Assessment Report for
Indiana, SPS-6 Experiment

December 21, 2004

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1 Executive Summary

A visit was made to the Indiana SPS-6 on December 21, 2004 for the purpose of conducting an assessment of the WIM system located on State Route 31 at milepost 216.9, 0.6 miles south of State Route 10. The LTPP lane is the driving lane in the northbound direction and is identified as lane number 1 in the WIM controller. **This WIM scale is installed on a PCC pavement.**

This site is not recommended for a site validation.

The site is instrumented with MSI piezo sensors. The WIM utilizes an IRD controller 1067 WIM Controller.

The equipment is not in working order. The following actions will be needed to make the equipment fully operational:

- Replace the trailing piezo sensor.
- Repair both inductive loops at the lead-in splice or replace if required.

Sufficient data was collected to provide a Sheet 16 for classification verification at this site. There are 2% unclassified vehicles. This does not exceed the percentage of 2% defined as the criteria for research data. Class 5 vehicles, however, had an error rate of 38% exceeding the threshold 2% of matches for truck classes. This was due to short axle spacings, resulting in Class 4 designations. **The algorithm for classification should be reviewed and the classification verification repeated at the next assessment or validation.**

The pavement smoothness is such that it may contribute to an inability to validate the system to obtain research quality data. The range of WIM Index values are between 0.300 and 0.949.

Distresses were observed that may influence truck motion, including a patch located approximately 212 feet prior to the WIM scale area in the right wheel path, and patches within the WIM scale area at the abandoned loop and weigh-pad frame installations. The abandoned weigh-pad frame is shown in Figure 13-3.

A review of the speed information collected on-site indicates that the range of truck speeds to be covered during an evaluation is 50 and 55 mph. The speed limit on site is 55 mph.

This site has 2 years of classification data and 1 year of weight data. **Based on available calibration information and review of the data submitted through November 2004, this site still needs 5 years of data to meet the need for 5 years of research quality classification and weight data.**

2 Corrective Actions Recommended

Electronic tests of the trailing piezo sensor indicate low resistance and voltage output values, and high capacitance values. This sensor should be replaced.

Both inductive loops indicate low insulation resistance levels and should be repaired at the point of the lead-in splice, if possible, or replaced.

As noted in the Executive Summary, the WIM index value of 0.789 m/km was exceeded for some of the profile passes. The range of WIM Index values are between 0.300 and 0.949. If remedial action is taken it should be done for the entire section. While grinding may sufficiently reduce the observed roughness to meet the recommended levels, it may be necessary to replace the pavement section to achieve the desired levels of smoothness.

At a minimum, the patch area 212 feet prior to the scale area and the patches at the abandoned weigh pad needs to be repaired so not to influence truck movements through the scale area.

A correction of the system classification algorithm needs to be performed to circumvent Class 5 vehicles being identified as Class 4 vehicles. This can be achieved by decreasing the minimum axle spacing for Class 5 vehicles. As this site has very small percentage of Class 4 vehicles, adjusting the algorithm to ensure that all Class 5 vehicles are correctly identified should not adversely affect the classification data quality at this site.

It is recommended that the 2003 WIM data be reevaluated to determine if it should be retained in the database due to the extremely low loading values. Further investigation is also recommended for the weight and classification data for 1992 and 1998. The comparison of the vehicle distributions for the two data types for both years, show inconsistencies. The 1992 loading data indicates a steady increase in loading values over the course of the year. The 1998 data is suspect since Class 5 vehicles significantly diminish in August.

3 Equipment inspection and diagnostics

The site is instrumented with 12-foot MSI piezo weighing sensors, installed twelve feet apart. An 8-foot wide by 6-foot long loop sensor is installed directly preceding the leading piezo sensor and immediately following the trailing piezo sensor. Each piezo sensor is used for speed, spacing determination and weight, while the loops are used for vehicle presence detection. The WIM system utilizes an IRD 1067 WIM Controller for signal processing, data storage, user-interface and remote operation.

A complete electrical check of all support service components including the power service equipment and telephone service was performed. All support equipment appears to be operating properly.

An electronic check of all WIM components was performed. The insulation resistance, capacitance and output voltage measurements for the trailing piezo indicated values outside acceptable tolerances. Both inductive loops indicated insulation resistances below tolerable levels. All other in-road sensors and WIM controller components appear to be working properly.

A visual inspection of all system components, including in-road sensors, cabinet, pull boxes, power and telephone service equipment and conduit was conducted. All components, except those noted above, appear to be in good physical condition.

4 Classification Verification with test truck recommendations

The agency uses a modified FHWA 13-bin classification scheme. A class “0” is added for unknown vehicles.

A sample of 100 vehicles was collected at the site. Video was taken at the site to provide ground truth for the evaluation. Based on a 100 percent sample it was determined that there are 2-percent unknown vehicles and 2-percent unclassified vehicles. The unknown vehicles are typically Class 5 vehicles. The unclassified vehicles are typically Class 5 vehicles with short axle separation (21.6 to 23.3 feet).

The second check is the ability of the algorithm to correctly distinguish between truck classes with no more than 2% errors in such classifications. Table 1 represents the classification error rates by class:

Table 1 Truck Misclassification Percentages for 180600 - 21-Dec-2004

Class	Percent Error	Class	Percent Error	Class	Percent Error
4	100	5	46	6	0
7	N/A				
8	29	9	0	10	0
11	N/A	12	0	13	N/A

The misclassification percentage is computed as the probability that a pair containing the class of interest does NOT include a match. Thus if there are eight pairs of observations with at least one Class 9 and only six of them are matches, the error rate is 25 percent. The percent error and the mean differences reported below do not represent the same statistic. It is possible to have error rates greater than 0 with a mean difference of zero. Table 2 below illustrates these error rates.

Table 2 Truck Classification Mean Differences for 180600 - 21-Dec-2004

Class	Mean Difference	Class	Mean Difference	Class	Mean Difference
4	Unknown	5	-38	6	0
7	N/A				
8	40	9	0	10	0
11	N/A	12	0	13	N/A

These error rates are normalized to represent how many vehicles of the class are expected to be over or under-counted for every hundred of that class observed by the equipment. Thus a value of 0 means the class is identified correctly on average. A number between –1 and –100 indicates at least that number of vehicles was either missed or not assigned to the class by the equipment. It is not possible to miss more than all or one hundred out of one hundred. Numbers 1 or larger indicate how many more vehicles are assigned to the class than the actual "hundred observed". Classes marked Unknown are those identified by the equipment but no vehicles of the type were seen by the observer. There is no way to tell how many more are reported than actually present in the population. N/A means, no vehicles of the class were recorded by either the equipment or the observer.

A review of the site data both collected on site and previously submitted by the agency indicated that Class 8 and Class 9 vehicles constitute at least 10 percent of the truck population. The Class 8s constitute fifteen percent, while the Class 9s comprise seventy percent of the truck population. Based on this information, in addition to the 3S2, the second vehicle used for a validation should also be a Class 9. Based on the review of the loading data, the second Class 9 should be partially loaded when performing a validation.

No additional vehicles are required, due to the short length of the truck turn around.

5 Profile Evaluation

The WIM site is a section of pavement that is 305 meters long with the WIM scale located at 274.5 meters from the beginning of the test section. An ICC profiler was used to collect longitudinal profiles of the test section with a sampling interval of 25 millimeters. The Long Range Index (LRI) incorporates the pavement profile starting 25.8 m prior to the scale and ending 3.2 m after the scale in the direction of travel. The Short Range Index (SRI) incorporates a shorter section of pavement profile beginning 2.7 m prior to the WIM scale and ending 0.5 m after the scale.

Profile data collected at the SPS WIM location by Stantec on June 24, 2004 were processed through the LTPP SPS WIM Index software (Alpha version). This WIM scale is installed on a PCC pavement.

A total of 11 profiler passes were conducted over the WIM site. Since the issuance of the LTPP directive on collection of longitudinal profile data for SPS WIM sections, the requirements have been a minimum of 3 passes in the center of the lane and one shifted to each side. For this site the RSC did 5 passes at the center of the lane, 3 passes shifted to the left side of the lane, and 3 passes shifted to the right side of the lane. Shifts to the sides of the lanes are made such that data is collected as close to the lane edges as safely possible. For each profiler pass, profiles were recorded under both the left wheel path (LWP) and the right wheel path (RWP).

Table 3 shows the computed index values for all 11 profiler passes for this WIM site. The average values over the passes at each path are also calculated when three or more passes are completed. These are shown in the right most column of the table. Values above the index limits are presented in italics.

Table 3 Long Range Index (LRI) and Short Range Index (SRI)

Profiler Passes			Pass 1	Pass 2	Pass 3	Pass 4	Pass 5	Ave.
Center	LWP	LRI (m/km)	0.706	0.669	0.713	0.686	0.694	**0.694**
		SRI (m/km)	0.406	0.350	0.335	0.345	0.351	**0.357**
	RWP	LRI (m/km)	*0.913*	*0.889*	*0.850*	*0.912*	*0.902*	***0.893***
		SRI (m/km)	0.523	0.515	0.584	0.513	0.374	**0.502**
Left Shift	LWP	LRI (m/km)	*0.802*	0.712	*1.062*			***0.859***
		SRI (m/km)	0.607	0.299	0.547			**0.484**
	RWP	LRI (m/km)	*0.804*	*0.798*	*0.848*			***0.817***
		SRI (m/km)	0.448	0.544	0.503			**0.498**
Right Shift	LWP	LRI (m/km)	*0.881*	*0.966*	0.724			***0.857***
		SRI (m/km)	0.257	0.415	0.229			**0.300**
	RWP	LRI (m/km)	*0.916*	*1.001*	*0.929*			***0.949***
		SRI (m/km)	0.516	0.662	0.501			**0.560**

It can be seen from Table 3 that although the SRI Index values on all the passes are below the WIM Index value of 0.789 m/km, the LRI Index values of all the passes, except the LRI values on Center LWP, exceed the WIM Index limit. When all values are less than 0.789 it is presumed unlikely that pavement conditions will significantly influence sensor output. Values above that level may influence the reported weights and potentially vehicle spacings. **Based on the profile data analysis, the Indiana SPS-6 WIM site does not meet the requirements for WIM site locations.** If any remedial action is taken it should be done for the entire section.

