAME OF PREPARER _____ PHONE _____
DATE PREPARED _____ revised February 21,2000

SHEET 14 LTPP TRAFFIC DATA EQUIPMENT INSTALLATION LOG	*STATE ASSIGNED ID [__ __ __ __] *STATE CODE [__ __] *SHRP SECTION ID [__ __ __ __]	LOCATION _____ INSTALLATION DATE _____

	TYPE	BRAND NAME	SERIAL NUMBER
Control Unit(s) and peripheral equipment			
Control Unit			
Interface			
Modem			
Loop Amplifiers			
Other _____			
Sensor(s) / Platform(s)			
LTPP Lane Sensor			
Sensor Next Adjacent Lane (1)			
Senor Next Adjacent Lane (2)			
Sensor Next Adjacent Lane (3)			
Diagonal Sensor			
Offscale Sensor			
Right Platform			
Left Platform			
Other _____			
Software			
Complete Package			
Axle Spacing Algorithm Only			
Other _____			
Loops			
Upstream - Lane 1			
Downstream - Lane 1			
Upstream - Other Lanes			
Downstream - Other Lanes			

SHEET 15 LTPP TRAFFIC DATA LOG OF CHANGE AT LTPP TEST LOCATIONS WITH PERM. AVC OR WIM	*STATE ASSIGNED ID [__ __ __ __] *STATE CODE [__ __] *SHRP SECTION ID [__ __ __ __]

LOCATION _____ TYPE EQUIP._____
MP#_____ MODEL #_____

DATE OF CHANGE	TIME OF CHANGE	DESCRIPTION OF CHANGE	PERSON MAKING CHANGE	PHONE #	NEW EQUIP. SERIAL #

revised November 11, 1999

SHEET 16 **LTPP MONITORED TRAFFIC DATA** **SITE CALIBRATION SUMMARY**	*STATE ASSIGNED ID [__ __ __ __] *STATE CODE [__ __] *SHRP SECTION ID [__ __ __ __]

SITE CALIBRATION INFORMATION

1. * DATE OF CALIBRATION (MONTH/DAY/YEAR) [__ __ / __ __ / __ __ __ __]

2. * TYPE OF EQUIPMENT CALIBRATED __ WIM __ CLASSIFIER ___ BOTH

3. * REASON FOR CALIBRATION
   ____ REGULARLY SCHEDULED SITE VISIT ____ RESEARCH
   ____ EQUIPMENT REPLACEMENT ____ TRAINING
   ____ DATA TRIGGERED SYSTEM REVISION ____ NEW EQUIPMENT INSTALLATION
   ____ OTHER (SPECIFY) _____

4. * SENSORS INSTALLED IN LTPP LANE AT THIS SITE (CHECK ALL THAT APPLY):
   ____ BARE ROUND PIEZO CERAMIC ____ BARE FLAT PIEZO ____ BENDING PLATES
   ____ CHANNELIZED ROUND PIEZO ____ LOAD CELLS ____ QUARTZ PIEZO
   ____ CHANNELIZED FLAT PIEZO ____ INDUCTANCE LOOPS ____ CAPACITANCE PADS
   ____ OTHER (SPECIFY) _____

5. EQUIPMENT MANUFACTURER _____

WIM SYSTEM CALIBRATION SPECIFICS**

6.** CALIBRATION TECHNIQUE USED:
   ____ TRAFFIC STREAM -- ____STATIC SCALE (Y/N) ____ TEST TRUCKS

   __ __ __ NUMBER OF TRUCKS COMPARED __ __ __ NUMBER OF TEST TRUCKS USED

   __ __ __ PASSES PER TRUCK

	TRUCK	TYPE	SUSPENSION
TYPE PER FHWA 13 BIN SYSTEM	1	_____	_____
SUSPENSION: 1 - AIR; 2 - LEAF SPRING	2	_____	_____
3 - OTHER (DESCRIBE)	3	_____	_____

7. SUMMARY CALIBRATION RESULTS (EXPRESSED AS A PERCENT)
   MEAN DIFFERENCE BETWEEN ---
   DYNAMIC AND STATIC GVW ___ ___ ___ . __ STANDARD DEVIATION __ __ . __
   DYNAMIC AND STATIC SINGLE AXLES ___ ___ ___ . __ STANDARD DEVIATION __ __ . __
   DYNAMIC AND STATIC DOUBLE AXLES ___ ___ ___ . __ STANDARD DEVIATION __ __ . __

8. ___ ____ NUMBER OF SPEEDS AT WHICH CALIBRATION WAS PERFORMED

9. DEFINE THE SPEED RANGES USED (MPH) _____ _____ _____ _____ _____ _____ _____ _____
   _____ _____ _____ _____ _____ _____ _____ _____ _____ _____

10. CALIBRATION FACTOR (AT EXPECTED FREE FLOW SPEED) ___ ___ ___ . ___ ___

11.** IS AUTO-CALIBRATION USED AT THIS SITE? (Y/N) _____
   IF YES, LIST AND DEFINE AUTO-CALIBRATION VALUE: _____

CLASSIFIER TEST SPECIFICS***

12.*** METHOD FOR COLLECTING INDEPENDENT VOLUME MEASUREMENT BY VEHICLE CLASS:
   ___ VIDEO ___ MANUAL ___ PARALLEL CLASSIFIERS

13. METHOD TO DETERMINE LENGTH OF COUNT ____ TIME ____ NUMBER OF TRUCKS

14. MEAN DIFFERENCE IN VOLUMES BY VEHICLES CLASSIFICATION:
   *** FHWA CLASS 9 ____ ____ ____ FHWA CLASS ____ ____ ____ ____ ____
   *** FHWA CLASS 8 ____ ____ ____ FHWA CLASS ____ ____ ____ ____ ____
   FHWA CLASS ____ ____ ____ ____ ____
   FHWA CLASS ____ ____ ____ ____ ____
   *** PERCENT "UNCLASSIFIED" VEHICLES: ____ ____ . ____

PERSON LEADING CALIBRATION EFFORT: _____
CONTACT INFORMATION: _____ rev. November 9, 1999

APPENDIX A. HISTORICAL TRAFFIC DATA COLLECTION

The purpose of historical traffic data collection was to ensure that all available traffic data for each 152 m (500-ft) long, single-lane SHRP General Pavement Studies (GPS) test section were retrieved from the records, files, and archives of the state and provincial highway agencies (SHA). Historical data have generally not been recorded for the Special Pavement Studies (SPS) sites, since monitoring data was submitted for these sites once they opened for traffic. The information was recorded on appropriate forms and formats, and made available for processing and storage in the Long Term Pavement Performance (LTPP) Central Traffic Data Base (CTDB) to be used in estimating total ESAL at the test section to date. Traffic volumes in the form of annual average daily traffic (AADT), truck AADT, and estimated total annual equivalent 18,000 pound single axle loads (ESAL) in the test lane were required for each year since the opening date. Where available, supporting vehicle classification and truck weight data were requested. It was understood that such data might be limited. ESAL calculations were made in accordance with the AASHTO Guide for Design of Pavement Structures (1986).

Historical data were submitted as a package for each site. All historical data sheets and supporting information for a particular GPS test section were packaged together and submitted to the Regional Contractor's Office Coordinator (RCOC). Historical LTPP Traffic Data Sheet 1 was placed on the face of the package as a summary of all pertinent information about the site and as a transmittal letter. The enclosed data forms provided uniform formats for submitting of the key traffic statistics needed in the performance analysis of the test sections, and perhaps more importantly, information on the method used for estimating these statistics and any available site-related data.

SHRP requested that each SHA select two GPS test sections as pilot sections, and locate all traffic data pertinent to those GPS sections. Once the data had been collected and the data sheets were completed, the packages for those two sections were transmitted to the RCOC for review. The pilot effort allowed early advice, guidance, and direction to minimize duplication of effort and to ensure understanding within each SHA and timely submittal of all historical data. A target date of June 30, 1990, was set for this pilot effort. The RCOC reviewed the packages and responded to each SHA to answer questions raised and to provide guidance for completing the historical data sheets for other GPS sections.

Truck weight data that had previously been provided by an SHA to the FHWA over the past 20 years did not need to be submitted to SHRP. Available FHWA Truck Weight Study Data were reviewed by the SHRP consultants and compared to the location of GPS test sections. A list of GPS locations where compatible truck weight data were available was provided to the Regional offices. Site-specific truck weight data relating directly to specific GPS test sections were extracted, reviewed, and analyzed by the consultant, and were included in the LTPP Central Traffic Data Base.

1. LTPP HISTORICAL TRAFFIC DATA REPORTING GUIDELINES

The following pages present a flow chart describing the process followed in completing the historical data forms. Also included are instructions for completing the LTPP Historical Traffic Data forms. State and provincial agencies were requested to provide traffic data based upon site-specific counts, classification studies, or weight measurements wherever possible. In the absence of data files, the state and provincial agencies were asked to provide the best annual estimates of the AADT and ESAL for each GPS test section since it was opened to traffic. An explanation of how estimates were derived and supporting

documentation were also requested. The forms were merely a guide for providing these base data to SHRP.

Sheets 1 through 9 were to be completed for each GPS test section. Equivalent information for SPS 5, 6, 7 and SPS 9 overlay projects is highly desirable for pre-overlay conditions. The information expected on Sheet 1 is also collected for all SPS new construction and rehabilitation projects separately.

If on-site traffic monitoring did not begin at a given site in 1990, Sheet 10 should have been submitted to provide traffic, (AADT) and loading estimates (ESAL) for that site for each year beginning in 1990 and extending to the year that on-site traffic monitoring was initiated. Sheet 10 is included in the main text of this document because Sheet 10 is considered a form for use during the monitoring period of LTPP.

The forms included in this section can be reproduced and used by the SHA for data entry. There are nine historical traffic data forms:

Sheet 1	Summary Transmittal Form
Sheet 2	Traffic Volumes and Load Estimates
Sheet 3	Procedures for Estimating Annual Average Volumes and Total Annual ESALs
Sheet 4	Traffic Volume Counts
Sheet 5	Vehicle Classification Data FHWA 13-Class System
Sheet 6	Vehicle Classification Data Agency Defined Classes
Sheet 7	Vehicle Classification Conversion Chart
Sheet 8	Truck Weight Session Information
Sheet 9	Truck Axle Load Measurements by Vehicle Classification

2. FLOW CHART DESCRIPTION

The flow chart in Figure A-1 illustrates the process that was to be followed by a SHA to fill out the historical traffic data sheets presented later in this section. By following this diagram, the flow of which is discussed below, the SHA representative could determine which forms to complete for each GPS site maintained by the agency. (Specific directions for completing these forms are presented immediately following the description of the flow diagram.)

