Assessment Report for
California, SPS 5

Visit date: March 4, 2004

List of Tables

List of Figures

1 Executive Summary

A visit was made to the California SPS-5 on March 4, 2004, for the purpose of conducting an assessment of the WIM system located on Interstate 40 at milepost 28.892, 5.24 miles east of the Fort Cady Road Interchange (Exit 23 on I-40). The LTPP lane is the driving lane in the eastern direction and is identified by the controller as lane number 1.

This site is not recommended for a site validation.

The site is instrumented with PAT America bending plate weight sensors and a PAT America DAW-200 WIM controller.

The equipment is in working order.

Sufficient data was collected to provide a Sheet 16 for classification verification at this site. There was 1 unclassified vehicle. This is below the percentage of 2% defined as the criteria for research data. However, Truck classes 5, 6 and 8 had an error rate exceeding 2% of matches. **The algorithm for classification should be reviewed and the classification verification repeated at the next assessment or evaluation**.

The PCC section installed specifically for the WIM installation is shorter than the minimum recommended length.

The pavement condition is such that it may contribute to an inability to calibrate the system to obtain research quality data. Among the distresses observed that may influence truck motion are longitudinal cracking, block cracking, alligator cracking, map cracking, and faulting. These are illustrated in Figure 13-1 through Figure 13-8 and the factors detailed in the profile evaluation.

A review of the speed information collected on-site indicates that the range of truck speeds to be covered during an evaluation is 50 to 70 mph. The speed limit at this site is 70 mph.

This site has 1 year of classification and 10 years of weight data. The site was last calibrated on May 16, 2000 as per the December 2003 upload. Based on available calibration information and review of the data submitted through last year, this site still needs 5 years of classification and weight data to meet the need for 5 years of research quality data.

2 Corrective Actions Recommended

It is recommended that the pavement at least 325 feet prior to and 75 feet following the WIM scales be replaced. The pavement replacement recommendation is based on the following factors:

- Longitudinal cracking at the lane centerline and alligator cracking in the right wheel path throughout the WIM scale approach, weighing and exiting areas
- Significant map cracking throughout the WIM scale approach, weighing and exiting areas
- Significant faulting at the asphalt transitions at each end of the WIM concrete section
- The PCC section installed specifically for the WIM installation is 75 feet in length, which is less than the recommended length of 400 feet.

A close review of the WIM equipment's classification algorithms should be performed to try to reduce or eliminate the cases of the recreational vehicles with trailers being classified as Class 8s in lieu of Class 5s.

Investigation should be done for the weight data in for 1999. On a more general basis, if the data is investigated, the trend for Class 9 ESALs might be a better starting point to look at how or why the seasonal trend exists.

3 Equipment inspection and diagnostics

The site is instrumented with PAT America bending plate weight sensors, installed in an in-line configuration, spanning the entire lane width. A 6- foot by 6-foot loop sensor is installed directly preceding the bending plates and another loop sensor is installed immediately after the bending plates. These loop sensors are used for vehicle presence detection, speed and spacing. The WIM system utilizes a PAT America DAW-200 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 is operating properly.

An electronic check of all WIM components was performed. All in-road sensors and WIM controller components are working properly.

A visual inspection of all system components, including in-road sensors, cabinet, pull boxes, drainage, power and telephone service panels and conduit was conducted. All components are in excellent physical condition.

4 Classification Verification with test truck recommendations

The agency uses the FHWA 13-bin classification scheme with an agency specific definition for Class 14 that describes a 5-axle tractor-trailer combination. Its dimensions could be typified as dump trucks hauling trailers. In contrast the last axle on the Class 9 must be a tandem, tridem or split tandem.

A sample of 100 trucks 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 zero-percent unknown vehicles and 1-percent unclassified vehicles. The unclassified vehicle was a recreational vehicle with a trailer.

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

Table 1 Truck Misclassification Percentages for 060500 – 04-Mar-2004

Class	Error rate	Class	Error rate	Class	Error rate
4	N/A	5	35	6	100
7	N/A				
8	75	9	1	10	N/A
11	0	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. When the percent error and the mean differences reported below do not represent the same element. It is possible to have error rates greater than 0 with a mean difference of zero.

Table 2 Truck Classification Mean Differences for 060500 - 04-Mar-2004

Class	Mean Difference	Class	Mean Difference	Class	Mean Difference
4	N/A	5	13	6	100
7	N/A				
8	300	9	1	10	N/A
11	0	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 every time. A number between –1 and –100 indicates the number of vehicles either missed or not assigned to the class by the equipment. It is not possible to miss more than all of them 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”. Class marked UNK are those identified by the equipment but no vehicles of the type were seen the observer. There is no way to tell how many more than those that might actually present exist. N/A means no vehicles of the class 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 9 constitutes more than 70 percent of the truck population. Based on this information in addition to the air-suspension 3S2, the second vehicle used for evaluation should be a Class 9. Due to the length of the truck turn around 1 additional vehicle should be used. It is recommended that it also be a Class 9. Since this site is a fully loaded site two fully loaded trucks and one partially loaded (45,000 – 55,000 lbs) is preferred.

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 Nichols Consulting Engineers, on February 11, 2004 was processed through the LTPP SPS WIM Index software. This WIM scale is installed on a Portland cement concrete pavement. The results are shown in Table 3.

A total of 8 profiler passes have been conducted over the WIM site. Since the issuance of the LTPP directive on collection of longitudinal profile data for SPS WIM section, 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 has done 4 passes at the center of the lane, 2 passes shifted to the left side of the lane, and 2 passes shifted to the right side of the lane. Shifts to the sides of the lanes were made such that data are collected as close to the lane edges as was safely possible. For each profiler pass, profiles are recorded under the left wheel path (LWP), and the right wheel path (RWP).

Table 3 shows the computed index values for all 8 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**	**Ave.**
Center	LWP	LRI (m/km)	*1.297*	*1.342*	*1.334*	*1.283*	***1.314***
		SRI (m/km)	0.520	*0.798*	0.609	0.573	**0.625**
	RWP	LRI (m/km)	*1.867*	*1.599*	*1.388*	*1.915*	***1.692***
		SRI (m/km)	*2.220*	*1.139*	*1.143*	*1.786*	***1.572***
Left Shift	LWP	LRI (m/km)	*1.602*	*1.679*			
		SRI (m/km)	*1.549*	*1.265*			
	RWP	LRI (m/km)	*1.545*	*1.733*			

Profiler Passes			**Pass 1**	**Pass 2**	**Pass 3**	**Pass 4**	**Ave.**
		SRI (m/km)	*1.059*	*1.385*			
Right Shift	LWP	LRI (m/km)	*1.404*	*1.365*			
		SRI (m/km)	0.677	0.682			
	RWP	LRI (m/km)	*1.311*	*1.340*			
		SRI (m/km)	*1.429*	*1.305*			

As seen from the table at almost all the locations the WIM Index value of 0.789 m/km is exceeded. When all values are less than 0.789 it is presumed unlikely that pavement roughness will significantly influence sensor output. Values above that level may or may not influence the reported weights and potentially vehicle spacings. **Based on the profile data analysis, the California SPS-5 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. Grinding may sufficiently reduce the roughness on the pavement surface to reduce the index below the limit. **However, due to the presence of significant distresses on the pavement the preferred option is to replace the entire pavement section**.

6 Distress survey and any applicable photos

The pavement appears to be in poor condition with a significant amount of distress.

Several pavement distresses that may affect the performance of the WIM scales were detected:

- Longitudinal cracking through the entire length of the WIM section as shown in Figure 13-1.
- Alligator cracking along right wheel path in several locations throughout the WIM section as shown in Figure 13-2.
- Block cracking throughout the asphalt pavement area prior to the WIM scale area as shown in Figure 13-3.
- Map cracking across the PCC pavement that comprises the WIM scale area as shown in Figure 13-4.
- Grinding begins 150 feet prior to the WIM scales
- Asphalt to PCC transition with a 1 inch fault 50 feet prior to the WIM scales as shown in Figure 13-5
- PCC to asphalt transition 25 feet following the WIM scales as shown in Figure 13-6.

Figure 13-7 shows the condition of the pavement in the downstream direction and Figure 13-8 shows in the condition of the pavement in the upstream direction.