Suggested alternatives for pavement corrections at this location are grinding or pavement replacement.

6 Distress survey and any applicable photos

A visual inspection of the pavement 425 feet in advance of the WIM area and 75 feet following the WIM area was conducted. Significant pavement distresses that may affect the performance of the WIM scales were detected.

The pavement is in poor condition, with rutting, cracking and mapping over the entire WIM scale approach, weighing and exit areas. There is a pothole that has been repaired with crack seal located in the right wheel path approximately 212 feet prior to the WIM scales. There is also a crack seal patch at an abandoned loop installation as well as an asphalt patch at an abandoned bending plate installation, both located within the present WIM scale installation site. These distresses are illustrated in Figure 13-1 through Figure 13-3.

7 Vehicle-pavement interaction discussion

A 2-foot long by 1-foot wide patch located in the right wheelpath 212 feet prior to the WIM scale area appears to create significant truck bouncing that continues through the WIM scale area.

Daylight cannot be seen between the tires indicating that the trucks are probably touching the sensors fully. Patches at the abandoned weigh pad and loop installations within the WIM scale area, however, appear to be causing moderate vertical truck movement.

8 Speed data with speed range recommendations for evaluation

Based on the data provided by the LTPP database prior to the visit and the data collected on site the 15th and 85th percentile speeds for Class 9s are 55 mph and 60 mph respectively. The upper end of the range exceeds the posted speed limit. This range does not vary significantly for other truck classes. As a result the recommended speeds for test trucks in an evaluation are 50 and 55 mph.

Measurements of speeds on-site indicated that the equipment is currently measuring speeds with a bias of +0.1 mph and an associated standard deviation of 1 mph.

The review of drive axle spacings for Class 9 vehicles indicates that this is not affecting the measurements of length and therefore vehicle classification. From on-site observation supported by video recording the site carries standard drive tandems for Class 9s indicating that the average drive axle spacing to be 4.35 feet. The data collected by the equipment shows the average drive axle spacings of Class 9s to be 4.25 feet.

9 Traffic Data Review: Overall Quantity and Sufficiency

As of December 21, 2004 this site does not have at least 5 years of research quality data.

Research quality data is defined to be at least 210 days in a year of data of known calibration meeting LTPP's precision requirements. The precision requirements are shown in Table 4. No information is available on the precision or bias of the weight data.

Table 4 Precision and Bias Requirements for Weight Data

Pooled Fund Site	95 Percent Confidence Limit of Error
Single Axles	± 20 percent
Axle groups	± 15 percent
Gross Vehicle Weight	± 10 percent
Vehicle Speed	±1 mph (2 kph)
Axle Spacing	± 0.5 ft (150 mm)

Data that has validation information available is reviewed in light of the patterns present in the two weeks immediately following a validation/calibration activity. A determination of research quality data is based on the consistency with the validation pattern. Data that follows consistent and rational patterns in the absence of calibration information may be considered nominally of research quality pending validation information with which to compare it. Data that is inconsistent with expected patterns and has no supporting validation information is not considered research quality.

The amount and coverage for the site is shown in Table 5. The value for months is a measure of the seasonal variation in the data. The indicator of coverage indicates whether day of week variation has been accounted for on an annual basis. As can be seen from the table 1992 and 1998 have a sufficient quantity for classification data and only 2003 has sufficient weight data to be considered complete years of data. **In the absence of previously gathered validation information it can be seen that at least 5 additional years of research quality data are needed to meet the goal of a minimum of 5 years of research weight data.**

Table 5 Amount of Traffic Data Available

Year	Class Days	Months	Coverage	Weight Days	Months	Coverage
1991	30	1	Complete Week	31	1	Complete Week
1992	237	9	Complete Week	190	9	Complete Week
1998	359	12	Complete Week	180	7	Complete Week
2003	151	6	Complete Week	231	8	Complete Week

To evaluate the consistency of the existing data and determine its probable quality a series of reports and graphs have been generated. They include the SPS Summary report, vehicle distribution graphs, GVW distributions both over all years and by month within years, average daily steering axle weights for Class 9 vehicles, and ESAL graphs.

Based on this review it is recommended that the 2003 WIM data be reevaluated to determine if it should be retained in the database due to the extremely low loading values. Further investigation is recommended for the weight and classification data for 1992 and 1998. The comparison of the vehicle distributions for the two data types for both years, show inconsistencies. The 1992 loading data indicates a steady increase in loading values over the course of the year. The 1998 data is suspect since Class 5 vehicles significantly diminish in August.

9.1 SPS Summary Report

The overall report is the SPS Summary Report. This report uses sets of benchmark data based on calibration information or consistent, rational data patterns. The report shows the trend in some basic statistics at the site over time. It provides a numeric equivalent to the graphs typically run for the comparison evaluation process. It includes the number of days of data and statistics associated with Class 9 vehicles. They include the average volumes, average ESALs, the average steering axle weight and mean loaded and unloaded weight on a monthly basis. Class Days and Percent Class 9s are generated from classification data submissions. All other values come from the weight data submissions. Counts derived from weight data are available for all months. Steering axle and weight statistics are only present when that data was loaded through LTPP's present traffic analysis software, since it is the only software that calculates them. Where there is no validation record an initial time point has been picked at which continuous data exists and that data is used as the basis for comparison. Excluded months have no data.

Table 6 SPS Summary Report

Indiana 0600

North Lane 1

Comparison Date Weight - 01-December-1991 Classification - 01-December-1991

Month-Year	Class Days	Percent Class 9s	Weight Days	Average No. Class 9s	Avg.ESALs Per Class 9	Average Class 9 Steering	Mean Loaded Weight	Mean Unloaded Weight
Comparison values		15.3		555	0.95	9,518	81,538	34,254
DEC 1991	30	12.3	31	479	0.95	9,540	73,792	33,119
JAN 1992	31	15.7	31	540	1.02	9,766	74,471	33,565
FEB 1992	29	10.5	21	535	0.78	9,179	73,805	32,927
MAR 1992	25	12.7	25	517	1.15	10,008	77,539	33,843
APR 1992	27	2.4	8	358	0.90	7,775	77,610	34,113
MAY 1992	31	6.3	18	497	1.40	10,481	81,169	34,747
JUN 1992	28	13.2	28	608	1.48	10,418	81,601	35,034
JUL 1992	31	6.0	19	462	1.28	9,671	81,663	34,859
AUG 1992	31	11.8	31	576	1.35	10,695	81,732	35,175
OCT 1992	4	18.9	9	418	1.35	10,672	81,747	35,078
JAN 1998	31	18.3	31	777	1.47	11,426	82,305	36,219
FEB 1998	28	17.7	28	821	1.57	11,563	85,085	36,486
MAR 1998	31	17.7	31	848	1.58	11,455	82,377	36,194
APR 1998	29	16.7	30	881	1.33	10,735	78,397	34,642
MAY 1998	31	14.7	31	812	1.48	10,905	81,497	35,022
JUN 1998	28	14.6	29	711	1.61	11,152	81,966	35,482
JUL 1998	31	10.2						
AUG 1998	31	10.2						
SEP 1998	30	11.4						
OCT 1998	29	12.6						
NOV 1998	30	12.0						
DEC 1998	30	12.2						
MAY 2003	10	11.3	25	519	0.29	7,894	54,918	25,443
JUN 2003	30	13.0	30	730	0.33	8,487	55,219	25,721
JUL 2003	31	12.9	31	747	0.32	8,437	55,147	25,490
AUG 2003	31	12.3	31	738	0.32	8,398	55,291	25,469
SEP 2003	30	15.2	30	837	0.28	8,060	54,920	22,623
OCT 2003	19	15.0	25	834	0.22	7,640	54,883	22,438
NOV 2003			30	548	0.16	7,588	55,116	25,875
DEC 2003			29	439	0.09	6,650	62,300	22,360

From the table it can be seen that the percentage of class 9s varies significantly from month to month for the years 1991 and 1992. It is fairly constant for years 1998 and 2003, with lesser values for both years during the summer months of July and August. The average Class 9 volumes for years 1998 and 2003 are significantly greater than 1991 and 1992, which not unreasonable given the time lapse between data submissions. The ESAL values are significantly higher in 1998 when compared to 1991 and 1992 and are drastically lower for 2003. Steering axle weights, and loaded and unloaded mean values follow a similar trend, with moderately higher values in 1998 and extremely lower values in 2003.

9.2 Vehicle Distribution

The vehicle distribution graphs indicate whether the fleet mix is stable over time and if any day of week or seasonal patterns may exist. The vehicle distribution graphs contain two types of comparisons, one for heavy trucks and one for all trucks. The heavy truck comparison is used to remove potential problems in Class 4 and Class 5 determination. The all trucks comparison is used to make the between equipment review simpler. Whether or not the data is equivalent is perhaps more important than the variation over time.