1. Fill Out Sheet 1 - When preparing the traffic information for submittal, start with Traffic Data Sheet 1, Summary Transmittal Form. This sheet summarizes the available site information for this GPS site as it pertains to traffic measurements.

2. Fill Out First or Next Row of Sheet 2 - After Sheet 1 is completed, move to Traffic Data Sheet 2, Traffic Volume and Load Estimates. This sheet provides the agency's best estimate of traffic volumes and loads on the GPS site by year. Fill out one sheet for each GPS site, and fill in one row of

information for each year the GPS site has been open to traffic (or since the most recent overlay or rehabilitation project).

After a row is filled in, proceed on to the other forms, as shown in Figure A-1, to describe the data and the procedures the agency used to develop the estimate. After providing this supporting information, return to Sheet 2 to fill in the next year's row of volume and ESAL estimates. Then provide supporting information for these estimates. Continue this process until the year the section was opened to traffic or the last overlay or major rehabilitation occurred, whichever comes first.

3. Fill Out Sheet 3 - As shown in Figure A-1, for each year's row of Sheet 2 (for each GPS site) that is completed, also complete one Traffic Data Sheet 3, Procedures for Estimating Average Annual Volumes and Total Annual ESALs. This sheet briefly describes the types of data and/or assumptions used to estimate the volumes and ESALs recorded on Sheet 2.

4. Do You Have Supporting Data? - After Sheet 3 is completed, the next step is to provide the traffic measurements that the agency used to develop the estimates that were just recorded in a row on Sheet 2.

   If the agency did not collect volume, classification, or weight data at or near the GPS site (on the same highway and in the same direction) for this year, then return to Sheet 2 and continue with the next year's ESAL estimate.

   If the agency did collect traffic data that specifically relate to the GPS site, continue to the lower portion of the flow chart.

5. Do You Have Electronic Data or Large Amounts of Data? - The next question is whether the traffic data available for this site consist of a few counts or a large number of counts.

   If there are only a few counts, continue to Section 8, Are There Volume Data Available?

   If the agency has a large number of counts (volume, vehicle class, or truck weight) that pertain to this GPS site, determine whether the data are in an electronic form (i.e., on computer disk) or are available only on paper forms. If the data are in electronic form, continue on to Section 6, Does Electronic Data Match SHRP Formats? If the data are only available on paper forms, go to Section 8, Are Volume Data Available?

6. Do the Electronic Data Match SHRP Formats? - If data are available in electronic form, determine whether the data can be transmitted to SHRP in the standard FHWA formats. (These formats are presented earlier in this document as Figures 2, 3, and 4.) If the current form of the data does not allow their submittal in FHWA format, summarize the data and submit the summaries on the paper forms discussed in this section. If the data are submitted electronically, it is not necessary to submit the paper forms Traffic Data Sheets 4 through 9.

7. Submit Data Electronically - Submit the data available in electronic form using the FHWA formats. See the directions for submitting these data presented earlier this chapter. When that is completed, return to Sheet 2, and fill out the next year of estimates for this LTPP site.

   If some data can be submitted electronically and other data can not, fill out the appropriate Traffic

Data Sheets (4 through 9) for the data that do not fit the FHWA format and submit the balance of the traffic data electronically in the FHWA format.

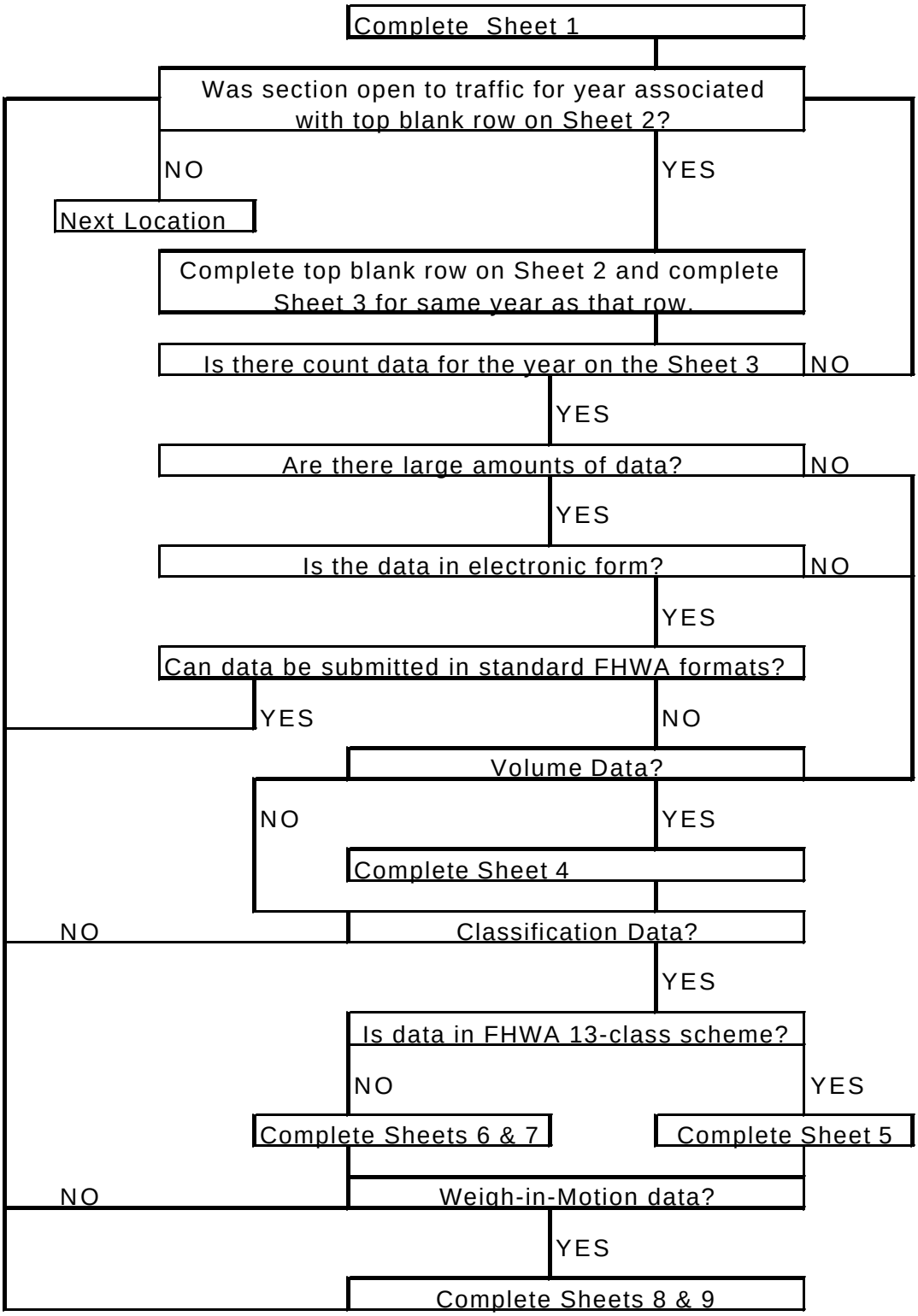

Figure A-1. Flow chart of process for completing historical traffic data sheets

8. Are Volume Data Available? - If volume data that relate directly to the GPS site are available, fill out one Traffic Data Sheet 4, Traffic Volume Counts, for each count session that was performed.

9. Are Classification Data Available? - If vehicle classification count data that pertain directly to the GPS site are available, fill out one Traffic Data Sheet 5, Vehicle Classification Data, for each count session that was performed. If these data are in the 13 FHWA classes, continue to Section 10, Are Truck Weight Data

   Available? If the vehicle classification counts were done with some other classification scheme, fill out Traffic Data Sheets 6 and 7 (Vehicle Classification Data Agency Defined Classes and Vehicle Classification Conversion Information) to describe how the agency would recommend that SHRP researchers convert these data into the FHWA classifications. (The conversion is done by SHRP to provide uniformity in data between agencies.)

10. Are Truck Weight Data Available? - If the agency did not collect truck weight data at or near the GPS site (on the same highway and in the same direction) for this year, then return to Sheet 2 and continue to the next row.

    If truck weight data that pertain directly to the GPS site (and year) are available, determine whether the data have been previously submitted to FHWA as part of the FHWA truck monitoring

    program. If the truck data have been submitted for the GPS site to FHWA, check with the RCOC to determine whether SHRP has the data and that they apply to this site. If the RCOC has the data, proceed to the next row on Sheet 2. If the data have not been submitted, or for some reason the RCOC did not receive the data from FHWA, fill out Traffic Data Sheets 8 and 9 (Truck Weight Session Information and Truck Axle Load Measurements by Vehicle Classification). When this process has been completed, return to the next row of Sheet 2.

When all rows (years) are completed on Sheet 2 and all of the supporting data sheets for each year are completed, package all of the data sheets for one GPS site together, and put Sheet 1 on the top of the package as a transmittal sheet. The package is now ready to be forwarded to the Regional office. Continue the same process for each GPS test section. Questions about any phase of this process should be referred to the SHRP Regional office.

3. HISTORICAL TRAFFIC DATA SHEETS AND INSTRUCTIONS

The following pages provide instructions and explanation for historical data sheets 1-9. Copies of the data sheets are provided at the end of this appendix.

Data Sections Common for all Data Sheets

Each of the forms requires general information. The general information items are enclosed in boxes in the upper right corner and at the bottom of each page.

Upper Right Corner

STATE ASSIGNED ID

Form Entry: State Assigned ID __ __ __ __

Explanation: Enter the four-digit number that has been assigned by the State or Province for the applicable LTPP site. If the State or Province has not assigned a number, leave this space blank.

STATE CODE

Form Entry: State Code __ __

Explanation: Enter the two-digit number that has been assigned by SHRP for the State or Province. For example, the state code for New York is 3 6.

SHRP ID

Form Entry: SHRP ID __ __ __ __

Explanation: Enter the four-digit number that has been assigned by SHRP for each LTPP site. For example, the SHRP ID number for the LTPP test site on I-88 at the Ostego/Delaware county line in the state of New York is 4 0 1 8.

Lower Portion of Page

NAME AND PHONE NUMBER OF PREPARER

Enter the name and phone number of the person responsible for the data entered on this form.

DATE PREPARED

Enter the date that the form was completed as follows:

Form Entry: Date ____-____-_____

Explanation: Month Day Year

Example: 02 - 18 - 1989

3.1 SUMMARY TRANSMITTAL FORM (SHEET 1)

PURPOSE: The purpose of this form is to serve as a cover sheet and transmittal form for the entire package of historical traffic data forms and supporting information for a particular GPS test section. It also provides a summary of all pertinent information about the traffic data collection effort at each GPS test site, including location data, and information about the surrounding environment. This form should be completed first before completing sheets 2-9 for a GPS test section.