7 Vehicle-pavement interaction discussion

A visual inspection of the pavement 425 feet in advance of the WIM area and 75 feet following the WIM area was conducted.

During the visual survey of the truck dynamics in the area of the WIM scales, no discernable motion of the passing trucks could be detected. However, the distresses described in the pervious section may contribute significantly to the WIM system's inability to provide research quality data.

Daylight cannot be seen between the tires and the sensors indicating that the trucks may be touching the sensors fully.

8 Speed data with speed range recommendations for evaluation

Based on the data collected on site the 15th and 85th percentile speeds for Class 9s are 55 and 65 mph respectively. The upper end of the range is below the posted speed limit of 70 mph. This range does not vary significantly for other truck classes. As a result the recommended speeds for test trucks in an evaluation are 50, 60 and 70 mph. The wider range is suggested because there are vehicles traveling at the lower end of the range and that a 10-mile per hour increments is preferred where possible.

Measurements of speeds on-site indicated that the equipment is currently measuring speeds with a bias of 2.1 mph and an associated standard deviation of 1.9 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. The equipment is measuring the average drive axle spacing of a Class 9 to be 4.4 feet.

9 Traffic Data review: Overall Quantity and Sufficiency

As of March 9, 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. **A record of a calibration visit for May 16, 2000 was provided as of December 2003 upload.** Review of the data indicates that sufficient information is not 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 none of the years have a sufficient quantity to be considered complete years of data. Together with the previously gathered calibration 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 classification and weight data.

Table 5 Amount of Traffic Data Available

Year	Class Days	Months	Coverage	Weight Days	Months	Coverage
1992	N/A	N/A	N/A	49	7	Complete Week
1993	N/A	N/A	N/A	70	10	Complete Week
1994	N/A	N/A	N/A	63	9	Complete Week
1995	N/A	N/A	N/A	70	10	Complete Week
1996	N/A	N/A	N/A	77	11	Complete Week
1997	N/A	N/A	N/A	84	12	Complete Week
1999	165	12	Complete Week	165	12	Complete Week
2000	N/A	N/A	N/A	117	8	Complete Week
2001	N/A	N/A	N/A	84	12	Complete Week
2002	N/A	N/A	N/A	84	12	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.

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 new traffic analysis software, since it is the only software that calculates them. The data is separated into blocks that depend on when the site was validated. 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

California 0500

East Lane 1

Comparison Date Weight - 01-June-2000 Classification - 02-Feb-1999

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		43.2		2110	1.83	10,700	73,921	35,643
JUN 1992			7	1518	1.83	10,686	77,566	36,057
JUL 1992			7	1629	1.90	10,671	77,523	35,902
AUG 1992			7	1244	1.83	10,714	77,498	36,085
SEP 1992			7	1423	1.78	10,643	77,237	35,910
OCT 1992			7	1534	1.71	10,564	76,856	35,926
NOV 1992			7	1555	1.64	10,479	76,429	35,677
DEC 1992			7	1183	1.46	10,350	74,695	35,548
JAN 1993			7	1105	1.54	10,543	76,669	36,073
FEB 1993			7	1134	1.59	10,557	76,579	36,206
MAR 1993			7	1284	1.62	10,629	76,717	35,409
APR 1993			7	1447	1.71	10,721	76,829	35,948
MAY 1993			7	1336	1.74	10,700	76,909	36,239
JUN 1993			7	1356	1.78	10,714	77,082	36,473
JUL 1993			7	1338	1.81	10,736	77,189	36,271
AUG 1993			7	1583	1.75	10,607	76,747	35,732
SEP 1993			7	1614	1.71	10,557	76,468	35,676
DEC 1993			7	1461	1.50	10,443	74,635	35,550
JAN 1994			7	1097	1.46	10,457	76,096	35,472
FEB 1994			7	1173	1.45	10,407	74,527	35,704
MAR 1994			7	1221	1.49	10,557	76,351	35,999
APR 1994			7	1495	1.60	10,600	76,210	36,132
MAY 1994			7	1573	1.63	10,593	76,277	35,782
JUN 1994			7	1452	1.68	10,643	76,436	35,753
JUL 1994			7	1652	1.77	10,650	76,611	35,782
AUG 1994			7	1663	1.74	10,600	76,661	35,559
OCT 1994			7	1661	1.56	10,479	74,366	35,691
JAN 1995			7	914	1.40	10,286	73,982	35,708
FEB 1995			7	1167	1.37	10,436	74,273	35,918
MAR 1995			7	1248	1.39	10,436	74,194	35,639
APR 1995			7	1549	1.47	10,471	73,779	35,954
JUL 1995			7	1691	1.64	10,593	74,392	35,947
AUG 1995			7	1680	1.64	10,600	74,454	35,561
SEP 1995			7	1667	1.53	10,500	74,093	35,842
OCT 1995			7	1656	1.50	10,450	73,839	35,675
NOV 1995			7	1752	1.44	10,400	73,737	35,632
DEC 1995			7	1448	1.38	10,400	73,860	35,423
JAN 1996			7	1139	1.33	10,371	73,704	35,443
FEB 1996			7	1154	1.34	10,407	73,920	35,414
MAR 1996			7	1346	1.31	10,357	73,621	35,721
APR 1996			7	1631	1.43	10,371	73,299	35,477
MAY 1996			7	1511	1.49	10,436	73,688	35,617
JUN 1996			7	1580	1.51	10,457	73,875	35,596

California 0500

East Lane 1

Comparison Date Weight - 01-June-2000 Classification - 02-Feb-1999

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		43.2		2110	1.83	10,700	73,921	35,643
JUL 1996			7	1725	1.62	10,543	74,255	35,872
AUG 1996			7	1784	1.58	10,557	74,179	35,400
SEP 1996			7	1760	1.52	10,521	73,896	35,465
NOV 1996			7	1898	1.39	10,436	73,248	35,503
DEC 1996			7	1570	1.30	10,371	73,303	35,243
JAN 1997			7	1037	1.26	10,257	72,878	35,589
FEB 1997			7	1340	1.22	10,321	73,020	35,187
MAR 1997			7	1374	1.29	10,407	73,286	35,725
APR 1997			7	1814	1.36	10,407	72,934	35,118
MAY 1997			7	1667	1.42	10,507	73,358	35,542
JUN 1997			7	1660	1.45	10,486	73,404	35,700
JUL 1997			7	1838	1.56	10,514	73,655	36,014
AUG 1997			7	1880	1.46	10,436	73,274	35,334
SEP 1997			7	1882	1.36	10,357	72,861	35,513
OCT 1997			7	1941	1.23	10,214	70,399	35,550
NOV 1997			7	1353	1.15	10,171	70,558	35,399
DEC 1997			7	1703	1.04	9,829	69,505	35,019
JAN 1999	12	38.5	12	1326	0.99	9,917	69,673	35,056
FEB 1999	14	43.2	14	1576	1.02	10,039	70,038	34,956
MAR 1999	10	41.5	10	1533	1.05	10,090	70,229	35,217
APR 1999	13	45.1	13	1902	1.12	10,138	69,769	35,545
MAY 1999	14	44.1	14	2007	1.18	10,207	69,975	35,739
JUN 1999	13	39.9	13	2019	1.24	10,200	70,303	35,665
JUL 1999	13	43.2	13	2159	1.28	10,177	70,392	35,689
AUG 1999	14	42.4	14	2277	1.30	10,154	70,399	35,711
SEP 1999	16	45.3	16	2218	1.25	10,131	70,179	35,667
OCT 1999	15	46.2	15	2175	1.17	10,093	69,921	35,520
NOV 1999	14	52.1	14	2304	1.12	10,039	69,761	35,685
DEC 1999	17	47.6	17	1712	1.06	9,997	69,762	35,681
JAN 2000			16	1497	1.04	10,059	70,001	35,573
FEB 2000			14	1757	1.05	10,132	70,155	35,309
MAR 2000			17	1840	1.08	10,129	70,114	35,513
APR 2000			14	2146	1.18	10,243	70,202	35,844
MAY 2000			14	2120	1.25	10,343	70,167	35,494
JUN 2000			14	2110	1.77	11,296	77,866	35,746
JUL 2000			14	2220	1.86	11,271	78,067	35,821
AUG 2000			14	2324	1.83	11,271	77,946	35,929
JAN 2001			7	1627		11,250	78,126	36,135
FEB 2001			7	1725		11,350	78,188	36,152
MAR 2001			7	1719		11,221	77,791	36,128
APR 2001			7	2079		11,229	77,548	35,995
MAY 2001			7	2115		11,329	77,872	36,139
JUN 2001			7	2063		11,386	77,946	36,182
JUL 2001			7	2160		11,336	78,218	35,816
AUG 2001			7	2320		11,336	78,212	36,159
SEP 2001			7	2344		11,264	77,851	36,245
OCT 2001			7	2331		11,264	77,699	35,923
NOV 2001			7	2359		11,229	77,612	35,923
DEC 2001			7	2466		11,314	78,177	36,044
JAN 2002			7	1775	1.69	11,364	78,322	35,785