Figure 14-1 shows the by week pattern for heavy truck classification data. The individual weeks show essentially the same heavy truck mix. Each vehicle class 6 through 13 that constitutes at least 10 percent of the heavy truck population is expected to stay within plus or minus 5 percent of the value observed during the two weeks following validation. This range is shown by the darker band inside the lighter band to the right of the weekly data. Weeks that go outside more than plus or minus 10 percent of the expected value will fall above or below the light gray areas of the band. These are weeks that should have been subjected to additional scrutiny prior to accepting the data as reasonable.

For this site, the fleet mix is comparatively stable for 1991 and 2003. There was no significant difference in the mix stability graphed for the weight data as illustrated in Figure 14-2. In 1992 the Class 8 percentages increased as the Class 9 percentages fell below the lower expected limits as shown in Figure 14-3. When the Class 9 percentages fell out of the expected bounds in the second half of 1998, the percentage of Class 14s and 15s increased as shown in Figure 14-4.

The between types comparison for all trucks is represented by two columns for every time unit present. The column on the left labeled with a 4 is for classification data. The right hand column of the pair is for weight data. Figure 14-5 shows the pattern for vehicle distribution by month by year for the data collected from the classifier versus the data collected by the WIM equipment. Truck traffic at this location is dominated by Class 9s. The data collected for all the months in 2001 and 2003 appear to be similar. The classifier data for months February, April, May and July in 1992 are significantly less than the WIM data. Conversely, when data is available for 1998 the classifier data exceeds the WIM data. In 1998, Class 5 vehicles greatly diminish from August on as illustrated in Figure 14-6.

9.3 GVW Distributions for Class 9s

The Class 9 GVW graph is a generally accepted way to evaluate loading data reported at a site. A typical graph has two peaks, one between 28,000 and 36,000 pounds and the other between 72,000 and 80,000 pounds. The first is the unloaded peak. The second, the loaded peak, reflects the legal weight limit for a 5-axle tractor-trailer vehicle on the interstate highway system. Additionally, it is expected that less than 3 percent of the trucks will be excessively light (less than 12,000 pounds) and less than 5 percent will be significantly overweight (in excess of 96,000 pounds). Data that falls outside of the expected conditions needs a record of validation to verify that the pattern is in fact correct for the location. Data meeting the expected patterns is not automatically considered to be of research quality, merely rational as bias in scale measurements may shift the peaks in the data from their true values.

The overall assessment of loading patterns is done using a Class 9 GVW graph by year over the available years. In Figure 14-7 and Figure 14-8 the typical pattern is shown in the red line with solid red squares. It can be seen from these figures that the loading patterns for years 1991, 1992 and 1998 are almost the same except that the unloaded and loaded peaks gradually shift slightly higher as the year's progress. In 2003 the loading pattern is significantly different from the other years in that the unloaded and loaded peaks fall well below their expected ranges with the loaded peak nearly within the unloaded peak range. The reason for this change cannot be determined from the available data.

To investigate any seasonal variations the Class 9 GVW distributions are graphed by month by year. As shown in Figure 14-9, there is no significant difference between the three months. A similar lack of seasonal variation is present for all years of loading data, whether the pattern is the expected one or not.

9.4 Axle Distributions

GVW graphs were available for all years. No axle distribution graphs were required.

9.5 ESALs per year

Average ESALs for Class 9 vehicles are a very crude method of identifying loading shifts. Figure 14-10 shows the average Class 9 ESALs per month for this location. To remove the influence of changing pavement structure all ESAL values have been computed with an SN = 5 and a p_t of 2.5. Average ESALs per Class 9 are not used as an indicator of research quality data.

For years 1992 and 1998, the average ESALS increase over the period of years. In 2003, the average ESALS drops during the year and is significantly lower than in previous years.

9.6 Average Daily Steering Axle Weight

A frequently used statistic for checking scale calibration and doing auto-calibration of WIM equipment is the weight of the front axle. This value is site specific and should be relatively constant particularly for loaded Class 9s (vehicles in excess of 60,000 lbs.). Typically when auto calibration is used this value either cycles repeatedly or with very large truck volumes results in an essentially straight line for the mean. The steering axle weights are between 10,000 and 12,000 through 1998. As shown in Figure 14-12, in 2003 the steering axle remains constant at 8,000 and then suddenly begins to decrease in October, averaging 6,300 by the end of December.

10 Updated handout guide and Sheet 17

A copy of the post-visit handout guide has been included following page 19. It includes a current Sheet 17 with all applicable maps and photographs. There are no significant changes in the information provided.

11 Updated Sheet 18

A current Sheet 18 as provided by the State, indicating the contacts, conditions for assessments and evaluations has been attached following the updated handout guide.

12 Traffic Sheet 16(s) (Classification Verification only)

Sufficient classification information was collected between 11:35 am and 1:40 pm on December 21, 2004 to complete a Sheet 16. A copy is attached following the Sheet 18 information.