STATE OR PROVINCE AND COUNTY

Enter the appropriate name of the State or Province and the County in which the LTPP test site is located. Provinces should leave the county name blank.

HIGHWAY ROUTE NO. AND MILE POST NO.

Form Entry: Highway Route # _____ Mile Post # _____

Explanation: Enter the common name or highway numbers used to identify the highway and the appropriate mile post number by using MP and then the mile post number. If a mile post system has not been developed, enter "N/A" on the mile post number line.

Example: Highway Route No. IH 35 Mile Post No. MP 269

NEAREST CITY/TOWN

Explanation: Enter the name of the nearest town or city that is included on the state highway map and the distance in miles from the test section to that city.

Example: 10 mi. N. of Austin, Texas

NEAREST INTERSECTION

Explanation: Enter the name of the nearest intersecting highway (or major arterial street in urban areas) and the distance in miles from the test section to that intersecting highway (or arterial street).

Example: 2 mi. S. of FM 620

FUNCTIONAL CLASS

Explanation: Enter the appropriate code for the functional classification for the highway on which the LTPP site is located. Codes are as follows:

RURAL		URBAN	
Code	Functional Classification	Code	Functional Classification
01	Principal Arterial - Interstate	11	Principal Arterial - Interstate
02	Principal Arterial - Other	12	Principal Arterial - Other Freeways or Expressways
		14	Principal Arterial - Other
06	Minor Arterial	16	Minor Arterial
07	Major Collector	17	Collector
08	Minor Collector		
09	Local System	19	Local System

NUMBER OF LANES EACH DIRECTION AND TOTAL NUMBER OF LANES

Explanation: Enter the number of lanes in each direction and the total number of lanes on the highway at the LTPP site.

Example: No. Lanes Each Direction 2 Total No. of Lanes 4

DIRECTION OF TRAVEL/LTPP LANE

Explanation: Enter the general direction of travel of vehicles crossing over the LTPP site. If the roadway is oriented north-south and the LTPP lane is carrying northbound traffic, enter the word or abbreviation for North.

Example: North or N

DATE OPENED TO TRAFFIC

Explanation: Enter the month, day, and year that the existing highway section was constructed and opened to traffic or most recently received an overlay or major rehabilitation.

Example: 10 - 30 - 1970
Month Day Year

FIPS COUNTY CODE

Enter the appropriate Federal Information Processing Standards (FIPS) County Identification Code Number assigned to the county in which the LTPP site is located. This is the same code number used by FHWA under the HPMS program. Provinces would omit this item.

FHWA STATION IDENTIFICATION NUMBER

Enter the FHWA Station Identification Number for this station if the site has previously been assigned one. A three-digit, alphanumeric designation is used. Only the numbers 0 through 9 and the 26 letters of the alphabet should be used. Leave blank if an FHWA Station Identification Number has not been issued.

HPMS SAMPLE NO. AND HPMS SUBDIVISION NO.

If the LTPP site has been designated as a HPMS site, enter the HPMS Sample No. and Subdivision No. If not, leave this space blank.

TYPE OF PAVEMENT: AC, PCC, OTHER

Mark the appropriate type of pavement by selecting either AC for flexible pavements (1), PCC for rigid pavements (2), or Other for composite pavements or other types (3).

CONTROL OF ACCESS AND MEDIAN

Indicate whether access is controlled (yes) or not (no), and whether a median exists (yes or no).

CURRENT SURROUNDING DEVELOPMENT

Indicate the nature of the surrounding development and the type of development that exists adjacent to the LTPP site by marking either urban, suburban, or the rural category.

HAS INTENSITY OF ROADSIDE DEVELOPMENT INCREASED OVER PAST 10 YEARS (BETWEEN 1980 AND 1990)?

Answer the question about the change in the roadside development over the past 10 years and briefly describe the changes. For example, "Ten years ago the adjacent land was farmland but now a residential subdivision has developed there."

GENERAL INSTRUCTIONS

Attach all related forms, supporting traffic count information, and a map indicating the location of the LTPP site and each traffic counting or weigh station, and submit the complete package to the SHRP Regional Engineer.

3.2 TRAFFIC VOLUME AND LOAD ESTIMATES (SHEET 2)

PURPOSE: The purpose of this form is to retrieve and summarize traffic volume and load data collected by the State for each LTPP site, dating back to the year the LTPP section was opened to traffic. That is, the date that the roadway construction was completed, or the date that the present pavement structure was added.

Sheet 3 should also be completed to provide information about the methodology used to estimate the annual average daily traffic (AADT), truck volumes and percentages, AADT in the LTPP lane, truck AADT in the LTPP lane, and annual ESAL. See Sheet 3 instructions for more details.

GENERAL INFORMATION: The general information such as state assigned ID, state code, SHRP section ID, and the name of the preparer should be provided in accordance with the requirements stipulated at the beginning of this section.

YEAR: This provides a column of years beginning with 1989 and descending in numerical order to 1965. The AADT, total truck AADT, AADT in the LTPP lane, the truck AADT for the LTPP lane, and the total ESAL per year in the LTPP lane should be entered for each year dating back to the year the section was opened to traffic.

COLUMN 1. ESTIMATED TOTAL VEHICLES AADT (TWO-WAY)

The estimated annual average daily traffic (AADT) volume data for both directions and all lanes should be entered in Column 1 for each year beginning in 1989 and descending to the year the section was opened to traffic. This date is defined in the Inventory Data submitted by the SHA for each site. For Example, if the estimated AADT is 29,250 vehicles per day in 1987, the entry placed on the line in Column 1 adjacent to the year 1987 would be 2 9 2 5 0 .

Where possible, the AADT estimates should be based upon traffic volume counts and vehicle classification counts at the LTPP site. However, if site-specific counts are not available the SHA is asked to provide estimates of the AADT, based upon other data available to the SHA, such as traffic flow maps, summary statistics, construction project files, or traffic engineering or planning studies. System-wide data and data from other sites may also be used, if other more exact site-specific data are not available. If the estimates are based on actual counts of the same traffic that crosses the LTPP site, the count data, if they are still available, should be forwarded to SHRP.

Sheet 4 is used to record each individual traffic count that was selected to develop the AADT estimates. Also, the factors used to convert those traffic count data to the AADT should be included. It is not necessary to fill out Sheet 4 for continuously operated ATR, AVC, or WIM equipment at a LTPP site. Data taken from a continuously operated ATR, AVC, or WIM location should be submitted in the format summarized and submitted in the format established by FHWA and adopted by SHRP for Monitoring Data. The procedures to follow in submitting these data are detailed in later sections.

COLUMN 2. ESTIMATED TOTAL TRUCK AADT (TWO-WAY)

For each year that the AADT is entered, the estimated average number of trucks for a 24-hour period is entered in Column 2. This is based upon actual truck counts made at the site and is for both directions and all lanes. A truck is considered to be any vehicle in FHWA vehicle classes 4-13, including buses. Backup for this estimate is submitted on Sheet 5. If actual counts are not available, best estimates are made by the SHA. For example, if the AADT of trucks in the traffic stream in 1987 is estimated to be 1320, the entry will be 1 3 2 0 .

COLUMN 3. ESTIMATED TOTAL VEHICLES AADT LTPP LANE

For each year, estimate the average number of vehicles per day traveling in the LTPP lane and enter the data in Column 3. This is a one-way, one-lane volume and should represent the estimated number of vehicles at the test site for a 24-hour period. If site-specific counts are not available, the SHA should provide its best estimate. For example, if the number of vehicles that are traveling in the LTPP test lane on a daily basis is estimated to be 10,660, the entry will be 1 0 6 6 0 .

COLUMN 4. ESTIMATED TOTAL TRUCKS AADT LTPP LANE

For each year, estimate the average number of trucks per day traveling in the LTPP lane and enter the data in Column 4. This is a one-way, one-lane average daily volume. A truck is considered to be any vehicle in FHWA vehicle classes 4-13, including buses. If site-specific counts are not available, the SHA should provide its best estimate. For example, if the number of trucks that are traveling in the LTPP lane in a 24-hour period in 1987 is estimated to be 1060, the entry will be 1 0 6 0.

COLUMN 5. ESTIMATED ESALs/YR LTPP LANE (1,000's)

The SHA should estimate equivalent single axle loads (ESALs) for each year from traffic volume, vehicle classification, and weight data, and enter the total annual number of ESALs computed for the LTPP lane in Column 5. The SHA should use the AASHTO Design Guide Method to determine truck equivalencies and calculate ESALs The number of ESALs will be recorded in 1000's. For example, if the number of ESALs was 1,250,000 in 1983, enter 1 2 5 0 in Column 5 for the year 1983.

3.3 PROCEDURES FOR ESTIMATING ANNUAL AVERAGE VOLUMES AND TOTAL ANNUAL ESALS (SHEET 3)

PURPOSE: The purpose of this form is to provide information about the method the SHA used for estimating the data that were entered on Sheet 2.

GENERAL INFORMATION: The general information such as state assigned ID, state code, SHRP section ID, and the name of the preparer should be provided in accordance with the requirements stipulated at the beginning of this section.

INSTRUCTIONS FOR SHEET 3:

To complete the form simply check the methodology that most appropriately describes the method used by the SHA to estimate each of the summary traffic statistics listed on Sheet 2. If the method is not listed, mark "Other" and fill in a description of the method used.

One sheet is completed for each year that data have been provided on Sheet 2. If the same method was used for several years, simply enter the range of years in the Year Applicable blank. For example, 1975-1983. However, if several methods were used over the years, one form is needed for each change in the methodology used.

Item 7, ESAL ESTIMATES, asks for information on the source of the data used to estimate annual ESAL and the type of scale that was used to collect those data. If the SHA uses a source or type of scale that is not listed, mark "Other " and fill in the appropriate source or type of scale. The optional methods listed for each of the other data types are self-explanatory and do not require further explanation.

3.4 TRAFFIC VOLUME COUNTS (SHEET 4)

PURPOSE: The purpose of this form is to record traffic volume data that were collected at or near a LTPP site. The form also provides for the calculation of the annual average daily traffic (AADT) in the LTPP lane based upon factoring of the raw count.

Record the traffic volume data collected at or near the LTPP site starting with the most recent year by completing a separate Sheet 4 for each traffic volume count. Counts of any duration may be used. Volume counts collected on a continuous basis from ATR, AVC, or WIM equipment should be submitted in the FHWA format as discussed earlier in this section and transmitted to the RCOC.

GENERAL INFORMATION: The general information such as state assigned ID, state code, SHRP section ID, and the name of the preparer are provided in accordance with the requirements stipulated at the beginning of this section.

