Validation Report

California, SPS-2
Task Order 16, CLIN 2
March 25 to 26, 2008

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1 Executive Summary

A visit was made to the California 0200 on March 25 to 26, 2008 for the purposes of conducting a validation of the WIM system located on SR 99, approximately 20 miles south of Modesto, CA. The SPS-2 is located in the righthand, northbound lane of a four-lane divided facility. The posted speed limit at this location is 55 mph. The LTPP lane is the only lane that is instrumented at this site. The validation procedures were in accordance with LTPP's SPS WIM Data Collection Guide dated August 21, 2001.

This is the first validation visit to this location. The site was installed on November 30, 2007 by International Road Dynamics Inc..

This site demonstrates the ability to produce research quality loading data under the observed conditions. The classification data is also of research quality.

The site is instrumented with bending plate sensors and iSYNC electronics. It is installed in portland cement concrete.

The validation used the following trucks:

1) 5-axle tractor-trailer with a tractor having an air suspension and a trailer with a standard rear tandem and an air suspension loaded to 76,580 lbs., the "golden" truck.
2) 5-axle tractor semi-trailer with a tractor having an air suspension and a trailer with a standard rear tandem and an air suspension loaded to 64,740 lbs., the "partial" truck.

The validation speeds ranged from 45 to 55 miles per hour. The pavement temperatures ranged from 35 to 79 degrees Fahrenheit. The desired speed range was achieved during this validation. The desired 30 degree Fahrenheit temperature range was also achieved.

Table 1-1 Post-Validation results – 060200 – 26-Mar-2008

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	0.3 ± 3.6%	Pass
Tandem axles	±15 percent	1.3 ± 2.7%	Pass
GVW	±10 percent	1.2 ± 1.4%	Pass
Axle spacing	± 0.5 ft [150mm]	0.0 ± 0.1 ft	Pass

Prepared: djw *Checked: bko*

The pavement condition appeared to be satisfactory for conducting a performance evaluation. There were no distresses observed that would influence truck motions significantly. A visual survey determined that there is no discernable bouncing or avoidance by trucks in the sensor area.

Based on profile data collected at this site on December 17, 2007 WIMIndex values have been computed. All WIMIndex values fell between the Lower and Upper Thresholds.

If this site had been evaluated using ASTM E-1318-02 it would have met the conditions for a Type I site exclusive of wheel loads. LTPP does not validate WIM performance with respect to wheel loads.

Table 1-2 Results Based on ASTM E-1318-02 Test Procedures

Characteristic	Limits for Allowable Error	Percent within Allowable Error	Pass/Fail
Single Axles	± 20%	100%	Pass
Axle Groups	± 15%	100%	Pass
GVW	± 10%	100%	Pass

Prepared: djw *Checked: bko*

This site needs five years of data to meet the goal of five years of research quality data.

2 Corrective Actions Recommended

There are no corrective actions required at this site at this time.

3 Post Calibration Analysis

This final analysis is based on test runs conducted March 26, 2008 during the morning and afternoon hours at test site 060200 on SR 99. This SPS-2 site is at milepost 32.5 on the northbound, righthand of a four-lane divided facility. No auto-calibration was used during test runs. The two trucks used for the validation included:

1. 5-axle tractor-trailer with a tractor having an air suspension and trailer with a standard rear tandem and air suspension loaded to 76,580 lbs., the "golden" truck.
2. 5-axle tractor semi-trailer with a tractor having an air suspension and a trailer with a standard rear tandem and an air suspension loaded to 64,740 lbs., the "partial" truck.

Each truck made a total of 20 passes over the WIM scale at speeds ranging from approximately 45 to 55 miles per hour. The desired speed range was achieved during this validation. Pavement surface temperatures were recorded during the test runs ranging from about 35 to 79 degrees Fahrenheit. The desired 30 degree Fahrenheit temperature range was achieved. The computed values of 95% confidence limits of each statistic for the total population are in Table 3-1.

As shown in Table 3-1, this site met all LTPP requirements for research quality loading data.

Table 3-1 Post-Validation Results – 060200 – 26-Mar-2008

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	0.3 ± 3.6%	Pass
Tandem axles	±15 percent	1.3 ± 2.7%	Pass
GVW	±10 percent	1.2 ± 1.4%	Pass
Axle spacing	± 0.5 ft [150mm]	0.0 ± 0.1 ft	Pass

Prepared: djw *Checked: bko*

The test runs were conducted primarily during the late morning and early afternoon hours under sunny weather conditions, resulting in a wide range of pavement temperatures. The runs were also conducted at various speeds to determine the effects of these variables on the performance of the WIM scale. To investigate these effects, the data set was split into three speed groups and two temperature groups. The distribution of runs by speed and temperature is illustrated in Figure 3-1. The figure indicates that the desired distribution of speed and temperature combinations was achieved for this set of validation runs.

The three speed groups were divided as follows: Low speed – 45 to 47 mph, Medium speed – 48 to 52 mph and High speed – 53 + mph. The two temperature groups were created by splitting the runs between those at 35 to 55 degrees Fahrenheit for Low temperature and 56 to 79 degrees Fahrenheit for High temperature.

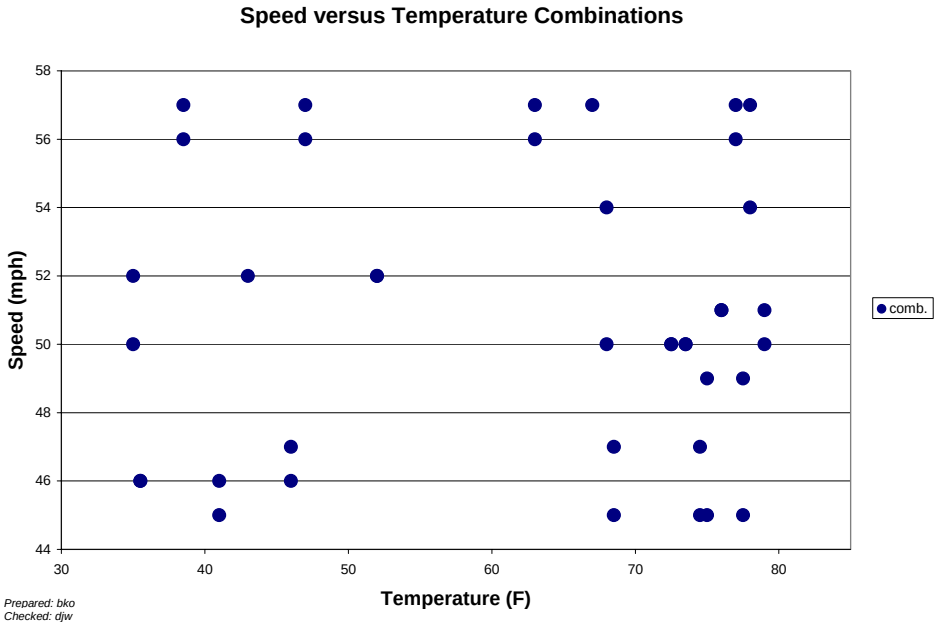

Figure 3-1 Post-Validation Speed-Temperature Distribution – 060200 – 26-Mar-2008

A series of graphs were developed to investigate visually any sign of a relationship between speed or temperature and the scale performance.

Figure 3-2 shows the GVW Percent Error vs. Speed graph for the population as a whole. It can be seen that the GVW is slightly overestimated by the WIM equipment over the entire speed range. The scatter of error is consistent over the entire speed range.

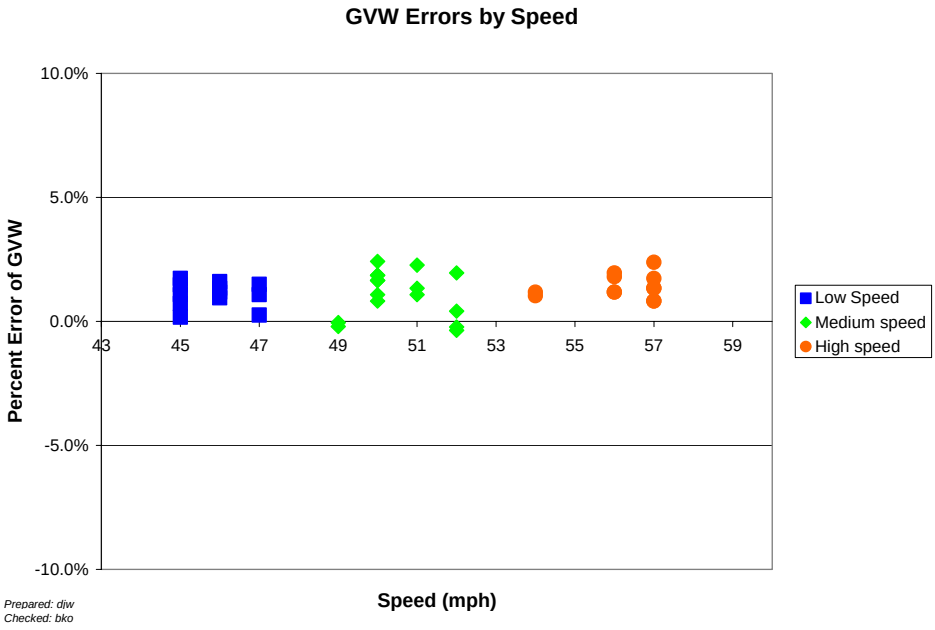

Figure 3-2 Post-validation GVW Percent Error vs. Speed – 060200 – 26-Mar-2008

Figure 3-3 shows the relationship between temperature and GVW percentage error. The graph illustrates that there does not appear to be a relationship between GVW error and pavement temperature. This figure shows the gap in the temperature range that led to the decision to create two temperature groups rather than three.

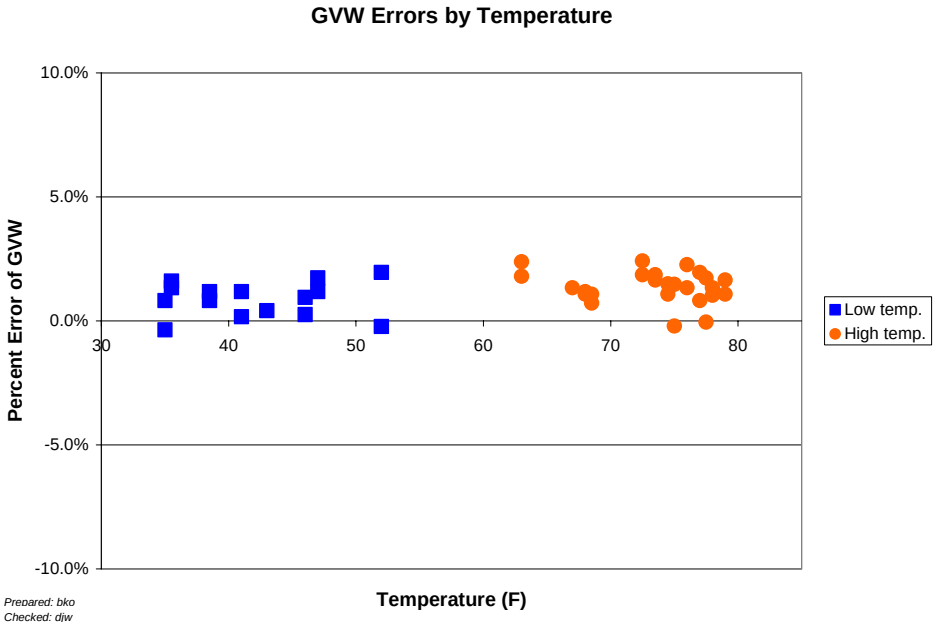

Figure 3-3 Post-Validation GVW Percent Error vs. Temperature – 060200 – 26-Mar-2008

Figure 3-4 shows the relationship between the drive tandem spacing errors in feet and speeds. This graph is used as a potential indicator of classification errors due to failure to correctly identify spacings on a vehicle. Since the most common reference value is the drive tandem on a Class 9 vehicle, this is the spacing evaluated and plotted for validations. Axle spacing errors appear to be consistent throughout the test truck speed range and are limited to about 1.2 inches (0.1 feet). Vehicle speeds appear to have no effect on the error of measured axle spacing.

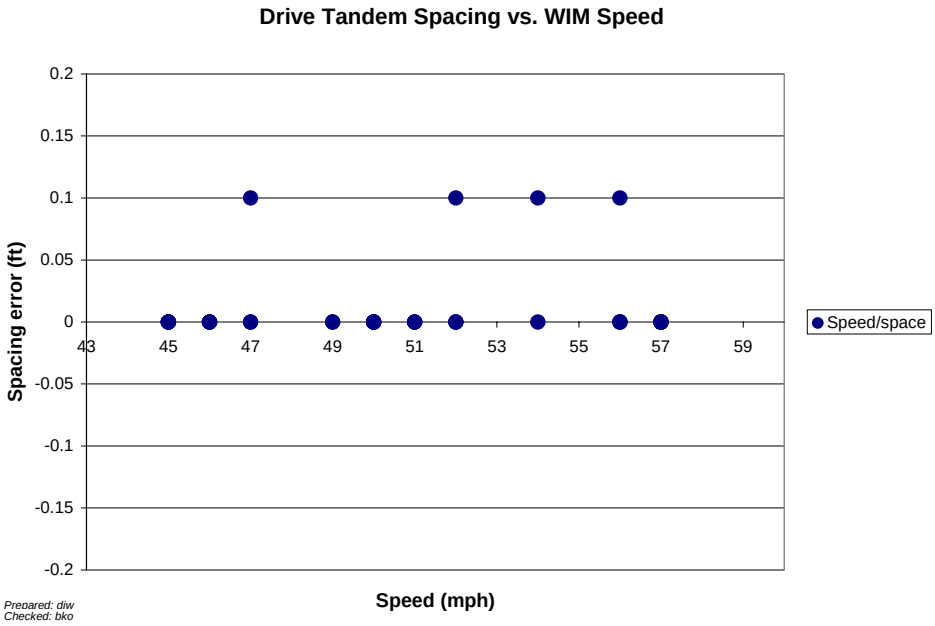

Figure 3-4 Post-Validation Spacing vs. Speed – 060200 – 26-Mar-2008

3.1 Temperature-based Analysis

The two temperature groups were created by splitting the runs between those at 35 to 55 degrees Fahrenheit for Low temperature and 56 to 79 degrees Fahrenheit for High temperature.

Table 3-2 Post-Validation Results by Temperature Bin – 060200 – 26-Mar-2008

Element	95% Limit	Low Temperature 35 to 55 °F	High Temperature 56 to 79 °F
Steering axles	±20 %	0.8 ± 3.5%	0.0 ± 3.8%
Tandem axles	±15 %	0.9 ± 2.8%	1.6 ± 2.6%
GVW	±10 %	0.9 ± 1.5%	1.4 ± 1.3%
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft

From Table 3-2, it appears that changes in temperature do not significantly affect mean errors of GVW, Tandem, or Steering axle weight estimates. The scatter of errors remains constant throughout the entire temperature range.

Figure 3-5 is the distribution of GVW Errors versus Temperature by Truck graph.

GVW estimation appears to be reasonably consistent over the entire temperature range for the population as a whole. The GVW results for both the Golden Truck (squares) and the partially loaded truck (diamonds) indicate similar results for both mean error and scatter.

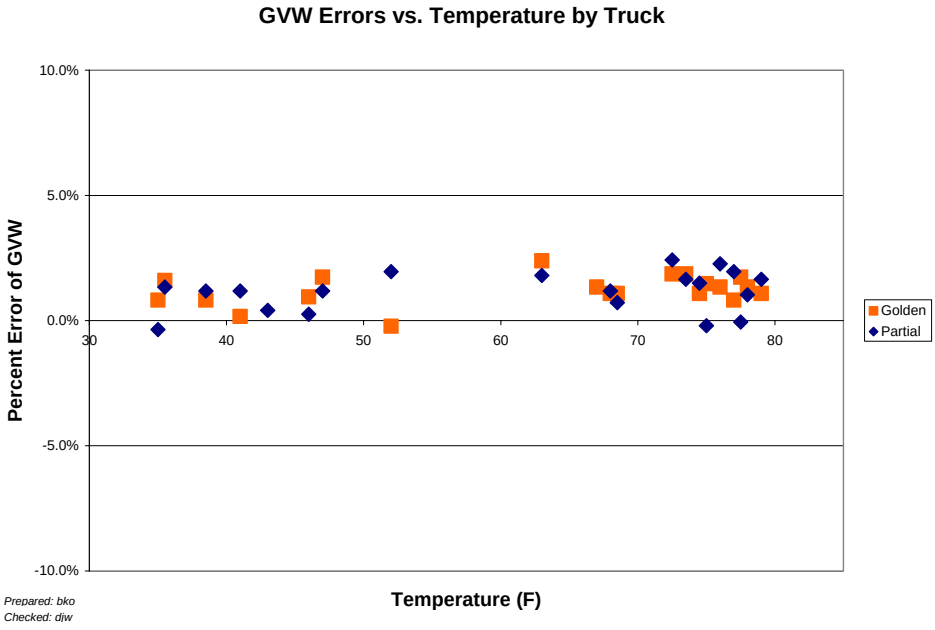

Figure 3-5 Post-Validation GVW Percent Error vs. Temperature by Truck – 060200 – 26-Mar-2008

Figure 3-6 shows the relation between steering axle errors and temperature. This graph is included due to the frequent use of steering axle weights of Class 9 vehicles for calibration. This site does not use auto-calibration. The steering axles in this graph are associated only with Class 9 vehicles. The figure illustrates the ability of the equipment to accurately estimate steering axle weights at all temperatures. The scatter of error appears to be slightly greater at the higher temperatures.