13 Distress Photographs

Figure 13-1 Pavement Condition in the Upstream Direction at 180600

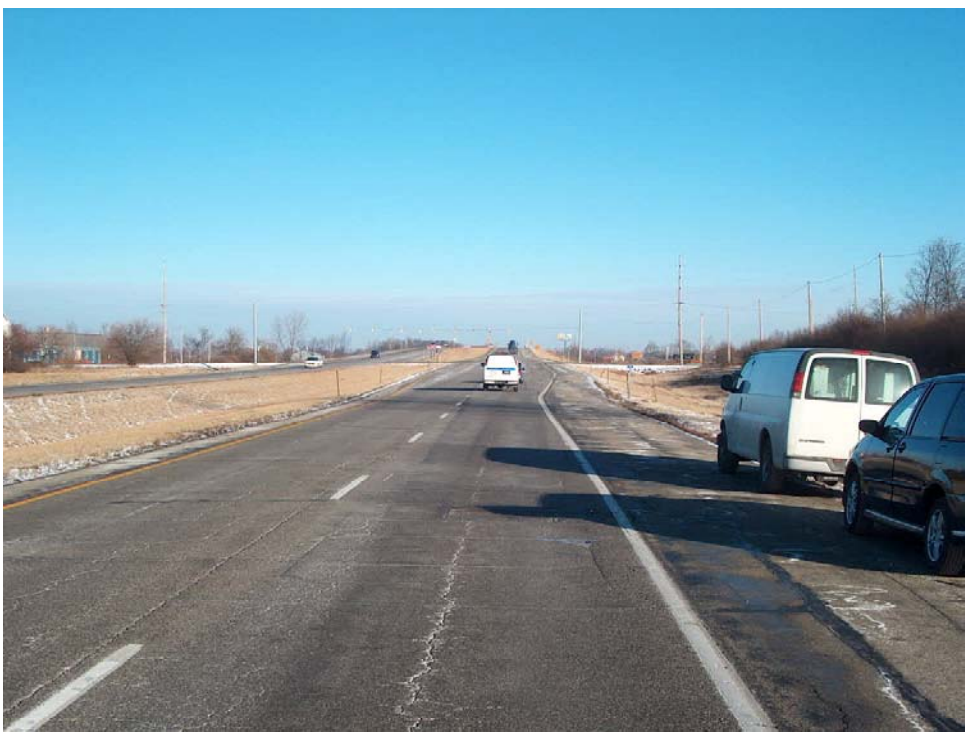

Figure 13-2 Pavement Condition in the Downstream Direction at 180600

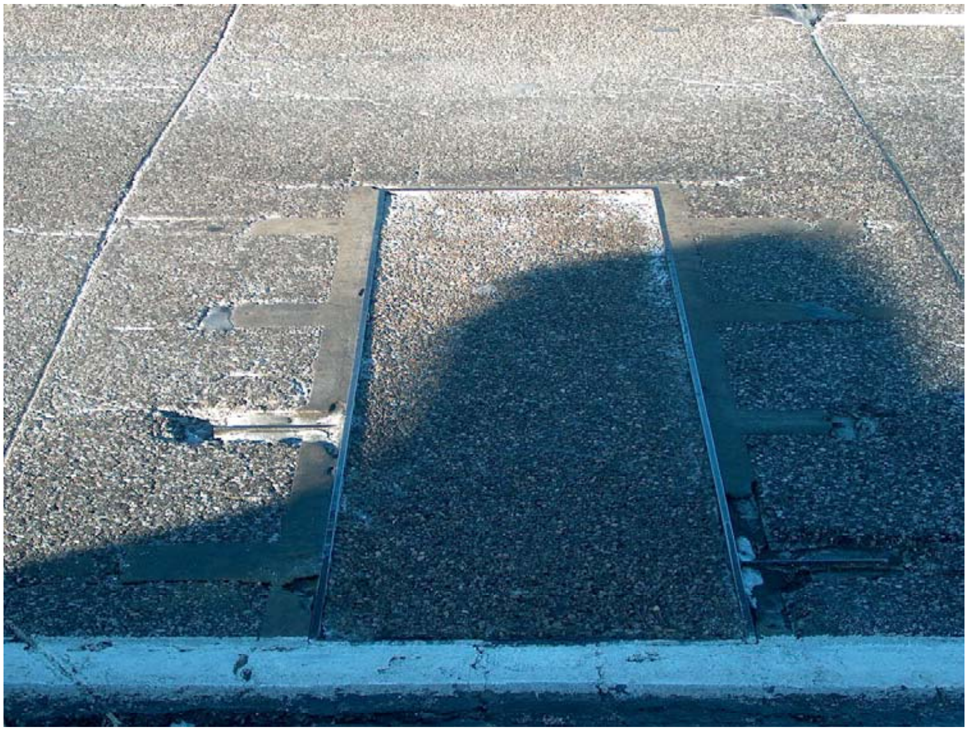

Figure 13-3 Abandoned Bending Plate Installation at 180600

14 Traffic Graphs

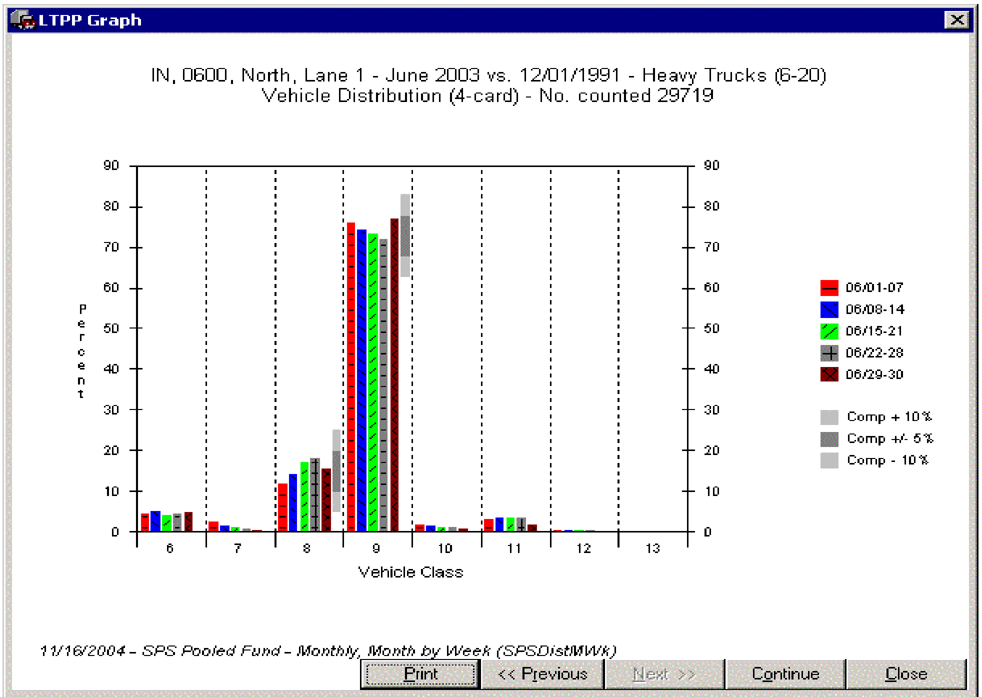

Figure 14-1 Heavy Truck Distribution Pattern for Classification Data for 180600

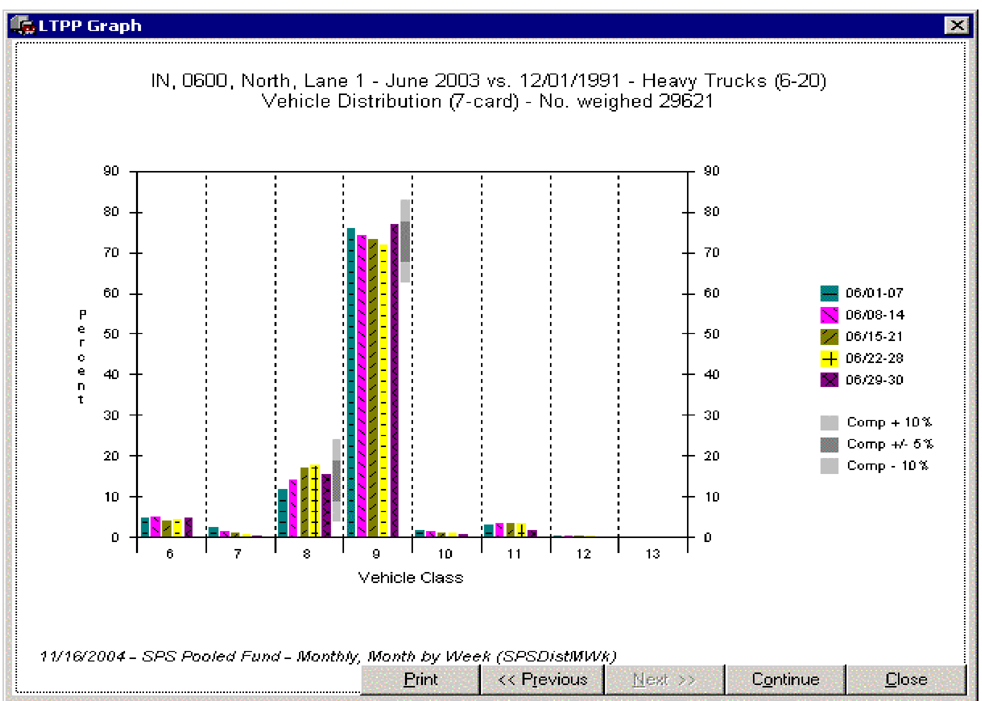

Figure 14-2 Heavy Truck Distribution Pattern for Weight Data for 180600

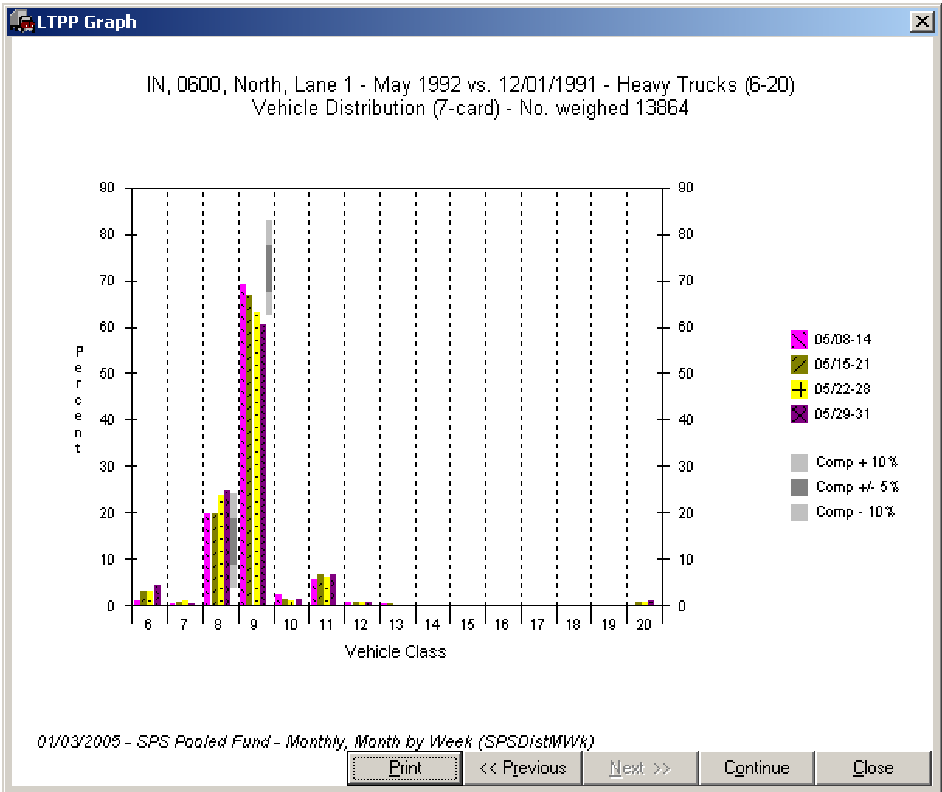