HIGHWAY ROUTE NO. (THIS COUNT) AND MILE POST NO. OR LOCATION (THIS COUNT)

Form Entry: Highway Route # (This Count) _____

Mile Post # or Location (This Count) _____

Explanation: Enter the common name or highway numbers used to identify the highway and the appropriate mile post number where the traffic volume count was made. This may be different from the LTPP site. If a mile post system has not been developed for this highway, describe the location of the volume count.

Examples: A. Highway Route # (This Count) IH 35

Mile Post # or Location (This Count) MP 269

B. Highway Route # (This Count) FM 2222

Mile Post # or Location (This Count) West of Loop 360 in Austin

BEGINNING DATE AND ENDING DATE

Explanation: Enter the date (month-day-year) that the counting period began and ended.

Example: Beginning Date 10 - 30 - 1988

Ending Date 10 - 31 - 1988

BEGINNING TIME AND ENDING TIME

Explanation: Enter the time of day that the counting began and ended, using the military method of recording time beginning at 12:01 AM as 0001 and continuing to 12 midnight as 2400. For example, 6 AM is 0600 and 6 PM is 1800.

NOTE: The use of military time will apply to all historical data forms.

Example: Beginning Time 0600 Ending Time 0600

COUNT DURATION

Explanation: Enter the length of time that the count covered and select the appropriate units by marking either hours, days, or months.

Example: Count Duration 24 [x] Hours

TYPE OF COUNTER AND NAME/MODEL NO.

Explanation: Enter the type of traffic counting equipment used to make the traffic count, and the name and brand or model number.

Example: Type of Counter Streeter Name/Model # Model 241

TYPE OF COUNT

Explanation: Choose which option describes the number of directions and lanes counted and enter an "X" on the line which is most descriptive.

Example: Two-way X One Dir. Only ___ LTPP Test Lane Only ___

ACTUAL COUNT INFORMATION

1. TOTAL NO. OF VEHICLES (RAW COUNT)

Record the number of vehicles counted for the duration of the count up to a maximum of 999,999 vehicles per day.

2. ADJUSTMENT FACTORS (FILL IN AS APPLICABLE)

This section is used to denote the methodology used by the SHA to factor a volume count of any duration to determine the AADT. Enter the appropriate factor or factors used by the SHA, and then calculate the AADT for that site based upon this count.

2A. ADJUSTMENT TO 24-HOUR COUNT

Enter the factor used by the SHA to convert a count that is for a period less or greater than a 24-hour period to a 24-hour count. For example, the factor to convert a 48-hour count to 24 hours might be 0 . 5 0 .

2B. AXLE CORRECTION FACTOR

If the SHA uses an Axle Correction Factor, enter the multiplying factor used to adjust the actual traffic count for axle variations.

2C. DAY OF WEEK CORRECTION FACTOR

If the SHA uses a Day of the Week Correction Factor, enter the multiplying factor used to adjust the actual traffic count for the variations depending upon the day(s) of the week in which the count was made. If Day of the Week and Month Factors are combined, enter the factor in the space labeled Month Factor.

2D. MONTH FACTOR

If the SHA uses a Month Factor, enter the multiplying factor used to adjust the actual traffic volume for the month in which the count was made. If Day of the Week and Month Factor are combined, enter the factor in this space.

2E. OTHER FACTOR (SPECIFY)

If the SHA uses other factors to estimate AADT, specify the type of factor in the space provided, and enter the multiplying factor in the units column.

3. ANNUAL AVERAGE DAILY TRAFFIC

Enter the results of applying the multiplying factors cited in paragraphs 2A through 2E to the traffic volume count. The resulting number will be the Annual Average Daily Traffic for both directions.

4. DIRECTIONAL DISTRIBUTION FACTOR

To compute the AADT for the LTPP lane, first enter the directional distribution factor. For example, if the percentage of traffic traveling in the same direction as the GPS lane is 55% enter 0 . 5 5 .

5. LTPP LANE DISTRIBUTION FACTOR

If there are two or more lanes carrying traffic in the same direction as the LTPP lane, enter the percentage of traffic that is traveling in the LTPP lane only. For example, if the traffic in the GPS lane is 80% of the total traffic traveling in the same direction, enter 0 . 8 0 .

6. AADT LTPP LANE

Compute the AADT in the LTPP lane by multiplying the AADT for two-way traffic by the Directional Distribution Factor entered on line 4 and by the LTPP Lane Distribution Factor entered on line 5. For example, if the adjusted AADT is 20,000, the Directional Distribution Factor is 0.55, and the LTPP Lane Distribution Factor is 0.80, the AADT in the GPS Lane is 8800 vehicles per day. (20,000 x 0.55 x 0.80 = 8800).

NOTE: One sheet should be completed for each counting session for each year. The AADT for the LTPP lane is also calculated based on each new traffic volume count. When two or more volume counts are available during the same year, the SHA may average the AADT computed for each of the volume counts to determine the actual annual average daily traffic (AADT) for the site or may use any other appropriate procedure for this calculation. The AADT estimates computed through this process are then entered on Sheet #2 in Column 1 for the appropriate year.

3.5 VEHICLE CLASSIFICATION DATA FHWA 13-CLASS SYSTEM (SHEET 5)

PURPOSE: The purpose of this form is to record vehicle classification data that were collected at or near the LTPP site. The top of Sheet 5 includes site, equipment, and specific count information for each classification count. This part of the form is completed for both Sheet 5 and Sheet 6. The lower part

of Sheet 5 is completed for classification counts using the FHWA 13-class system. Data collected in other classification schemes are recorded on Sheet 6.

One sheet is completed for each vehicle classification session in each year since the section was opened to traffic. It is not necessary to estimate vehicle classification data if real, site-specific data are not available.

GENERAL INFORMATION: The general information such as state assigned ID, state code, SHRP section ID, and the name of the preparer is provided in accordance with the requirements stipulated at the beginning of this section.

HIGHWAY ROUTE NO. (THIS COUNT) AND MILE POST NO. (THIS COUNT):

Form Entry: Highway Route # (This Count) _____ Mile Post # _____

Explanation: Enter the common name or Highway numbers used to identify the highway and mile post number where the classification count was conducted. This may be different than the LTPP site. If a mile post numbering system has not been developed, enter "N/A" on the mile post line.

Example: Highway Route # IH 35 Mile Post # MP 269

LOCATION (THIS COUNT)

Form Entry: Location (This Count) ____

Explanation: Describe the location of the classification count, especially if a mile post system has not been established for this highway.

Example: Location (This Count) North of Austin near Parmer Lane

FUNCTIONAL CLASS

Explanation: Enter the code number for the appropriate functional classification for the highway on which the vehicle classification count was made. The functional classes are defined in the FHWA Traffic Monitoring Guide and are as follows:

RURAL		URBAN	
Code	Functional Classification	Code	Functional Classification
01	Principal Arterial - Interstate	11	Principal Arterial - Interstate
02	Principal Arterial - Other	12	Principal Arterial - Other Freeways or Expressways
		14	Principal Arterial - Other
06	Minor Arterial	16	Minor Arterial
07	Major Collector	17	Collector
08	Minor Collector		
09	Local System	19	Local System

BEGINNING DATE AND ENDING DATE

Explanation: Enter the date (month-day-year) that the counting period began and ended.

Example: Beginning Date 07 - 11 - 1988

Ending Date 07 - 12 - 1988

BEGINNING TIME AND ENDING TIME

Explanation: Enter the time of day that the counting began and ended.

Example: Beginning Time 0600 Ending Time 0600

DURATION (HRS)

Explanation: Enter the length of time that the count covered in hours.

Example: 24

TYPE OF COUNT

Form Entry: Type of Count: Manual ___ Automated ___

Explanation: Make a mark in the appropriate blank to indicate whether the count is a manual count or one that was made with Automatic Vehicle Classification Equipment. If the count was manual, it is not necessary to complete the type of equipment and equipment name/model information.

Example: Manual X Automated ___

NUMBER OF LANES COUNTED

Explanation: Enter the number of lanes that were counted and included in the classification count data. If only one lane was counted, note whether it was the LTPP lane.

Example: No. of Lanes Counted 1 (LTPP)

TYPE OF EQUIPMENT

Explanation: Select the appropriate description for the type of equipment used to make the automated vehicle classification count, including either a permanent Automatic Vehicle Classification (AVC) counter, portable AVC counter, permanent Weigh-In-Motion (WIM) counter, or portable WIM counter.

EQUIPMENT NAME/MODEL NO.

Explanation: Enter the brand name and model number of the classification equipment used to make the automated classification count.

TOTAL NUMBER OF VEHICLES CLASSIFIED

Explanation: Enter the total number of vehicles that were classified in this counting session.

NUMBER OF TRUCKS

Explanation: Enter the total number of trucks that were classified in this counting session.

PERCENTAGE OF TRUCKS

Explanation: Enter the ratio of total trucks classified to total vehicles classified in the form of a percentage.

NUMBER OF TRUCKS IN LTPP LANE

Explanation: Enter the number of trucks that were classified during this count session that were traveling in the LTPP test lane. If the LTPP test lane was not specifically counted, leave this blank.

PERCENTAGE OF TRUCKS IN LTPP LANE

Explanation: Enter the ratio of the number of trucks in the LTPP lane to the total number of trucks classified and recorded in Number of Trucks on the previous line on Sheet #5. The rate is stated as a percentage. If the LTPP lane was not specifically counted, estimate the percentage of trucks that traveled in the LTPP lane.

VEHICLE CLASSIFICATION METHOD

Explanation: Mark the appropriate blank to indicate the classification scheme used in making this classification count. The lower part of this form is designed for the FHWA 13-class system only. Sheet 6 is filled out if something other than the FHWA scheme was used.

If any scheme is used that differs from the FHWA 13-class system, Sheet 7 is completed to describe the vehicle classification scheme used by the agency and how that scheme is expanded or collapsed by the agency to correspond as nearly as possible with the FHWA 13 classes.

VEHICLE CLASSES

Explanation: The FHWA classes are listed in the left-hand column. Classes 1, 2, and 3 are combined. Class 4 is for buses. Buses are considered to be trucks in the LTPP project. Classes 5-13 are types of trucks varying in number of units and axles. Item number 12 allows other vehicles to be recorded. The grand total is entered at the bottom of the form.

TOTAL NUMBER OF VEHICLES (TWO WAY)

Explanation: If the classification count was for all vehicles traveling in both directions, enter the total number of vehicles counted for each class or combination of classes. Leave this column blank if data were not collected in all lanes or in both directions.

TOTAL NUMBER OF VEHICLES (LTPP DIRECTION)

Explanation: If the classification count was conducted for vehicles traveling in the direction of the LTPP lane only, enter the total number of vehicles counted for each class or combination of classes. Leave this blank if only the LTPP lane was counted or if data are only available for both directions combined.