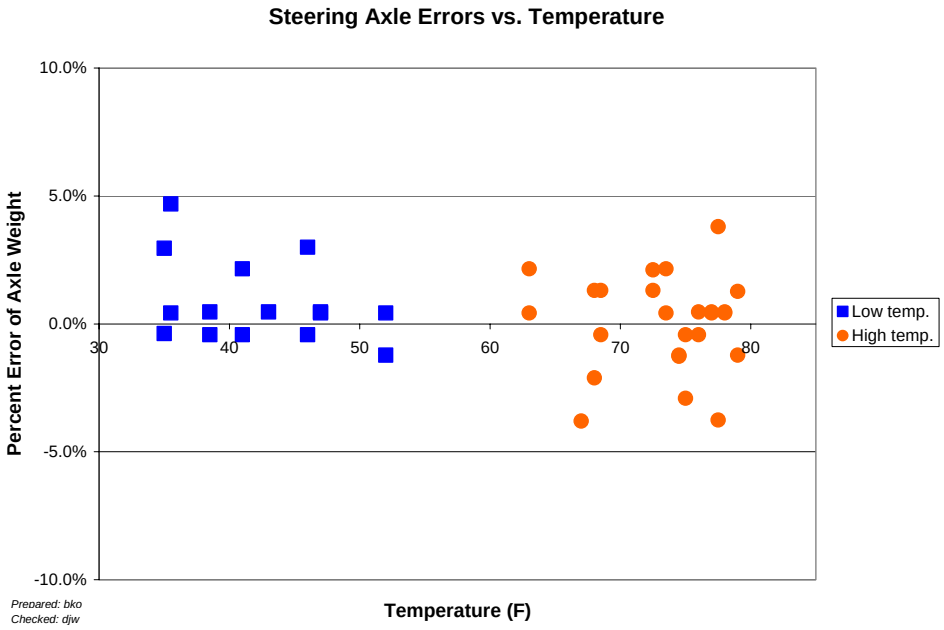

Figure 3-6 Post-Validation Steering Axle Error vs. Temperature by Group – 060200 – 26-Mar-2008

3.2 Speed-based Analysis

The three speed groups were divided using 45 to 47 mph for Low speed, 48 to 52 mph for Medium speed and 53+ mph for High speed.

Table 3-3 Post-Validation Results by Speed Bin – 060200 – 26-Mar-2008

Element	95% Limit	Low Speed 45 to 47 mph	Medium Speed 48 to 52 mph	High Speed 53+ mph
Steering axles	±20 %	0.9 ± 4.5%	0.0 ± 4.0%	0.2 ± 3.1%
Tandem axles	±15 %	1.0 ± 2.9%	1.3 ± 2.7%	1.7 ± 2.9%
GVW	±10 %	1.1 ± 1.1%	1.1 ± 2.0%	1.4 ± 1.1%
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft

Prepared: djw *Checked: bko*

From Table 3-3, it appears that the equipment estimates all weights with reasonable accuracy at all speeds. Scatter for Tandem axles and GVW errors are consistent over the entire speed range. Scatter of Steering axle weight errors slightly decrease as speed increases.

Figure 3-7 illustrates the accuracy of the equipment in estimating GVW for the truck population as a whole as well as for each truck individually. The range of error for the trucks combined and individually is also consistent over the entire speed range.

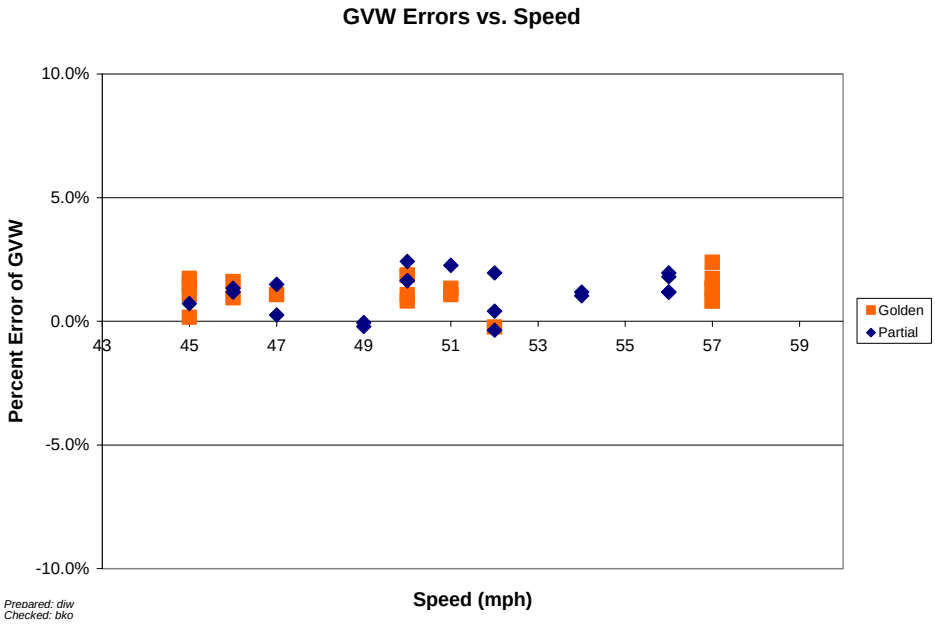

Figure 3-7 Post-Validation GVW Percent Error vs. Speed by Truck – 060200 – 26-Mar-2008

Figure 3-8 shows the relationship between steering axle errors and speed. This graph is included due to the frequent use of steering axle weights of Class 9 vehicles for auto-calibration. This site does not use auto-calibration. The steering axles in this graph are associated only with Class 9 vehicles. The figure shows how the WIM equipment estimates steering axle weights with reasonable accuracy at all speeds.

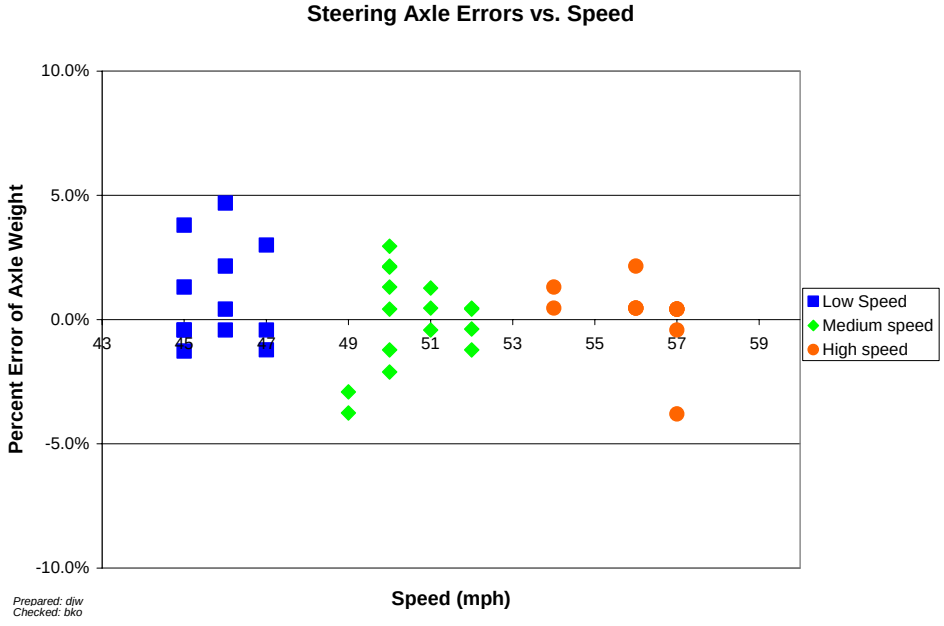

Figure 3-8 Post-Validation Steering Axle Percent Error vs. Speed by Group – 060200 – 26-Mar-2008

3.3 Classification Validation

This LTPP installed site uses the FHWA 13-bin classification scheme and the LTPP ETG mod 3 classification algorithm. Classification 15 has been added to define unclassified vehicles.

The classification validation is intended to find gross errors in vehicle classification, not to validate the installed algorithm. 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 the sample it was determined that there are zero percent unknown vehicles and zero percent unclassified vehicles.

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 3-4 has the classification error rates by class. The overall misclassification rate is zero percent.

Table 3-4 Truck Misclassification Percentages for 060200 – 26-Mar-2008

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

Prepared: djw *Checked: bko*

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 3-5 Truck Classification Mean Differences for 060200 – 26-Mar-2008

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

Prepared: djw *Checked: bko*

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 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 at least how many more vehicles are assigned to the class than the actual "hundred observed". Classes marked Unknown (UNK) 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 vehicles of that type might actually exist. N/A means no vehicles of the class were recorded by either the equipment or the observer.

A limited investigation of the precision and bias of the speeds reported by the equipment was undertaken. The values were not within the expected tolerances. Since the classification data met research quality standards, the observed bias and variability are thought to be more strongly related to radar speed precision than errors in the WIM equipment.

3.4 Evaluation by ASTM E-1318 Criteria

The ASTM E-1318 criteria for a successful validation of Type I sites is 95% of the observed errors within the limits for allowable errors for each of the relevant statistics. If this site had been evaluated using ASTM E-1318-02 it would have met the conditions for a Type I site exclusive of wheel loads. LTPP does not validate WIM performance with respect to wheel loads.

Table 3-6 Results of Validation Using ASTM E-1318-02 Criteria

Characteristic	Limits for Allowable Error	Percent within Allowable Error	Pass/Fail
Single Axles	± 20%	100%	Pass
Axle Groups	± 15%	100%	Pass
GVW	± 10%	100%	Pass

Prepared: djw *Checked: bko*

4 Pavement Discussion

The pavement condition did not appear to influence truck movement across the sensors.

4.1 Profile Analysis

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 collected longitudinal profiles of the test section with a sampling interval of 25 mm.

Profile data collected at the SPS WIM location by Nichols Consulting Engineers on December 17, 2007 were processed through the LTPP SPS WIM Index Software version 1.1. This WIM scale is installed on rigid pavement.

A total of 8 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 has completed 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 lane were collected as close to the lane edge as was safely possible. For each profiler pass, profiles were collected under the left wheel path (LWP) and the right wheel path (RWP).

The SPS WIM Index software was developed with four different indices: LRI, SRI, Peak LRI, and Peak SRI. The 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 SRI incorporates a shorter section of pavement profile beginning 2.74 m prior to the WIM scale and ending 0.46 m after the scale. The LRI and SRI are the index values for the actual location of the WIM scale. Peak LRI is the highest value of the LRI within 30 m prior to the scale. Peak SRI indicates the highest value of SRI that is located between 2.45 m prior to the scale and 1.5 m after the scale. Also, a range for each of the indices was developed to provide the smoothness criteria. The ranges are shown in Table 4-1. When all of the values are below the lower thresholds, it is presumed unlikely that the pavement smoothness will significantly influence sensor output. When one or more values exceed an upper threshold, there is a reasonable expectation that the pavement smoothness will influence the outcome of the validation. When all values are below the upper threshold but not all below the lower threshold, the pavement smoothness may or may not influence the validation outcome.

Table 4-1 Thresholds for WIM Index Values

Index	**Lower Threshold (m/km)**	**Upper Threshold (m/km)**
LRI	0.50	2.1
SRI	0.50	2.1
Peak LRI	0.50	2.1
Peak SRI	0.75	2.9

Prepared: als *Checked: jrn*

Table 4-2 shows the computed index values for all 8 profiler passes for this WIM site. The average values over the passes in each path were also calculated when three or more passes were completed. These are shown in the rightmost column of the table. Values above the upper index limits are presented in bold while values below the lower index limits are presented in italics.

Table 4-2 WIM Index Values – 060200 – 17-Dec-2007

Profiler Passes			Pass 1	Pass 2	Pass 3	Pass 4	Ave.
Center	LWP	LRI (m/km)	1.085	1.021	1.063	1.078	1.062
		SRI (m/km)	0.974	1.358	0.952	0.628	0.978
		Peak LRI (m/km)	1.093	1.120	1.081	1.308	1.150
		Peak SRI (m/km)	1.217	1.620	1.125	1.057	1.255
	RWP	LRI (m/km)	1.214	1.278	1.300	1.064	1.214
		SRI (m/km)	1.381	1.427	1.445	0.904	1.289
		Peak LRI (m/km)	1.216	1.281	1.301	1.077	1.219
		Peak SRI (m/km)	1.594	1.449	1.638	1.241	1.480
Left Shift	LWP	LRI (m/km)	1.218	1.191			
		SRI (m/km)	1.209	0.765			
		Peak LRI (m/km)	1.419	1.548			
		Peak SRI (m/km)	1.452	0.996			
	RWP	LRI (m/km)	1.137	1.413			
		SRI (m/km)	1.318	1.827			
		Peak LRI (m/km)	1.137	1.416			
		Peak SRI (m/km)	1.363	1.917			
Right Shift	LWP	LRI (m/km)	1.147	0.875			
		SRI (m/km)	0.571	0.778			
		Peak LRI (m/km)	1.173	0.892			
		Peak SRI (m/km)	0.988	0.959			
	RWP	LRI (m/km)	1.173	1.123			
		SRI (m/km)	1.029	0.811			
		Peak LRI (m/km)	1.256	1.275			
		Peak SRI (m/km)	1.404	1.268			

Prepared: als *Checked: jrn*

From the table, it can be seen that all of the values fall between the threshold limits indicating that the pavement roughness may or may not interfere with the validation outcome.

4.2 Distress Survey and Any Applicable Photos

During a visual survey of the pavement, no distresses that would influence truck movement across the WIM scales were noted.

4.3 Vehicle-pavement Interaction Discussion

A visual observation of the trucks as they approach, traverse and leave the sensor area did not indicate any visible motion of the trucks that would affect the performance of the WIM scales. Trucks appear to track down the wheel path and daylight cannot be seen between the tires and any of the sensors for the equipment.

5 Equipment Discussion

The traffic monitoring equipment at this location includes bending plate sensors and iSYNC electronics. The sensors are installed in a portland cement concrete pavement.

5.1 Pre-Evaluation Diagnostics

A complete electronic and electrical check of all system components including in-road sensors, electrical power, and telephone service were performed immediately prior to the validation. All sensors and system components were found to be operating within acceptable tolerances.

5.2 Calibration Process

The equipment required no iterations of the calibration process between the initial 40 runs and the final 40 runs.

The operating system weight compensation parameters that were in place during the validation and remained afterward are as follows:

	Left Sensor 1	Right Sensor 2
72 kph	3395	3395
80 kph	3395	3395
88 kph	3420	3420
96 kph	3360	3360
104 kph	3360	3360

5.3 Summary of Traffic Sheet 16s

Table 5-1 has the information for TRF_CALIBRATION_AVC from Sheet 16s submitted for the current visit. . We have no Sheet 16 information for the initial calibration for this site.

Table 5-1 Classification Validation History – 060200 – 26-Mar-2008

Date	Method	Mean Difference				Percent Unclassified
		Class 9	Class 8	Other 1	Other 2	
26-Mar-08	Manual	0	0			0
25-Mar-08	Manual	0	0			0

Prepared: djw *Checked: bko*

Table 5-2 has the information for TRF_CALIBRATION_WIM from Sheet 16s submitted for the current visit. We have no Sheet 16 information for the initial calibration for this site.

Table 5-2 Weight Validation History – 060200 – 26-Mar-2008

Date	Method	Mean Error and (SD)		
		GVW	Single Axles	Tandem Axles
26-Mar-08	Test Trucks	1.2 (0.7)	0.3 (1.8)	1.3 (1.4)
25-Mar-08	Test Trucks	1.1 (1.1)	1.2 (1.7)	1.0 (1.4)

Prepared: djw *Checked: bko*

5.4 Projected Maintenance/Replacement Requirements

Under a separate contract with the Phase II Contractor, this site is to be visited semi-annually for routine preventive equipment diagnostics and inspection.

