Validation Report

Washington, SPS-2
Task Order 24, CLIN 2
April 22 to 23, 2008

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1 Executive Summary

A visit was made to the Washington 0200 on April 22 to 23, 2008 for the purposes of conducting a validation of the WIM system located on US 395, approximately 2 miles south of I-90, near Ritzville. The SPS-2 is located in the righthand, northbound lane of a four-lane divided facility. The posted speed limit at this location is 60 mph for trucks. The LTPP lane is one of four lanes instrumented at this site. Both of the northbound lanes are instrumented with quartz piezo WIM sensors. Both of the southbound lanes are instrumented with BL piezo WIM sensors. The validation procedures were in accordance with LTPP's SPS WIM Data Collection Guide dated August 21, 2001.

This is the third validation visit to this location. The site was installed in March 1998 by the agency.

This site demonstrates the ability to produce research quality loading data under the observed conditions. The classification algorithm is not currently providing research quality classification information.

The site is instrumented with quartz piezo WIM and IRD 1068 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 71,150 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 a 3 tapered leaf suspension loaded to 62,920 lbs., the "partial" truck.

The validation speeds ranged from 49 to 60 miles per hour. The pavement temperatures ranged from 48 to 78 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 – 530200 – 23-Apr-2008

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	3.2 ± 9.7%	Pass
Tandem axles	±15 percent	1.0 ± 9.6%	Pass
GVW	±10 percent	1.2 ± 6.9%	Pass
Axle spacing	± 0.5 ft [150mm]	0.0 ± 0.1 ft	Pass

Prepared: djw *Checked: bko*

The pavement condition was 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. A review of the WIMIndex values show nine (9) values are below the lower

threshold values with the remaining values falling between the two limits. These values indicate that the roughness at the site may or may not interfere with the ability to calibrate the scale. Given the current condition of the scale at this review, the roughness does not appear to be a factor in the performance of the scale.

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 four years of data to meet the goal of five years of research quality data.

Upon our arrival at the site, we found the system parameters were not the same as we left them at the conclusion of our last validation on July 12, 2007. The agency representative indicated that the modifications were a function of the equipment and not human intervention. While the modification was very minor, we have no way of knowing if this was the only modification to the system or one of many. Therefore the 2007 data needs careful review before being accepted as research quality.

2 Corrective Actions Recommended

No corrective actions are required at this site at this time.

3 Post Calibration Analysis

This final analysis is based on test runs conducted April 23, 2008 during the morning and afternoon hours at test site 530200 on US 395. This SPS-2 site is at milepost 93.0 on the northbound, righthand of a four-lane divided facility. No auto-calibration was used during test runs. The two trucks used for the calibration and for the subsequent 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 71,150 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 a 3 tapered leaf suspension loaded to 62,920 lbs., the "partial" truck.

Each truck made a total of 20 passes over the WIM scale at speeds ranging from approximately 49 to 60 miles per hour. The desired speed range was achieved during this validation. Pavement surface temperatures were recorded during the test runs ranging from about 48 to 78 degrees Fahrenheit. The desired 30 degree Fahrenheit temperature range was also 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 passed all of the performance criteria for weight and spacing.

Table 3-1 Post-Validation Results – 530200 – 23-Apr-2008

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	3.2 ± 9.7%	Pass
Tandem axles	±15 percent	1.0 ± 9.6%	Pass
GVW	±10 percent	1.2 ± 6.9%	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 morning and afternoon hours under mostly cloudy weather conditions, resulting in the desired 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 three 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 – 49 to 52 mph, Medium speed – 53 to 56 mph and High speed – 57 + mph. The three temperature groups were created by splitting the runs between those at 48 to 59 degrees Fahrenheit for Low temperature, 60 to 69 degrees Fahrenheit for Medium temperature and 70 to 78 degrees Fahrenheit for High temperature.

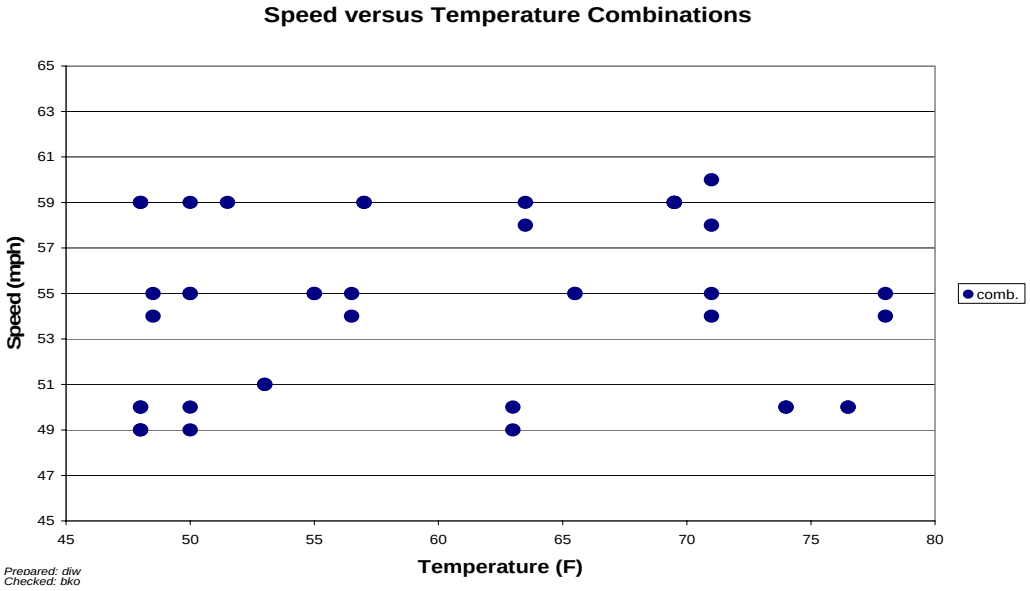


Figure 3-1 Post-Validation Speed-Temperature Distribution – 530200 – 23-Apr-2008

A series of graphs was 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. From the graph, it can be see that the equipment slightly overestimates GVW over the entire speed range. Variability in error appears to be consistent throughout the speed range.

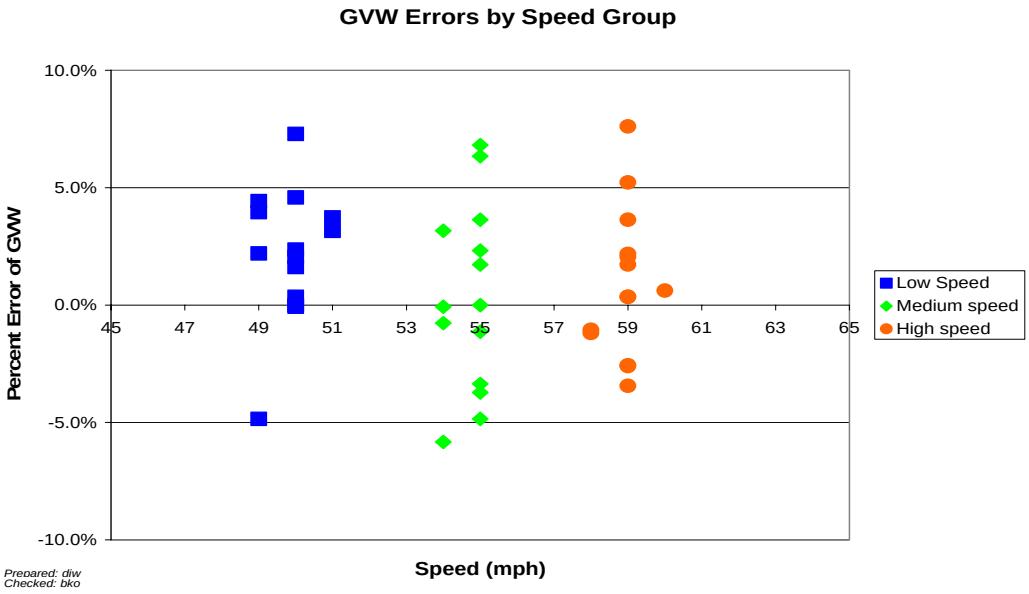


Figure 3-2 Post-validation GVW Percent Error vs. Speed – 530200 – 23-Apr-2008

Figure 3-3 shows the relationship between temperature and GVW percentage error. It can be seen from the graph that temperature does not affect the estimation of GVW at this site. The greater variability in error at the lower temperatures may be a function of the number of data points.