California 0500

East Lane 1

Comparison Date Weight - 01-June-2000 Classification - 02-Feb-1999

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		43.2		2110	1.83	10,700	73,921	35,643
FEB 2002			7	1854	1.63	11,393	78,318	36,251
MAR 2002			7	1935	1.65	11,364	78,098	36,157
APR 2002			7	2108	1.74	11,357	77,892	35,795
MAY 2002			7	2186	1.75	11,379	77,769	35,523
JUN 2002			7	2049	1.82	11,443	78,010	35,777
JUL 2002			7	2231	1.93	11,464	78,225	35,887
AUG 2002			7	2388	1.90	11,393	78,134	35,967
SEP 2002			7	2384	1.80	11,321	77,883	35,193
OCT 2002			7	2374	1.69	11,336	77,616	35,985
NOV 2002			7	2603	1.63	11,343	77,469	35,396
DEC 2002			7	1935	1.61	11,371	78,029	35,701

As seen from the table there is not sufficient classification data. From the available data it appears that the percent of Class 9s is essentially the same in 1999. The weight data is available for significant amount of years. However, each year the data was not collected for sufficient amount of days. It can be seen that the amount of Class 9s is essentially exhibiting a seasonal pattern. The amount is gradually increasing from winter till fall and slightly falling by the start of the winter season. The average ESALs per Class 9 also exhibited similar pattern and also were decreasing each year. The most possible reason might be that the calibration of the equipment was drifting. After the calibration was performed in May 2000 the values increased drastically to 1992 levels and again exhibited seasonal variation. The average steering axle weights, the mean loaded and unloaded weights remained essentially the same for all the years except after June 2000 when the values were slightly higher.

9.2 Vehicle Distribution

The vehicle distribution graphs indicate whether the fleet mix is stable over time and any day of week or seasonal patterns that may exist. The vehicle distribution graphs contain two types of comparisons, one between data types and one over time. The between types comparison is represented by the 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. Whether or not the data is equivalent is perhaps more important than the variation over time.

Figure 14-1 shows a typical by week pattern for heavy truck classification data. The individual weeks show essentially the same heavy truck mix. Every vehicle in Classes 6 through 13 that constitutes at least 10 percent of the 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 essentially the same albeit the classification data is for only one year. A typical graph for this period is shown in Figure 14-1. There was no significant difference in the mix stability graphed for the weight data as shown in Figure 14-2.

Figure 14-3 shows the typical pattern for vehicle distribution by month by year for the data collected from the classifier versus the data collected by the WIM equipment. From the figure it appears that the data collected by the classifier and the WIM equipment are the same. Also, as mentioned earlier the data seems to exhibit a seasonal pattern.

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 14-4 the typical pattern is shown in the red line with Xs. As seen in the figure it appears that the site is a fully loaded site and the peak loads for all years are within the range except 1999. The reason for the shift should be investigated.

To investigate any seasonal variations the Class 9 GVW distributions are graphed by month by year. As shown in Figure 14-5 there is no significant seasonal variation in the peak loads for this site.

9.4 Axle Distributions

Axle distribution graphs are not needed for data review since GVW graphs were available for all years.

9.5 ESALs per year

Average ESALs for Class 9 vehicles are a very crude method of identifying loading shifts. Figure 14-6 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 and SN = 5 and a p_t of 2.5. Average ESALs per Class 9 are not used as an indicator of research quality data. It may appear from the figure that values are exhibiting seasonal variation and at the same time decreasing as the years progressed. In 2002 the values increased drastically. This change in behavior and the seasonal variation should be investigated.

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. As shown in Figure 14-7 there is limited data albeit the available data suggests that the average is essentially the same for the entire year.

10 Updated handout guide and Sheet 17

A copy of the post visit handout has been included following page 22. It includes a current Sheet 17 with all applicable maps and photographs. There are no significant changes in the information provided from the pre visit handout.

11 Updated Sheet 18

A current Sheet 18 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 11.30 a.m. and 12.30 p.m. on March 4, 2004 to complete a Sheet 16. A copy is attached at the very end of the report.