No corrective actions are required at this time.

6 Pre-Validation Analysis

This pre-validation analysis is based on test runs conducted March 25, 2008 during the late morning and early afternoon hours at test site 060200 on SR 99. This SPS-2 site is at milepost 32.5 on the northbound, righthand of a four-lane divided facility. No auto-calibration was used during test runs. The two trucks used for initial validation included:

1. 5-axle tractor semi-trailer combination with a tractor having an air suspension and trailer with standard rear tandem and an air suspension loaded to 77,260 lbs., the "golden" truck.
2. 5-axle tractor semi-trailer with a tractor having an air suspension and a trailer with a standard rear tandem and an air suspension loaded to 64,930 lbs., the "partial" truck.

For the initial validation, each truck made a total of 20 passes over the WIM scale at speeds ranging from approximately 44 to 55 miles per hour. The desired speed range was achieved during this validation. Pavement surface temperatures were recorded during the test runs ranging from about 52 to 97degrees Fahrenheit. The desired 30 degree Fahrenheit temperature range was achieved. The computed values of 95% confidence limits of each statistic for the total population are in Table 6-1.

As shown in Table 6-1 this site passed all of the performance criteria for weight and spacing. As a result, it was determined that a calibration of the system was not necessary.

Table 6-1 Pre-Validation Results – 060200 – 25-Mar-2008

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	1.2 ± 3.5%	Pass
Tandem axles	±15 percent	1.0 ± 2.8%	Pass
GVW	±10 percent	1.1 ± 2.1%	Pass
Axle spacing	± 0.5 ft [150mm]	0.0 ± 0.1 ft	Pass

Prepared: djw *Checked: bko*

The test runs were conducted primarily during the late morning and early afternoon hours under sunny weather condition, resulting in a wide range of pavement temperatures. The runs were also conducted at various speeds to determine the effects of these variables on the performance of the WIM scale. To investigate these effects, the dataset was split into three speed groups and three temperature groups. The distribution of runs within these groupings is illustrated in Figure 6-1. The figure indicates that the desired distribution of speed and temperature combinations was achieved for this set of validation runs.

The three speed groups were divided into 44 to 47 mph for Low speed, 48 to 52 mph for Medium speed and 53+ mph for High speed. The three temperature groups were created by splitting the runs between those at 52 to 63 degrees Fahrenheit for Low temperature, 64 to 71 degrees Fahrenheit for Medium temperature and 72 to 97 degrees Fahrenheit for High temperature.

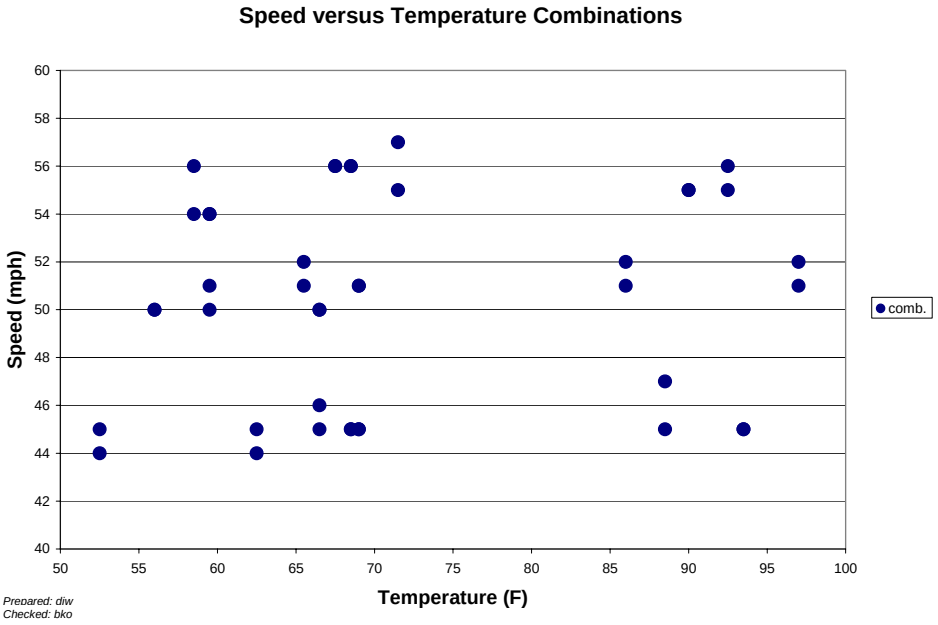

Figure 6-1 Pre-Validation Speed-Temperature Distribution – 060200 – 25-Mar-2008

A series of graphs was developed to investigate visually for any sign of any relationship between speed or temperature and the scale performance.

Figure 6-2 shows the GVW Percent Error vs. Speed graph for the population as a whole. The figure illustrates the ability to estimate GVW accurately at all speeds. Variability appears to be consistent over the entire speed range.

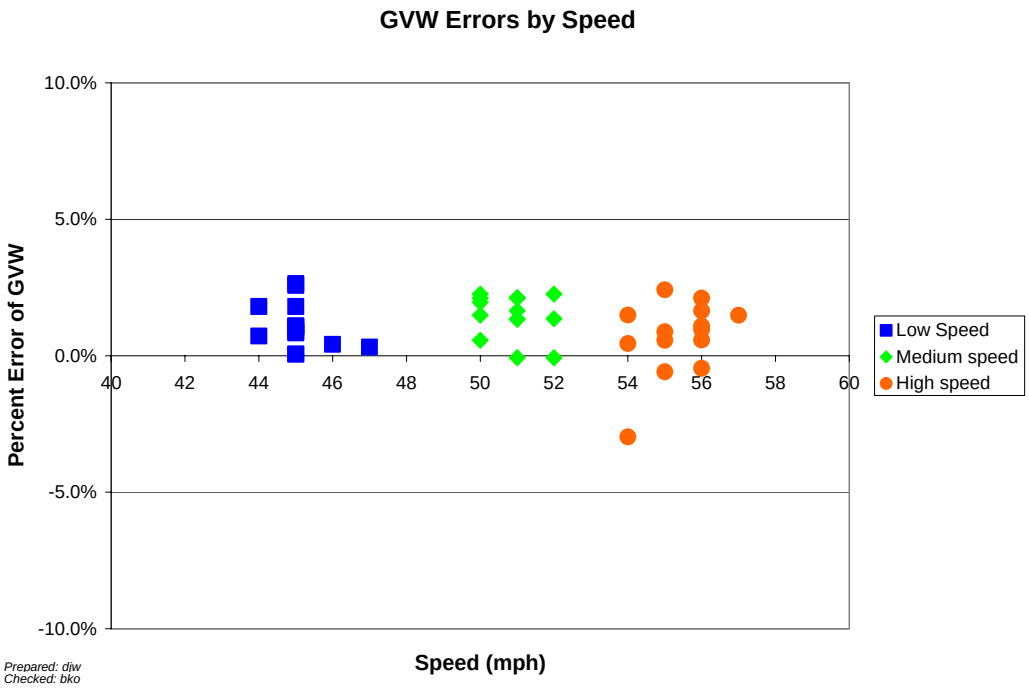

Figure 6-2 Pre-validation GVW Percent Error vs. Speed – 060200 – 25-Mar-2008

Figure 6-3 shows the lack of a relationship between temperature and GVW percentage error.

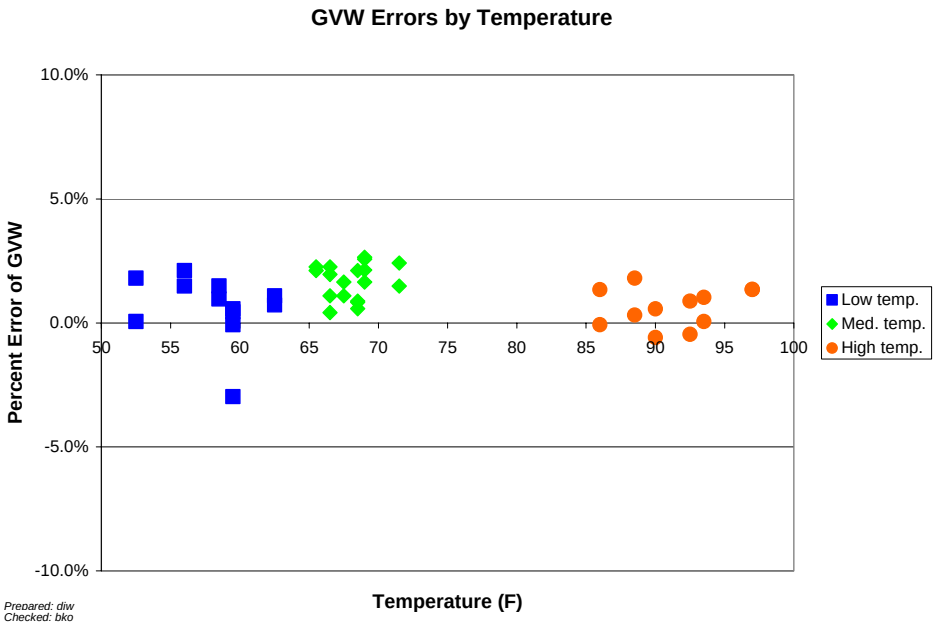

Figure 6-3 Pre-Validation GVW Percent Error vs. Temperature – 060200 – 25-Mar-2008

Figure 6-4 shows the relationship between the drive tandem spacing errors in feet and speeds. This graph is used as a potential indicator of classification errors due to failure to correctly identify spacings on a vehicle. Since the most common reference value is the drive tandem on a Class 9 vehicle, this is the spacing evaluated and plotted for validations. The graph indicates that the errors in tandem spacings for the test trucks were not affected by changes in speed.

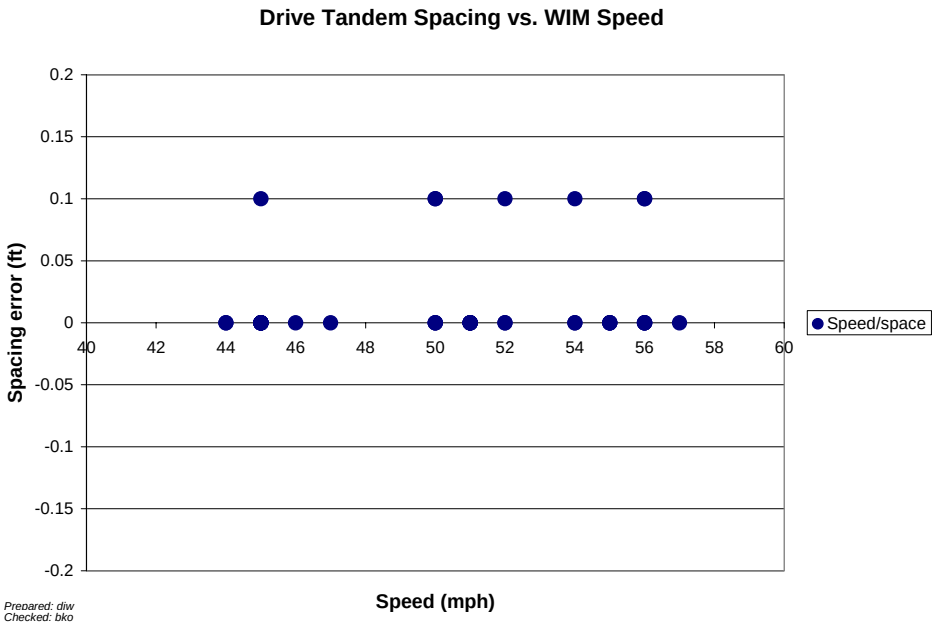

Figure 6-4 Pre-Validation Spacing vs. Speed - 060200 – 25-Mar-2008

6.1 Temperature-based Analysis

The three temperature groups were created by splitting the runs between those at 52 to 63 degrees Fahrenheit for Low temperature, 64 to 71 degrees Fahrenheit for Medium temperature and 72 to 97 degrees Fahrenheit for High temperature.

Table 6-2 Pre-Validation Results by Temperature Bin – 060200 – 25-Mar-2008

Element	95% Limit	Low Temperature 52 to 63 °F	Medium Temperature 64 to 71 °F	High Temperature 72 to 97 °F
Steering axles	±20 %	1.5 ± 4.6%	1.6 ± 3.4%	0.4 ± 3.1%
Tandem axles	±15 %	0.5 ± 3.2%	1.7 ± 2.6%	0.6 ± 2.2%
GVW	±10 %	0.6 ± 2.9%	1.7 ± 1.5%	0.6 ± 1.7%
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft

Prepared: djw *Checked: bko*

From Table 6-2, it appears that the equipment estimates all weights with reasonable accuracy.

Figure 6-5 shows the distribution of GVW Errors versus Temperature by Truck. The equipment appears to estimate GVW accurately at all temperatures for each truck and for the population as a whole. The variability in error for each truck appears to be similar at all temperatures and appears to be consistent for the truck population as a whole over the entire temperature range.

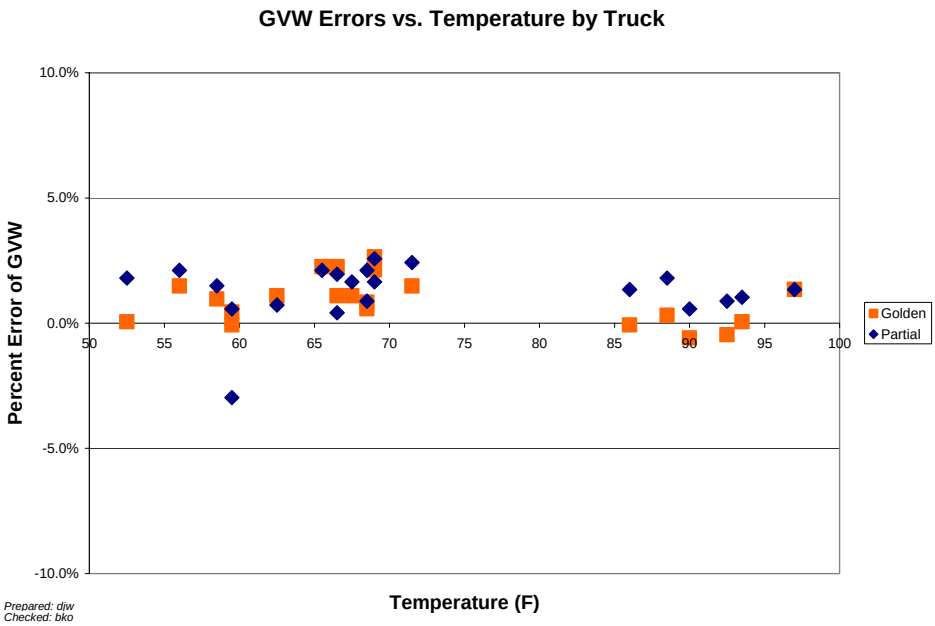

Figure 6-5 Pre-Validation GVW Percent Error vs. Temperature by Truck – 060200 – 25-Mar-2008

Figure 6-6 shows the relationship between steering axle errors and temperature. This graph is included due to the frequent use of steering axle weights of Class 9 vehicles for auto-calibration. This site does not use auto-calibration. The steering axles in this graph are associated only with Class 9 vehicles. The figure shows that steering axle weights are slightly overestimated at the lower temperatures and estimated with reasonable accuracy at the higher temperatures.