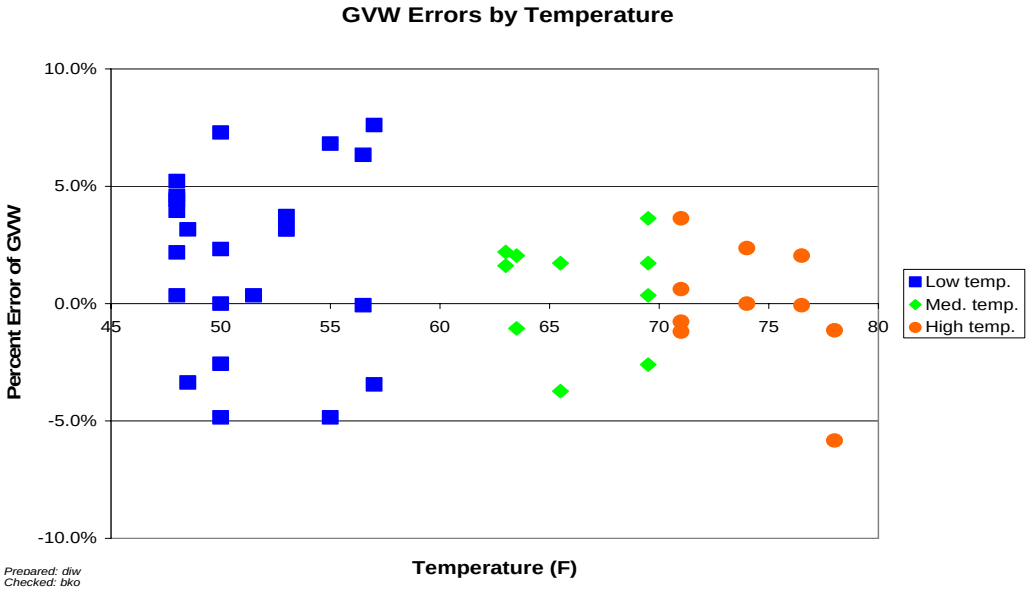


Figure 3-3 Post-Validation GVW Percent Error vs. Temperature – 530200 – 23-Apr-2008

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. From the graph, it appears that speed does not affect the ability of the equipment to measure axle spacing.

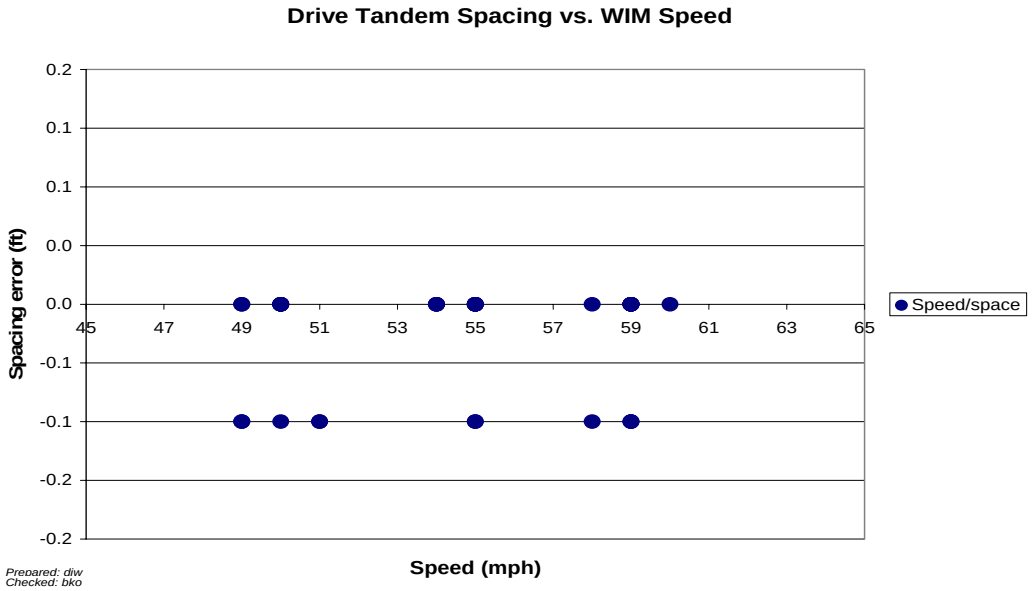


Figure 3-4 Post-Validation Spacing vs. Speed – 530200 – 23-Apr-2008

3.1 Temperature-based Analysis

The three temperature groups were created by splitting the runs between those at 48 to 59 degrees Fahrenheit for Low temperature, 60 to 69 degrees Fahrenheit for Medium temperature and 70 to 78 degrees Fahrenheit for High temperature.

Table 3-2 Post-Validation Results by Temperature Bin – 530200 – 23-Apr-2008

Element	95% Limit	Low Temperature 48 to 59 °F	Medium Temperature 60 to 69 °F	High Temperature 70 to 78 °F
Steering axles	±20 %	5.9 ± 7.9%	0.6 ± 8.4%	-0.1 ± 10.8%
Tandem axles	±15 %	1.4 ± 10.7%	0.8 ± 8.5%	0.2 ± 9.7%
GVW	±10 %	2.0 ± 8.3%	0.6 ± 5.3%	0.0 ± 6.3%
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft	0.0 ± 0.0 ft

Prepared: djw *Checked: bko*

From Table 3-2, it can be seen that for all weights, the equipment overestimates at lower temperatures and estimates with reasonable accuracy at the medium and high temperatures. Variability in steering axle weight estimation appears to increase as temperature increases. For tandem axles and GVW, variability in error appears to be less at the medium temperatures when compared with low and high temperatures.

Figure 3-5 is the distribution of GVW Errors versus Temperature by Truck graph. For the truck population as a whole, the equipment appears to estimate GVW with reasonable

accuracy. GVW for the Golden Truck (squares) is generally underestimated. GVW for the Partial Truck (diamonds) is generally overestimated at the medium and high temperatures, resulting in a higher scatter of error for the truck population as a whole. The scatter is much less for each truck individually.

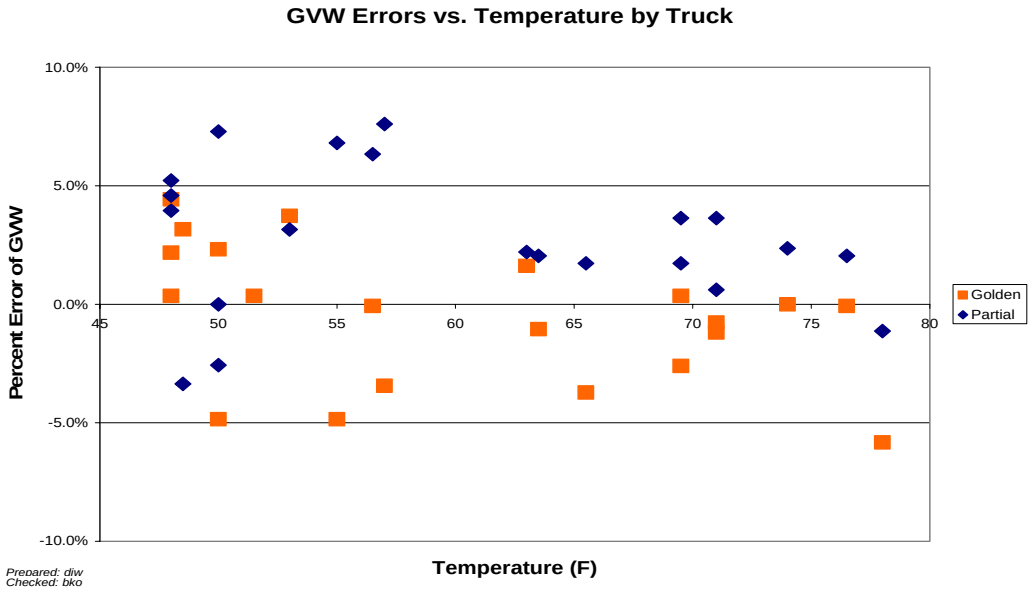


Figure 3-5 Post-Validation GVW Percent Error vs. Temperature by Truck – 530200 – 23-Apr-2008

Figure 3-6 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 calibration. This site does not use auto-calibration. The steering axles in this graph are associated only with Class 9 vehicles. It can be seen from the graph that the equipment estimates steering axle weights with reasonable accuracy at the medium and high temperatures. At the lower temperatures, the equipment tends to overestimate steering axle weight. Variability in error is greater at the lower temperatures when compared with the medium and high temperatures.