TOTAL NUMBER OF VEHICLES (LTPP LANE)

Explanation: If the classification count was conducted for vehicles in the LTPP lane only, or if the number of vehicles in the LTPP lane can be derived directly from counts made in other lanes, enter the total number of vehicles counted or derived for each class or combination of classes in the LTPP lane.

3.6 VEHICLE CLASSIFICATION DATA AGENCY DEFINED CLASSES (SHEET 6)

PURPOSE: The purpose of this form is to record vehicle classification data that were collected at or near the LTPP site and that were classified in a manner that differs from the FHWA 13-classification system. It is to be used in conjunction with Sheet 5. Site-related information and information about the date and time of the count, type of count, type of equipment used, and total number of vehicles classified is entered on Sheet 5 and attached to Sheet 6. Data collected in accordance with the FHWA 13-class system are recorded on Sheet 5. Highway agencies using 4-bin or 6-bin length classifiers should use this form. One sheet is completed for each classification counting session.

GENERAL INFORMATION: The general information such as state assigned ID, state code, SHRP section ID, and the name of the preparer should be provided in accordance with the requirements stipulated at the beginning of this section.

HIGHWAY ROUTE NO. (THIS COUNT) AND MILE POST NO. (THIS COUNT)

Form Entry: Highway Route # (This Count) ____

Mile Post # (This Count) ____

Explanation: Enter the common name or Highway numbers used to identify the highway and mile post number where the classification count was conducted. This may be a different location than the test section. If a mile post numbering system has not

been developed, enter "N/A" on the mile post line and add a description of the count location in the space for the Highway Route No.

Examples: A. Highway Route # IH 35 Mile Post # MP 269

B. Highway Route # FM 2222 West of Loop 360 Mile Post # N/A

BEGINNING DATE AND ENDING DATE

Explanation: Enter the date (month-day-year) that the counting period began and ended.

Example: 07 - 11 - 1988

BEGINNING TIME AND ENDING TIME

Explanation: Enter the time of day that the counting began and ended.

Example: Beginning Time 0600 Ending Time 0600

NAME OF SHA CLASSIFICATION SCHEME

This a unique identifier for this SHA classification scheme, which is used by the SHA and SHRP to identify this specific classification scheme from other schemes used by the SHA. (For example, this name could differentiate a WIM classification program that produces 15 classes of vehicles from an AVC device that produces 14 classes.) Enter the Name of the SHA Classification Scheme. The name must be a one-digit code in either alpha or numeric characters.

Explanation: Name of SHA Classification Scheme

Example: Name 01

DURATION

Explanation: Enter the length of time that the count covered in hours.

Example: 24

VEHICLE CLASSES

Beginning with A and running through T, enter a description of each class of vehicles used by the agency in its classification scheme. If axle spacing is used to classify vehicles, also enter the axle spacing category for each class. For example, a four-bin classification scheme might be described as follows:

A. Passenger vehicles, motorcycles, pickups and single unit vehicles.

<___ feet

B. Light trucks, pickups and single unit vehicles with trailers.

> __ feet and <__ feet

C. Semitrailer trucks with 4-6 axles.

> __ feet and <__ feet

D. Multi-trailer trucks with 6 or more axles.

> __ feet and <__ feet

Up to twenty classes can be listed on this form. Complete Sheet 7 to describe how the agency would relate this classification scheme to the FHWA 13-class system.

TOTAL NUMBER OF VEHICLES (TWO WAY)

Explanation: If the classification count was for all vehicles traveling in both directions, enter the total number of vehicles counted for each class or combination of classes. Leave this column blank if data were not collected in all lanes or in both directions.

TOTAL NUMBER OF VEHICLES (LTPP DIRECTION)

Explanation: If separate classification count data are available for vehicles traveling in the direction of the LTPP lane, enter the total number of vehicles counted for each class or combination of classes for the direction of the LTPP lane in this space. Leave this blank if only the LTPP lane was counted or if data are only available for both directions combined.

TOTAL NUMBER OF VEHICLES (LTPP LANE)

Explanation: If the classification count was conducted for vehicles in the LTPP lane only, enter the total number of vehicles counted for each class or combination of classes. Complete this column only if data were collected in the LTPP lane.

3.7 VEHICLE CLASSIFICATION CONVERSION CHART (SHEET 7)

PURPOSE: The purpose of this form is to define the relationship between an agency classification scheme and the FHWA 13-class scheme. States or provinces using 4-bin, or 6-bin, or other non-FHWA classification systems would complete this form. Only one such form is required unless the relationship varied over time. Complete one form for each new classification scheme and record the period of time that this classification scheme is applicable.

GENERAL INFORMATION: The general information such as state assigned ID, state code, SHRP section ID, and the name of the preparer is provided in accordance with

the requirements stipulated at the beginning of this section.

SHA CLASSES

Explanation: Name of SHA Classification Scheme is the designation given to a classification scheme used by the SHA to describe the data recorded on the corresponding Sheets 6, 12, or 13. In the left-hand column are the letters A through T, which are comparable to the state or province classes defined on Sheet 6 (Non-FHWA 13-class system). Alpha characters are used to distinguish between the SHA classification scheme and the FHWA 13-class numerical system. Sheet 6 should be attached to Sheet 7 to further describe the SHA Classification Scheme.

FHWA CLASSES

Explanation: Across the top of the form are the FHWA 13-classes with classes 1, 2, and 3 combined in the first column and the remaining columns provided for each of the remaining classes from Class 4 to Class 13. The FHWA classes are defined as follows:

Class	Type
1	Motorcycles (Optional). All two- or three-wheeled motorized vehicles. Typical vehicles in this category have saddle-type seats and are steered by handle bars rather than a wheel. This category includes motorcycles, motor scooters, mopeds, motor-powered bicycles, and three-wheel motorcycles. This vehicle type may be reported at the option of the State.
2	Passenger Cars. All sedans, coupes, and station wagons manufactured primarily for the purpose of carrying passengers and including those passenger cars pulling recreational or other light trailers.
3	Other Two-Axle, Four-Tire Single Unit Vehicles. All two-axle, four-tire vehicles, other than passenger cars. Included in this classification are pickups, panels, vans, and other vehicles such as campers, motor homes, ambulances, hearses, and carryalls. Other two-axle, four-tire single unit vehicles pulling recreational or other light trailers are included in this classification.
4	Buses. All vehicles manufactured as traditional passenger-carrying buses with two axles and six tires or three or more axles. This category includes only traditional buses (including school buses) functioning as passenger-carrying vehicles. All two-axle, four-tire minibuses should be classified as other two-axle, four-tire single unit vehicles. Modified buses are considered to be a truck and classified appropriately.

Note: In reporting information on trucks, the following criteria should be used:

a. Truck tractor units traveling without a trailer are considered single unit trucks.

b. A truck tractor unit pulling other such units in a "saddle mount" configuration are considered as one single unit truck and are defined only by the axles on the pulling unit.

c. Vehicles are defined by the number of axles in contact with the roadway. Therefore, "floating" axles are counted only when in the down position.

d. The term "trailer" includes both semi-and full trailers.

5 Two-Axle, Six-Tire, Single Unit Trucks. All vehicles on a single frame including trucks, camping and recreation vehicles, motor homes, etc., having two axles and dual rear wheels.

6 Three-Axle Single Unit Trucks. All vehicles on a single frame including trucks, camping and recreational vehicles, motor homes, etc., having three axles.

7 Four or More Axle Single Unit Trucks. All trucks on a single frame with four or more axles.

8 Four or Less Axle Single Trailer Trucks. All vehicles with four or fewer axles consisting of two units, one of which is a tractor or straight truck power unit.

9 Five-Axle Single Trailer Trucks. All five-axle vehicles consisting of two units, one of which is a tractor or straight truck power unit.

10 Six or More Axle Single Trailer Trucks. All vehicles with six or more axles consisting of two units, one of which is a tractor or straight truck power unit.

11 Five or Less Axle Multi-Trailer Trucks. All vehicles with five or fewer axles consisting of three or more units, one of which is a tractor or straight truck power unit.

12 Six-Axle Multi-Trailer Trucks. All six-axle vehicles consisting of three or more units, one of which is a tractor or straight truck power unit.

13 Seven or More Axle Multi-Trailer Trucks. All vehicles with seven or more axles consisting of three or more units, one of which is a tractor or straight truck power unit.

14 The FHWA classification scheme includes only thirteen classes. However, many WIM and AVC devices include a fourteenth class. This class becomes a catchall for vehicles that cannot be readily classified by the machine algorithm on the basis of the information received from the sensor. If the SHA has a class, or bin, defined for this purpose, Sheet 7, Column 14 should be marked as converting 100% from the corresponding catchall SHA class to Class 14. This maintains integrity of the data and does not force distribution of those unclassified vehicles back into the other thirteen classes.

15 Likewise, FHWA does not include Class 15, but many WIM and AVC devices have a class to record all partial vehicles. This includes off-scale vehicles or lane changing vehicles or other malfunctions in the system. Again, to assure truth-in-data, the SHA

denotes that 100% of the vehicle records of this class in the SHA classification scheme are converted to Class 15 in the FHWA classification scheme.

CONVERSION DATA

Explanation: Enter the percentage to the nearest whole number that converts the state or province classification data to the FHWA 13-class system. For example, if SHA Class A was 45% FHWA Class 1-3 and 55% FHWA Class 4, enter 4 5 in the column under Class 1-3 and adjacent to SHA Class A and 5 5 in the column under Class 4 and adjacent to SHA Class A. Complete the Total column on the right side of Sheet #7 for each SHA Class and the Total line at the bottom of the matrix for each FHWA Class. The grand total of all entries in the Total Column and the entries on the Total Line should equal 100%. It is not necessary to complete the squares where no data exist. Simply leave them blank.

3.8 TRUCK WEIGHT SESSION INFORMATION (SHEET 8)

PURPOSE: The purpose of this form is to record information about the location of truck weight measurements, type of equipment used, period of operations, and other pertinent information for each truck weight session. Truck weights by axle range and vehicle class are submitted on Sheet 9 forms. One Sheet 8 is submitted with each set of Sheet 9 forms that are submitted. A set of Sheet 9 forms includes one form for each vehicle classification for each truck session.

NOTE: All weight data that has been previously provided to FHWA as part of the FHWA Truck Weight Study was provided to SHRP and were reviewed to determine their compatibility with LTPP sites. Where such data do relate to a specific LTPP site, it is not necessary to resubmit these data on Sheet 9. Data that were not previously submitted to FHWA from the LTPP site are submitted to SHRP on Sheets 8 and 9. To avoid duplication, please contact the SHRP Regional Engineer for your state or province before filling out this form.