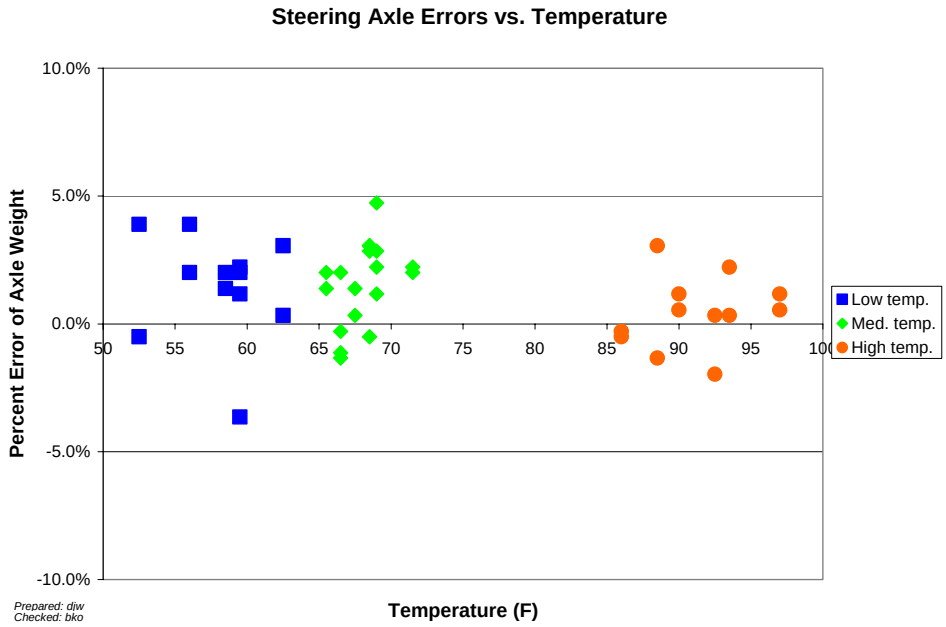

Figure 6-6 Pre-Validation Steering Axle Error vs. Temperature by Group – 060200 – 25-Mar-2008

6.2 Speed-based Analysis

The speed groups were divided as follows: Low speed – 44 to 47 mph, Medium speed – 48 to 52 mph and High speed – 53+ mph.

Table 6-3 Pre-Validation Results by Speed Bin – 060200 – 25-Mar-2008

Element	95% Limit	Low Speed 44 to 47 mph	Medium Speed 48 to 52 mph	High Speed 53+ mph
Steering axles	±20 %	1.2 ± 4.5%	1.5 ± 2.8%	0.9 ± 3.9%
Tandem axles	±15 %	1.1 ± 2.7%	1.4 ± 2.0%	0.6 ± 3.6%
GVW	±10 %	1.1 ± 1.8%	1.5 ± 1.7%	0.7 ± 2.9%
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft

Prepared: djw *Checked: bko*

From Table 6-3, it can be seen that the equipment generally estimates all weights and spacings accurately. Variability in error for all weights is slightly lower at the medium speeds.

Figure 6-2 illustrates the ability of the equipment to estimate GVW for both trucks with reasonable accuracy at all speeds. Variability in error appears to be similar for both trucks at all speeds.

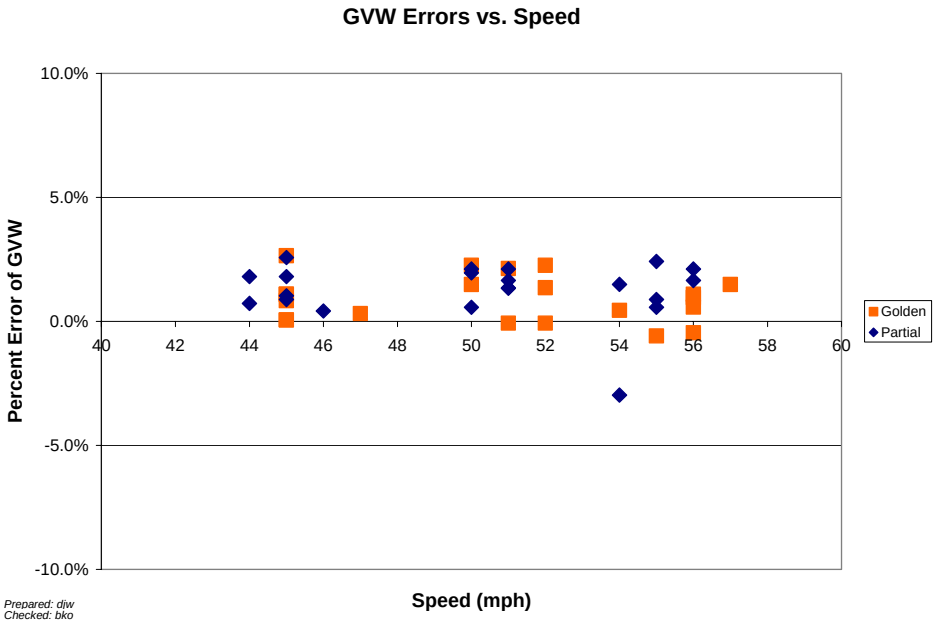

Figure 6-7 Pre-Validation GVW Percent Error vs. Speed Group - 060200 –25-Mar-2008

Figure 6-8 shows the relationship between steering axle errors and speed. This graph is included due to the frequent use of steering axle weights of Class 9 vehicles for calibration. This site does not use auto-calibration. The steering axles in this graph are associated only with Class 9 vehicles. From the figure, it appears that the equipment overestimates steering axle weights at all speeds. Variability in error appears to remain fairly constant over the entire speed range, with a slight increase at the high speeds.

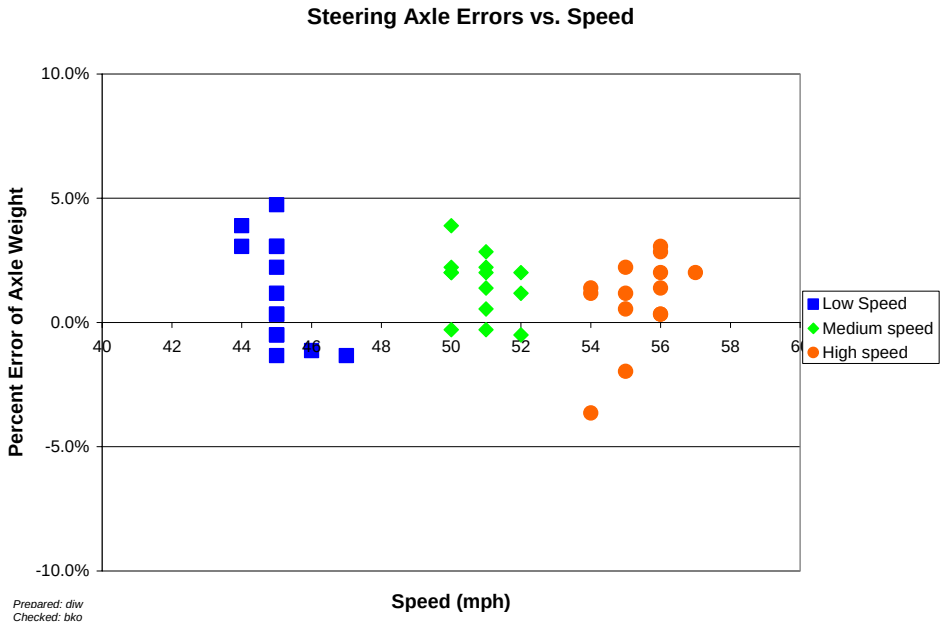

Figure 6-8 Pre-Validation Steering Axle Percent Error vs. Speed Group - 060200 – 25-Mar-2008

6.3 Classification Validation

This LTPP installed site uses the FHWA 13-bin classification scheme and the LTPP ETG mod 3 classification algorithm. Classification 15 has been added to define unclassified vehicles.

The classification validation is intended to find gross errors in vehicle classification, not to validate the installed algorithm. A sample of 100 trucks was collected at the site. The classification identification is to identify gross errors in classification, not validate the classification algorithm. Video was taken at the site to provide ground truth for the evaluation. Based on the sample it was determined that there are zero percent unknown vehicles and zero percent unclassified vehicles.

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 6-4 has the classification error rates by class. The overall misclassification rate is zero percent.

Table 6-4 Truck Misclassification Percentages for 060200 – 25-Mar-2008

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

Prepared: djw *Checked: bko*

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 a re 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 6-5 Truck Classification Mean Differences for 060200 – 25-Mar-2008

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

Prepared: djw *Checked: bko*

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 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 at least 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 the observer. There is no way to tell how many vehicles of that type might actually exist. N/A means no vehicles of the class were recorded by either the equipment or the observer.

A limited investigation of the precision and bias of the speeds reported by the equipment was undertaken. The values were not within the expected tolerances. Since the classification data met research quality standards, the observed bias and variability are thought to be more strongly related to radar speed precision than errors in the WIM equipment.

6.4 Evaluation by ASTM E-1318 Criteria

The ASTM E-1318 criteria for a successful validation of Type I sites is 95% of the observed errors within the limits for allowable errors for each of the relevant statistics. If this site had been evaluated using ASTM E-1318-02 it would have met the conditions for a Type I site exclusive of wheel loads. LTPP does not validate WIM performance with respect to wheel loads.

Table 6-6 Results of Validation Using ASTM E-1318-02 Criteria

Characteristic	Limits for Allowable Error	Percent within Allowable Error	Pass/Fail
Single Axles	± 20%	100%	Pass
Axle Groups	± 15%	100%	Pass
GVW	± 10%	100%	Pass

Prepared: djw *Checked: bko*

7 Data Availability and Quality

As of March 25, 2008 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.

Data that has validation information available has been 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.

This site is a new installation. Therefore, there is no historical data for this site and 5 years of data is needed to meet the goal of a minimum of 5 years of research quality data.

GVW graphs and characteristics associated with them are used as data screening tools. As a result classes constituting more that ten percent of the truck population are considered major sub-groups whose evaluation characteristics should be identified for use in screening. The typical values to be used for reviewing incoming data after a validation are determined starting with data from the day after the completion of a validation.

Class 9s and Class 5s constitute more than 10 percent of the truck population. Based on the data collected following this validation the following are the expected values for these populations. The precise values to be used in data review will need to be determined by the Regional Support Contractor on receipt of the first 14 days of data after the successful validation. For sites that do not meet LTPP precision requirements, this period may still be used as a starting point from which to track scale changes.

Table 7-1 is generated with a column for every vehicle class 4 or higher that represents 10 percent or more of the truck (class 4-20) population. In creating Table 7-1 the following definitions are used:

- Class 9 overweights are defined as the percentage of vehicles greater than 88,000 pounds
- Class 9 underweights are defined as the percentage of vehicles less than 20,000 pounds.

- Class 9 unloaded peak is the bin less than 44,000 pounds with the greatest percentage of trucks.
- Class 9 loaded peak is the bin 60,000 pounds or larger with the greatest percentage of trucks.
- For all other trucks the typical axle configuration is used to determine the maximum allowable weight based on 18,000 pounds for single axles and 34,000 pounds for tandem axles. A ten percent cushion above that maximum is used to set the overweight threshold.
- For all other trucks in the absence of site specific information the computation of under weights assumes the power unit weighs 10,000 pounds and each axle on a trailer 5,000 pounds. Ninety percent of the total for the unloaded configuration is the value below which a truck is considered under weight.
- For all trucks other than class 9s that have a bi-modal distribution the unloaded peak is defined to be in a bin less than or equal to half of the allowable maximum weight.
- For all trucks other than class 9s that have a bi-modal distribution the loaded peak is defined to be in a bin greater than or equal to half of the allowable maximum weight.

There may be more than one bin identified for the unloaded or loaded peak due to the small sample size collected after validation. Where only one peak exists, the peak rather than a loaded or unloaded peak is identified. This may happen with single unit trucks. It is not expected to occur with combination vehicles.

Table 7-1 GVW Characteristics of Major sub-groups of Trucks – 060200 – 26-Mar-2008

Characteristic	Class 9	Class 5
Percentage Overweights	0.0%	0.1%
Percentage Underweights	0.1%	0.1%
Unloaded Peak	32,000 lbs	
Loaded Peak	78,000 lbs	
Peak		8,000 lbs

Prepared: djw *Checked: bko*

The expected percentage of unclassified vehicles is 1.7%. This is based on the percentage of unclassified vehicles in the post-validation data download.

The graphical screening comparison figures are found in Figure 7-1 through Figure 7-4. These are based on data collected immediately after the validation and may not be wholly representative of the population at the site. They should however provide a sense of the statistics expected when SPS comparison data is computed for the Post-Validation period.

Figure 7-1 Expected GVW Distribution Class 5 – 060200 – 26-Mar-2008

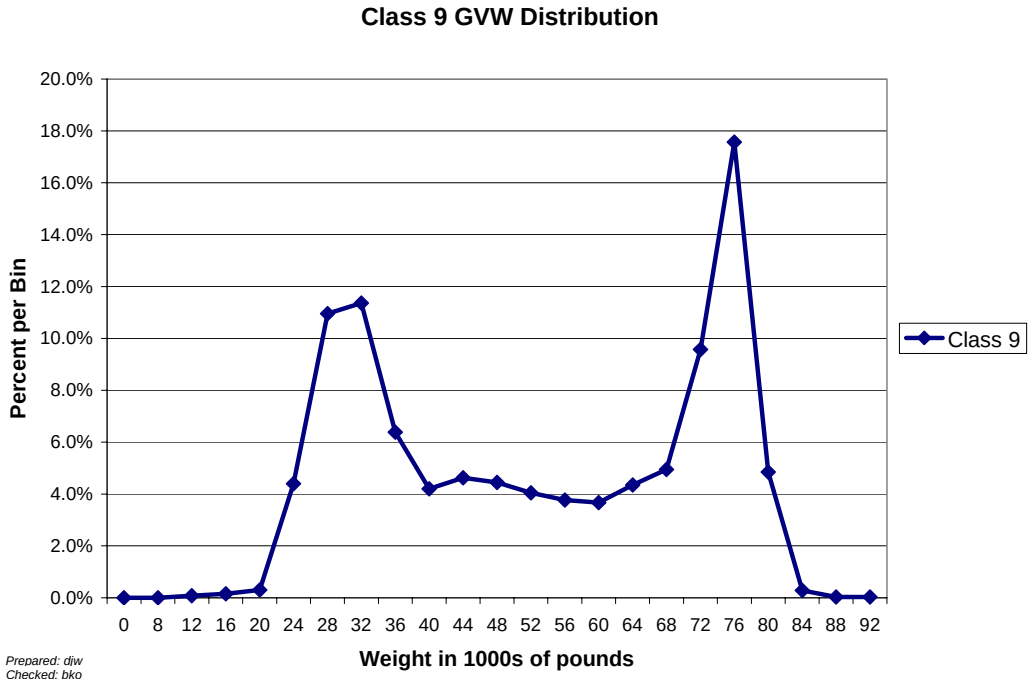

Figure 7-2 Expected GVW Distribution Class 9 – 060200 – 26-Mar-2008

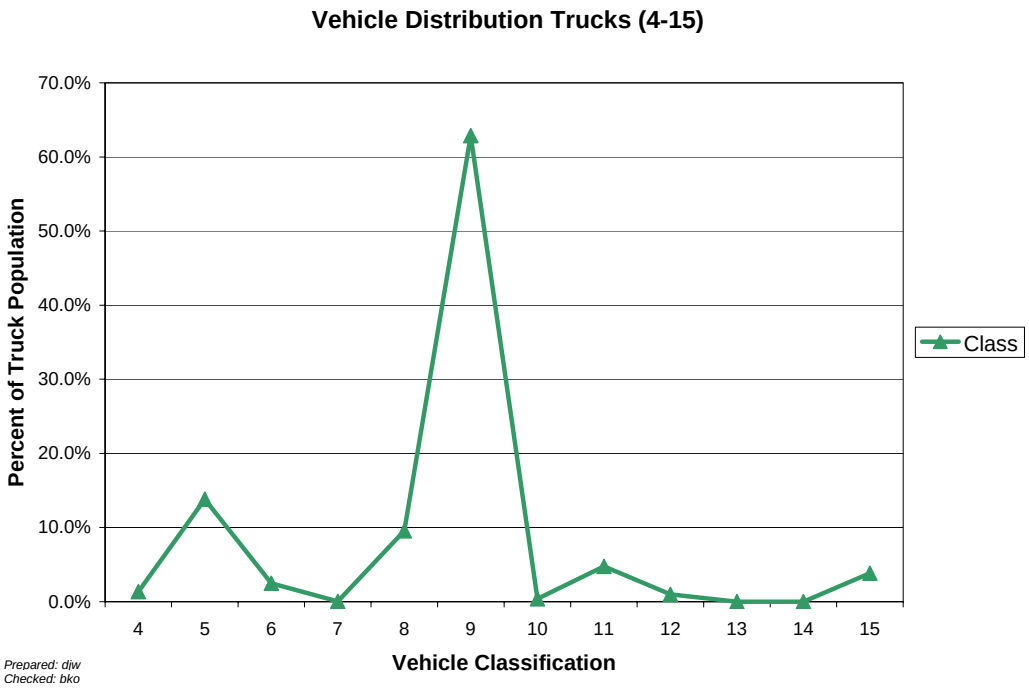

Figure 7-3 Expected Vehicle Distribution – 060200 – 26-Mar-2008

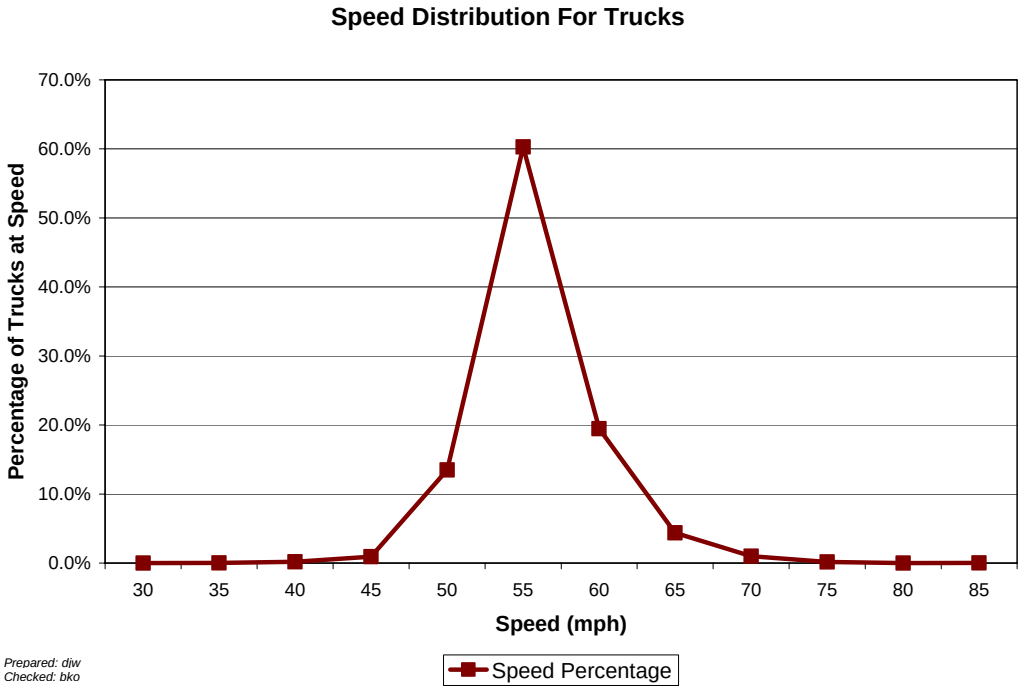

Figure 7-4 Expected Speed Distribution – 060200 – 26-Mar-2008

8 Data Sheets

The following is a listing of data sheets incorporated in Appendix A.