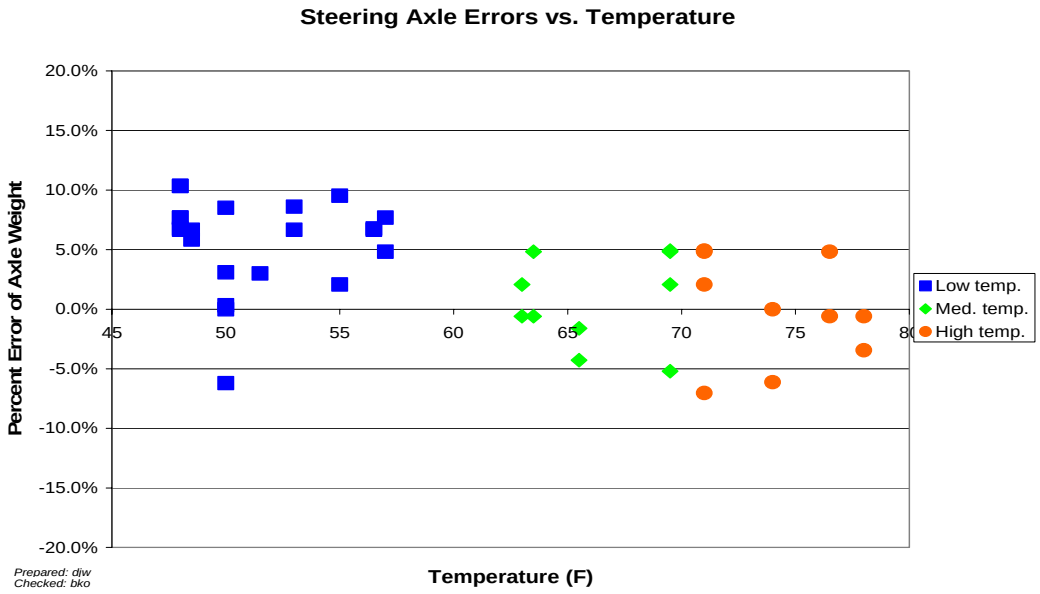


Figure 3-6 Post-Validation Steering Axle Error vs. Temperature by Group – 530200 – 23-Apr-2008

3.2 Speed-based Analysis

The three speed groups were divided using 49 to 52 mph for Low speed, 53 to 56 mph for Medium speed and 57+ mph for High speed.

Table 3-3 Post-Validation Results by Speed Bin – 530200 – 23-Apr-2008

Element	95% Limit	Low Speed 49 to 52 mph	Medium Speed 53 to 56 mph	High Speed 57+ mph
Steering axles	±20 %	3.1 ± 11.8%	3.3 ± 10.0%	3.2 ± 10.3%
Tandem axles	±15 %	2.3 ± 7.9%	-0.1 ± 12.2%	0.7 ± 9.0%
GVW	±10 %	2.4 ± 6.3%	0.3 ± 8.9%	0.9 ± 6.7%
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 3-3, it can be seen that the equipment overestimates steering axle weight at all speeds, and overestimates tandem axles and GVW at the lower speeds. Variability in steering axle error is reasonably consistent throughout the entire speed range. For tandem axles and GVW, variability in error is greater at the medium speeds, when compared with low and high speeds.

Figure 3-7 illustrates the tendency for the system to overestimate GVW at the lower speeds and estimate GVW with reasonable accuracy at the medium and high speeds for the population as a whole and for each truck when observed individually. Variability in GVW error is also reasonably consistent over the entire speed range.

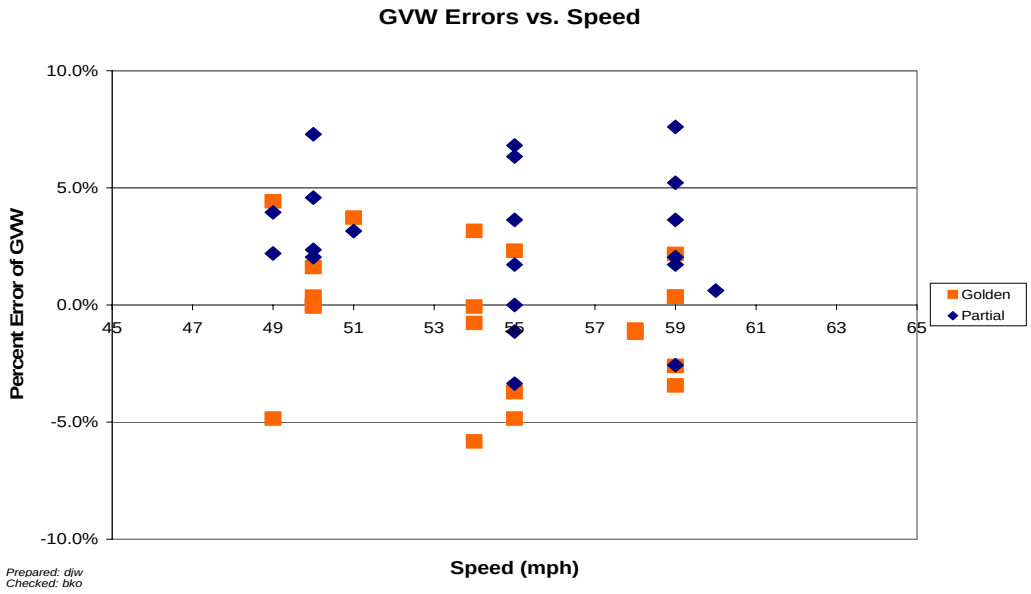


Figure 3-7 Post-Validation GVW Percent Error vs. Speed by Truck – 530200 – 23-Apr-2008

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 illustrates the tendency of the equipment to overestimate steering axle loads at all speeds.

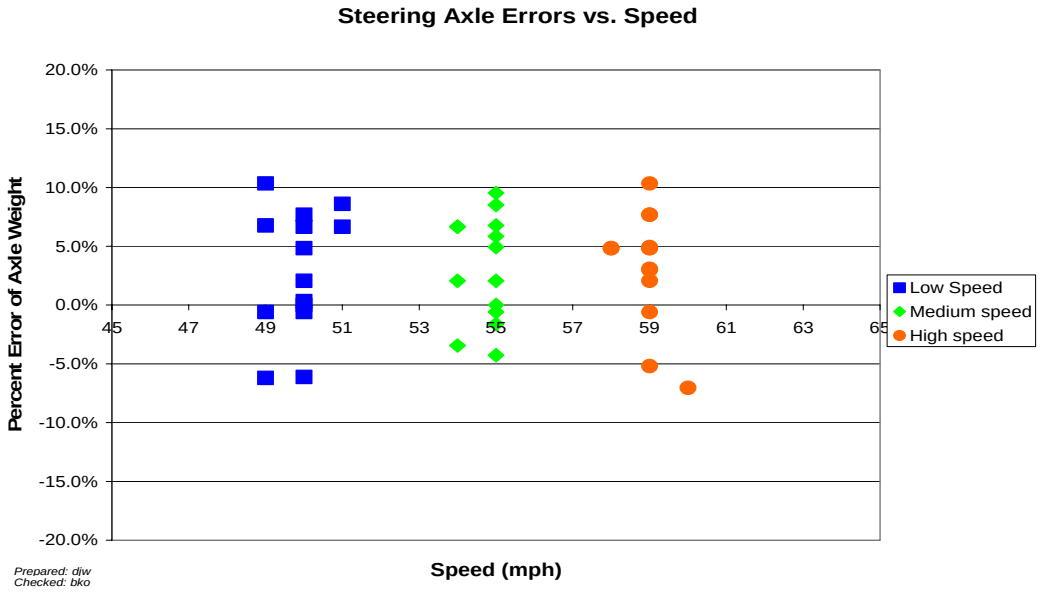


Figure 3-8 Post-Validation Steering Axle Percent Error vs. Speed by Group – 530200 – 23-Apr-2008

3.3 Classification Validation

This agency installed site uses the FHWA 13-bin classification scheme and an agency modified LTPP ETG mod 3 classification algorithm. Classification 15 has been added to define unclassified vehicles. Additional Class 10 algorithms have been added to better distinguish common axle configurations for these trucks at this site.