GENERAL INFORMATION: The general information such as state assigned ID, state code, SHRP section ID, and the name of the preparer is provided in accordance with the requirements stipulated at the beginning of this section.

HIGHWAY ROUTE NO. (THIS SESSION) AND MILE POST NO. (THIS SESSION)

Form Entry: Highway Route # (This Session) _____

Mile Post # (This Session) _____

Explanation: Enter the common name or Highway numbers used to identify the highway and mile post number where the weight session was conducted. It may be different from the LTPP site. If a mile post numbering system has not been developed, enter "N/A" on the mile post line.

Example: Highway Route # IH 35 Mile Post # MP 269

LOCATION (THIS SESSION)

Form Entry: Location (This Session) _____

Explanation: Describe the location of the weight session, especially if a mile post system has not been established for this highway.

Example: Location (This Session) North of Austin near Parmer Lane

FUNCTIONAL CLASSIFICATION

Explanation: Enter the code number for the appropriate functional classification for the highway on which the weight session was made. The functional classes, which are defined in detail in the FHWA Traffic Monitoring Guide, are as follows:

RURAL		URBAN	
Code	Functional Classification	Code	Functional Classification
01	Principal Arterial - Interstate	11	Principal Arterial - Interstate
02	Principal Arterial - Other	12	Principal Arterial - Other Freeways or Expressways
		14	Principal Arterial - Other
06	Minor Arterial	16	Minor Arterial
07	Major Collector	17	Collector
08	Minor Collector		
09	Local System	19	Local System

DIRECTION OF TRAVEL

Explanation: Enter the general direction of travel of vehicles crossing over the site where the truck weight measurements are made. If the roadway is oriented north-south, and the weight measurements are made in the northbound lane, enter the word or abbreviation for North.

Example: North or N

1. FHWA STATION IDENTIFICATION NUMBER

Explanation: Enter the assigned FHWA Station Identification Number for this station. It is a three-digit, alphanumeric designation. Only the numbers 0 through 9 and the 26 letters of the alphabet should be used. If a FHWA Station Identification Number has not been issued, leave this blank.

2. TYPE OF WEIGHING EQUIPMENT

Explanation: Select the item that best describes the type of weighing equipment, including Permanent Scale, Permanent Weigh-In-Motion (WIM), Portable WIM, or Portable Scale, and enter an "X" in the space following that option.

3. COUNT DURATION (HOURS) AND COUNT LANE

Explanation: Enter the total duration of the count in hours. Any period of time may be entered. For example if the count covered 54 hours enter 5 4.

For Count Lane, select the appropriate code to represent the description of the lane(s) in which the truck weight measurements were made.

Code	Lane Description
0	All lanes in the same direction.
1	Curb lane or lane adjacent to shoulder or outside edge of pavement.
2	Lane adjacent to the curb lane on four lane highway or adjacent to median on divided four lane highways.
3	Lane adjacent to centerline or median on six lane highway.
4-9	Other lane designation if highway has four or more lanes in one direction.

4. BEGINNING TIME (MONTH, DAY, YEAR, TIME)

Explanation: Enter the time that the weigh session began in month-day-year-time format.

5. ENDING TIME (MONTH, DAY, YEAR, TIME)

Explanation: Enter the time that the weigh session ended in month-day-year-time format.

6. EQUIPMENT MANUFACTURER/MODEL NUMBER

Explanation: Enter the equipment manufacturer or brand name and model number of the equipment used to make the weight measurements.

7. PURPOSE OF WEIGHT SESSION

Explanation: Select the appropriate purpose of the weight measurement by marking either Data Collection or Enforcement.

8. VEHICLE CLASSIFICATION SCHEME

Explanation: Mark the appropriate classification scheme used by the equipment for this weigh session. If a non-FHWA 13-class scheme is used, enter the number of classes or bins included in that system. Complete Sheet 6 to describe the SHA classification scheme and Sheet 7 to describe how the non-FHWA system is converted to a FHWA 13-class system.

9. PAVEMENT TYPE

Explanation: Mark the appropriate type of pavement by selecting either AC for flexible pavements (1), PCC for rigid pavements (2), or Other for composite pavements or other types including AC/PCC and PCC/AC overlays (3).

10. METHOD OF CALIBRATION AND FREQUENCY

Explanation: Describe the methodology for calibration of the weighing device and how often it is calibrated.

3.9 TRUCK AXLE LOAD MEASUREMENTS BY VEHICLE CLASSIFICATION (SHEET 9)

PURPOSE: The purpose of this form is to record truck axle load data for one weight session by vehicle classification. One form is completed for each vehicle classification for each weight session. If weight data are not collected by vehicle classification, complete one sheet and note that all classes are combined.

NOTE: All weight data that has been previously provided to FHWA as part of the FHWA Truck Weight Study were provided to SHRP and were reviewed to determine their compatibility with LTPP sites. Where such data do relate to a specific LTPP site, it is not necessary to resubmit those data on Sheet 9. Data that were not previously submitted to FHWA from the LTPP site are submitted to SHRP on Sheets 8 and 9. To avoid duplication, please contact the SHRP Regional Engineer (or RCOC) for your state or province before filling out this form.

GENERAL INFORMATION: The general information such as state assigned ID, state code, SHRP section ID, and the name of the preparer is provided in accordance with the requirements stipulated at the beginning of this section.

FHWA CLASSIFICATION SCHEME

Explanation: Mark the appropriate blank to indicate the classification scheme used during this weight session. The form is designed for the FHWA 13-class system. However, this form is also used for other classification schemes, provided that Sheet 6 is submitted to define the classification scheme and Sheet 7 is attached describing the conversion from the SHA scheme to the FHWA 13-class system.

1. VEHICLE CLASS

Explanation: Enter the two-digit number that describes the FHWA vehicle class for which axle loads are reported. For FHWA Classes 1-3 use 0 1. For Class 4 use 0 4, Class 5 0 5, etc., through class thirteen (1 3). If the agency uses another classification scheme, attach Sheet 6 to describe the scheme and enter the appropriate alpha character as follows B. Also attach Sheet 7 to describe how the SHA classification scheme is converted to the FHWA 13-class system.

2. TOTAL NUMBER OF VEHICLES COUNTED

Explanation: Enter the total number of vehicles counted in this class. The total number of truck axles by type of axle group and by load range for this vehicle class is entered in columns 3, 4 and 5.

3. SINGLE AXLES BY LOAD RANGE

Explanation: Enter the total number of axle loads measured in each load range for all single axles measured this weight session and by this vehicle classification.

NOTE: If axle weight data were collected in increments other than 1,000 pound categories, please annotate Sheet #9 with brackets to indicate the appropriate grouping of categories and enter the number of axles for that grouping of categories in the lowest weight range. Leave the other weight ranges in the grouping blank. For example, if 2000 pound increments are used, annotate the weight ranges in pairs and enter the number of axles in the lower weight range. Then leave the other range blank. This applies to each of the types of axle groups (single, tandem, triple, and quad).

4. TANDEM AXLES BY LOAD RANGE

Explanation: Enter the total number of axle loads measured in each load range for all tandem axles measured this weight session and by this vehicle classification.

5. TRIPLE AXLES BY LOAD RANGE

Explanation: Enter the total number of axle loads measured in each load range for all triple axles measured this weight session and by this vehicle classification.

6. USE SECOND PAGE FOR FOUR AXLE GROUPS

Explanation: If any four-axle groupings (Quads) are recorded, use another Sheet 9 to record the number of axles, but strike Triple Axles and write in Quad Axles on Item #5.

SHEET 1 **LTPP TRAFFIC DATA** **SUMMARY TRANSMITTAL FORM**	*STATE ASSIGNED ID [__ __ __ __] *STATE CODE [__ __] *SHRP SECTION ID [__ __ __ __]

STATE OR PROVINCE _____ COUNTY _____

HIGHWAY ROUTE NO. _____ MILEPOST# _____

NEAREST CITY/TOWN _____ NEAREST INTERSECTION _____

*FUNCTIONAL CLASS _____ NO. LANES EACH DIRECTION _____TOTAL NO. LANES _____

*DIRECTION OF TRAVEL LTPP LANE _____ [N S E W]

*DATE OPENED TO TRAFFIC __ __-__ __-__ __ __ __

FIPS COUNTY CODE _____ FHWA STATION IDENTIFICATION NO. _____

HPMS SAMPLE NO. _____ HPMS SUBDIVISION _____

*TYPE OF PAVEMENT: 1- AC ____ 2 - PCC ____ 3 - OTHER _____

CONTROL OF ACCESS: YES _____ NO _____ MEDIAN: YES _____ NO _____

CURRENT (1990) SURROUNDING DEVELOPMENT:
URBAN _____ SUBURBAN _____ RURAL _____

DID INTENSITY OF ROADSIDE DEVELOPMENT INCREASE BETWEEN 1980 AND 1990?
YES _____ NO _____
IF YES, DESCRIBE CHANGES _____
_____
_____
_____

NEW FUNCTIONAL CLASS: _____ DATE FUNCTIONAL CLASS CHANGED: _____

NOTE: ATTACH ALL RELATED FORMS AND COUNT DATA AND SUBMIT TO THE SHRP REGIONAL OFFICE. ATTACH MAP INDICATING THE LOCATION OF EACH TRAFFIC COUNT, VEHICLE CLASSIFICATION COUNT, OR WEIGHT STATION RELATIVE TO THIS LTPP SITE.