Figure 14-3 Decrease in Class 9s and Increase in Class 8s - May 1992 180600

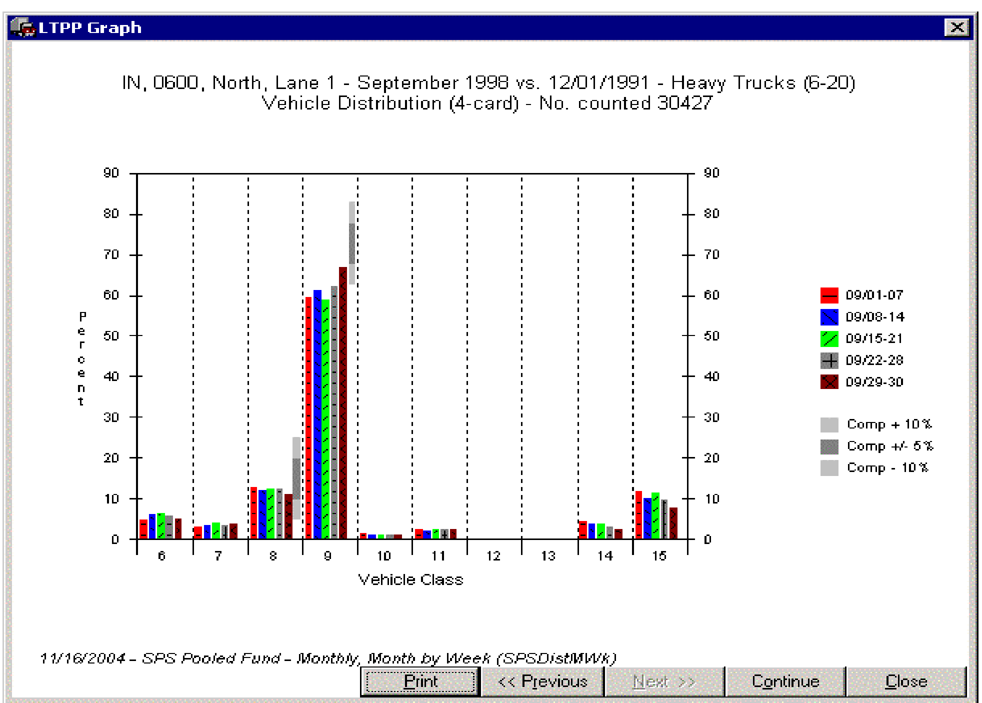

Figure 14-4 Change in Class 9, 15 and 15 percentages for 1998 - 180600

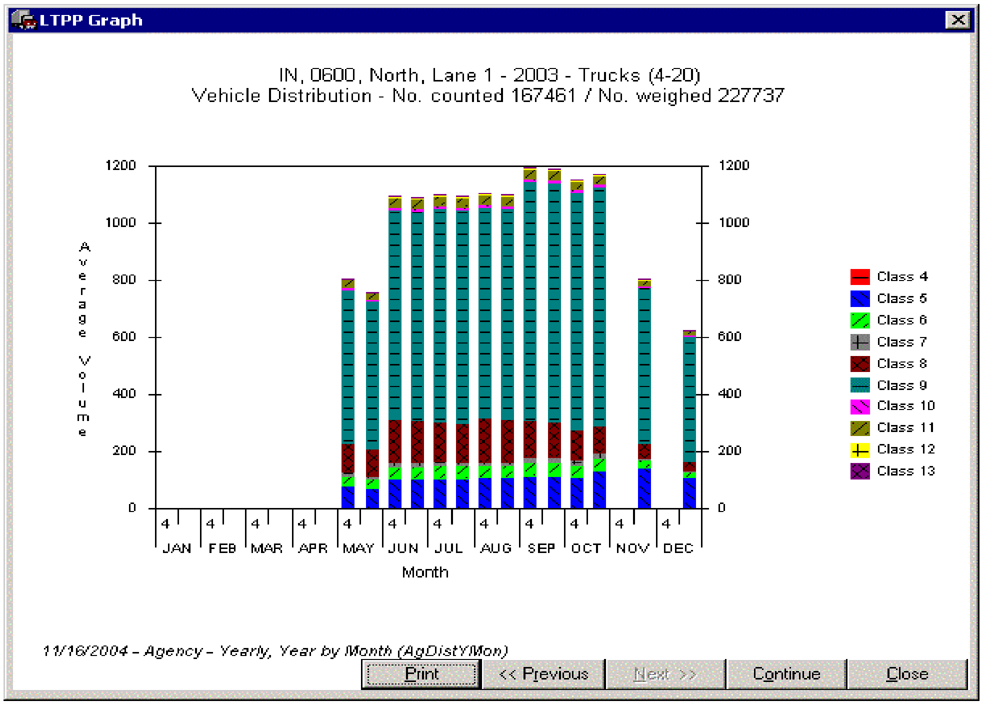

Figure 14-5 Truck Distribution by Month for the Year 2003 for 180600

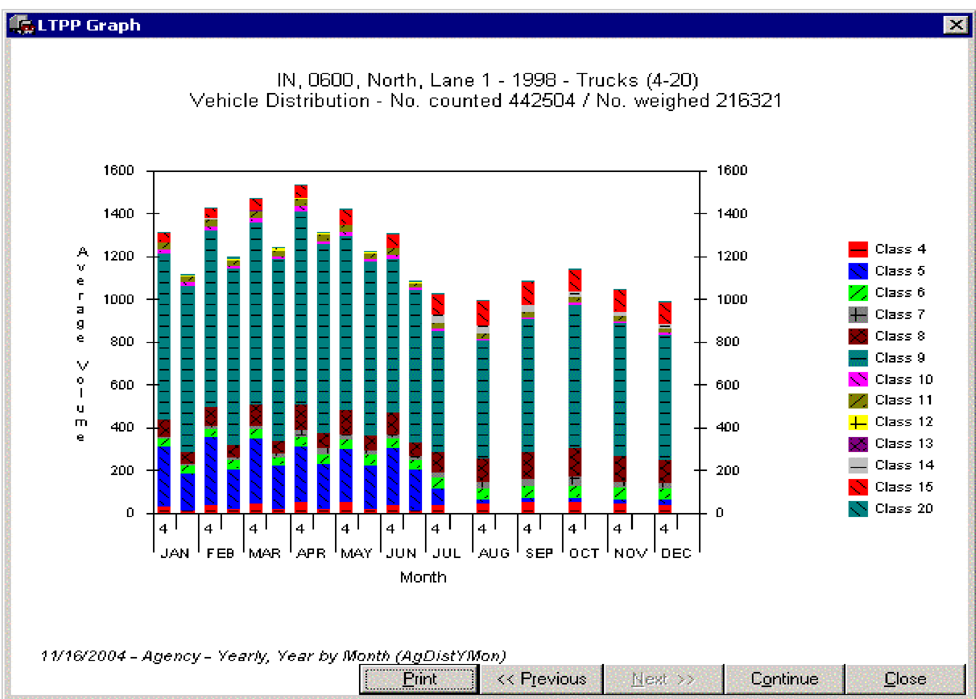

Figure 14-6 Class 5 Reduction for the Year 1998 for 180600

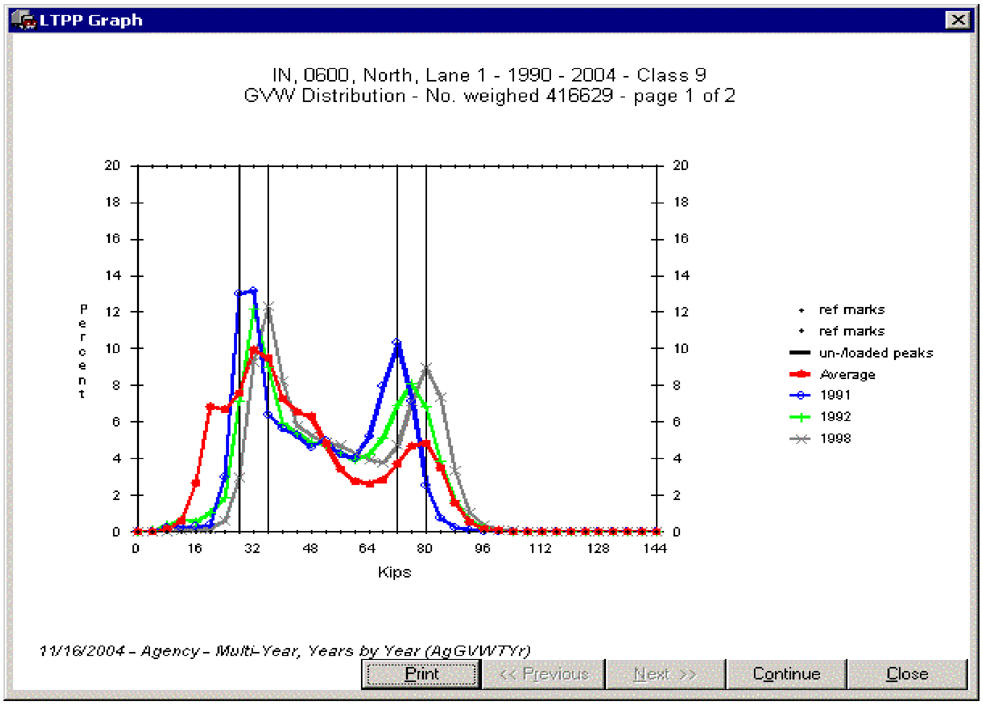

Figure 14-7 Class 9 GVW Distribution - 1991 to 2003 for 180600 (page 1 of 2)

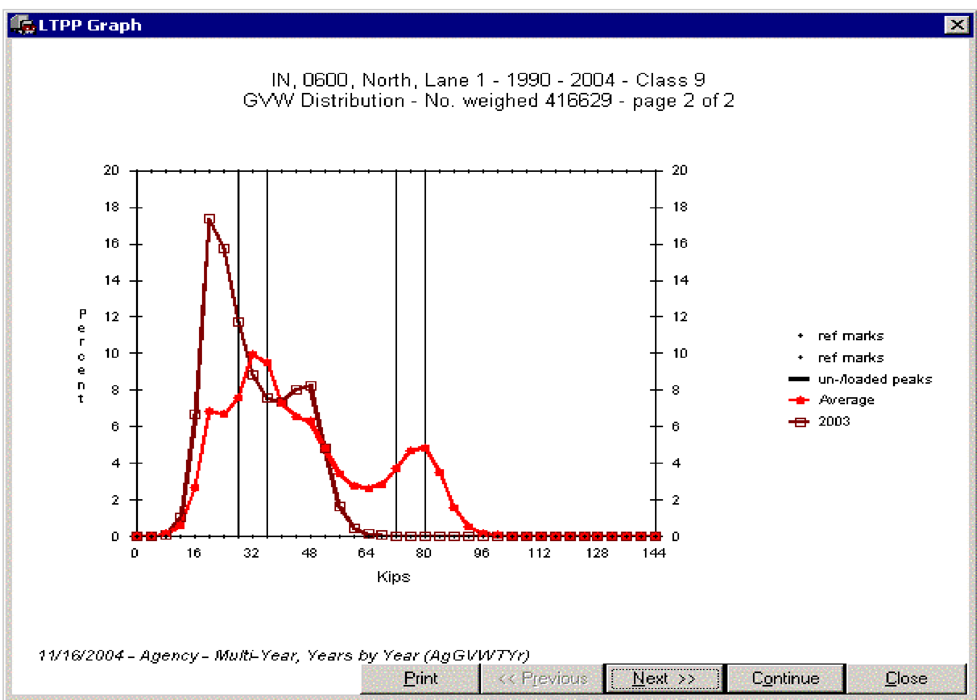

Figure 14-8 Class 9 GVW Distribution - 1991 to 2003 for 180600 (page 2 of 2)