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 12.3 percent.

Table 3-4 Truck Misclassification Percentages for 530200 – 23-Apr-2008

Class	Percent Error	Class	Percent Error	Class	Percent Error
4	100	5	33	6	100
7	N/A				
8	25	9	2	10	11
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 530200 – 23-Apr-2008

Class	Mean Difference	Class	Mean Difference	Class	Mean Difference
4	-100	5	14	6	-100
7	N/A				
8	33	9	2	10	- 11
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. Many of the misclassifications are attributed to single vehicles pulling trailers.

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 for the predominant Class 9 vehicles at this site, 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 collect longitudinal profiles of the test section with a sampling interval of 25 millimeters.

Profile data collected at the SPS WIM location by Nichols Consulting Engineers on July 19, 2007 were processed through the LTPP SPS WIM Index software, version 1.1. This WIM scale is installed on a 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 lanes were made such that data were collected as close to the lane edges as was safely possible. For each profiler pass, profiles were recorded 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 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 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: bx *Checked: als*

Table 4-2 shows the computed index for all 8 profiler passes for this WIM site values for the profile completed within a year of the current site validation. The average values over the passes in each path were also calculated when three or more passes were completed. These are shown in the right most 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 - 530200 –19-Jul-2007

Profiler Passes			Pass 1	Pass 2	Pass 3	Pass 4	Pass 5	Ave.
Center	LWP	LRI (m/km)	0.884	1.135	1.155	1.017		1.048
		SRI (m/km)	*0.455*	1.198	1.214	0.962		0.957
		Peak LRI (m/km)	0.964	1.181	1.197	1.044		1.096
		Peak SRI (m/km)	1.060	1.318	1.404	1.040		1.205
	RWP	LRI (m/km)	0.955	1.052	1.203	1.016		1.056
		SRI (m/km)	0.515	0.516	*0.492*	0.590		0.528
		Peak LRI (m/km)	1.277	1.227	1.280	1.285		1.267
		Peak SRI (m/km)	*0.615*	*0.729*	*0.669*	*0.706*		*0.680*
Left Shift	LWP	LRI (m/km)	0.956	0.950				
		SRI (m/km)	0.548	0.636				
		Peak LRI (m/km)	1.069	1.082				
		Peak SRI (m/km)	1.139	1.097				
	RWP	LRI (m/km)	1.001	0.987				
		SRI (m/km)	0.892	0.657				
		Peak LRI (m/km)	1.079	1.088				
		Peak SRI (m/km)	0.977	0.794				
Right Shift	LWP	LRI (m/km)	0.873	0.852				
		SRI (m/km)	0.614	0.651				
		Peak LRI (m/km)	0.878	0.909				
		Peak SRI (m/km)	*0.746*	*0.668*				
	RWP	LRI (m/km)	1.095	0.931				
		SRI (m/km)	0.670	0.535				
		Peak LRI (m/km)	1.432	1.072				
		Peak SRI (m/km)	0.851	*0.647*				

Prepared: als *Checked: bko*

From Table 4-2 it can be seen that nine (9) values are below the lower threshold values with the remaining values falling between the two limits. These values indicate that the roughness at the site may or may not interfere with the ability to calibrate the scale. Given the current condition of the scale at this review, the roughness does not appear to be a factor in the performance of the scale.

Table 4-3 shows the computed index values for the prior site validation 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 right most 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.

From Table 4-3 it can be seen that 2 values are above the upper threshold values indicating that it is likely that the pavement roughness could interfere with ability to calibrate this scale.

Table 4-3 WIM Index Values - 530200 –7-Jun-2006

Profiler Passes			Pass 1	Pass 2	Pass 3	Pass 4	Pass 5	Ave.
Center	LWP	LRI (m/km)	1.139	1.181	1.151	1.130		1.150
		SRI (m/km)	0.616	0.888	0.715	0.853		0.768
		Peak LRI (m/km)	1.303	1.275	1.279	1.211		1.267
		Peak SRI (m/km)	1.110	1.202	0.910	1.041		1.066
	RWP	LRI (m/km)	1.185	1.172	1.249	1.201		1.202
		SRI (m/km)	1.409	1.385	1.403	1.659		1.464
		Peak LRI (m/km)	1.206	1.225	1.270	1.258		1.240
		Peak SRI (m/km)	1.410	1.457	1.466	1.671		1.501
Left Shift	LWP	LRI (m/km)	1.076	0.865				
		SRI (m/km)	1.049	1.074				
		Peak LRI (m/km)	1.108	1.011				
		Peak SRI (m/km)	1.213	1.262				
	RWP	LRI (m/km)	0.913	1.063				
		SRI (m/km)	0.972	1.408				
		Peak LRI (m/km)	0.962	1.075				
		Peak SRI (m/km)	1.251	1.725				
Right Shift	LWP	LRI (m/km)	0.956	0.850				
		SRI (m/km)	1.032	0.606				
		Peak LRI (m/km)	1.062	0.929				
		Peak SRI (m/km)	1.250	0.796				
	RWP	LRI (m/km)	**2.109**	1.183				
		SRI (m/km)	1.490	1.707				
		Peak LRI (m/km)	**2.175**	1.231				
		Peak SRI (m/km)	2.318	1.762				

Prepared: bx *Checked: als*

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. A moderate number of trucks appeared to track down the right side of the lane, none of which appeared to avoid the WIM sensors. Daylight cannot be seen between the tires of any of the sensors for the equipment.

5 Equipment Discussion

The traffic monitoring equipment at this location includes quartz piezo WIM sensors and IRD 1068 electronics. The sensors are installed in a portland cement concrete pavement.

Since the assessment/validation on July 12, 2008, the system operating parameters had changed. The final parameters left in the system following the last validation were as follows:

	Left Sensor 1	Right Sensor 2
80 kph	6.691444	6.691444
100 kph	6.691444	6.691444
120 kph	6.691444	6.691444

The operating system weight compensation parameters that were in place prior to the validation were as follows:

	Left Sensor 1	Right Sensor 2
80 kph	6.690078	6.690078
100 kph	6.690078	6.690078
120 kph	6.690078	6.690078

According to the agency representative on site, the values are changed by the equipment itself, through a "rounding off" process. In this case, the change was .02%, which is not significant enough to alter the quality of the weight data assuming no intermediate changes occurred.

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 evaluation. All sensors and system components were found to be within operating parameters.

5.2 Calibration Process

No calibration iterations were required, but improving the statistics was desired. The Task Leader performed one-iteration of the calibration process between the initial 40 runs and the final 40 runs.

5.2.1 Calibration Iteration 1

As a result of the pre-validation, where the equipment produced an average underestimation of 3.2%, all operating parameters were increased by 3.0%. The operating system weight compensation parameters that were in place for the calibration iteration verification runs and the subsequent post-validation were as follows:

	Left Sensor 1	Right Sensor 2
80 kph	6.890780	6.890780
100 kph	6.890780	6.890780
120 kph	6.890780	6.890780

The results of the calibration iteration are shown below.