13 Distress Photographs

Figure 13-1 Longitudinal Cracking at 060500

Figure 13-2 Alligator Cracking of Asphalt Pavement at 060500

Figure 13-3 Block Cracking of Asphalt Pavement at 060500

Figure 13-4 Map Cracking of PCC Pavement at 060500

Figure 13-5 Faulting at Asphalt to PCC Pavement Transition at 060500

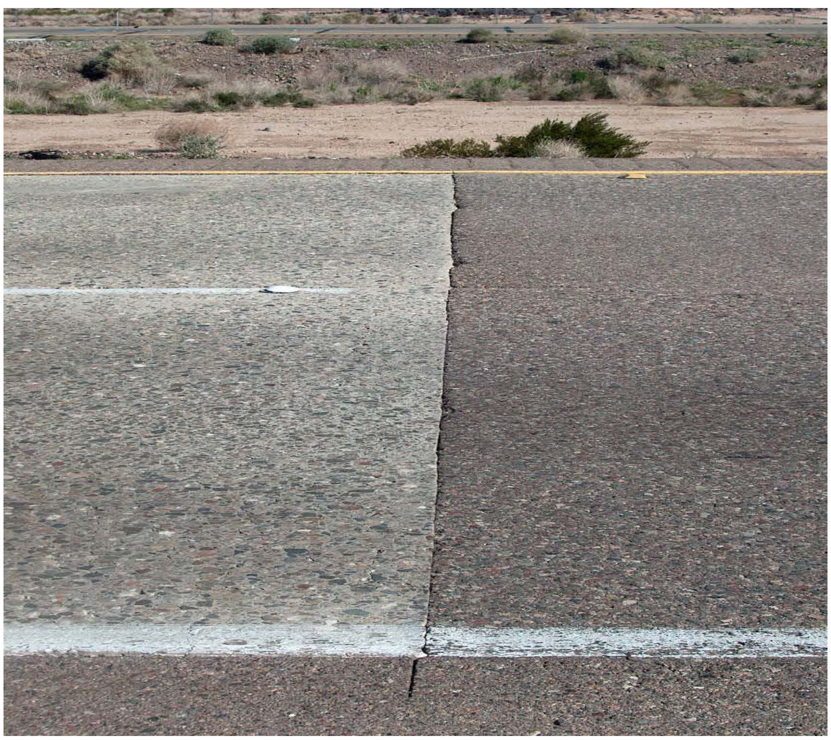


Figure 13-6 Faulting at PCC to Asphalt Pavement Transition at 060500

Figure 13-7 Pavement Condition in Downstream direction at 060500

Figure 13-8 Pavement Condition in Upstream direction at 060500

14 Traffic Graphs

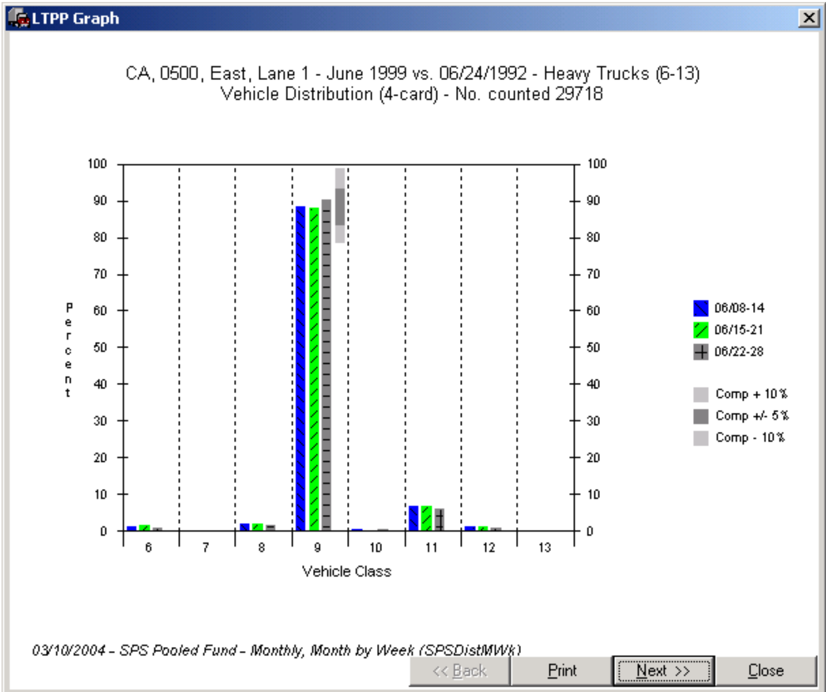


Figure 14-1 Heavy Truck Distribution Pattern for Classification Data for 060500

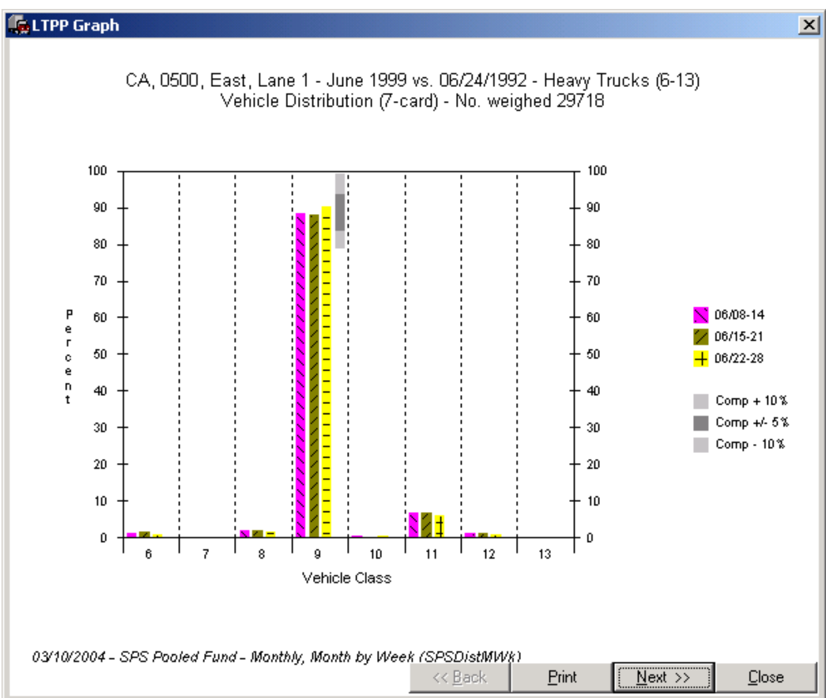


Figure 14-2 Typical Heavy Truck Distribution Pattern for Weight Data for 060500

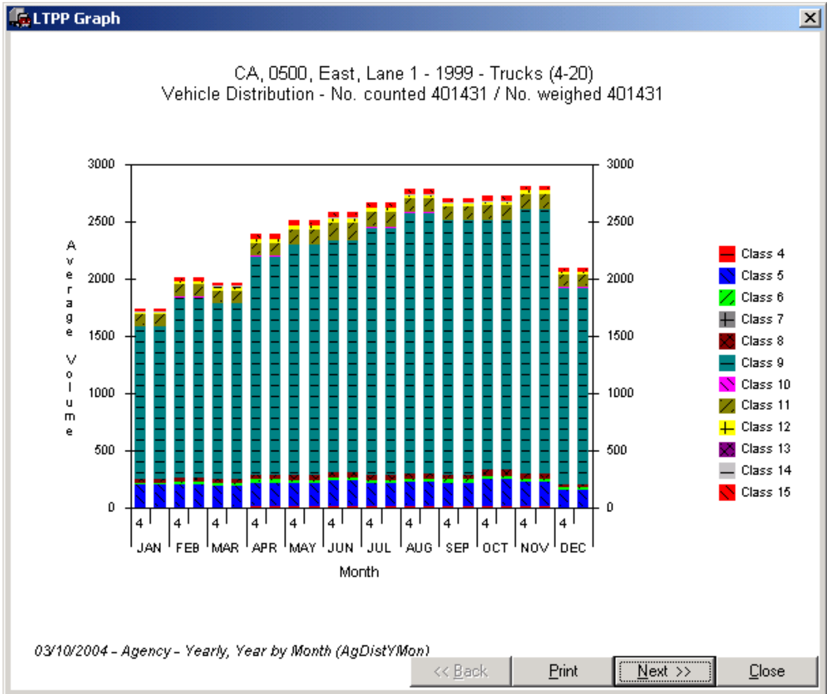


Figure 14-3 Vehicle Distribution by Month for the Year 1999 for 060500

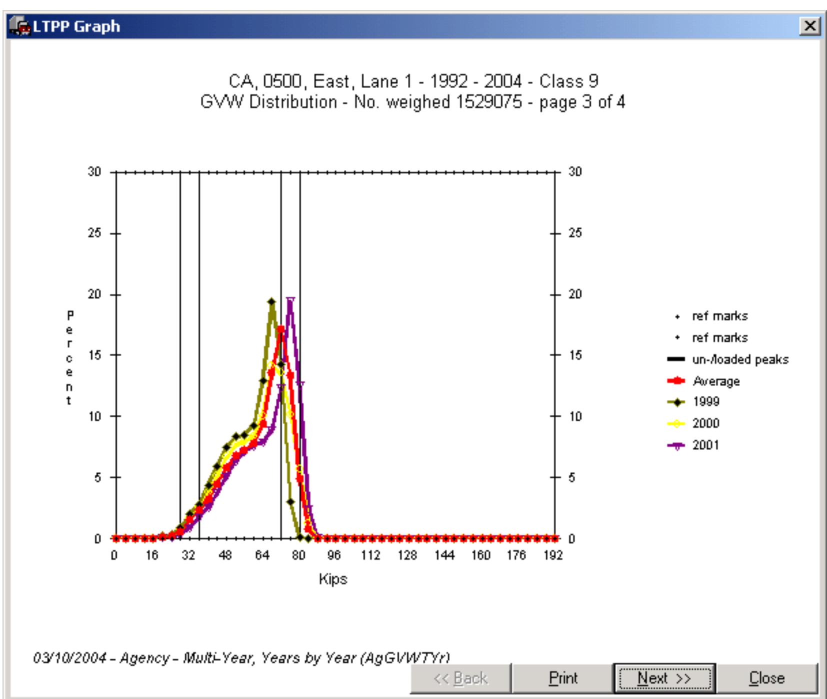


Figure 14-4 Class 9 GVW Distribution - 1999 to 2001 for 060500

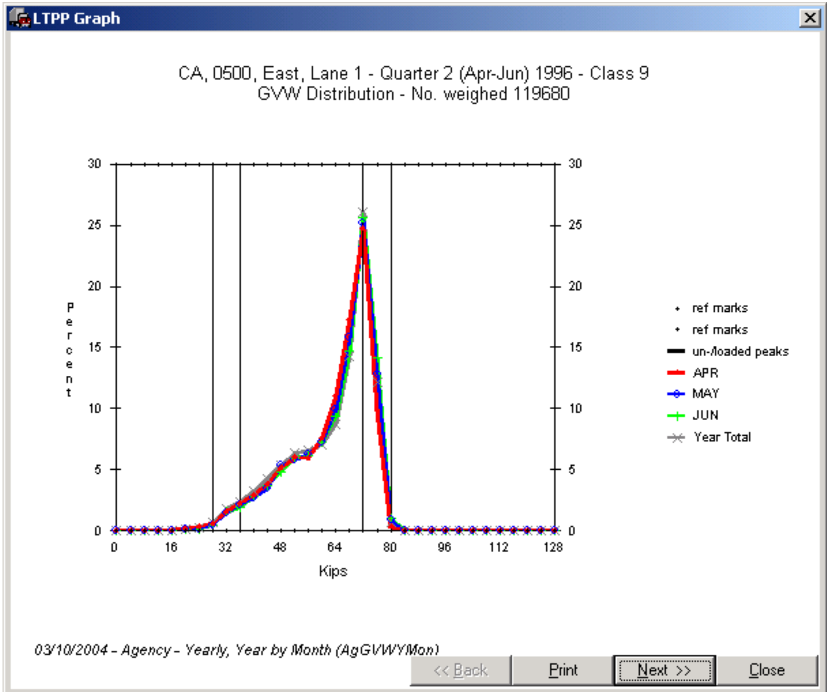


Figure 14-5 Class 9 GVW Distribution - April to June 1996 for 060500

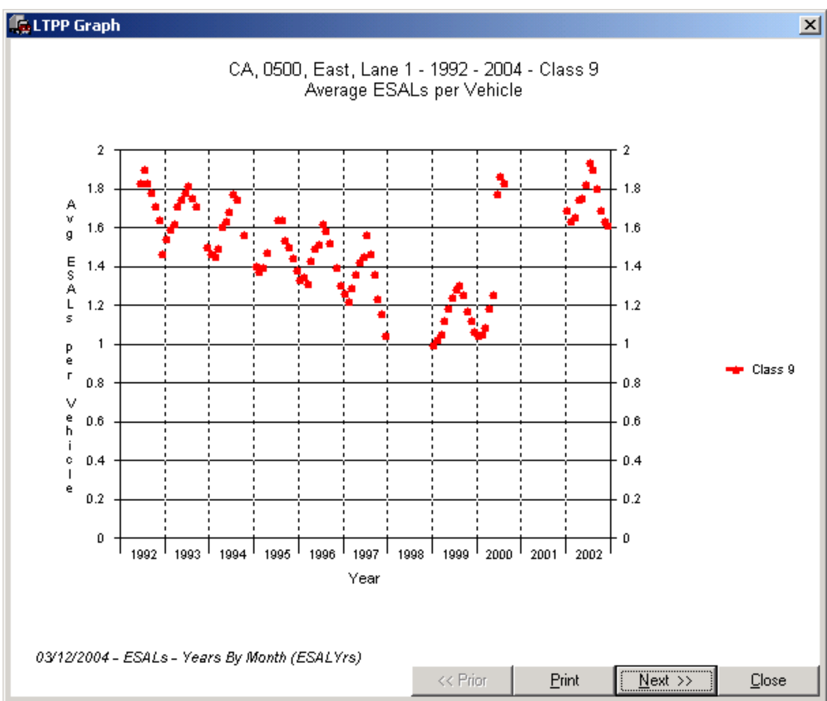


Figure 14-6 Average Class 9 ESALs for site from 1992 to 2002 for 060500