Sheet 19 – Truck 1 – 3S2 loaded air suspension (3 pages)
Sheet 19 – Truck 2 – 3S2 partially loaded air suspension (3 pages)

Sheet 20 – Classification and Speed verification – pre-validation (2 pages)
Sheet 20 – Classification and Speed verification – post-validation (2 pages)

Sheet 21 – Pre-validation (3 pages)
Sheet 21 – Post-validation (3 pages)

Test Truck Photographs (6 pages)

LTPP Mod 3 Classification Scheme (1 page)

Final System Parameters (1 page)

9 Updated Handout Guide and Sheet 17

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

10 Updated Sheet 18

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

11 Traffic Sheet 16(s)

Sheet 16s for the pre-validation and post-validation conditions are attached following the current Sheet 18 information at the very end of the report.

POST-VISIT HANDOUT GUIDE FOR SPS WIM FIELD VALIDATION

STATE: California

SHRP ID: 060200

Figures

Photos

1. General Information

SITE ID: *060200*

LOCATION: *SR 99, milepost 32.5, near Delhi, CA*

VISIT DATE: *March 25, 2008*

VISIT TYPE: *Validation*

2. Contact Information

POINTS OF CONTACT:

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

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

Nick Burmas, 916-324-2906, nick.burmas@dot.ca.gov

Alfredo Rodriguez, 916-324-2244, alfredo_b_rodriguez@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: *No briefing requested for this visit.*

ON SITE PERIOD: *March 25 and 26, 2008*

TRUCK ROUTE CHECK: *Completed*

4. Site Location/ Directions

NEAREST AIRPORT: *San Jose International Airport, San Jose, CA (approximately 100 miles from the site)*

DIRECTIONS TO THE SITE: *SR 99, approximately 20 miles south of Modesto.*

MEETING LOCATION: *On site at 9:00 am, March 25, 2008.*

WIM SITE LOCATION: *SR 99, milepost32.5; GPS = N 37.4160°, W -120.7580°.*

WIM SITE LOCATION MAP: *See Figure 4.1*

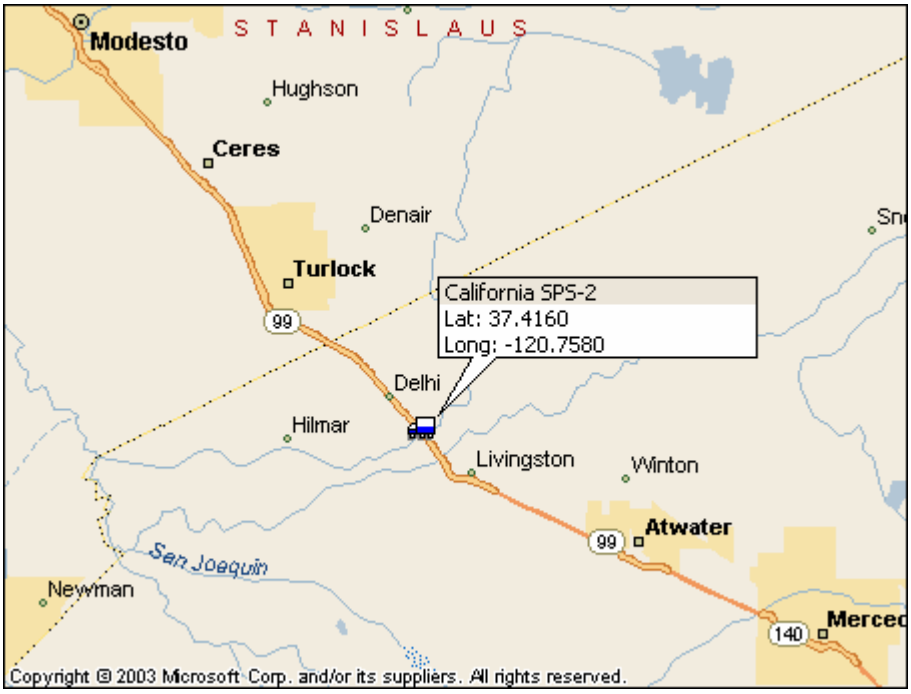

Figure 4-1 – Site 060200 in California

5. Truck Route Information

ROUTE RESTRICTIONS: *None*

CERTIFIED SCALE LOCATION: *CAT Scales located at TA Livingston, SR 99 at Winton Parkway exit , Livingston, CA; GPS = 37.38888° N, -120.7363. See Figure 5.1*

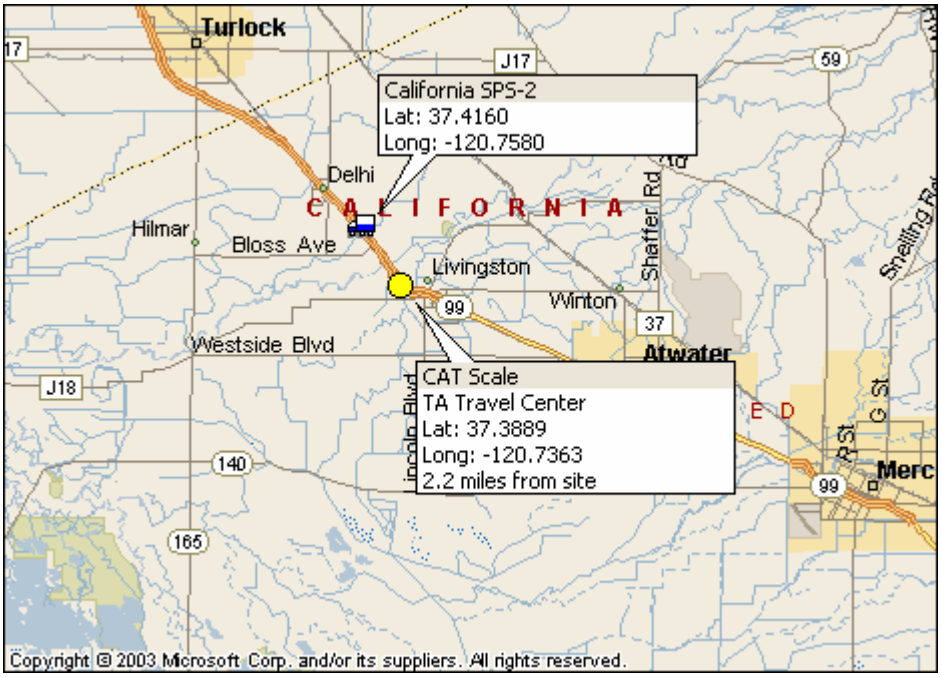

Figure 5-1 - Truck Scale Location for 060200

TRUCK ROUTE: *See Figure 5.2*

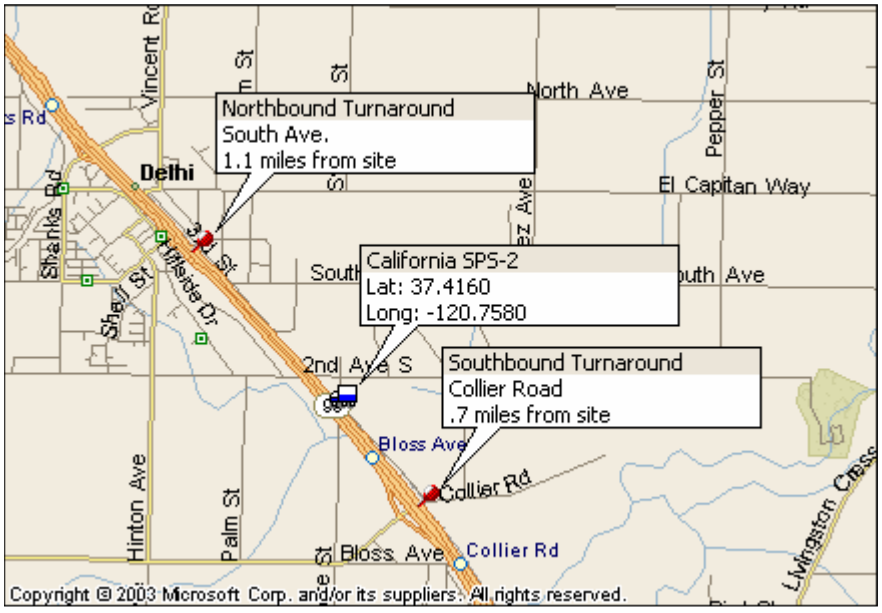

Figure 5-2 – Truck Route at 060200 in California

6. Sheet 17 – California (060200)

1.* ROUTE ____SR 99____ MILEPOST _32.5___ LTPP DIRECTION - **N** S E W

2.* WIM SITE DESCRIPTION - Grade __<1_____ % Sag vertical Y / N
Nearest SPS section upstream of the site ___0211_____
Distance from sensor to nearest upstream SPS Section ____72_____ 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 __11__ft

4.* PAVEMENT TYPE ___portland cement concrete_____

5.* PAVEMENT SURFACE CONDITION – Distress Survey
Date __3/25/2008_ Photo Filename: __06_0200_Upstream_03_25_2008 .jpg _____
Date __3/25/2008_ Photo Filename: __06_0200_Downstream_03_25_2008.jpg_____
Date _____ Photo Filename: _____

6. * SENSOR SEQUENCE _____Loop – Bending Plate – 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 _____
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 _____6_ . _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 __31____ ft
Distance from system __37___ ft
TYPE _____3R_____

CABINET ACCESS controlled by LTPP / STATE / **JOINT** ?
Contact - name and phone number __Roy Czinku____306-653-6627____
Alternate - name and phone number ____Joe Avis 916-654-3072_____

11. * POWER

Distance to cabinet from drop __10_____ ft Overhead / underground / **solar** /
AC in cabinet?
Service provider _____N/A_____ Phone number _____

12. * TELEPHONE

Distance to cabinet from drop ___0_____ ft Overhead / underground / **cell**?
Service provider _____ Phone Number _____

13.* SYSTEM (software & version no.)- _____iSYNC_____
Computer connection – RS232 / Parallel port / USB / Other _____

14. * TEST TRUCK TURNAROUND time _____6 min_____.

15. PHOTOS FILENAME

Power source 06_0200_Solar_Panel_03_25_2008.jpg
06_0200_Solar_Power_Box_03_25_2008.jpg
Phone source 06_0200_Cell_Modem_03_25_2008.jpg
Cabinet exterior 06_0200_Cabinet_Exterior_03_25_2008.jpg
Cabinet interior 06_0200_Cabinet_Interior_Front_03_25_2008.jpg
06_0200_Cabinet_Interior_Rear_03_25_2008.jpg
Weight sensors 06_0200_Leading_WIM_Sensor_03_25_2008.jpg
06_0200_Trailing_WIM_Sensor_03_25_2008.jpg
Classification sensors _____
Other sensors 06_0200_Leading_Loop_03_25_2008.jpg
06_0200_Trailing_Loop_03_25_2008.jpg
Description ___Loops_____

Downstream direction at sensors on LTPP lane
06_0200_Downstream_03_25_2008 .jpg _____
Upstream direction at sensors on LTPP lane
06_0200_Upstream_03_25_2008 .jpg _____