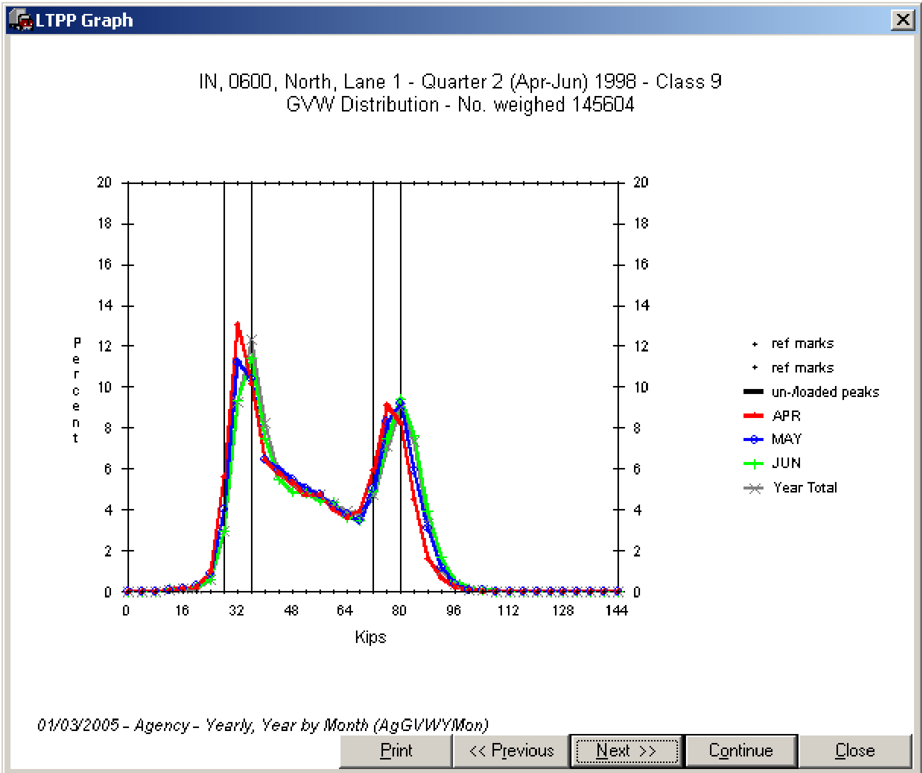

Figure 14-9 Class 9 GVW Distribution – July to June 1998- 180600

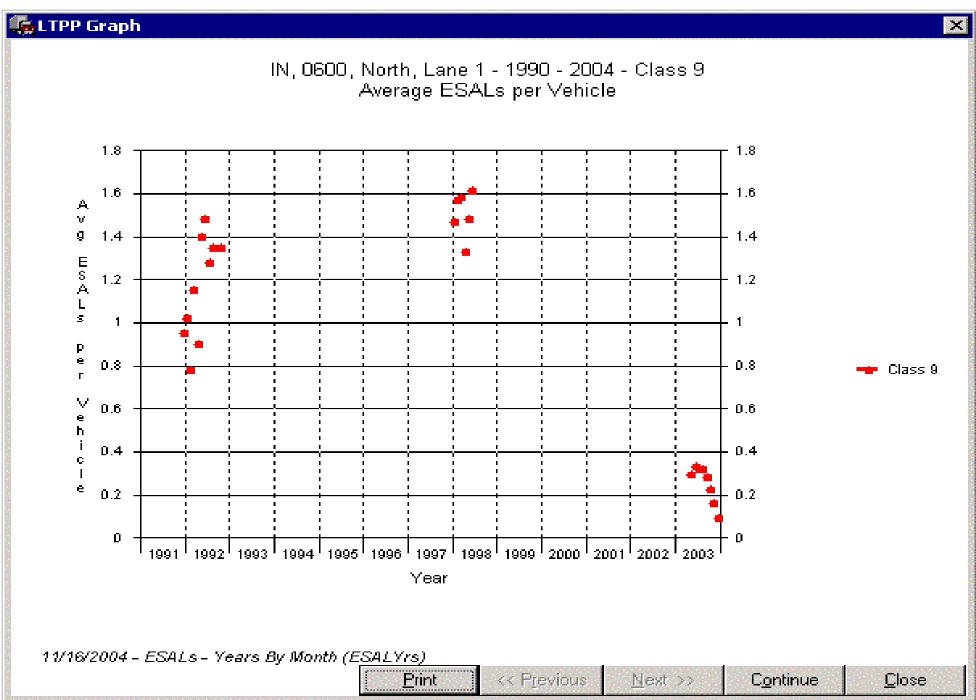

Figure 14-10 Average Class 9 ESALs for site from 1991 to 2003 for 180600

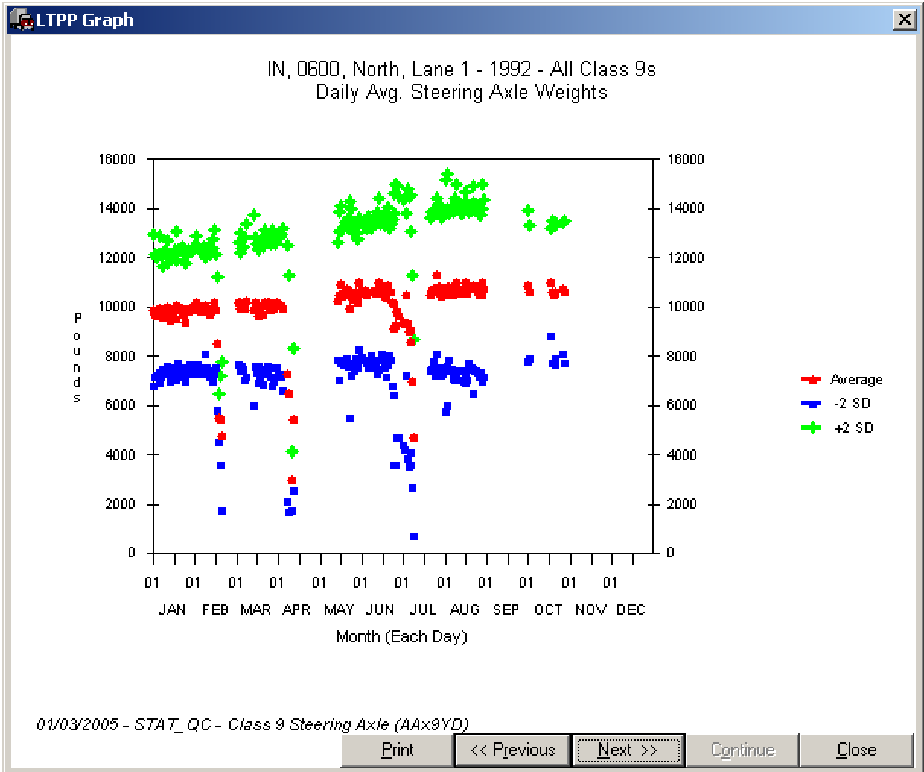

Figure 14-11 General Pattern for Steering Axle Weights through 1998 – 180600

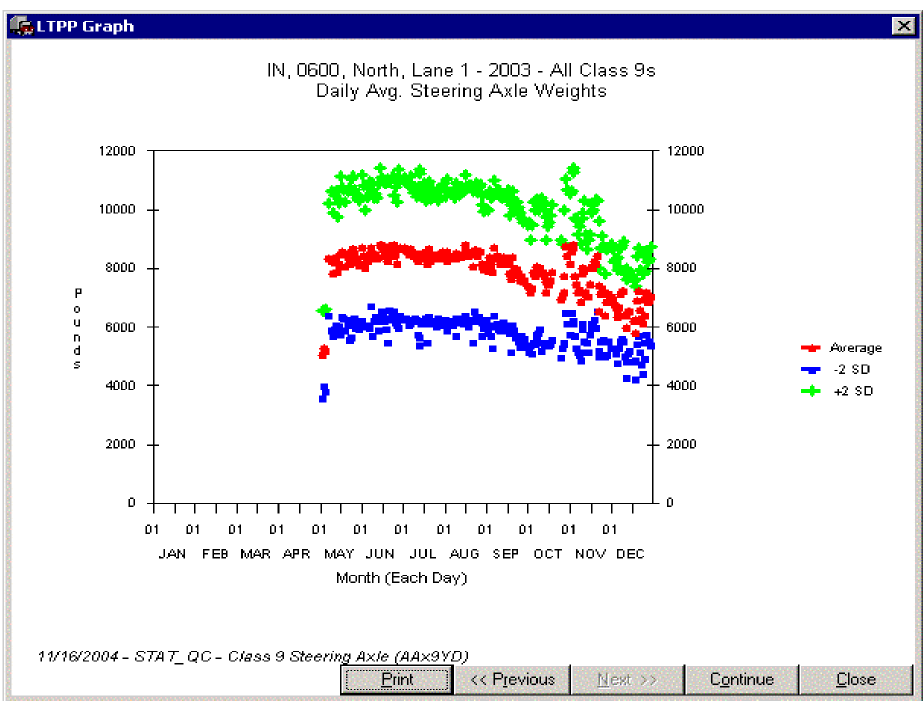

Figure 14-12 Average Daily Class 9 Steering Axle Weight - 2003 for 180600

POST-VISIT HANDOUT GUIDE FOR SPS WIM FIELD ASSESSMENT

STATE: Indiana

SHRP ID: 180600

Figures

1. General Information

SITE ID: *180600*

LOCATION: *US Route 31 north (M.P. 216.9)*

VISIT DATE: *December 21, 2004*

VISIT TYPE: *Assessment*

2. Contact Information

POINTS OF CONTACT:

Assessment Team: *Dean J. Wolf, 301-210-5105, djwolf@mactec.com*

Highway Agency: *Tommy Nantung, 765-463-1521 x248, tnantung@indot.state.in.us*

William Flora, 317-233-1060, wflora@indot.state.in.us

Marcia Gustafson, 317-232-5134, mgustafson@indot.state.in.us

Phillip Zurawski, 317-232-5463, pzurawski@indot.state.in.us

Kirk Mangold, 317-233-3690, kmangold@indot.state.in.us

Donn Klepinger, 317-502-2258(c), dklepinger@indot.state.in.us

FHWA COTR: *Debbie Walker, 202-493-3068, deborah.walker@fhwa.dot.gov*

FHWA Division Office Liaison: *Victor (Lee) Gallivan, 317-226-7493, victor.gallivan@fhwa.dot.gov*

LTPP SPS WIM WEB PAGE: *http://www.tfhrc.gov/pavement/ltpp/spstraffic/index.htm*

3. Agenda

BRIEFING DATE: *No briefing requested.*

ON SITE PERIOD: *December 21, 2004 beginning at 9:00 a.m.*

TRUCK ROUTE CHECK: *Completed*

4. Site Location/ Directions

NEAREST AIRPORT: *Fort Wayne International Airport, Fort Wayne, Indiana.*

DIRECTIONS TO THE SITE: *US Route 31, 0 .6 miles south of State Road 10.*

MEETING LOCATION: *On site beginning at 9:00 a.m.*

WIM SITE LOCATION: *US Route 31 north (M.P. 216.9) (Latitude: 41.2290 ^{0} and Longitude: -86.2610^{0})*

WIM SITE LOCATION MAP: *See Figure 4.1*

Figure 4-1 Site 180600 in Indiana

5. Truck Route Information

ROUTE RESTRICTIONS: *None*

SCALE LOCATION: *Crazy D's, Route 30 & Route 31, Plymouth, IN; 2.0 miles; Phone: 574-936-6688, Fax: 574-936-6486, Manager: Mary Malekcar; Latitude: 41.36201 Longitude: -86.30704 ; Open 24/7; $8.00 per weigh.*

TRUCK ROUTE:

- *Northbound: 0 .6 miles to SR10 intersection*
- Southbound: 0 .98 miles to 18th Road

6. Sheet 17 – Indiana (180600)

1.* ROUTE ___US-31_____MILEPOST _216.9_LTPP DIRECTION - N S E W

2.* WIM SITE DESCRIPTION - Grade __<_1___ % Sag vertical Y / N
Nearest SPS section upstream of the site __0_6_0_7__ __
Distance from sensor to nearest upstream SPS Section _3__3__8__0___ ft

3.* LANE CONFIGURATION
Lanes in LTPP direction __2__ Lane width _1_ 2_ ft

Median - 1 – painted
2 – physical barrier
3 – grass
4 – none

Shoulder - 1 – curb and gutter
2 – paved AC
3 – paved PCC
4 – unpaved
5 – none

Shoulder width __1_0___ ft

4.* PAVEMENT TYPE ____Asphalt______________

5.* PAVEMENT SURFACE CONDITION – Distress Survey
Date ____12-21-04__Photo__Downstream_TO_7_18_143_0600_12_21_04.JPG_
Date ____12-21-04 _ Photo _Upstream_TO_7_18_143_0600_12_21_04.JPG_______
Date ______________________Distress Photo Filename _________________

6. * SENSOR SEQUENCE
____________________loop – piezo – piezo – loop _____________________

7. * REPLACEMENT AND/OR GRINDING __ __ __ / __ __ / __ __ __ __
REPLACEMENT AND/OR GRINDING __ __ __ / __ __ / __ __ __ __
REPLACEMENT AND/OR GRINDING __ __ __ / __ __ / __ __ __ __

8. RAMPS OR INTERSECTIONS
Intersection/driveway within 300 m upstream of sensor location Y / N
distance __________
Intersection/driveway within 300 m downstream of sensor location Y / N
distance __7_5_6_f_t_
Is shoulder routinely used for turns or passing? Y / N

9. DRAINAGE (*Bending plate and load cell systems only)*
1 – Open to ground
2 – Pipe to culvert
3 – None

Clearance under plate ___ ___ . ___ in
Clearance/access to flush fines from under system Y / N

10. * CABINET LOCATION

Same side of road as LTPP lane Y / N   Median Y/ N   Behind barrier Y / N

Distance from edge of traveled lane _7__1__ ft

Distance from system __9__4__ ft

TYPE _____M____________________

CABINET ACCESS controlled by LTPP / STATE / JOINT ?

Contact - name and phone number __ Donn Klepinger (317) 591-5264_

Alternate - name and phone number _ Kirk Mangold, 317-233-3690__

11. * POWER

Distance to cabinet from drop ___5___ ___ ft   Overhead / underground / solar / AC in cabinet?

Service provider _____________________   Phone number _______________

12. * TELEPHONE

Distance to cabinet from drop ___5___ ___ ft   Overhead / under ground / cell?

Service provider _____________________   Phone Number _______________

13.* SYSTEM (software & version no.)- ___IRD 1067____________________________

Computer connection – RS232 / Parallel port / USB / Other ________________

14. * TEST TRUCK TURNAROUND time ___7___ minutes   DISTANCE _2.94_ mi

15. PHOTOS	FILENAME
Power source	__Power_Service_2_TO_7_18_143_0600_12_21_04.JPG______
Phone source	__Telephone_Pedestal_TO_7_18_143_0600_12_21_04.JPG____
Cabinet exterior	__Cabinet_Exterior_2_TO_7_18_143_0600_12_21_04.JPG_____
Cabinet interior	__Cabinet_Interior_2_TO_7_18_143_0600_12_21_04.JPG_____
Weight sensors	__Leading_WIM_Sensor_TO_7_18_143_0600_12_21_04.JPG__
Classification sensors	__Trailing_WIM_Sensor_TO_7_18_143_0600_12_21_04.JPG__
Other sensors	__Leading_Loop_Sensor_TO_7_18_143_0600_12_21_04.JPG__
Other sensors	__Trailing_Loop_Sensor_TO_7_18_143_0600_12_21_04.JPG__

Downstream direction at sensors on LTPP lane
_Downstream_TO_7_18_143_0600_12_21_04.JPG________________

Upstream direction at sensors on LTPP lane
_Upstream_TO_7_18_143_0600_12_21_04.JPG__________________

COMMENTS __ ____
______________GPS Coordinates: Latitude: 41.2290^0 and Longitude: -86.2610^0_______
____
_______Amenities - ____
____
___________0.6 miles north – McDonald's, Subway, BP Gas ____________________
___________10 miles north (Plymouth) – various hotels, gas, restaurants, ACE _______
________________hardware____