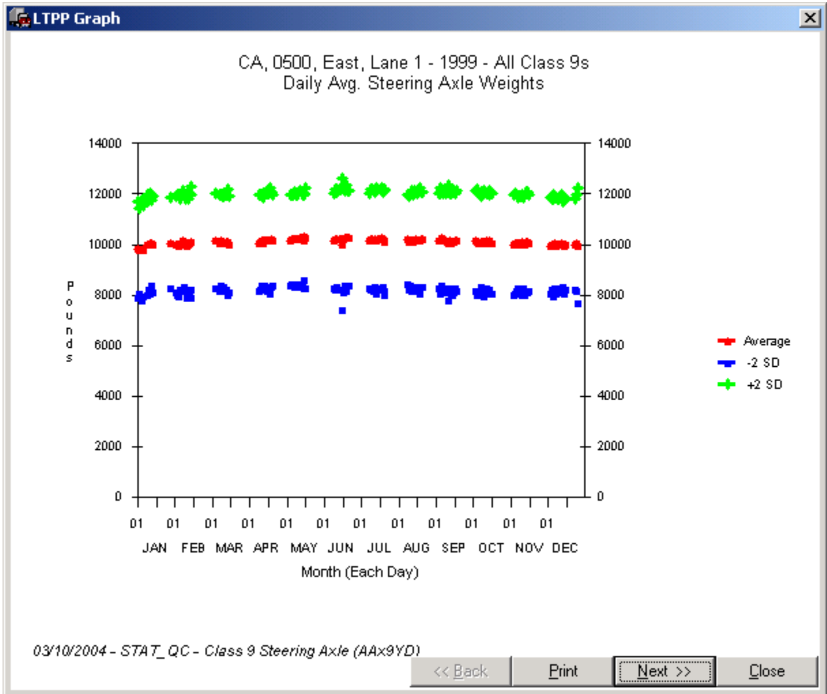


Figure 14-7 Average Daily Class 9 Steering Axle Weight - 1999 for 060500

POST VISIT HANDOUT GUIDE FOR SPS WIM FIELD ASSESSMENT

STATE: California

SHRP ID: 0500

Figures

1. General Information

SITE ID: *060500*

LOCATION: *Interstate 40 East at M.P. 28.892*

VISIT DATE: *March 4th, 2004*

VISIT TYPE: *Assessment*

2. Contact Information

POINTS OF CONTACT:

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

Highway Agency: *Joe Avis, 916-654-3072, joe.avis@dot.ca.gov*

Linda Savinelli, 916-654-7375, linda.savinelli@dot.ca.gov

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

FHWA Division Office Liaison: *Jason Dietz, 916-498-5886, jason.dietz@fhwa.dot.gov*

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

3. Agenda

BRIEFING DATE: *To be held at a later date.*

ON SITE PERIOD: *March 4th, 2004 beginning at 9:00 a.m.*

TRUCK ROUTE CHECK: *Completed. See truck route.*

4. Site Location/ Directions

NEAREST AIRPORT: *Ontario International Airport, Ontario, CA*

DIRECTIONS TO THE SITE: *5.24 miles east of Fort Cady Road Interchange (Exit 23)*

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

WIM SITE LOCATION: *Interstate 40 East at M.P. 23.78 (Latitude: 34^0 47.934' and Longitude: -116^0 30.888')*