COMMENTS _____None_____

COMPLETED BY ____Dean J. Wolf_____

PHONE _301-210-5105_____ DATE COMPLETED 03 / 25 / 2008

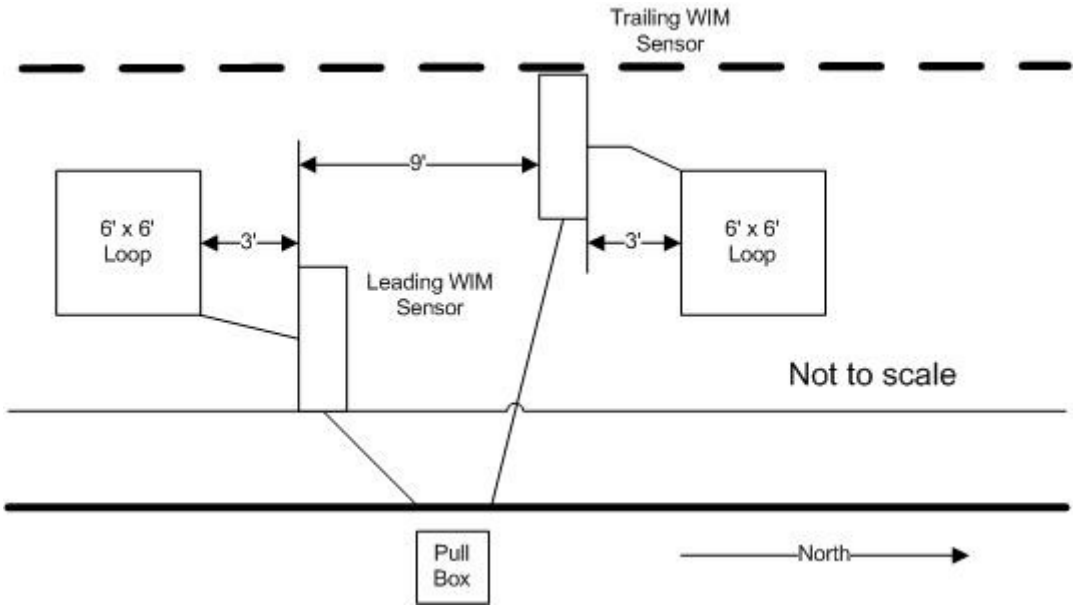

Figure 6-1 Sketch of Equipment Layout

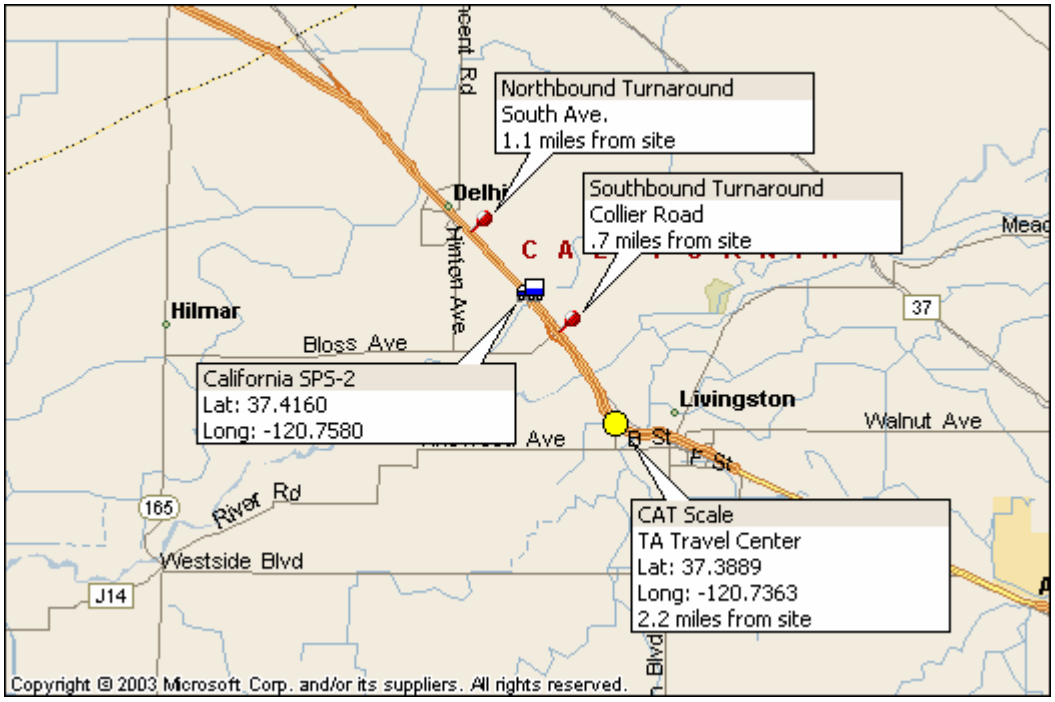

Figure 6-2 – Site Map of 060200 in California

Photo 1 06_0200_Upstream_03_25_2008 .jpg

Photo 2 06_0200_Downstream_03_25_2008.jpg

Photo 3 06_0200_Solar_Panel_03_25_2008.jpg

Photo 4 06_0200_Solar_Power_Box_03_25_2008.jpg

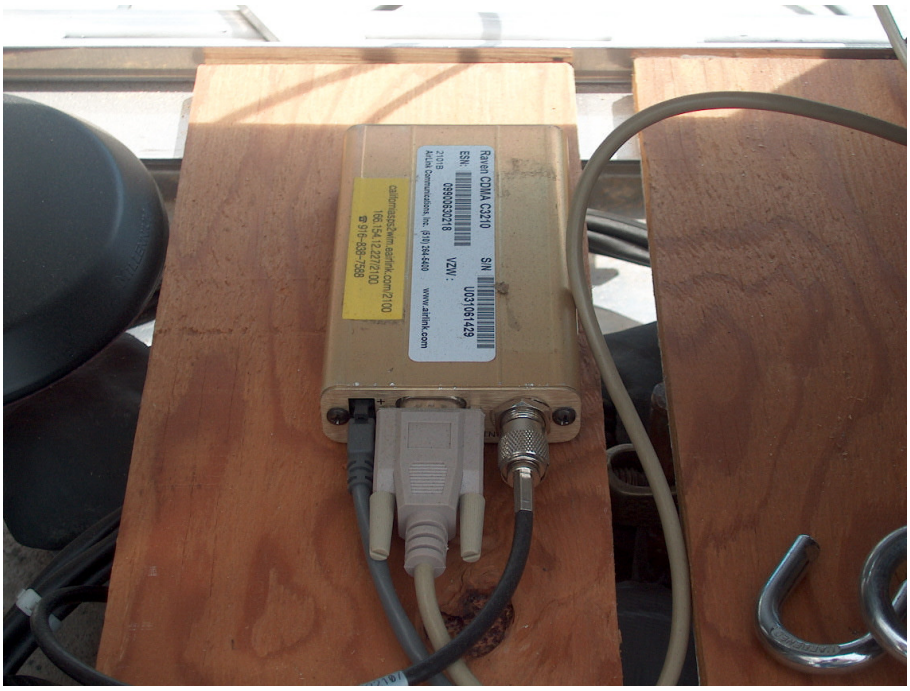

Photo 5 06_0200_Cell_Modem_03_25_2008.jpg

Photo 6 06_0200_Cabinet_Exterior_03_25_2008.jpg

Photo 7 06_0200_Cabinet_Interior_Front_03_25_2008.jpg

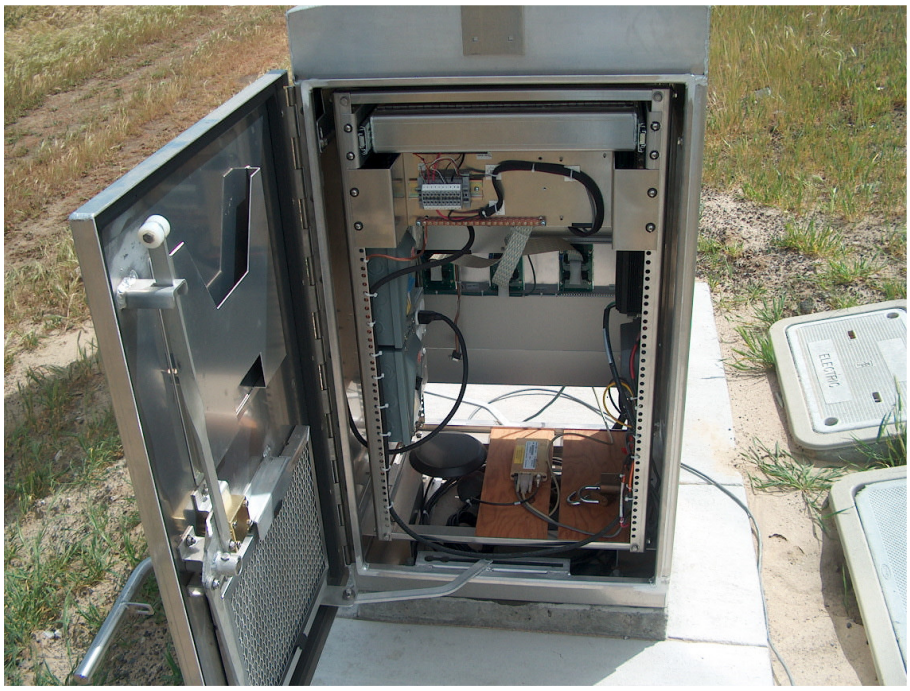

Photo 8 06_0200_Cabinet_Interior_Rear_03_25_2008.jpg

Photo 9 06_0200_Leading_Loop_03_25_2008.jpg

Photo 10 06_0200_Leading_WIM_Sensor_03_25_2008.jpg

Photo 11 06_0200_Trailing_WIM_Sensor_03_25_2008.jpg

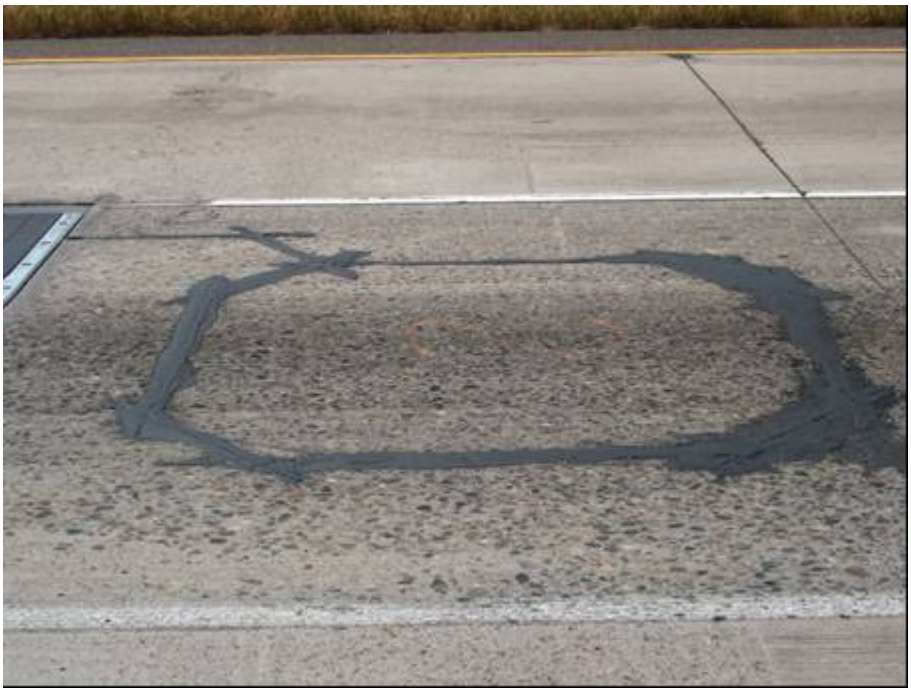

Photo 12 06_0200_Trailing_Loop_03_25_2008.jpg

SHEET 18	STATE CODE [6]
LTPP MONITORED TRAFFIC DATA	SPS PROJECT ID [0200]
WIM SITE COORDINATION	DATE: (mm/dd/yyyy) 3/25/2008

Rev. 05/15/07

1. DATA PROCESSING –
   a. Down load –
      - ☐ State only
      - ☐ LTPP read only
      - ☒ LTPP download
      - ☐ LTPP download and copy to state

   b. Data Review –
      - ☐ State per LTPP guidelines
      - ☐ State – ☐ Weekly ☐ Twice a Month ☐ Monthly ☐ Quarterly
      - ☒ LTPP

   c. Data submission –
      - ☐ State – ☐ Weekly ☐ Twice a month ☐ Monthly ☐ Quarterly
      - ☒ LTPP

2. EQUIPMENT –
   a. Purchase –
      - ☐ State
      - ☒ LTPP

   b. Installation –
      - ☐ Included with purchase
      - ☐ Separate contract by State
      - ☐ State personnel
      - ☒ LTPP contract

   c. Maintenance –
      - ☒ Contract with purchase – Expiration Date _5 years from installation_
      - ☐ Separate contract LTPP – Expiration Date _____
      - ☐ Separate contract State – Expiration Date _____
      - ☐ State personnel

   d. Calibration –
      - ☒ Vendor
      - ☐ State
      - ☐ LTPP

   e. Manuals and software control –
      - ☐ State
      - ☐ LTPP

   f. Power –
      i. Type –
         - ☐ Overhead
         - ☐ Underground
         - ☒ Solar

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

g. Communication –

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

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

3. PAVEMENT –

a. Type –
- ☒ Portland Concrete Cement
- ☐ Asphalt Concrete

b. Allowable rehabilitation activities –
- ☐ Always new
- ☐ Replacement as needed
- ☒ Grinding and maintenance as needed
- ☐ Maintenance only
- ☐ No remediation

c. Profiling Site Markings –
- ☐ Permanent
- ☒ Temporary

4. ON SITE ACTIVITIES –

a. WIM Validation Check - advance notice required _2__ ☐ days ☒ weeks

b. Notice for straightedge and grinding check - __2_ ☐ days ☒ weeks

i. On site lead –
- ☒ State
- ☐ LTPP

ii. Accept grinding –
- ☐ State
- ☒ LTPP

c. Authorization to calibrate site –
- ☐ State only
- ☒ LTPP

d. Calibration Routine –
- ☒ LTPP – ☐ Semi-annually ☒ Annually
- ☐ State per LTPP protocol – ☐ Semi-annually ☐ Annually
- ☐ State other – _____

e. Test Vehicles
   i. Trucks –
      1st – Air suspension 3S2 ☐ State ☒ LTPP
      2nd – _3S2 different weight/suspension__ ☐ State ☒ LTPP
      3rd – _____ ☐ State ☐ LTPP
      4th – _____ ☐ State ☐ LTPP
   ii. Loads – ☐ State ☒ LTPP
   iii. Drivers – ☐ State ☒ LTPP

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

   _____

g. Access to cabinet
   i. Personnel Access –
      ☐ State only
      ☒ Joint
      ☐ LTPP
   ii. Physical Access –
      ☒ Key
      ☒ Combination

h. State personnel required on site – ☐ Yes ☒ No

i. Traffic Control Required – ☐ Yes ☒ No

j. Enforcement Coordination Required – ☐ Yes ☒ No

5. SITE SPECIFIC CONDITIONS –
   a. Funds and accountability – _____
   b. Reports – _____
   c. Other – _____
   d. Special Conditions – _____

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

      Name: Roy Czinku Phone:(306) 653-6627

      Agency: IRD

b. Maintenance (equipment) –

Name: Roy Czinku Phone:(306) 653-6627

Agency: IRD

c. Data Processing and Pre-Visit Data –

Name: Roy Czinku Phone:(306) 653-6627

Agency: IRD

d. Construction schedule and verification –

Name: Joe Ais Phone:916-654-3072

Agency: CalTrans

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

Name: _____ Phone:_____

Agency: _____

f. Traffic Control –

Name: _____ Phone:_____

Agency: _____

g. Enforcement Coordination –

Name: _____ Phone:_____

Agency: _____

h. Nearest Static Scale

Name: CAT @ TA Livingston Location:SR-99 @ Winton Parkway Exit

Phone: _____

SHEET 16 **LTPP MONITORED TRAFFIC DATA** **SITE CALIBRATION SUMMARY**	*STATE ASSIGNED ID [__ __ __ __] *STATE CODE [06] *SHRP SECTION ID [0200]

SITE CALIBRATION INFORMATION

1. * DATE OF CALIBRATION (MONTH/DAY/YEAR) [3/25/2008]

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

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

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

5. EQUIPMENT MANUFACTURER ___IRD/ PAT Traffic_____

WIM SYSTEM CALIBRATION SPECIFICS**

6.**CALIBRATION TECHNIQUE USED:

____ TRAFFIC STREAM -- ____STATIC SCALE (Y/N) _X__ TEST TRUCKS

___ NUMBER OF TRUCKS COMPARED __ 2 __ NUMBER OF TEST TRUCKS USED

__ 20__ PASSES PER TRUCK

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

TRUCK	TYPE	SUSPENSION
1	___9____	___1_____
2	___9____	___1_____
3	_____	_____

7. SUMMARY CALIBRATION RESULTS (EXPRESSED AS A PERCENT)

MEAN DIFFERENCE BETWEEN ---

DYNAMIC AND STATIC GVW	___1.1	STANDARD DEVIATION	___1.1
DYNAMIC AND STATIC SINGLE AXLES	___1.2	STANDARD DEVIATION	___1.7
DYNAMIC AND STATIC DOUBLE AXLES	___1.0	STANDARD DEVIATION	___1.4

8. 3 ____ NUMBER OF SPEEDS AT WHICH CALIBRATION WAS PERFORMED

9. DEFINE THE SPEED RANGES USED (MPH) _____ _45_ __50__ __55_ _____ __ __ _____ _____
_____ _____ _____ _____ _____ _____ _____ _____ _____ _____

10. CALIBRATION FACTOR (AT EXPECTED FREE FLOW SPEED) ___3360___

11.** IS AUTO-CALIBRATION USED AT THIS SITE? (Y/N) _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 ____	____ ____	_____
*** FHWA CLASS 8 ____ 0	FHWA CLASS ____	____ ____	_____
	FHWA CLASS ____	____ ____	_____
	FHWA CLASS ____	____ ____	_____

*** PERCENT "UNCLASSIFIED" VEHICLES: ____ 0.0

PERSON LEADING CALIBRATION EFFORT: __Dean J. Wolf, MACTEC_____
CONTACT INFORMATION: _____301-210-5105_____ rev. November 9, 1999

SHEET 16 **LTPP MONITORED TRAFFIC DATA** **SITE CALIBRATION SUMMARY**	*STATE ASSIGNED ID [__ __ __ __] *STATE CODE [06] *SHRP SECTION ID [0200]

SITE CALIBRATION INFORMATION

1. * DATE OF CALIBRATION (MONTH/DAY/YEAR) [3/26/2008]

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

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

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

5. EQUIPMENT MANUFACTURER ___IRD/ PAT Traffic

WIM SYSTEM CALIBRATION SPECIFICS**

6.**CALIBRATION TECHNIQUE USED:

____ TRAFFIC STREAM -- ____STATIC SCALE (Y/N) _X_ TEST TRUCKS

___ NUMBER OF TRUCKS COMPARED __ 2 __ NUMBER OF TEST TRUCKS USED

__ 20__ PASSES PER TRUCK

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

TRUCK	TYPE	SUSPENSION
1	9	1
2	9	1
3		

7. SUMMARY CALIBRATION RESULTS (EXPRESSED AS A PERCENT)
   MEAN DIFFERENCE BETWEEN ---
   - DYNAMIC AND STATIC GVW ___1.2 STANDARD DEVIATION ___0.7
   - DYNAMIC AND STATIC SINGLE AXLES ___0.3 STANDARD DEVIATION ___1.8
   - DYNAMIC AND STATIC DOUBLE AXLES ___1.3 STANDARD DEVIATION ___1.4

8. 3 ____ NUMBER OF SPEEDS AT WHICH CALIBRATION WAS PERFORMED

9. DEFINE THE SPEED RANGES USED (MPH) _____ _45_ __50__ __55_ ___ __ __ _____ _____
   _____ _____ _____ _____ _____ _____ _____ _____ _____ _____

10. CALIBRATION FACTOR (AT EXPECTED FREE FLOW SPEED) ___3360___

11.** IS AUTO-CALIBRATION USED AT THIS SITE? (Y/N) _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 8 ____ 0
   - FHWA CLASS ____ ____ ____ _____
   - FHWA CLASS ____ ____ ____ _____
   - FHWA CLASS ____ ____ ____ _____
   - FHWA CLASS ____ ____ ____ _____
   - *** PERCENT "UNCLASSIFIED" VEHICLES: ____ 0.0

PERSON LEADING CALIBRATION EFFORT: __Dean J. Wolf, MACTEC_____
CONTACT INFORMATION: _____301-210-5105_____ rev. November 9, 1999

APPENDIX A

Sheet 19	* STATE_CODE 06
LTPP Traffic Data	* SPS PROJECT ID 0200
*CALIBRATION TEST TRUCK #_1_	* DATE 3/26/08

Rev. 08/31/01

truck #28
trailer #~~120~~ log 2
129 lbs
day 1

PART I.