NAME OF PREPARER _____ PHONE #_____
DATE PREPARED _____ rev. February 28, 2000

SHEET 2 **LTPP TRAFFIC DATA** **TRAFFIC VOLUMES** **AND LOAD ESTIMATES**	*STATE ASSIGNED ID [__ __ __ __] *STATE CODE [__ __] *SHRP SECTION ID [__ __ __ __]

*YEAR	1. ESTIMATED TOTAL VEHICLES AADT (TWO-WAY)	2. ESTIMATED TOTAL TRUCK AADT (TWO-WAY)	3. ESTIMATED TOTAL VEHICLES AADT LTPP LANE	*4. ESTIMATED TOTAL TRUCKS AADT LTPP LANE	*5. ESTIMATED ESALs/YEAR LTPP LANE (1000'S)
1989					
1988					
1987					
1986					
1985					
1984					
1983					
1982					
1981					
1980					
1979					
1978					
1977					
1976					
1975					
1974					
1973					
1972					
1971					
1970					
1969					
1968					
1967					
1966					
1965					

NAME OF PREPARER _____ PHONE #_____

DATE PREPARED _____

Rev. March 12, 2001

SHEET 3 **LTPP TRAFFIC DATA** **PROCEDURES FOR ESTIMATING ANNUAL AVERAGE VOLUMES AND TOTAL ANNUAL ESALS**	*STATE ASSIGNED ID [__ __ __ __] *STATE CODE [__ __] *SHRP SECTION ID [__ __ __ __]

*1. Year Applicable _____

2. **METHOD FOR ESTIMATING AADT**

_____ Factored a single count taken this year at the LTPP site. (1)
_____ Averaged multiple counts taken this year at the LTPP site. (2)
_____ Averaged and factored multiple count taken this year at the LTPP site. (5)
_____ Growth factored last year's estimate. (6)
_____ Estimated based on volume counts at nearby locations. (3)
_____ Used flow maps. (7)
_____ Used computerized network analyses. (4)
_____ Other: (8) _____
_____
_____

3. **METHOD FOR ESTIMATING TRUCK VOLUMES OR PERCENTAGES**

_____ Used a single count taken this year at the LTPP site. (5)
_____ Factored a single count taken this year at the LTPP site. (1)
_____ Averaged multiple counts taken this year at the LTPP site. (2)
_____ Used system averages from counts taken this year. (6)
_____ Used count data from nearby sites. (3)
_____ Used count data taken in earlier years at the LTPP site. (7)
_____ Used system averages taken in earlier years at the LTPP site. (8)
_____ Used computerized network analyses. (4)
_____ Other: (9) _____
_____
_____

4. **METHOD FOR ESTIMATING AADT BY LTPP LANE**

_____ Based on actual lane count data. (1)
_____ System distribution factors. (2)
_____ Other: (3) _____
_____

*5. **METHOD FOR ESTIMATING TRUCK AADT IN LTPP LANE**

_____ Based on actual lane data count. (1)
_____ System distribution factors. (2)
_____ Other: (3) _____
_____

*6. **METHOD FOR ESTIMATING ESAL/VEHICLE**

_____ ESAL/Truck (1)
_____ ESAL/Vehicle class. (2)
(No. of classes)_____
_____ Other: (4) _____
_____

7. **ESAL ESTIMATES**

(A) Source of Data

_____ Weight data collected at LTPP site this year (1)
_____ Weight data collected at LTPP site prior years. (2)
_____ Weight data from system averages this year. (3)
_____ Weight data from system averages prior years. (4)
_____ Weight data from historic W-4 Tables used. (5)
_____ Other: (6)_____
_____

(B) Weight Scale Type.

_____ WIM scale. (1)
_____ Static scale used for enforcement. (2)
_____ Static scale not used for enforcement. (3)
_____ Other: (4) _____
_____

NAME OF PREPARER _____ PHONE #_____
DATE PREPARED _____ rev. March 12, 2001

SHEET 4 **LTPP TRAFFIC DATA** **TRAFFIC VOLUME COUNTS**	*STATE ASSIGNED ID [__ __ __ __] *STATE CODE [__ __] *SHRP SECTION ID [__ __ __ __]

HIGHWAY ROUTE NO. (THIS COUNT)_____

MILEPOST # OR LOCATION (THIS COUNT)_____

*BEGINNING DATE_____ ENDING DATE_____

*COUNT DURATION_____ [ ] HOURS (1) [ ] DAYS (2) [ ] MONTHS (3)

TYPE OF COUNTER_____ NAME/MODEL#_____

* TYPE OF COUNT: 1- TWO-WAY____ 2 - ONE DIRECTION ONLY____ 3 - LTPP TEST LANE ONLY____

ITEM	**ACTUAL COUNT**	**FACTORS**
*1. TOTAL NO. OF VEHICLES (RAW COUNT)	__ __ __ __ __ __	
2. ADJUSTMENT FACTOR (FILL IN AS APPLICABLE)		
A. ADJUSTMENT TO 24-HOUR COUNT		__.__ __ __ __
B. AXLE CORRECTION FACTOR		__.__ __ __ __
C. DAY OF WEEK FACTOR		__.__ __ __ __
D. MONTH FACTOR		__.__ __ __ __
E. OTHER FACTOR (_____)		__.__ __ __ __
*3. ANNUAL AVERAGE DAILY TRAFFIC (AADT) (TWO-WAY)	__ __ __ __ __ __	
4. DIRECTIONAL DISTRIBUTION FACTOR		__.__ __ __ __
5. LTPP LANE DISTRIBUTION FACTOR		__.__ __ __ __
*6. AADT LTPP LANE	__ __ __ __ __ __	

NOTE: COMPLETE ONE SHEET FOR EACH COUNTING SESSION.

NAME OF PREPARER_____ PHONE#_____
DATE PREPARED_____ rev. November 8, 1999

SHEET 5 **LTPP TRAFFIC DATA** **VEHICLE CLASSIFICATION DATA** **FHWA 13-CLASS SYSTEM**	*STATE ASSIGNED ID [__ __ __ __] *STATE CODE [__ __] *SHRP SECTION ID [__ __ __ __]

HIGHWAY RT. NO. (THIS COUNT) _____ MILEPOST # (THIS COUNT) ____

LOCATION (THIS COUNT) _____ FUNCTIONAL CLASS _____
*BEGINNING DATE _____ ENDING DATE _____
BEGINNING TIME _____ END TIME _____ DURATION (HRS) _____

TYPE OF COUNT: 1 - MANUAL _____ 2 - AUTOMATED_____ NO. OF LANES COUNTED_____

TYPE OF EQUIP.: 1 - AVC PERM.___ 2 - AVC PORT.___ 3 - WIM PERM.____ 4 - WIM PORT._____
5 - NONE (Manual) ____ 6 - UNKNOWN ____

EQUIPMENT NAME/MODEL# _____

TOTAL NO. OF VEHICLES CLASSIFIED_____ * NO. OF TRUCKS_____ PERCENT TRUCKS_____

* NO. OF TRUCKS IN LTPP LANE_____ % OF TRUCKS IN LTPP LANE_____

* VEHICLE CLASSIFICATION METHOD: 1 - FHWA_____ 2 - OTHER_____ #BINS_____

NOTE: IF THIS COUNT DOES NOT USE THE FHWA 13-BIN CLASSIFICATION SYSTEM USE SHEET 6. PLEASE DESCRIBE ON AN ATTACHED PAGE THE VEHICLE CLASSIFICATION SYSTEM USED BY THE AGENCY AND COMPLETE SHEET 7 DESCRIBING HOW THE SHA WOULD EXPAND OR COLLAPSE THE USER CLASSIFICATION SYSTEM TO CORRESPOND WITH THE FHWA 13 CLASSES.

VEHICLE CLASSES	**TOTAL NUMBER OF VEHICLES TWO-WAY**	**TOTAL NUMBER OF VEHICLES LTPP DIRECTION**	**TOTAL NUMBER OF VEHICLES LTPP LANE***
1. FHWA CLASSES 1-3 (Cars, Motorcycles, Vans)	__ __ __ __ __ __	__ __ __ __ __ __	__ __ __ __ __ __
2. FHWA CLASS 4 (Buses)	__ __ __ __ __ __	__ __ __ __ __ __	__ __ __ __ __ __
3. FHWA CLASS 5 (Two Axle, 6-Tire, SU Truck)	__ __ __ __ __ __	__ __ __ __ __ __	__ __ __ __ __ __
4. FHWA CLASS 6 (3 Axle SU Truck)	__ __ __ __ __ __	__ __ __ __ __ __	__ __ __ __ __ __
5. FHWA CLASS 7 (4 or more Axle, 1-Trlr. Truck)	__ __ __ __ __ __	__ __ __ __ __ __	__ __ __ __ __ __
6. FHWA CLASS 8 (4 or less Axle, 1-Trlr. Truck)	__ __ __ __ __ __	__ __ __ __ __ __	__ __ __ __ __ __
7.FHWA CLASS 9 (5 Axle, 1-Trlr. Truck)	__ __ __ __ __ __	__ __ __ __ __ __	__ __ __ __ __ __
8. FHWA CLASS 10 (6 or more Axle, 1-Trlr Truck)	__ __ __ __ __ __	__ __ __ __ __ __	__ __ __ __ __ __
9. FHWA CLASS 11 (5 or less Axle, Multi-Trlr.. Truck)	__ __ __ __ __ __	__ __ __ __ __ __	__ __ __ __ __ __
10. FHWA CLASS 12 (6 Axle, Multi-Trlr.. Truck)	__ __ __ __ __ __	__ __ __ __ __ __	__ __ __ __ __ __
11. FHWA CLASS 13 (7 or more Axle, Multi-Trlr.. Truck)	__ __ __ __ __ __	__ __ __ __ __ __	__ __ __ __ __ __
12. OTHER VEHICLES	__ __ __ __ __ __	__ __ __ __ __ __	__ __ __ __ __ __
GRAND TOTAL	__ __ __ __ __ __	__ __ __ __ __ __	*__ __ __ __ __ __

NAME OF PREPARER_____ PHONE#_____
DATE PREPARED_____ rev. November 8, 1999

SHEET 6 **LTPP TRAFFIC DATA** **VEHICLE CLASSIFICATION DATA** **AGENCY DEFINED CLASSES**	*STATE ASSIGNED ID [__ __ __ __] *STATE CODE [__ __] *SHRP SECTION ID [__ __ __ __]

FOR 4-BIN OR OTHER CLASSIFICATION SYSTEMS
HIGHWAY ROUTE NO. (THIS COUNT)_____ MILEPOST # (THIS COUNT)_____
* BEGINNING DATE_____ ENDING DATE_____
BEGINNING TIME_____ ENDING TIME_____

VEHICLE CLASSES (DESCRIBE VEHICLE TYPES IN EACH CLASS OR AXLE SPACING CATEGORY)	**TOTAL NUMBER OF VEHICLES TWO-WAY**	**TOTAL NUMBER OF VEHICLES LTPP DIRECTION**	**TOTAL NUMBER OF VEHICLES LTPP LANE**
*A.	__ __ __ __ __ __	__ __ __ __ __ __	*__ __ __ __ __ __
*B.	__ __ __ __ __ __	__ __ __ __ __ __	* __ __ __ __ __ __
C.	__ __ __ __ __ __	__ __ __ __ __ __	__ __ __ __ __ __
D.	__ __ __ __ __ __	__ __ __ __ __ __	__ __ __ __ __ __
E.	__ __ __ __ __ __	__ __ __ __ __ __	__ __ __ __ __ __
F.	__ __ __ __ __ __	__ __ __ __ __ __	__ __ __ __ __ __
G.	__ __ __ __ __ __	__ __ __ __ __ __	__ __ __ __ __ __
H.	__ __ __ __ __ __	__ __ __ __ __ __	__ __ __ __ __ __
I.	__ __ __ __ __ __	__ __ __ __ __ __	__ __ __ __ __ __
J.	__ __ __ __ __ __	__ __ __ __ __ __	__ __ __ __ __ __
K.	__ __ __ __ __ __	__ __ __ __ __ __	__ __ __ __ __ __
L.	__ __ __ __ __ __	__ __ __ __ __ __	__ __ __ __ __ __
M.	__ __ __ __ __ __	__ __ __ __ __ __	__ __ __ __ __ __
N.	__ __ __ __ __ __	__ __ __ __ __ __	__ __ __ __ __ __
O.	__ __ __ __ __ __	__ __ __ __ __ __	__ __ __ __ __ __
P.	__ __ __ __ __ __	__ __ __ __ __ __	__ __ __ __ __ __
Q.	__ __ __ __ __ __	__ __ __ __ __ __	__ __ __ __ __ __
R.	__ __ __ __ __ __	__ __ __ __ __ __	__ __ __ __ __ __
S.	__ __ __ __ __ __	__ __ __ __ __ __	__ __ __ __ __ __
T.	__ __ __ __ __ __	__ __ __ __ __ __	__ __ __ __ __ __
GRAND TOTAL	__ __ __ __ __ __	__ __ __ __ __ __	* __ __ __ __ __ __