WIM SITE LOCATION MAP:*See Figure 4.1*

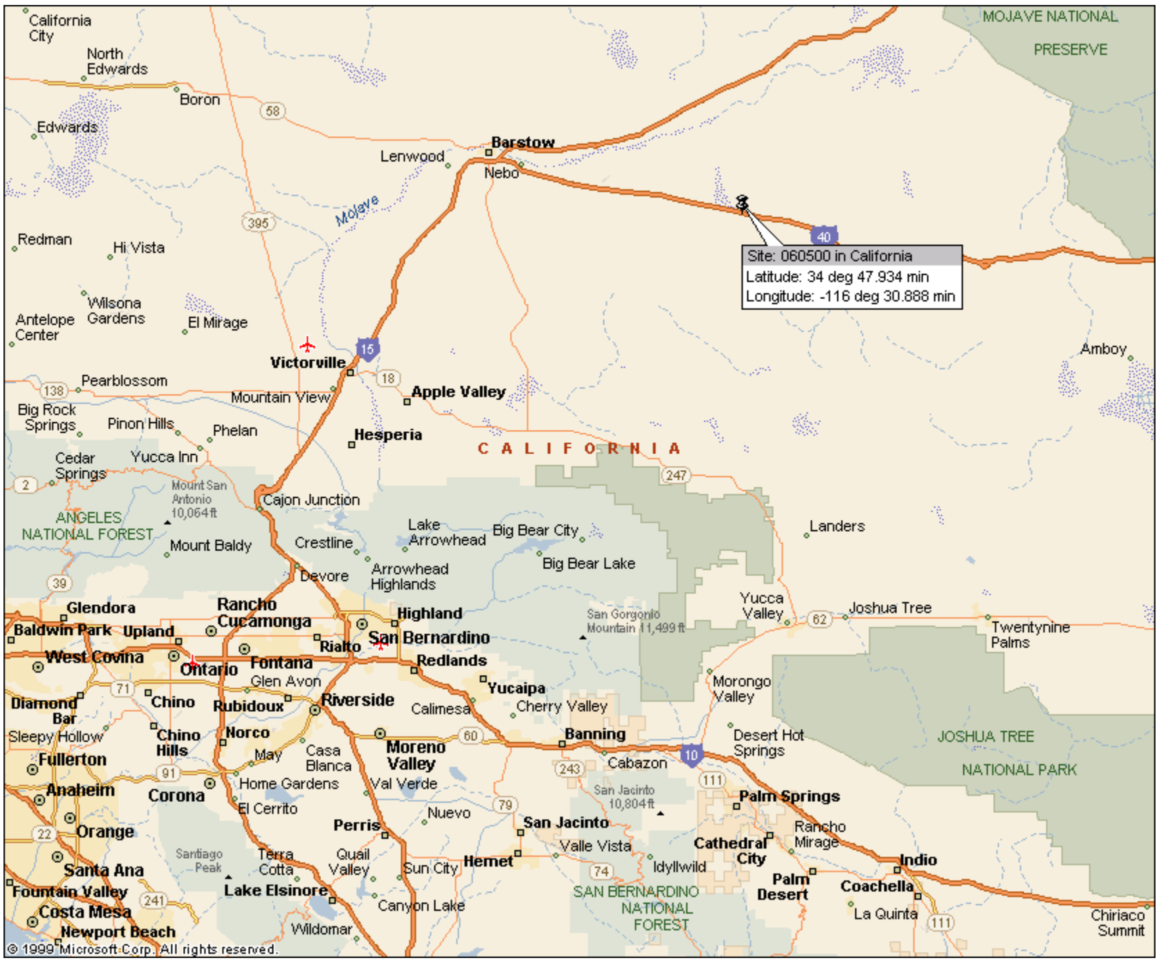


Figure 4.1: Site 060500 in California

5. Truck Route Information

ROUTE RESTRICTIONS: *None.*

SCALE LOCATION: *Pilot Travel Center, I-15 at Lenwood Road exit, Barstow, CA; latitude: 34.85411, longitude: -117.08840; Shawn Conyers - proprietor Phone No: (760) 253-2861; open 7 days a week 24 hrs a day, $8.00 per run.*

TRUCK ROUTE:

- *Eastbound to exit 32 (Hector Road), 3.42 miles from site*
- *Westbound to exit 23 (Fort Cady Road), 5.24 miles from site*
- *Total length of truck turnaround is 8.66 miles*

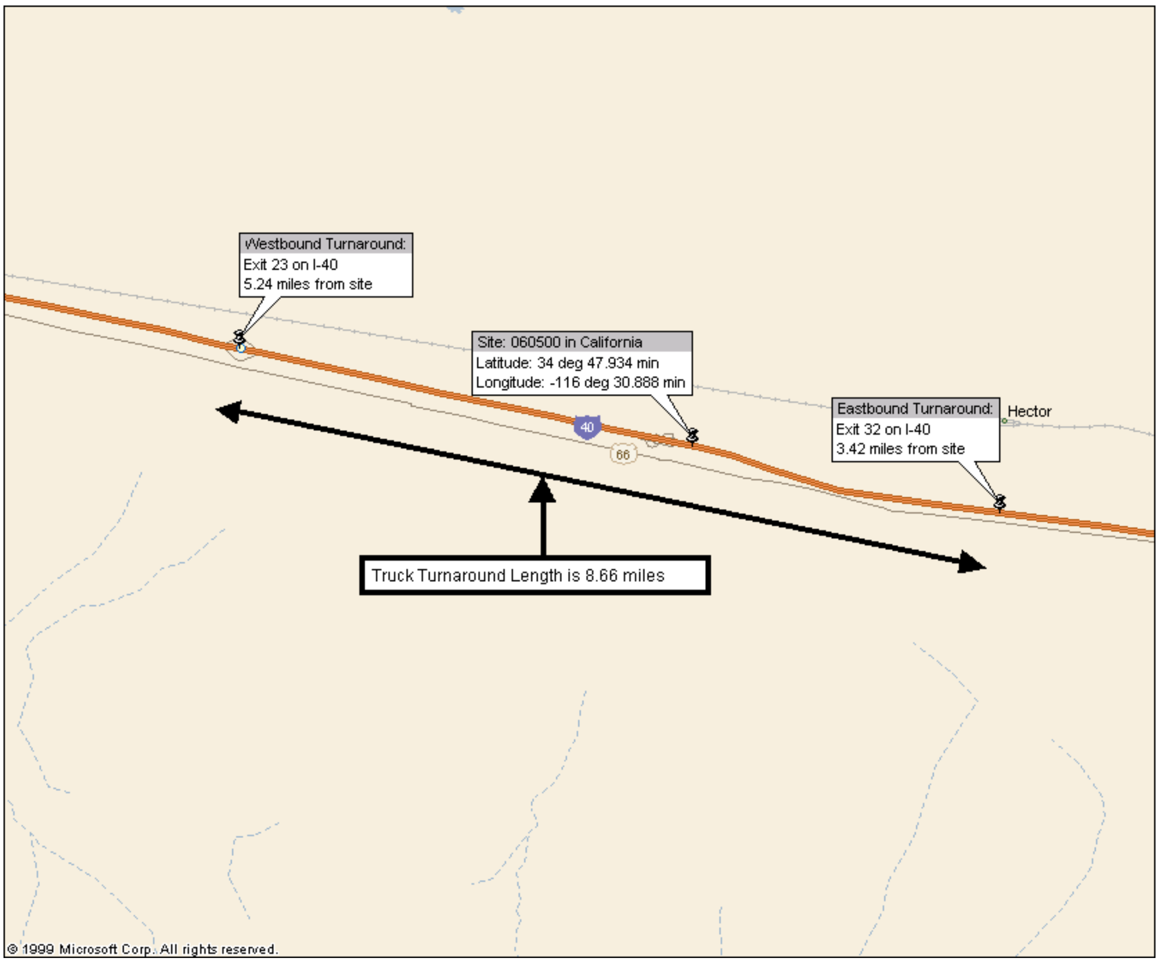


Figure 5.1: Truck Route at 060500 in California

6. Sheet 17 – California (060500)

1.* ROUTE ___I-40_______MILEPOST ___28.892__LTPP DIRECTION - N S E W

2.* WIM SITE DESCRIPTION - Grade ___<_1____ % Sag vertical Y / N
Nearest SPS section upstream of the site _060509__ ___ ___ ___
Distance from sensor to nearest upstream SPS Section __1_ _6__ _4__ _2__ 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__ _1__ ft

4.* PAVEMENT TYPE ______Portland Cement Concrete___________________

5.* PAVEMENT SURFACE CONDITION – Distress Survey
Date _____03-04-04_________________Distress Photo Filename
_Distress_1_TO_4_06_31A_0500_03_04_04.JPG________________
Date _____03-04-04_________________Distress Photo Filename
_Distress_2(1)_TO_4_06_31A_0500_03_04_04.JPG________________
Date _____03-04-04_________________Distress Photo Filename
_Distress_3_TO_4_06_31A_0500_03_04_04.JPG________________

6. * SENSOR SEQUENCE __________Loop – 2 x Bending Plate – 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 ___635'_(Rest Area Merge)______
Intersection/driveway within 300 m downstream of sensor location Y / N
distance __________
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 ___ __4_. _0__ 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 _2_ _6_ ft
Distance from system __ _2_ _8_ ft
TYPE ______332_____________________

CABINET ACCESS controlled by LTPP / STATE / JOINT?
Contact - name and phone number _Joe Avis (916) 654-3072 ______
Alternate - name and phone number _Linda Savinelli (916) 654-7375

11. * POWER
Distance to cabinet from drop __2280_ ___ ft Overhead / underground / solar /
AC in cabinet?
Service provider _____________________   Phone number _______________

12. * TELEPHONE
Distance to cabinet from drop __2280_ ___ ft Overhead / under ground / cell?
Service provider _____________________   Phone Number _______________

13.* SYSTEM (software & version no.)- ____DAW 200______________________
Computer connection – RS232 / Parallel port / USB / Other ________________