1.* FHWA Class 9 2.* Number of Axles 5 Number of weight days 2

AXLES - units - (lbs) / 100s lbs / kg

GEOMETRY

8 a) * Tractor Cab Style - Cab Over Engine / (Conventional) b) * Sleeper Cab? (Y) / N

9. a) * Make: KENWORTH b) * Model: _____

10.* Trailer Load Distribution Description:

PALLETIZED LUMBER LOADED OVER TRAILER TANDEMS

11. a) Tractor Tare Weight (units): _____

b). Trailer Tare Weight (units): _____

12.* Axle Spacing – units m / feet and inches / (feet and tenths)

A to B 18.3 B to C ~~4.3~~ 4.3 C to D 32.1

D to E ~~4.2~~ 4.2 E to F _____

Wheelbase (measured A to last) _____ Computed _____

13. *Kingpin Offset From Axle B (units) _____ (+1.6)

(+ is to the rear)

SUSPENSION

Axle	14. Tire Size	15.* Suspension Description (leaf, air, no. of leaves, taper or flat leaf, etc.)
A	75R24.5	2 FULL LEAF
B	80R24.5	AIR
C	80R24.5	AIR
D	75R22.5	AIR
E	75R22.5	AIR
F		

Sheet 19	* STATE_CODE 06
LTPP Traffic Data	* SPS PROJECT ID 0200
*CALIBRATION TEST TRUCK # 1	* DATE 3/26/08

Rev. 08/31/01

PART II

Day 1

*b) Average Pre-Test Loaded weight 77480
*c) Post Test Loaded Weight 77030
*d) Difference Post Test – Pre-test -450

Table 5. Raw data – Axle scales – pre-test

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	12020	16800	16800	15940	15940		77500
2	12020	16780	16780	15940	15940		77460
3							
Average	12020	16790	16790	15940	15940		77480

Table 6. Raw data – Axle scales –

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1							
2							
3							
Average							

Table 7. Raw data – Axle scales – post-test

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	11920	16700	16700	15870	15870		77060
2	11880	16690	16690	15870	15870		77000
3							
Average	11900	~~16700~~ 16695	~~16700~~ 16695	15870	15870		77030

Measured By DEAN WOLF Verified By [signature] Weight date 3/25/08

Sheet 19	* STATE_CODE 06
LTPP Traffic Data	* SPS PROJECT ID 0200
*CALIBRATION TEST TRUCK # [redacted]	* DATE 3/26/08

Rev. 08/31/01

Day 2

7.2 *b) Average Pre-Test Loaded weight 76760

*c) Post Test Loaded Weight 76390

*d) Difference Post Test – Pre-test 370

Table 5.2. Raw data – Axle scales – pre-test

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	11880	16630	16630	15810	15810		76760
2	11920	16620	16620	15800	15800		76760
3							
Average	11900	16625	16625	15805	15805		76760

Table 6.2. Raw data – Axle scales –

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
2							
3							
Average							

Table 7.2 Raw data – Axle scales – post-test

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	11780	16550	16550	15750	15750		76380
2	11820	16520	16520	15770	15770		76400
3							
Average	11800	~~16540~~ 16535	~~16540~~ 16535	15760	15760		76390

Measured By DW Verified By MZ Weight date 3/26/08

Sheet 19	* STATE_CODE 06
LTPP Traffic Data	* SPS PROJECT ID 0200
*CALIBRATION TEST TRUCK # 2	* DATE 3/26/08

Rev. 08/31/01

TRUCK # 33
TRAILER # 129

PART I.

1.* FHWA Class 9 2.* Number of Axles 5 Number of weight days 2

AXLES - units - (lbs) / 100s lbs / kg

GEOMETRY

8 a) * Tractor Cab Style - Cab Over Engine / (Conventional) b) * Sleeper Cab? (Y) / N

9. a) * Make: FREIGHTLINER b) * Model: _____

10.* Trailer Load Distribution Description:

~~REFLECTIVE~~ LUMBER LOADED OVER TANDEMS

11. a) Tractor Tare Weight (units): _____

b). Trailer Tare Weight (units): _____

12.* Axle Spacing – units m / feet and inches / (feet and tenths)

A to B 18.5 B to C ~~4.2~~ 4.2 C to D 32.0

D to E 4.3 E to F _____

Wheelbase (measured A to last) _____ Computed _____

13. *Kingpin Offset From Axle B (units) _____ (+1.0)
(+ is to the rear)

SUSPENSION

Axle	14. Tire Size	15.* Suspension Description (leaf, air, no. of leaves, taper or flat leaf, etc.)
A	275R 24.5	2 FULL LEAF
B	88 R 24.5	AIR
C	275R 24.5	AIR
D	11R 22.5	AIR
E	11R 22.5	AIR
F	_____	_____

Sheet 19	* STATE_CODE 06
LTPP Traffic Data	* SPS PROJECT ID 0200
*CALIBRATION TEST TRUCK # 2	* DATE 3/26/08

Rev. 08/31/01

PART II

Day 1

*b) Average Pre-Test Loaded weight 65020
*c) Post Test Loaded Weight 64840
*d) Difference Post Test – Pre-test -180

Table 5. Raw data – Axle scales – pre-test

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	11980	13060	13060	13460	13460		65020
2	12000	13050	13050	13460	13460		65020
3							
Average	11990	13055	13055	13460	13460		65020

Table 6. Raw data – Axle scales –

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1							
2							
3							
Average							

Table 7. Raw data – Axle scales – post-test

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	11900	13010	13010	13450	13450		64820
2	11860	13030	13030	13470	13470		64860
3							
Average	11880	13020	13020	13460	13460		64840

Measured By DEAN Wolf Verified By [signature] Weight date 3-25-08

Sheet 19	* STATE_CODE 06
LTPP Traffic Data	* SPS PROJECT ID 0200
*CALIBRATION TEST TRUCK # 2	* DATE 3/26/08

Rev. 08/31/01

Day 2

7.2 *b) Average Pre-Test Loaded weight 64820

*c) Post Test Loaded Weight 64650

*d) Difference Post Test – Pre-test -170

Table 5.2. Raw data – Axle scales – pre-test

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	11920	13010 ~~12920~~	13010	13450	13450		64840
2	11900	13000	13000	13450	13450		64800
3							
Average	11910	13005	13005	13450	13450		64820

Table 6.2. Raw data – Axle scales –

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1							
2							
3							
Average							

Table 7.2 Raw data – Axle scales – post-test

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	11800	12980	12980	13440	13440		64640
2	11760	13010	13010	13440	13440		64660
3							
Average	11780	~~13000~~ 12995 mm	~~13000~~ 12995	13440	13440		64650

Measured By DJW Verified By MB Weight date 3/26/08

Sheet 20	* STATE_CODE 06
LTPP Traffic Data	*SPS PROJECT_ID 0 2 0 0
Speed and Classification Checks * 1 of* 2	* DATE 3 / 25 / 08

Rev. 08/31/2001

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
69	5	34908	69	5	60	9	35016	60	9
50	11	34912	50	11	58	9	35022	61	9
62	9	34921	57	9	58	9	35027	59	9
62	9	34923	60	9	57	9	35028	55	9
57	11	34927	54	11	55	9	35039	53	9
57	9	34934	58	9	54	9	35041	51	9
62	5	34938	62	5	54	9	35049	54	9
56	9	34947	58	9	54	9	35050	54	9
56	9	34948	58	9	66	5	35054	66	5
59	5	34952	60	5	55	11	35060	53	11
60	9	34953	59	9	55	5	35067	55	5
57	9	34957	57	9	62	9	35072	59	9
54	9	34960	58	9	62	6	35073	63	6
56	9	34961	56	9	57	9	35079	58	9
60	9	34964	58	9	59	8	35075	60	8
59	9	34968	59	9	64	5	35083	63	5
57	9	34974	58	9	55	9	35087	55	9
59	10	34982	58	10	58	9	35089	56	9
58	9	34987	58	9	52	9	35092	55	9
55	8	34990	54	8	55	9	35098	55	9
59	9	34995	61	9	54	11	35104	53	11
59	9	34998	59	9	57	9	35107	54	9
60	9	35002	62	9	57	9	35108	57	9
67	5	35006	66	5	55	9	35114	57	9
59	9	35010	60	9	56	9	35115	56	9

Recorded by MARK Z Direction N Lane 1 Time from 1235PM to 1255PM

Sheet 20	* STATE_CODE	_06_
LTPP Traffic Data	*SPS PROJECT_ID	_0_2_0_0_
Speed and Classification Checks * 2 of* 2	* DATE	3 / 25 / 08

Rev. 08/31/2001

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
58	9	35119	58	9	57	9	35234	55	9
56	8	35122	54	8	55	9	35245	54	9
58	9	35138	60	9	54	5	35246	54	5
55	9	35144	55	9	58	9	35252	62	9
57	9	35150	57	9	60	5	35261	62	5
62	9	35153	61	9	59	11	35267	61	11
53	8	35155	54	8	56	9	35272	54	9
56	9	35159	54	9	57	9	35280	57	9
57	9	35167	58	9	61	9	35287	61	9
60	9	35168	58	9	57	9	35289	57	9
58	5	35174	55	5	57	8	35301	57	8
58	5	35175	58	5	57	8	35311	55	8
57	9	35182	61	9	56	9	35315	55	9
57	11	35185	55	11	59	8	35318	59	8
57	5	35188	58	5	57	9	35319	58	9
55	9	35194	56	9	55	8	35320	53	8
55	9	35195	55	9	54	9	35326	52	9
57	11	35201	57	11	55	9	35328	55	9
56	9	35202	54	9	57	11	35329	57	11
54	9	35209	55	9	62	5	35336	65	5
59	9	35220	59	9	59	9	35340	59	9
51	5	35226	50	5	58	9	35344	58	9
64	10	35227	64	10	58	9	35348	58	9
57	11	35231	55	11	55	9	35349	55	9
55	8	35232	55	8	54	9	35351	53	9

Recorded by MARK Z Direction N Lane 1 Time from 12:55PM to 1:14PM

Sheet 20	* STATE_CODE	0 6
LTPP Traffic Data	*SPS PROJECT_ID	0 2 0 0
Speed and Classification Checks * 1 of* 2	* DATE	3 / 26 / 03

Rev. 08/31/2001

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
60	9	49290	60	9	54	5	49374	54	5
58	9	49295	58	9	53	9	49375	53	9
57	9	49296	55	9	55	9	49379	55	9
63	9	49298	63	9	56	8	49380	55	8
57	8	49301	55	8	60	9	49390	60	9
65	5	49307	65	5	59	9	49392	59	9
62	9	49308	63	9	56	9	49396	56	9
57	8	49310	57	8	58	9	49412	58	9
66	5	49313	65	5	58	9	49413	58	9
61	9	49319	63	9	57	9	49416	57	9
59	9	49321	60	9	62	9	49421	61	9
57	9	49323	58	9	59	9	49428	61	9
62	8	49327	64	8	57	9	49429	61	9
62	9	49328	62	9	58	9	49432	55	9
58	9	49334	60	9	55	9	49435	56	9
59	9	49335	59	9	57	6	49439	57	6
62	5	49342	63	5	58	6	49443	61	6
67	4	49348	65	4	56	9	49449	55	9
60	9	49347	61	9	57	9	49450	55	9
55	9	49348	55	9	59	9	49454	59	9
55	9	49349	54	9	62	5	49455	62	5
57	9	49354	56	9	57	9	49459	58	9
58	8	49358	55	8	62	9	49461	62	9
59	9	49359	58	9	59	6	49462	60	6
58	8	49368	59	8	57	5	49469	54	5

Recorded by MARK Z Direction N Lane 1 Time from 1:23 PM to 1:37 PM

Sheet 20	* STATE_CODE	0 6
LTPP Traffic Data	*SPS PROJECT_ID	0 2 0 0
Speed and Classification Checks * 2 of* 2	* DATE	3 / 26 / 08

Rev. 08/31/2001

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
56	8	49483	60	8	60	9	49597	60	9
58	9	49485	59	9	54	9	49602	53	9
56	8	49490	57	8	52	9	49603	53	9
55	9	49496	55	9	56	9	49609	58	9
59	5	49500	62	5	54	11	49612	56	11
54	9	49504	54	9	59	9	49620	60	9
57	9	49510	56	9	60	8	49622	57	8
59	9	49517	62	9	59	9	49628	59	9
54	9	49522	54	9	55	9	49629	54	9
57	9	49526	54	9	55	9	49636	53	9
60	9	49528	62	9	55	8	49641	55	8
59	9	49533	58	9	58	9	49649	58	9
54	8	49537	53	8	59	9	49667	60	9
58	9	49541	55	9	55	9	49668	54	9
55	9	49542	54	9	56	9	49672	54	9
58	9	49545	54	9	57	9	49685	59	8
59	9	49555	59	9	59	9	49688	58	9
63	5	49560	62	5	59	9	49691	61	9
61	9	49570	65	9	64	5	49693	63	5
54	5	49573	54	5	60	9	49694	63	9
59	9	49581	60	9	55	9	49697	59	9
59	9	49582	59	9	57	9	49698	58	9
58	9	49585	58	9	59	9	49702	61	9
59	9	49586	59	9	60	9	49706	58	9
60	9	49590	61	9	53	12	49719	53	12

Recorded by MARK 2 Direction N Lane 1 Time from 1381PM to 1559PM

Sheet 21	* STATE_CODE	0 6
LTPP Traffic Data	*SPS PROJECT_ID	0 2 0 0
WIM System Test Truck Records 1 of 3	* DATE	3 / 25 / 08

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight	Axle B weight	Axle C weight	Axle D weight	Axle E weight	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
62.5	46	1	1	9:04	32016	45	69/60	88/80	84/82	85/77	79/86		78.1	18.2	4.3	32.2	4.1	
62.5	45	2	1	9:04	32017	44	59/64	67/64	65/66	71/68	66/65		65.4	18.4	4.2	31.8	4.3	
59.5	52	1	2	9:10	32026	51	63/59	88/80	84/86	85/73	75/79		77.2	18.2	4.3	32.3	4.1	
59.5	52	2	2	9:10	32028	50	61/61	66/64	63/68	70/66	67/68		65.3	18.4	4.3	32.1	4.3	
59.5	54	1	3	9:15	32150	54	62/59	87/83	81/88	83/76	74/82		77.6	18.2	4.3	32.3	4.2	
59.5	54	2	3	9:15	32151	54	55/60	61/64	59/67	66/68	60/70		63.0	18.5	4.3	32.1	4.3	
52.5	45	1	4	9:21	32223	45	61/58	89/81	84/81	84/75	80/81		77.3	18.1	4.3	32.1	4.1	
52.5	44	2	4	9:21	32226	44	69/64	68/62	66/65	73/67	69/67		66.1	18.4	4.2	31.8	4.3	
56	50	1	5	9:27	32299	50	63/59	87/82	82/86	86/75	79/85		78.4	18.2	4.3	32.3	4.1	
56	50	2	5	9:27	32307	50	61/63	79/65	65/67	71/66	69/65		66.3	18.4	4.3	32.0	4.3	
58.5	54	1	6	9:32	32379	56	62/60	90/83	81/87	83/78	73/83		78.0	18.2	4.3	32.1	4.1	
58.5	53	2	6	9:32	32381	54	59/62	67/66	62/68	70/71	63/70		65.9	18.5	4.2	32.0	4.3	
68.5	45	1	7	10:40	33305	45	59/60	88/82	83/84	86/76	77/85		77.9	18.2	4.3	32.2	4.1	
68.5	45	2	7	10:40	33306	45	59/64	67/61	64/66	74/66	67/68		65.5	18.5	4.2	31.9	4.3	
65.5	51	1	8	10:45	33373	52	63/59	90/83	85/85	86/74	84/82		79.0	18.2	4.3	32.3	4.0	
65.5	51	2	8	10:46	33378	51	69/61	68/65	62/70	71/69	67/69		66.3	18.4	4.2	32.0	4.3	