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DATE PREPARED_____
rev. November 8, 1999

SHEET 7 **LTPP TRAFFIC DATA** **VEHICLE CLASSIFICATION** **CONVERSION CHART**	*STATE ASSIGNED ID [__ __ __ __] *STATE CODE [__ __] *SHRP SECTION ID [__ __ __ __]

FOR 4-BIN, 6-BIN, OR OTHER CLASSIFICATION SYSTEMS NOT MATCHING FHWA 13-BIN SCHEME.

USE THIS SHEET TO DESCRIBE HOW THE AGENCY'S CLASSIFICATION SYSTEM CAN BE CONVERTED TO THE FHWA 13 BINS. ENTER PERCENTAGE OF TOTAL SHA CLASS DISTRIBUTED TO EACH FHWA CLASS.
APPLICABLE PERIOD *FROM_____ *TO_____

	FHWA CLASSES												
SHA CLASS	1-3	4	5	6	7	8	9	10	11	12	13	OTHER	TOTAL
*A	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	_ __	__ __	*__ __
*B	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	_ __	__ __	*__ __
C	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	_ __	__ __	__ __
D	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	_ __	__ __	__ __
E	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	_ __	__ __	__ __
F	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	_ __	__ __	__ __
G	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	_ __	__ __	__ __
H	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	_ __	__ __	__ __
I	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	_ __	__ __	__ __
J	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	_ __	__ __	__ __
K	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	_ __	__ __	__ __
L	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	_ __	__ __	__ __
M	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	_ __	__ __	__ __
N	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	_ __	__ __	__ __
O	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	_ __	__ __	__ __
P	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	_ __	__ __	__ __
Q	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	_ __	__ __	__ __
R	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	_ __	__ __	__ __
S	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	_ __	__ __	__ __
T	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	__ __	_ __	__ __	__ __

NAME OF PREPARER_____ PHONE#_____
DATE PREPARED_____ rev. March 12, 2001

SHEET 8 **LTPP TRAFFIC DATA** **TRUCK WEIGHT** **SESSION INFORMATION**	*STATE ASSIGNED ID [__ __ __ __] *STATE CODE [__ __] *SHRP SECTION ID [__ __ __ __]

HIGHWAY RT. NO. (THIS SESSION)_____ MILEPOST# (THIS SESSION)_____

LOCATION (THIS SESSION)_____

* FUNCTIONAL CLASSIFICATION_____

DIRECTION OF TRAVEL_____ 1- EAST; 2 - WEST; 3 - NORTH; 4 - SOUTH

1. FHWA STATION IDENTIFICATION NUMBER_____

2. TYPE OF WEIGHING EQUIPMENT: 1 - PERM. SCALE _____ 2 - PERM. WIM _____
   3 - PORT. SCALE _____ 4 - PORT. WIM _____

3. COUNT DURATION (HOURS)_____ COUNT LANE_____ [Per TMG code]

4. BEGINNING TIME (MONTH, DAY, YEAR, TIME) * ____-____-_____ - __ __ __ __

5. ENDING TIME (MONTH, DAY, YEAR, TIME) * ____-____-_____ - __ __ __ __

6. EQUIPMENT MANUFACTURER/MODEL #_____

7. PURPOSE OF WEIGHT SESSION:
   1 - DATA COLLECTION_____ 2 - ENFORCEMENT_____ 3 - OTHER _____

*8. VEHICLE CLASSIFICATION SCHEME: 1 - FHWA _____
   2 - OTHER _____ NUMBER OF BINS____

9. PAVEMENT TYPE: 1 - AC_____ 2 - PCC_____ 3 - OTHER_____

10. METHOD OF CALIBRATION AND FREQUENCY:_____
_____
_____
_____
_____

NOTE: IF THIS WEIGHT SESSION IS NOT BASED UP THE FHWA 13-BIN CLASSIFICATION SYSTEM, USE SHEET 7 TO DESCRIBE HOW THE SHA WOULD EXPAND OR COLLAPSE THE AGENCY CLASSIFICATION SYSTEM TO CORRESPOND WITH THE FHWA 13 CLASSES. ALSO PROVIDE A DESCRIPTION OF THE CLASSIFICATION SCHEME THAT WAS USED.

NAME OF PREPARER_____ PHONE#_____
DATE PREPARED_____ rev. November 8, 1999

SHEET 9 **LTPP TRAFFIC DATA** **TRUCK AXLE LOAD MEASUREMENTS** **BY VEHICLE CLASSIFICATION**	*STATE ASSIGNED ID [__ __ __ __] *STATE CODE [__ __] *SHRP SECTION ID [__ __ __ __]

*CLASSIFICATION SCHEME: 1- FHWA _____ 2 - OTHER _____ NUMBER OF BINS _____

NOTE: FOR CLASSIFICATION SCHEMES OTHER THAN FHWA SCHEME F, ATTACH SHEET 7 DESCRIBING CONVERSION FROM AGENCY CLASSIFICATION SCHEME TO FHWA 13 CLASSES (SCHEME F).

*1. VEHICLE CLASS ___ ___

*2. TOTAL NUMBER VEHICLES COUNTED ___ ___ ___ ___ ___ ___

3. SINGLE AXLES LOAD RANGE	NUMBER OF SINGLE AXLES WEIGHED	4. TANDEM AXLES LOAD RANGE	NUMBER OF TANDEM AXLES WEIGHED	5. TRIPLE AXLES LOAD RANGE	NUMBER OF TRIPLE AXLES WEIGHED
< 3000	__ __ __ __ __ __	< 6000	__ __ __ __ __ __	< 12000	__ __ __ __ __ __
3000 - 3999	__ __ __ __ __ __	6000 - 7999	__ __ __ __ __ __	12000 - 14999	__ __ __ __ __ __
4000 - 4999	__ __ __ __ __ __	8000 - 9999	__ __ __ __ __ __	15000 - 17999	__ __ __ __ __ __
5000 - 5999	__ __ __ __ __ __	10000 - 11999	__ __ __ __ __ __	18000 - 20999	__ __ __ __ __ __
6000 - 6999	__ __ __ __ __ __	12000 - 13999	__ __ __ __ __ __	21000 - 23999	__ __ __ __ __ __
7000 - 7999	__ __ __ __ __ __	14000 - 15999	__ __ __ __ __ __	24000 - 26999	__ __ __ __ __ __
8000 - 8999	__ __ __ __ __ __	16000 - 17999	__ __ __ __ __ __	27000 - 29999	__ __ __ __ __ __
9000 - 9999	__ __ __ __ __ __	18000 - 19999	__ __ __ __ __ __	30000 - 32999	__ __ __ __ __ __
10000 - 10999	__ __ __ __ __ __	20000 - 21999	__ __ __ __ __ __	33000 - 35999	__ __ __ __ __ __
11000 - 11999	__ __ __ __ __ __	22000 - 23999	__ __ __ __ __ __	36000 - 38999	__ __ __ __ __ __
12000 - 12999	__ __ __ __ __ __	24000 - 25999	__ __ __ __ __ __	39000 - 41999	__ __ __ __ __ __
13000 - 13999	__ __ __ __ __ __	26000 - 27999	__ __ __ __ __ __	42000 - 44999	__ __ __ __ __ __
14000 - 14999	__ __ __ __ __ __	28000 - 29999	__ __ __ __ __ __	45000 - 47999	__ __ __ __ __ __
15000 - 15999	__ __ __ __ __ __	30000 - 31999	__ __ __ __ __ __	48000 - 50999	__ __ __ __ __ __
16000 - 16999	__ __ __ __ __ __	32000 - 33999	__ __ __ __ __ __	51000 - 53999	__ __ __ __ __ __
17000 - 17999	__ __ __ __ __ __	34000 - 35999	__ __ __ __ __ __	54000 - 56999	__ __ __ __ __ __
18000 - 18999	__ __ __ __ __ __	36000 - 37999	__ __ __ __ __ __	57000 - 59999	__ __ __ __ __ __
19000 - 19999	__ __ __ __ __ __	38000 - 39999	__ __ __ __ __ __	60000 - 62999	__ __ __ __ __ __
20000 - 20999	__ __ __ __ __ __	40000 - 41999	__ __ __ __ __ __	63000 - 65999	__ __ __ __ __ __
21000 - 21999	__ __ __ __ __ __	42000 - 43999	__ __ __ __ __ __	66000 - 68999	__ __ __ __ __ __
22000 - 22999	__ __ __ __ __ __	44000 - 45999	__ __ __ __ __ __	69000 - 71999	__ __ __ __ __ __
23000 - 23999	__ __ __ __ __ __	46000 - 47999	__ __ __ __ __ __	72000 - 74999	__ __ __ __ __ __
24000 - 24999	__ __ __ __ __ __	48000 - 49999	__ __ __ __ __ __	75000 - 77999	__ __ __ __ __ __
25000 - 25999	__ __ __ __ __ __	50000 - 51999	__ __ __ __ __ __	78000 - 79999	__ __ __ __ __ __
26000 - 26999	__ __ __ __ __ __	52000 - 53999	__ __ __ __ __ __	> 80000	
27000 - 27999	__ __ __ __ __ __	54000 - 55999	__ __ __ __ __ __		
28000 - 28999	__ __ __ __ __ __	56000 - 57999	__ __ __ __ __ __		
29000 - 29999	__ __ __ __ __ __	58000 - 59999	__ __ __ __ __ __		
> 30000		> 60000			

6. USE SECOND PAGE FOR FOUR AXLE GROUPS.

NAME OF PREPARER_____ PHONE#_____

DATE PREPARED_____ rev. November 8, 1999