Table 5-1 Calibration Iteration 1 Results – 530200 – 23-Apr-2008 (08:32 AM)

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	4.9 ± 5.3%	Pass
Tandem axles	±15 percent	0.9 ± 10.4%	Pass
GVW	±10 percent	1.4 ± 6.4%	Pass
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	Pass

Prepared: djw *Checked: bko*

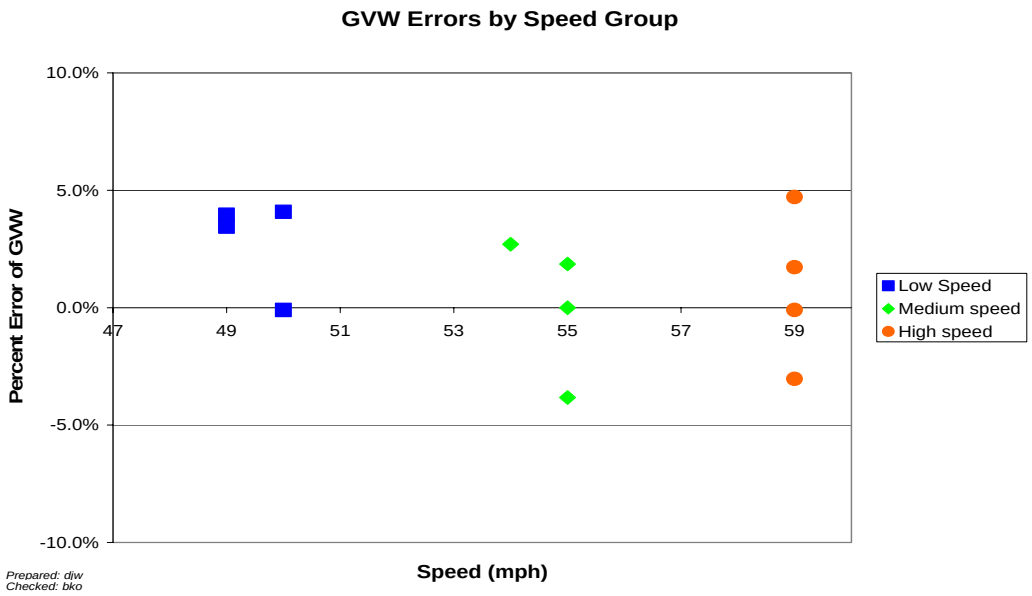


Figure 5-1 Calibration Iteration 1 GVW Percent Error vs. Speed Group – 530200 – 23-Apr-2008 (08:32 AM)

5.3 Summary of Traffic Sheet 16s

This site has validation information from previous visits as well as the current one in the tables below. Table 5-2 has the information for TRF_CALIBRATION_AVC for Sheet 16s submitted prior to this validation as well as the information for the current visit. The Sheet 16s available reflect agency submissions and this contractor's validation visits.

Table 5-2 Classification Validation History – 530200 – 23-Apr-2008

Date	Method	Mean Difference				Percent Unclassified
		Class 9	Class 8	Other 1	Other 2	
23-Apr-08	Manual	2	33			0.9
22-Apr-08	Manual	-2	25			0.0
12-Jul-07	Manual	0	0			0.0
11-Jul-07	Manual	0	0			0.0
29-Nov-06	Manual	0	-50			1.0
28-Nov-06	Manual	0	-50			1.0
24-May-06	Manual	-2		-17		0.7

Prepared: djw *Checked: bko*

Table 5-3 has the information for TRF_CALIBRATION_WIM for Sheet 16s submitted prior to this validation as well as the information for the current visit. The Sheet 16s available reflect agency submissions and this contractor's validation visits.

Table 5-3 Weight Validation History – 530200 – 23-Apr-2008

Date	Method	Mean Error and (SD)		
		GVW	Single Axles	Tandem Axles
23-Apr-08	Test Trucks	1.2 (3.4)	3.2 (4.8)	1.0 (4.8)
22-Apr-08	Test Trucks	-3.3 (2.3)	-2.8 (4.6)	-3.2 (3.6)
12-Jul-07	Test Trucks	-1.0 (2.3)	0.6 (5.5)	-1.2 (2.9)
11-Jul-07	Test Trucks	11.7 (2.5)	6.2 (6.6)	12.7 (3.2)
29-Nov-06	Test Trucks	0.3 (3.2)	-3.7 (5.7)	1.2 (4.2)
28-Nov-06	Test Trucks	-6.0 (4.2)	-12.9 (3.6)	-4.5 (5.9)
18-Jan-06	Test Trucks	-3.6 (1.6)	3.1 (2.4)	-4.9 (2.4)
06-May-04	Test Trucks	1.9 (1.4)	-1.3 (7.4)	2.5 (1.1)

Prepared: djw *Checked: bko*

5.4 Projected Maintenance/Replacement Requirements

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

6 Pre-Validation Analysis

This pre-validation analysis is based on test runs conducted April 22, 2008 from mid-morning to late afternoon at test site 530200 on US 395. This SPS-2 site is at milepost 93.0 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 71,230 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 a 3 tapered leaf suspension loaded to 63,550 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 46 to 59 miles per hour. The desired speed range was achieved during this validation. Pavement surface temperatures were recorded during the test runs ranging from about 50 to 95degrees Fahrenheit. The desired 30 degree Fahrenheit temperature range was also 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 weight and spacing precision requirements for research quality data.

Table 6-1 Pre-Validation Results – 530200 – 22-Apr-2008

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	-2.8 ± 9.3%	Pass
Tandem axles	±15 percent	-3.2 ± 7.1%	Pass
GVW	±10 percent	-3.3 ± 4.7%	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 morning and afternoon hours under partly cloudy weather conditions, resulting in a 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 46 to 50 mph for Low speed, 51 to 54 mph for Medium speed and 55+ mph for High speed. The three temperature groups were created by splitting the runs between those at 50 to 65 degrees Fahrenheit for Low temperature, 66 to 78 degrees Fahrenheit for Medium temperature and 79 to 95 degrees Fahrenheit for High temperature.

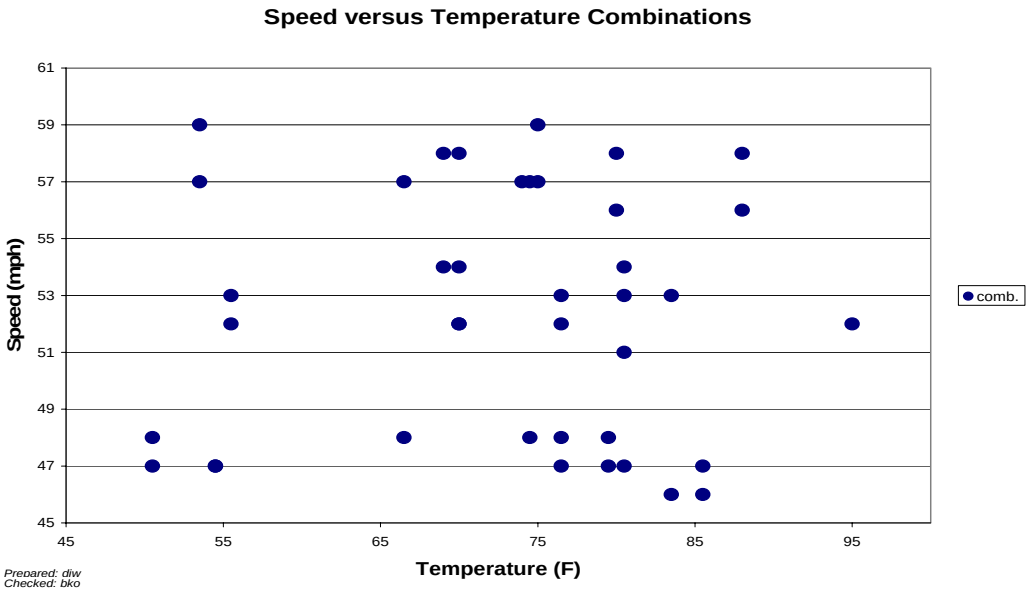


Figure 6-1 Pre-Validation Speed-Temperature Distribution – 530200 – 22-Apr-2008

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 tendency for the equipment to underestimate GVW at all speeds. Variability in error appears to be consistent over the entire speed range.