14. * TEST TRUCK TURNAROUND time __22___ minutes DISTANCE _17.32__ mi

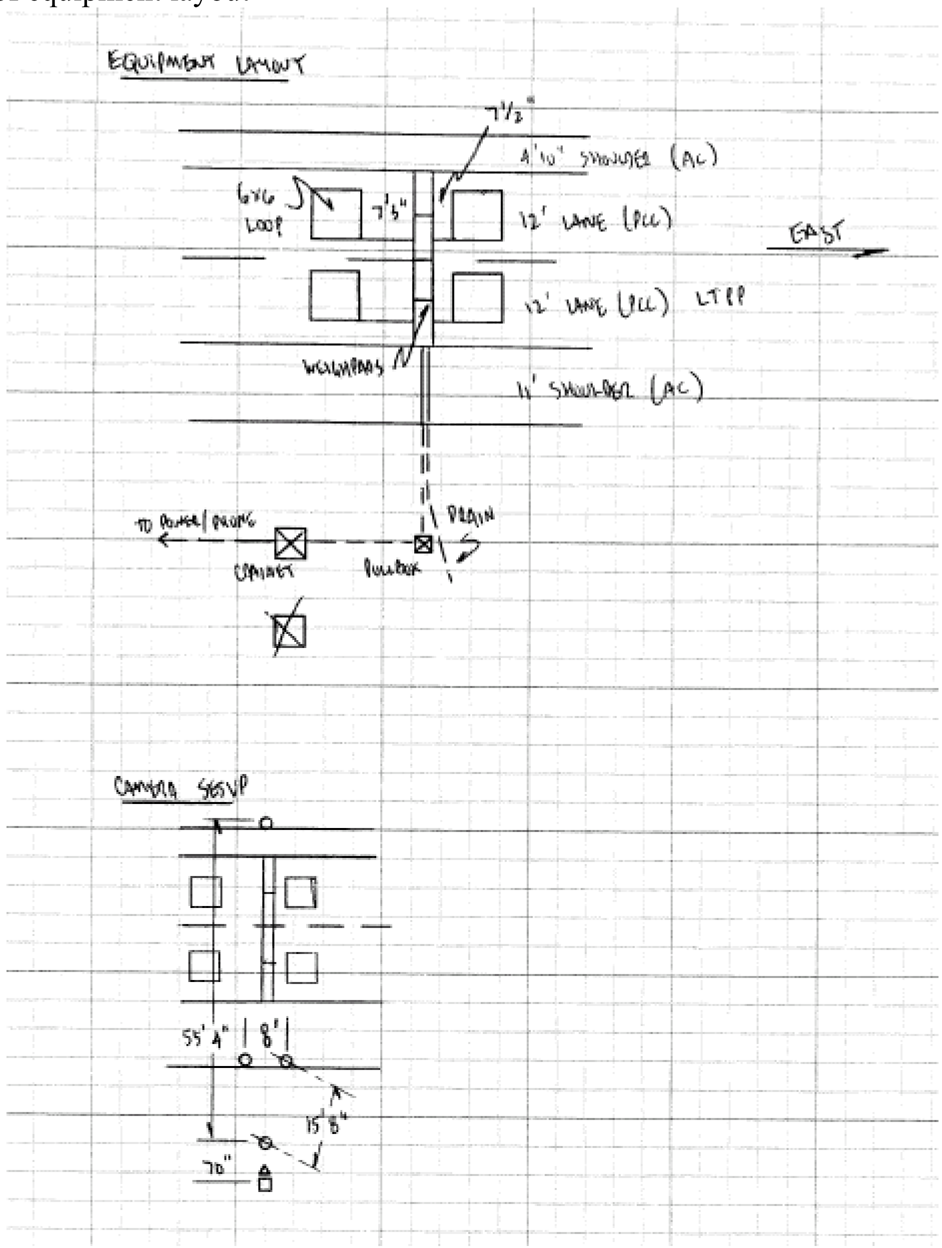
15. PHOTOS   FILENAME
Power source   __Power_Source_TO_4_06_31A_0500_03_04_04.JPG___
Phone source   __Phone_Source_TO_4_06_31A_0500_03_04_04.JPG____
Cabinet exterior   __Cabinet_Exterior_TO_4_06_31A_0500_03_04_04.JPG___
Cabinet interior   __Cabinet_Interior_TO_4_06_31A_0500_03_04_04.JPG____
Weight sensors   __Weighing_Sensor_TO_4_06_31A_0500_03_04_04.JPG____
Classification sensors   __ Classification _Sensor_TO_4_06_31A_0500_03_04_04.JPG
Other sensors   ________________________
Description _________________
Downstream direction at sensors on LTPP lane
__Downstream_TO_4_06_31A_0500_03_04_04.JPG__________________
Upstream direction at sensors on LTPP lane
__Upstream_TO_4_06_31A_0500_03_04_04.JPG__________________

COMMENTS __ ____
_______________GPS Coordinates: Latitude: 34^0 47.934' and Longitude: -116^0 30.888'_
____
____
_______________Closest Amenities – 28 miles west at Barstow______________________
____
_______________Power/Telephone service in rest area against southern fence___________
____
____
_______________ Test Truck Recommendations: __________________________________
________________Types of Trucks: Two Class 9s_and one Class 5___________________
____
Truck 1: Class 9, 72,000 to 80,000 legal limit on gross and axles, air suspension;
Truck 2: Class 9, 72,000 to 80,000 legal limit on gross and axles________
Truck 3: Class 9, Partially Loaded to 45,000 – 55,000 lb _______________
____
____________ Expected Speeds: 50, 60 and 70 mph________________________________
____
_____________Speed Limit is 70 mph____
____
____