Recorded by MARK Z

Checked by

Sheet 21	* STATE_CODE	0 6
LTPP Traffic Data	*SPS PROJECT_ID	0 2 0 0
WIM System Test Truck Records 2 of 3	* DATE	3 / 25 / 08

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight	Axle B weight	Axle C weight	Axle D weight	Axle E weight	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
67.5	54	1	9	10:51	33455	56	61/59	86/84	79/90	79/79	73/89		78.1	18.2	4.3	32.2	4.1	
67.5	54	2	9	10:51	33456	56	60/61	64/66	62/69	70/71	65/71		66.0	18.5	4.3	32.1	4.3	
69	46	1	10	10:56	33528	45	61/60	94/80	83/88	86/79	81/82		79.3	18.1	4.3	32.2	4.1	
69	45	2	10	10:56	33530	45	61/64	68/64	64/66	75/68	70/67		66.6	18.4	4.2	31.9	4.3	
66.5	52	1	11	11:02	33603	50	62/60	92/83	83/84	86/73	82/83		79.0	18.2	4.3	32.2	4.1	
66.5	50	2	11	11:02	33606	50	57/62	66/65	65/71	71/69	68/69		66.2	18.4	4.2	32.0	4.3	
68.5	54	1	12	11:08	33696	56	62/61	85/83	83/87	82/76	75/83		77.7	18.3	4.3	32.3	4.1	
68.5	55	2	12	11:08	33702	56	60/63	62/65	63/70	70/72	66/73		66.3	18.6	4.3	32.1	4.3	
66.5	45	1	13	11:14	33785	45	58/60	89/80	82/82	89/76	78/85		78.1	18.2	4.3	32.2	4.1	
66.5	45	2	13	11:14	33786	46	57/61	70/63	63/67	72/66	67/67		65.2	18.4	4.2	31.9	4.3	
69	50	1	14	11:19	33867	51	61/62	89/83	84/87	88/74	79/82		78.9	18.2	4.3	32.3	4.1	
69	50	2	14	11:20	33870	51	60/62	71/63	63/68	70/68	68/68		66.0	18.4	4.2	31.9	4.3	
71.5	56	1	15	11:26	33958	57	62/60	87/85	84/89	83/79	73/84		78.4	18.2	4.3	32.2	4.1	
71.5	56	2	15	11:26	33959	55	60/62	69/66	65/69	68/71	67/71		66.5	18.4	4.2	31.9	4.3	
93.5	45	1	16	13:37	35640	45	60/60	89/78	87/80	87/72	83/78		77.3	18.2	4.3	32.1	4.1	
93.5	45	2	16	13:37	35641	45	59/63	68/64	66/65	72/65	68/65		65.6	18.4	4.3	31.9	4.3	

Recorded by MARK Z

Checked by

Sheet 21	* STATE_CODE 06
LTPP Traffic Data	*SPS PROJECT_ID 0200
WIM System Test Truck Records 3 of 3	* DATE 3/25/08

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
97	50	1	17	13:43	35712	52	62/59	87/89	83/86	88/74	79/80		78.3	18.2	4.3	32.4	4.1	
97	51	2	17	13:43	35718	51	57/63	69/64	63/69	70/69	65/69		65.8	18.4	4.2	32.0	4.3	
92.5	59	1	18	13:48	35790	56	62/58	86/81	84/86	81/75	73/84		76.9	18.2	4.3	32.1	4.1	
92.5	55	2	18	13:49	35802	55	57/60	68/65	65/68	68/68	66/69		65.5	18.4	4.2	31.8	4.3	
88.5	46	1	19	13:54	35880	47	59/59	88/80	83/82	89/77	77/81		77.5	18.2	4.3	32.3	4.1	
88.5	45	2	19	13:54	35881	45	60/63	69/63	65/65	72/65	70/67		66.1	18.3	4.2	31.8	4.3	
86	50	1	20	14:00	35953	52	61/58	89/80	82/84	88/72	81/78		77.2	18.3	4.4	32.4	4.2	
86	50	2	20	14:00	35956	51	58/61	69/64	64/67	72/67	69/69		65.8	18.4	4.2	32.0	4.3	
90	54	1	21	14:05	36026	55	61/60	85/82	81/87	81/76	72/82		76.8	18.2	4.3	32.2	4.1	
90	54	2	21	14:05	36034	55	59/61	68/65	61/69	68/69	64/70		65.3	18.4	4.2	31.8	4.3	

Recorded by MARK Z

Checked by

Sheet 21	* STATE_CODE	06
LTPP Traffic Data	*SPS PROJECT_ID	0200
WIM System Test Truck Records 1 of 3	* DATE	3/26/08

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
35.5	45	1	1	8:35	45536	46	57/62	91/79	85/79	83/73	82/80		77.8	18.1	4.3	32.1	4.1	
35.5	46	2	1	8:36	45544	46	59/65	69/64	64/65	73/66	69/63		65.6	18.4	4.2	32.0	4.3	
35	51	1	2	8:41	45601	50	64/58	87/81	82/84	84/74	78/81		77.2	18.2	4.3	32.2	4.1	
35	51	2	2	8:41	45603	52	58/60	67/62	61/68	71/65	66/67		64.5	18.4	4.2	32.0	4.3	
38.5	55	1	3	8:46	45676	57	62/56	86/82	81/87	84/75	76/83		77.2	18.2	4.3	32.2	4.1	
38.5	55	2	3	8:47	45684	56	58/61	67/64	59/68	69/71	67/72		65.5	18.4	4.2	31.9	4.3	
41	45	1	4	8:52	45753	45	57/61	88/79	84/79	89/74	75/81		76.7	18.2	4.3	32.2	4.1	
41	46	2	4	8:52	45754	46	59/62	69/64	64/64	74/65	69/65		65.5	18.4	4.2	31.9	4.3	
43	51	2	5	8:58	45830	52	60/59	67/61	65/68	70/67	65/67		65.0	18.4	4.2	31.9	4.3	
47	57	1	5	9:02	45904	57	61/58	87/83	83/86	84/79	76/86		77.9	18.2	4.3	32.2	4.2	
47	55	2	6	9:04	45910	56	58/61	66/63	66/68	69/70	66/70		65.5	18.5	4.2	31.9	4.3	
46	46	1	6	9:09	45981	46	58/60	87/80	81/82	86/74	82/83		77.3	18.2	4.3	32.2	4.1	
46	45	2	7	9:09	45982	47	59/63	68/63	64/65	71/64	68/64		64.9	18.4	4.3	32.0	4.3	
52	53	1	7	9:53	46558	52	69/59	88/82	84/84	84/76	79/77		76.4	18.1	4.3	32.3	4.1	
52	52	2	8	9:53	46562	52	58/59	69/66	62/69	71/68	67/70		66.0	18.4	4.3	32.0	4.3	
63	57	1	8	9:59	46634	57	69/59	85/86	81/89	84/79	79/84		78.4	18.2	4.3	32.3	4.2	

Recorded by MARK Z

Checked by

Sheet 21	* STATE_CODE	_06_
LTPP Traffic Data	*SPS PROJECT_ID	_0_2_0_0_
WIM System Test Truck Records 2 of 3	* DATE	3/26/08

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight	Axle B weight	Axle C weight	Axle D weight	Axle E weight	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
63	55	2	9	9:59	46640	56	58/63	64/65	64/68	69/70	67/70		65.9	18.5	4.2	31.9	4.3	
74.5	46	1	9	10:05	46712	46	59/58	90/77	84/78	86/74	80/85		77.4	18.1	4.3	31.9	4.1	
74.5	47	2	10	10:05	46715	47	59/58	69/63	64/68	72/66	71/66		65.7	18.4	4.2	32.0	4.3	
73.5	53	1	10	10:10	46783	50	60/59	88/82	84/87	84/72	85/78		78.0	18.2	4.3	32.3	4.2	
73.5	53	2	11	10:11	46788	50	61/60	69/63	64/66	70/67	68/68		65.8	18.4	4.2	31.9	4.3	
68	50	1	11	10:16	46860	50	62/54	89/82	82/87	82/75	76/84		77.4	18.1	4.3	32.3	4.1	
68	54	2	12	10:16	46861	54	59/61	67/64	62/68	71/68	66/69		65.5	18.4	4.3	32.0	4.3	
68.5	47	1	12	10:23	46947	47	61/57	89/79	86/81	88/76	79/82		77.4	18.1	4.3	31.9	4.1	
68.5	47	2	13	10:23	46948	45	58/62	68/61	63/66	74/66	66/67		65.2	18.4	4.2	31.9	4.3	
72.5	53	1	13	10:31	47047	50	63/58	90/80	81/84	85/76	79/84		78.0	18.1	4.3	32.1	4.1	
72.5	52	2	14	10:32	47058	50	59/61	68/66	64/69	71/67	68/70		66.3	18.4	4.2	32.0	4.3	
67	56	1	14	10:41	47189	57	59/55	86/86	85/89	78/76	88/73		77.6	18.4	4.3	31.9	4.0	
75	~~56~~ 45	~~1~~	15	11:41	47933	45	58/60	87/77	81/83	87/75	84/83		77.7	18.2	4.3	32.2	4.1	
75	48	2	15	11:41	~~47934~~	49	57/58	67/66	64/68	71/65	66/65		64.6	18.6	4.2	32.2	4.3	
76	51	1	16	11:46	48007	51	60/58	88/81	85/84	85/76	77/82		77.6	18.2	4.3	32.3	4.1	
76	50	2	16	11:46	48012	51	59/60	69/64	63/70	72/67	68/70		66.2	18.4	4.2	32.0	4.3	

Recorded by MARK B

Checked by

Sheet 21	* STATE_CODE	06
LTPP Traffic Data	*SPS PROJECT_ID	0200
WIM System Test Truck Records 3 of 3	* DATE	3/26/08

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
77	56	1	17	11:53	48092	57	60/59	86/85	82/88	82/76	74/82		77.2	18.2	4.3	32.2	4.1	
77	58	2	17	11:53	48096	56	59/60	68/65	62/69	70/70	68/71		66.0	18.5	4.3	32.0	4.3	
77.5	46	1	18	11:58	48177	45	59/64	89/78	85/79	87/74	82/81		77.9	18.1	4.3	32.0	4.1	
77.5	49	2	18	11:59	48184	49	57/57	66/63	67/66	71/63	69/66		64.7	18.4	4.2	32.0	4.3	
79	51	1	19	12:04	48252	50	60/60	89/82	82/85	80/75	74/81		77.4	18.1	4.3	32.2	4.1	
79	51	2	19	12:04 PM	48255 48259	50	59			71/66	69/69		65.8	18.4	4.2	32.0	4.3	
78	57	1	20	12:10	48332	57	60/59	69/64	63/69	83/76	78/83		77.6	18.2	4.3	32.2	4.1	
78	54	2	20	12:10	48339	54	59/60	84/85 79/62	80 91 66/65	71/66	65/69		65.4	18.3	4.2	31.8	4.2	

Recorded by MARK Z

Checked by

TEST VEHICLE PHOTOGRAPHS FOR SPS WIM VALIDATION

March 25-26, 2008

STATE: California

SHRP ID: 060200

Photo 1 06_0200_Truck_1_Tractor_03_25_2008.jpg

Photo 2 06_0200_Truck_1_Trailer_03_25_2008.jpg

Photo 3 06_0200_Truck_1_Suspension_2_03_25_2008.jpg

Photo 4 06_0200_Truck_1_Suspension_3_03_25_2008.jpg

Photo 5 06_0200_Truck_2_Tractor_03_25_2008.jpg

Photo 6 06_0200_Truck_2_Trailer_03_25_2008.jpg

Photo 7 06_0200_Truck_2_Suspension_1_03_25_2008.jpg

Photo 8 06_0200_Truck_2_Suspension_2_03_25_2008.jpg

Photo 9 06_0200_Truck_2_Suspension_3_03_25_2008.jpg

ETG LTPP CLASS SCHEME, MOD 3

Class	Vehicle Type	No. Axles	Spacing 1	Spacing 2	Spacing 3	Spacing 4	Spacing 5	Spacing 6	Spacing 7	Spacing 8	Gross Weight Min-Max	Axle 1 Weight Min *
1	Motorcycle	2	1.00-5.99								0.10-3.00	
2	Passenger Car	2	6.00-10.10								1.00-7.99	
3	Other (Pickup/Van)	2	10.11-23.09								1.00-7.99	
4	Bus	2	23.10-40.00								12.00 >	
5	2D Single Unit	2	6.00-23.09								8.00 >	2.5
2	Car w/ 1 Axle Trailer	3	6.00-10.10	6.00-25.00							1.00-11.99	
3	Other w/ 1 Axle Trailer	3	10.11-23.09	6.00-25.00							1.00-11.99	
4	Bus	3	23.10-40.00	3.00-7.00							20.00 >	
5	2D w/ 1 Axle Trailer	3	6.00-23.09	6.30-30.00							12.00-19.99	2.5
6	3 Axle Single Unit	3	6.00-23.09	2.50-6.29							12.00 >	3.5
8	Semi, 2S1	3	6.00-23.09	11.00-45.00							20.00 >	3.5
2	Car w/ 2 Axle Trailer	4	6.00-10.10	6.00-30.00	1.00-11.99						1.00-11.99	
3	Other w/ 2 Axle Trailer	4	10.11-23.09	6.00-30.00	1.00-11.99						1.00-11.99	
5	2D w/ 2 Axle Trailer	4	6.00-26.00	6.30-40.00	1.00-20.00						12.00-19.99	2.5
7	4 Axle Single Unit	4	6.00-23.09	2.50-6.29	2.50-12.99						12.00 >	3.5
8	Semi, 3S1	4	6.00-26.00	2.50-6.29	13.00-50.00						20.00 >	5.0
8	Semi, 2S2	4	6.00-26.00	8.00-45.00	2.50-20.00						20.00 >	3.5
3	Other w/ 3 Axle Trailer	5	10.11-23.09	6.00-25.00	1.00-11.99	1.00-11.99					1.00-11.99	
5	2D w/ 3 Axle Trailer	5	6.00-23.09	6.30-35.00	1.00-25.00	1.00-11.99					12.00-19.99	2.5
7	5 Axle Single Unit	5	6.00-23.09	2.50-6.29	2.50-6.29	2.50-6.30					12.00 >	3.5
9	Semi, 3S2	5	6.00-30.00	2.50-6.29	6.30-65.00	2.50-11.99					20.00 >	5.0
9	Truck+FullTrailer (3-2)	5	6.00-30.00	2.50-6.29	6.30-50.00	12.00-27.00					20.00>	3.5
9	Semi, 2S3	5	6.00-30.00	16.00-45.00	2.50-6.30	2.50-6.30					20.00 >	3.5
11	Semi+FullTrailer, 2S12	5	6.00-30.00	11.00-26.00	6.00-20.00	11.00-26.00					20.00 >	3.5
10	Semi, 3S3	6	6.00-26.00	2.50-6.30	6.10-50.00	2.50-11.99	2.50-10.99				20.00 >	5.0
12	Semi+Full Trailer, 3S12	6	6.00-26.00	2.50-6.30	11.00-26.00	6.00-24.00	11.00-26.00				20.00 >	5.0
13	7 Axle Multi's	7	6.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00			20.00 >	5.0
13	8 Axle Multi's	8	6.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00		20.00 >	5.0
13	9 Axle Multi's	9	6.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00	20.00 >	5.0

Spacings in feet
Weights in kips (Lbs/1000)
* Suggested Axle 1 minimum weight threshold if allowed by WIM system's class algorithm programming

System Operating Parameters

California SPS-2 (Lane 1)

Calibration Factors for Sensor #1

Validation Visit	March 26, 2008
80 kph	3395
88 kph	3395
96 kph	3420
105 kph	3360
112 kph	3360

Calibration Factors for Sensor #2

Validation Visit	March 26, 2008
80 kph	3395
88 kph	3395
96 kph	3420
105 kph	3360
112 kph	3360