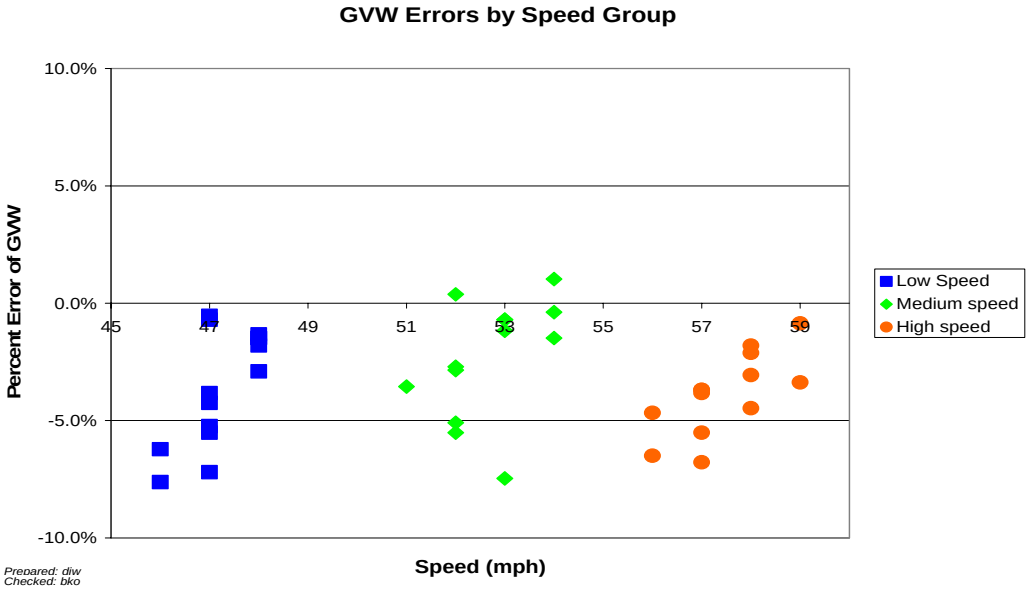


Figure 6-2 Pre-validation GVW Percent Error vs. Speed – 530200 – 22-Apr-2008

Figure 6-3 shows the relationship between temperature and GVW percentage error. The figure illustrates the tendency for the equipment to underestimate GVW at all temperatures. Variability in error appears to be consistent over the entire temperature range.

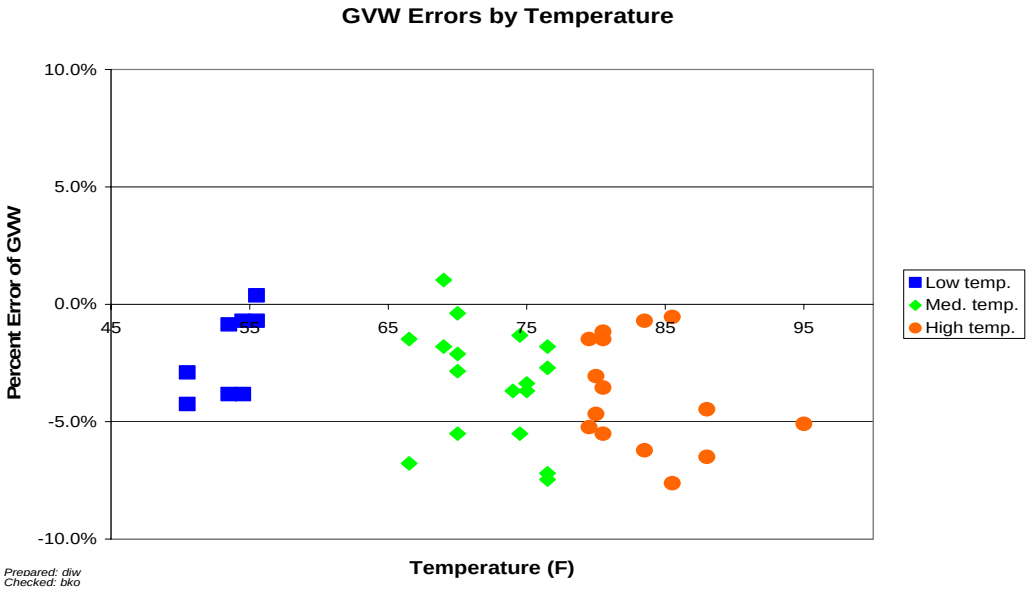


Figure 6-3 Pre-Validation GVW Percent Error vs. Temperature – 530200 – 22-Apr-2008

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. As shown in the figure, speed does not appear to affect the accuracy of the equipment spacing measurements.

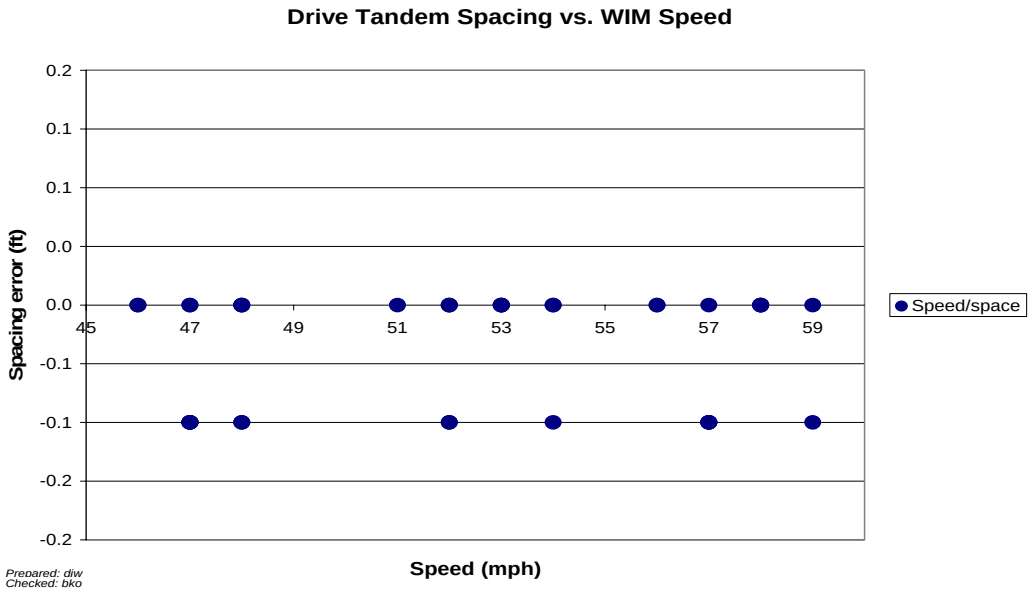


Figure 6-4 Pre-Validation Spacing vs. Speed - 530200 – 22-Apr-2008

6.1 Temperature-based Analysis

The three temperature groups were created by splitting the runs between those at 50 to 65 degrees Fahrenheit for Low temperature, 66 to 78 degrees Fahrenheit for Medium temperature and 79 to 95 degrees Fahrenheit for High temperature.

Table 6-2 Pre-Validation Results by Temperature Bin – 530200 – 22-Apr-2008

Element	95% Limit	Low Temperature 50 to 65 °F	Medium Temperature 66 to 78 °F	High Temperature 79 to 95 °F
Steering axles	±20 %	2.4 ± 7.1%	-3.2 ± 7.8%	-5.1 ± 8.8%
Tandem axles	±15 %	-2.8 ± 8.1%	-3.2 ± 7.7%	-3.3 ± 6.9%
GVW	±10 %	-2.1 ± 4.3%	-3.3 ± 5.2%	-3.8 ± 4.9%
Axle spacing	± 0.5 ft	-0.1 ± 0.1 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft

Prepared: djw *Checked: bko*

From Table 6-2, it can be seen that the equipment has a tendency to underestimate all weights at all temperatures. Variability in error appears to be generally consistent throughout the entire temperature range.

Figure 6-5 shows the distribution of GVW Errors versus Temperature by Truck. For the truck population as a whole and for each truck individually, the equipment underestimates GVW at all temperatures. The tendency of the equipment to underestimate the GVW of the Golden Truck (squares) by a greater degree than the Partial truck (diamonds) results in a higher scatter in error than when the scatter of each truck is considered separately.