COMPLETED BY _____Dean J. Wolf_______________

PHONE _(301) 210-5105________ DATE COMPLETED _1_2_ /_2_1_ / _2_0_0_4__

Sketch of equipment layout

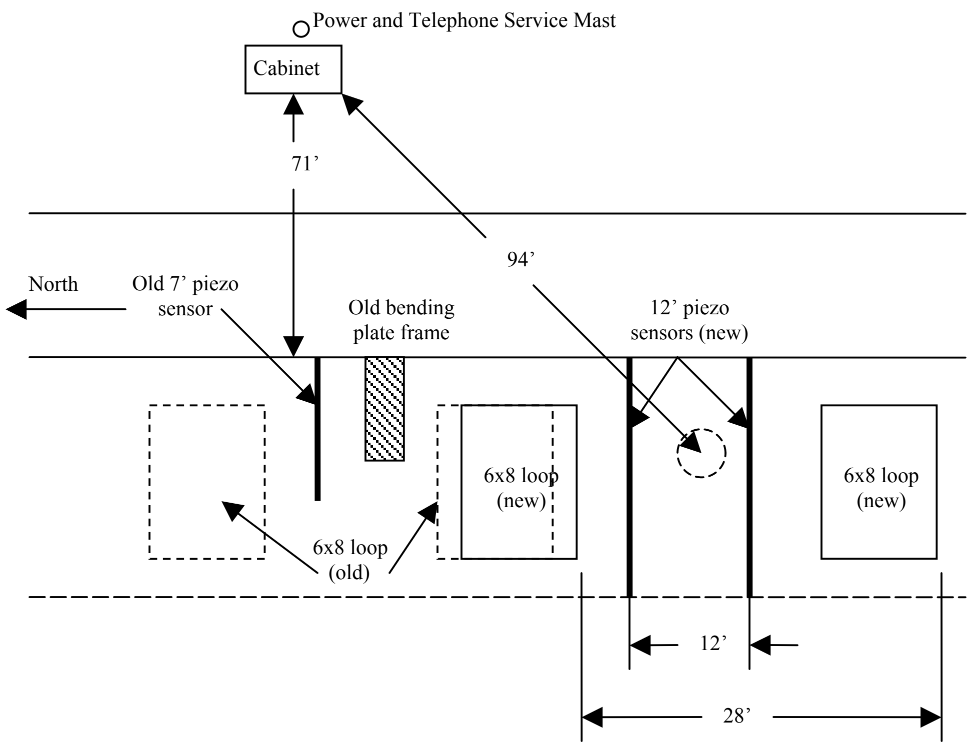

Figure 6-1 Equipment Layout 180600

Site Map

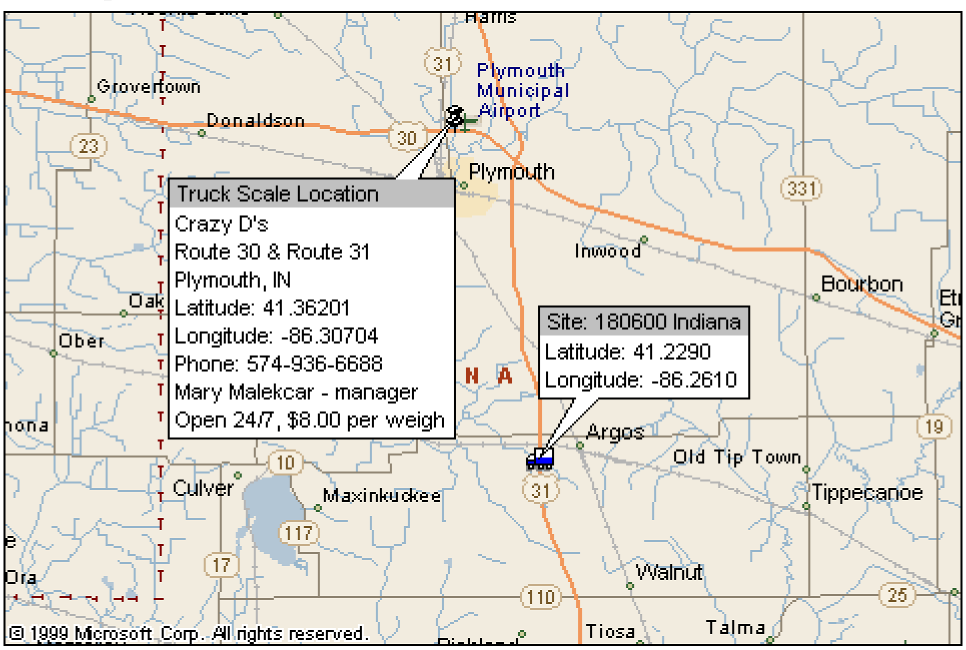

Figure 6-2 Site Map of 180600 in Indiana

Cabinet_Exterior_TO_7_18_143_0600_12_21_04.JPG

Cabinet_ Interior_ TO_7_18_143_0600_12_21_04.JPG

Leading_Loop_Sensor_TO_7_18_143_0600_12_21_04.JPG

Leading_WIM_Sensor_TO_7_18_143_0600_12_21_04.JPG

Trailing_WIM_Sensor_TO_7_18_143_0600_12_21_04.JPG

Trailing_Loop_Sensor_TO_7_18_143_0600_12_21_04.JPG

Power_Service_TO_7_18_143_0600_12_21_04.JPG

Telephone_Pedestal_TO_7_18_143_0600_12_21_04.JPG

Telephone_Service_Box_TO_7_18_143_0600_12_21_04.JPG

SHEET 18	STATE CODE [_18_]
LTPP MONITORED TRAFFIC DATA	SPS PROJECT ID [_0600 _]
WIM SITE COORDINATION	DATE: (mm/dd/yyyy) 12 /21/ 2004

Rev. 05/18/04

1. DATA PROCESSING –

a. Down load –

x State only
□ LTPP read only
□ LTPP download
□ LTPP download and copy to state

b. Data Review –

□ State per LTPP guidelines
x State – □ Weekly □ Twice a Month □ Monthly □ Quarterly x Annual
□ LTPP

c. Data submission –

□ State – □ Weekly □ Twice a month □ Monthly □ Quarterly x Bi-monthly
□ LTPP

2. EQUIPMENT –

a. Purchase –

□ LTPP
x State

b. Installation –

x Included with purchase
□ Separate contract by State
□ State personnel
□ LTPP contract

c. Maintenance –

□ Contract with purchase
□ Separate contract LTPP
x Separate contract State
□ State personnel

d. Calibration –

x Vendor
□ State
□ LTPP

e. Manuals and software control –

x State
□ LTPP

f. Power –

i. Type –

x Overhead
□ Underground
□ Solar

ii. Payment –
- x State
- ☐ LTPP
- ☐ N/A

g. Communication –

i. Type –
- x Landline
- ☐ Cellular
- ☐ Other

ii. Payment –
- x State
- ☐ LTPP
- ☐ N/A

3. PAVEMENT –

a. Type –
- x Portland Concrete Cement
- x Asphalt Concrete

b. Condition –
- ☐ Always new
- x Replacement as needed
- ☐ Grinding and maintenance as needed
- ☐ Maintenance only
- ☐ No remediation

c. Profiling Site Markings –

i. Short wave –
- x Permanent
- ☐ Temporary

ii. Long wave –
- x Permanent
- ☐ Temporary

4. ON SITE ACTIVITIES –

a. WIM Validation Check - advance notice required __14_ days / weeks

b. Notice for straightedge and grinding check - __14__ days / weeks

i. On site lead –
- x State
- ☐ LTPP

ii. Accept grinding –
- x State
- □ LTPP

c. Calibration Routine –
- □ LTPP – □ Semi-annually □ Annually
- □ State per LTPP protocol – □ Semi-annually □ Annually
- x State other – _____Annual____________________

d. Test Vehicles

i. Trucks –

1st – Air suspension 3S2	□ State	□ LTPP
2nd – class 9 semi_______	x State	□ LTPP
3rd – _______________	□ State	□ LTPP
4th – _______________	□ State	□ LTPP

ii. Loads – 74,000-79000 x State □ LTPP

iii. Drivers – □ State □ LTPP

e. Contractor(s) with prior successful experience in WIM calibration in state:

_____International Road Dynamics (IRD)

f. Access to cabinet

i. Personnel Access –
- x State only
- □ Joint
- □ LTPP

ii. Physical Access –
- x Key
- □ Combination

g. State personnel required on site – x Yes □No

h. Traffic Control Required – □Yes x No

i. Enforcement Coordination Required – □Yes x No

j. Authorization to calibrate site –
- x State only
- □ LTPP

5. SITE SPECIFIC CONDITIONS –

a. Funds and accountability – ____

b. Reports – ____

c. Other – ____

SHEET 18	STATE CODE	[_18_]
LTPP MONITORED TRAFFIC DATA	SPS PROJECT ID	[_0600 _]
WIM SITE COORDINATION	DATE: (mm/dd/yyyy)	12 /21/ 2004

Rev. 05/18/04

6. CONTACTS –

a. Equipment (operational status, access, etc.) –

Name: _____Lowell Basey______________ Phone:317-591-5262______

Agency: ___INDOT______________________________________

b. Data Processing and Pre-Visit Data –

Name: _Marcia Gustafson______________ Phone: 317-232-5134______

Agency: ___INDOT______________________________________

c. Construction schedule and verification –

Name: __Larry Torrance_______________ Phone: _317-591-5265____

Agency: ___INDOT______________________________________

d. Test Vehicles (trucks, loads, drivers) –

Name: __Jeff Wourms________________ Phone: _317-694-4224_____

Agency: ___IRD______________________________________

e. Traffic Control –

Name: ___Larry Torrance______________ Phone: _317-694-4224_____

Agency: ______same_____________________________________

f. Enforcement Coordination –

Name: _______________________ Phone: _________________

Agency: ____

SHEET 16 LTPP MONITORED TRAFFIC DATA SITE CALIBRATION SUMMARY	*STATE ASSIGNED ID [_4_6_0_0__] *STATE CODE [_1_8_] *SHRP SECTION ID [_0_6_0_0__]

SITE CALIBRATION INFORMATION

1. * DATE OF CALIBRATION (MONTH/DAY/YEAR) [_1_2_ / _2_1_ / _2_0_0_4_ __]

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

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

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

5. EQUIPMENT MANUFACTURER _____IRD________________________________

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

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

TRUCK	TYPE	SUSPENSION
1	________	________________
2	________	________________
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 _X_ MANUAL ___ PARALLEL CLASSIFIERS

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

14. MEAN DIFFERENCE IN VOLUMES BY VEHICLES CLASSIFICATION:
*** FHWA CLASS 9 ____0____ ____ FHWA CLASS __5_ ____ ____3_8_ ____
*** FHWA CLASS 8 ____4_0__ ____ FHWA CLASS ____ ____ ____ ____ ____
FHWA CLASS ____ ____ ____ ____ ____
FHWA CLASS ____ ____ ____ ____ ____
*** PERCENT "UNCLASSIFIED" VEHICLES: ____ ___2_. _0___

PERSON LEADING CALIBRATION EFFORT: ____Dean J. Wolf________________________________
CONTACT INFORMATION: __MACTEC Engineering and Consulting, Inc. (301) 210-5105___ rev. November 9, 1999