COMPLETED BY ____Dean J. Wolf____________________________

PHONE __301-210-5105___DATE COMPLETED _0_ _3_ /_0_ _4_ / _2_ _0_ _0_ _4_

Sketch of equipment layout



Site Map

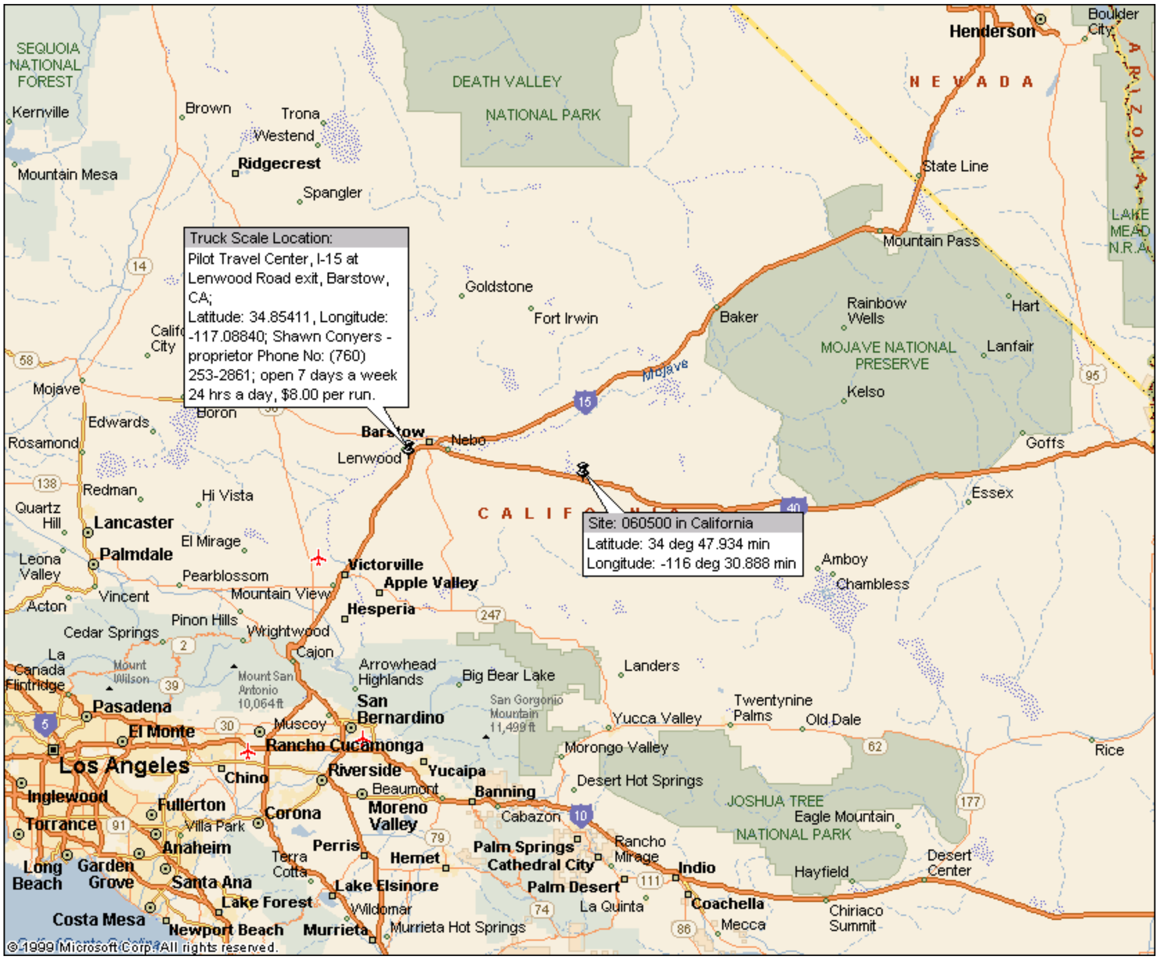


Figure 6.1: Site Map of 060500 in California

Distress_1_TO_4_06_31A_0500_03_04_04.JPG

Distress_2(1)_TO_4_06_31A_0500_03_04_04.JPG


Distress_3_TO_4_06_31A_0500_03_04_04.JPG


Power_Source_TO_4_06_31A_0500_03_04_04.JPG

Phone_Source_TO_4_06_31A_0500_03_04_04.JPG

Cabinet_Exterior_TO_4_06_31A_0500_03_04_04.JPG

Cabinet_Interior_TO_4_06_31A_0500_03_04_04.JPG

Weighing_Sensor_TO_4_06_31A_0500_03_04_04.JPG

Classification_Sensor_TO_4_06_31A_0500_03_04_04.JPG

Downstream_TO_4_06_31A_0500_03_04_04.JPG

Upstream_TO_4_06_31A_0500_03_04_04.JPG

STATE_CODE _0_ _6_

WIM SITE COORDINATION

SPS Project_ID _0_ _5_ _0_ _0_

1. Equipment –
   - Maintenance – contract with purchase / separate contract LTPP / separate contract State / state personnel
     Contact ___Joe Avis – (916) 654-3072___________________________
   - Purchase by LTPP / State
     Constraints on specifications (sensor, electronics, warranties, maintenance, installation)
   - Installation – Included with purchase / separate contract by State / state personnel / LTPP contract
   - Calibration – Vendor / State / LTPP
   - Manuals and software – State / LTPP
   - Pavement PCC/AC – always new / replacement as needed / grinding and maintenance as needed / maintenance only / no remediation
   - Power - overhead / underground / solar billed to State / LTPP / N/A
   - Communication - Landline / Cellular / Other billed to State / LTPP / N/A

2. Site visits – Evaluation
   - WIM Validation Check - advance notice required _7__ days / weeks
   - Trucks – air suspension 3S2 State / LTPP
     2nd common State / LTPP
     3rd common State / LTPP
     4th common State / LTPP
     Loads State / LTPP
     Contact ____

     Drivers State / LTPP
     Contact ____

     Contractors with prior successful experience in WIM calibration in state:
     __________PAT/IRD____
     Nearest static scale (commercial or enforcement)
     ____
   - Profiling – short wave -- permanent / temporary site marking
     -- long wave – permanent / temporary site marking

STATE_CODE _0_ _6_

WIM SITE COORDINATION SPS Project_ID _0_ _5_ _0_ _0_

- Pre-visit data
  – Classification and speed: Contact ___Joe Avis – (916) 654-3072_________
  --Typical operating conditions (congestion, high truck volumes)
  Contact __Joe Avis – (916) 654-3072___________________________
  -- Equipment operational status: Contact __Joe Avis – (916) 654-3072________

- Access to cabinet
  State only / Joint / LTPP Key / Combination

- State personnel required on site Y / N
  Contact information ____Joe Avis – (916) 654-3072__________________________

- Enforcement Coordination required: Y / N
  Contact information ____

- Traffic Control Required: Y/ N
  Contact information ____

- Maximum number of personnel on site _5_;
  Invitees ____________________________

- Authorization to calibrate site -- State only / LTPP

- Special conditions ____

3. Data Processing
   - Down load State only / LTPP read only / LTPP download / LTPP download and copy to state
   - Data Review State per LTPP guidelines / State weekly / LTPP
   - Data submission for QC State - weekly; twice a month; monthly / LTPP

4. Site visits – Validation

   - WIM Validation Check - advance notice required __7_ days / weeks
     LTPP Semi-annually / Sate per LTPP protocol semi-annually / State other

   - Trucks – air suspension 3S2 State / LTPP
     2nd common State / LTPP
     3rd common State / LTPP
     4th common State / LTPP
     Loads State / LTPP
     Contact ____

     Drivers State / LTPP

STATE_CODE _0_ _6_

WIM SITE COORDINATION

SPS Project_ID _0_ _5_ _0_ _0_

Contact ____

Contractors with prior successful experience in WIM calibration in state:
___________PAT/IRD____

- Profiling – short wave -- permanent / temporary site marking
  -- long wave – permanent / temporary site marking

- Pre-visit data
  – Classification and speed: Contact ___Joe Avis – (916) 654-3072____________
  -- Equipment operational status: Contact ___Joe Avis – (916) 654-3072________

- Access to cabinet
  State only / Joint / LTPP Key / Combination

- State personnel required on site Y / N
  Contact information ___Joe Avis – (916) 654-3072______________________________

- Enforcement Coordination required: Y / N
  Contact information ____

- Traffic Control Required: Y/ N
  Contact information ____

- Authorization to calibrate site -- State only / LTPP

- Special conditions ____

5. Site visit – Construction

- Construction schedule and verification – Contact Mohammed Ratsmi 916-654-6448

- Notice for straightedge and grinding check - _14_ days / weeks
  On site lead to direct / accept grinding – State / LTPP

- WIM Calibration - advance notice required __7__ days / weeks
  Number of lanes -- __4___
  LTPP / State per LTPP protocol / State Other ________________

- Trucks – air suspension 3S2 State / LTPP
  2nd common State / LTPP
  Loads State / LTPP
  Drivers State / LTPP

Contractors with prior successful experience in WIM calibration in state:

WIM SITE COORDINATION SPS Project_ID _0_ _5_ _0_ _0_

______________PAT/IRD____

- Profiling – straight edge -- permanent / temporary site marking
  -- long wave – permanent / temporary site marking

- Pre-visit data
  – Classification and speed: Contact ___Joe Avis – (916) 654-3072___________
  -- Equipment operational status: Contact __Joe Avis – (916) 654-3072________

- Access to cabinet
  State only / Joint / LTPP Key / Combination

- State personnel required on site Y / N
Contact information ___Joe Avis – (916) 654-3072_____________________________

- Enforcement Coordination required: Y / N
Contact information ____

- Traffic Control Required: Y/ N
Contact information ____

- Authorization to calibrate site -- State only / LTPP

- Special conditions ____

6. Special conditions
   - Funds and accountability
   - Reports
   - Other

SHEET 16 LTPP MONITORED TRAFFIC DATA SITE CALIBRATION SUMMARY	*STATE ASSIGNED ID [_0_ _0_ _2_ _5_] *STATE CODE [0__ _6_] *SHRP SECTION ID [_0_ _5_ _0_ _0_]

SITE CALIBRATION INFORMATION

1. * DATE OF CALIBRATION (MONTH/DAY/YEAR) [_0_ _3_ / _0_ _4_ / _2_ _0_ _0_ _4_]

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

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

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

5. EQUIPMENT MANUFACTURER __________PAT DAW____

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 _XX__ MANUAL ___ PARALLEL CLASSIFIERS

13. METHOD TO DETERMINE LENGTH OF COUNT ____ TIME _100___ NUMBER OF TRUCKS

14. MEAN DIFFERENCE IN VOLUMES BY VEHICLES CLASSIFICATION:
*** FHWA CLASS 9 ____ _1___ ____ FHWA CLASS _____ ____ ____
*** FHWA CLASS 8 ____ _300___ ____ FHWA CLASS ____ ____ ____ ____ ____
FHWA CLASS ____ ____ ____ ____ ____
FHWA CLASS ____ ____ ____ ____ ____
*** PERCENT "UNCLASSIFIED" VEHICLES: ____ _1___ ____

PERSON LEADING CALIBRATION EFFORT: _____Dean J. Wolf__________________________________
CONTACT INFORMATION: ________301-210-5105 ________________________ rev. November 9, 1999