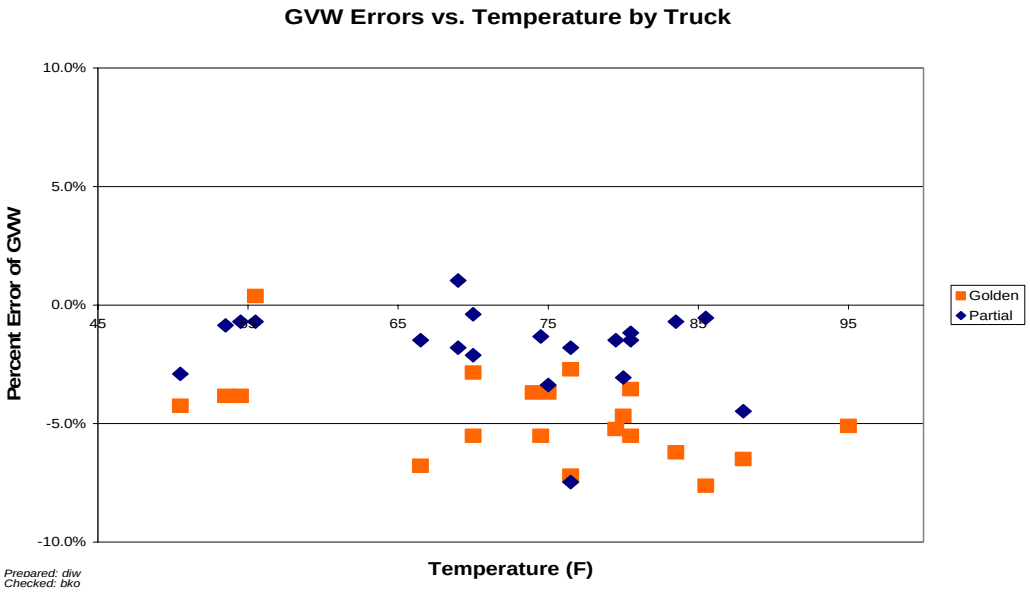


Figure 6-5 Pre-Validation GVW Percent Error vs. Temperature by Truck – 530200 – 22-Apr-2008

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 graph illustrates the tendency of the equipment to overestimate steering axle weights at low temperatures and the increasingly underestimate steering axle weights as temperature increases. Variability in error appears to remain reasonably consistent throughout the entire temperature range.

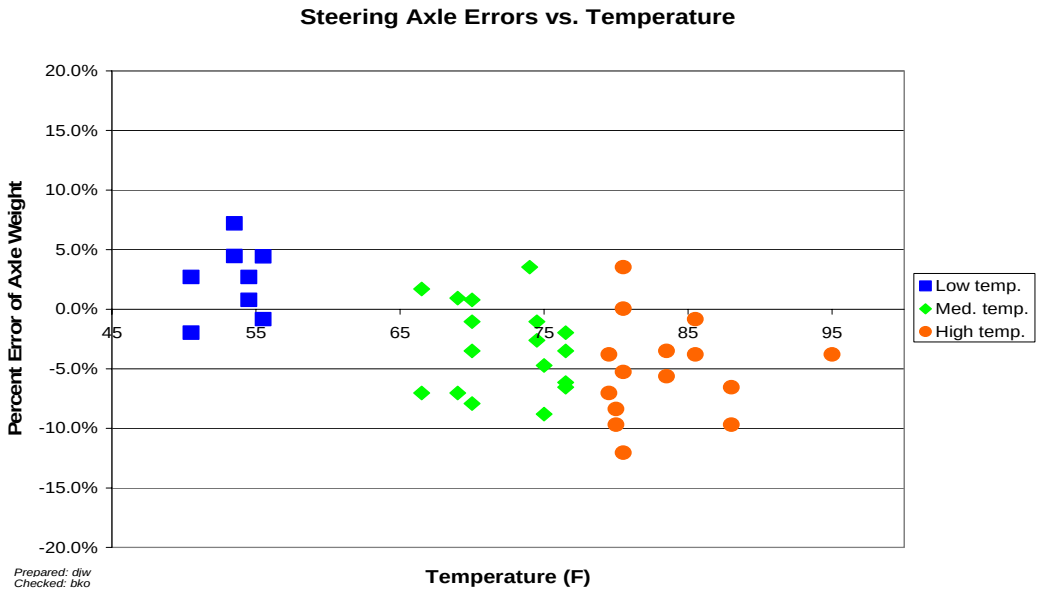


Figure 6-6 Pre-Validation Steering Axle Error vs. Temperature by Group – 530200 – 22-Apr-2008

6.2 Speed-based Analysis

The speed groups were divided as follows: Low speed – 46 to 50 mph, Medium speed – 51 to 54 mph and High speed – 55+ mph.

Table 6-3 Pre-Validation Results by Speed Bin – 530200 – 22-Apr-2008

Element	95% Limit	Low Speed 46 to 50 mph	Medium Speed 51 to 54 mph	High Speed 55+ mph
Steering axles	±20 %	-2.0 ± 7.5%	-2.8 ± 9.2%	-3.6 ± 13.1%
Tandem axles	±15 %	-3.7 ± 7.9%	-2.1 ± 6.5%	-3.7 ± 7.5%
GVW	±10 %	-3.6 ± 5.3%	-2.3 ± 5.5%	-3.9 ± 3.8%
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft

Prepared: djw *Checked: bko*

Table 6-3 shows that the equipment underestimates all weights at all speeds. Variability in steering axle error appears to increase as speed increases. For tandem axle weights, variability appears to be slightly less at the medium speeds when compared to low and high speeds.

From Figure 6-7, it can be seen that the equipment underestimates GVW at all speeds for the truck population as a whole and for each truck individually. Variability in error appears to be consistent throughout the speed range, both for the population as a whole as well as for each truck individually.

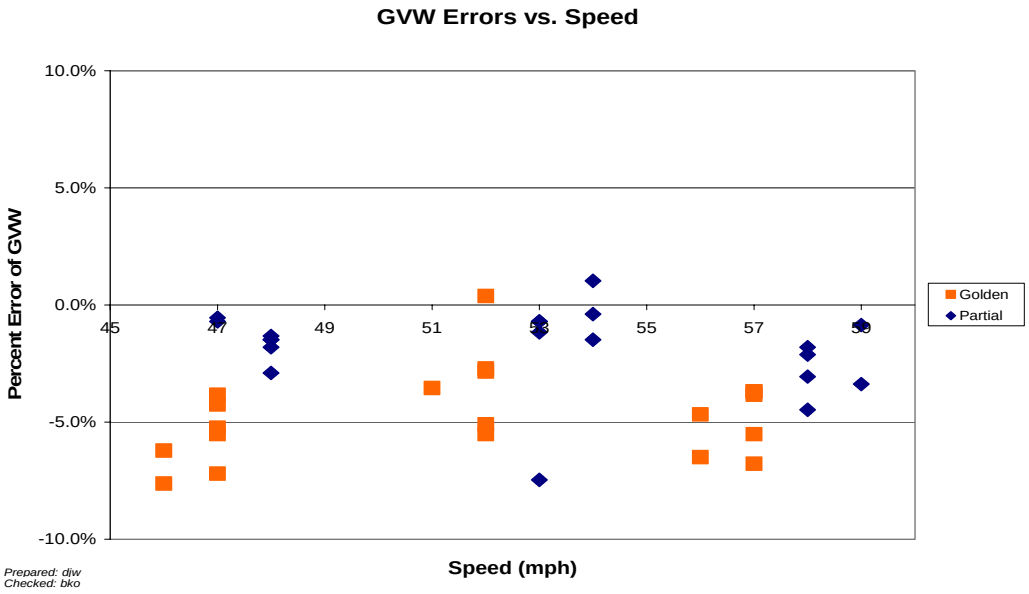


Figure 6-7 Pre-Validation GVW Percent Error vs. Speed Group - 530200 –22-Apr-2008

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. As shown in the graph, steering axle weights are generally underestimated by the equipment at all speeds.

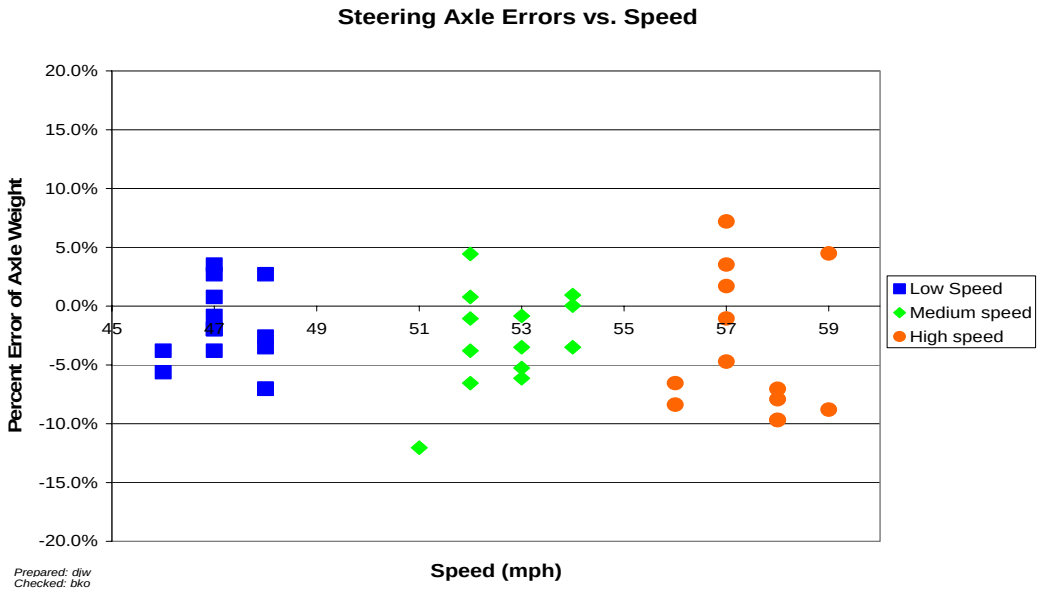


Figure 6-8 Pre-Validation Steering Axle Percent Error vs. Speed Group - 530200 – 22-Apr-2008

6.3 Classification Validation

This agency installed site uses the FHWA 13-bin classification scheme and an agency modified LTPP ETG mod 3 classification algorithm. Classification 15 has been added to define unclassified vehicles. Additional Class 10 algorithms have been added to better distinguish common axle configurations for these trucks at this site.

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 6-4 has the classification error rates by class. The overall misclassification rate is 9.5 percent.

Table 6-4 Truck Misclassification Percentages for 530200 – 22-Apr-2008

Class	Percent Error	Class	Percent Error	Class	Percent Error
4	0	5	33	6	0
7	N/A				
8	50	9	2	10	4
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 6-5 Truck Classification Mean Differences for 530200 – 22-Apr-2008

Class	Mean Difference	Class	Mean Difference	Class	Mean Difference
4	0	5		6	0
7	N/A				
8	25	9	- 2	10	- 4
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 for the predominant Class 9 vehicles at this site, 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*

6.5 Prior Validations

The last validation for this site was done July 12, 2007. It was the second validation of the site. The site was producing research quality data. Figure 6-9 shows the GVW Percent Error vs. Speed for the post validation runs. The site was validated with two trucks. The "Golden" truck was loaded to 70,120 lbs. The "partial" truck which had an air suspension truck tandem and a 3 tapered steel leaf trailer suspension was loaded to 60,240 lbs.

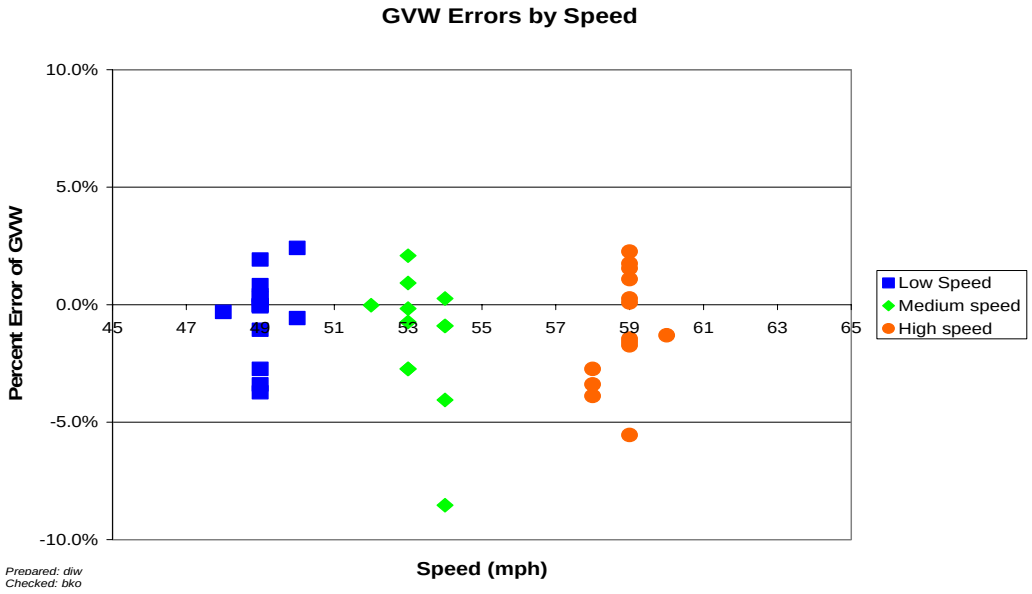


Figure 6-9 Last Validation GVW Percent Error vs. Speed – 530200 – 12-Jul-2007

Table 6-7 shows the overall results from the last validation. The steering axle scatter was somewhat greater for the visit's initial validation runs. The scatter for the tandems has increased somewhat but that of the GVW is the same.

Table 6-7 Last Validation Final Results – 530200 – 12-Jul-2007

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	0.6 ± 11.2%	Pass
Tandem axles	±15 percent	-1.2 ± 5.7%	Pass
Gross vehicle weights	±10 percent	-1.0 ± 4.7%	Pass
Axle spacing	± 0.5 ft [150 mm]	0.0 ± 0.1 ft	Pass

Prepared: djw *Checked: bko*

Table 6-8 has the results at the end of the last validation by temperature. The prior validation occurred under sunny weather conditions, resulting in a range of high temperatures. As shown in the table, the equipment estimated all weights with reasonable accuracy at all temperatures. Through this validation the equipment has been observed at temperature from 14 to 140 degrees Fahrenheit. The temperatures for this validation fell within the previously observed range.

Table 6-8 Last Validation Results by Temperature Bin – 530200 – 12-Jul-2007

Element	95% Limit	Low Temperature 101 - 110 °F	Medium Temperature 111 - 119 °F	High Temperature 120 - 126 °F
Steering axles	±20 %	2.1 ± 13.0%	-0.6 ± 9.8%	-0.1 ± 13.1%
Tandem axles	±15 %	-1.0 ± 6.7%	-0.4 ± 4.8%	-2.4 ± 5.3%
GVW	±10 %	-0.6 ± 6.2%	-0.6 ± 3.4%	-2.1 ± 4.1%
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft

Prepared: djw *Checked: bko*

Table 6-9 has the results of the prior post validation by speed groups. Somewhat different tendencies are present by speed group when comparing the two visits.

Table 6-9 Last Validation Results by Speed Bin – 530200 – 12-Jul-2007

Element	95% Limit	Low Speed 48 to 51 mph	Medium Speed 52 to 56 mph	High Speed 57+ mph
Steering axles	±20 %	1.4 ± 10.7%	0.5 ± 8.1%	0.0 ± 16.0%
Tandem axles	±15 %	-0.7 ± 5.5%	-1.7 ± 6.9%	-1.2 ± 5.3%
GVW	±10 %	-0.4 ± 3.9%	-1.5 ± 6.2%	-1.0 ± 5.0%
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft

Prepared: djw *Checked: bko*

7 Data Availability and Quality

As of April 22, 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.

The amount and coverage for the site is shown in Table 7-1. 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, year 1999, and years 2002 through 2007 have a sufficient quantity to be considered complete years of classification data and years 2003 through 2005 and year 2007 have a sufficient quantity to be considered complete years of weight data.

Together with the previously gathered calibration information, it can be seen that at least four additional years of research quality data are needed to meet the goal of a minimum of 5 years of research weight data based on the 210 days per calendar year requirement.

Table 7-1 Amount of Traffic Data Available 530200 – 22-Apr-2008

Year	Classification Days	Months	Coverage	Weight Days	Months	Coverage
1997	30	1	Full Week	28	1	Full Week
1998	160	7	Full Week	141	6	Full Week
1999	216	10	Full Week	173	6	Full Week
2000	161	10	Full Week	152	5	Full Week
2001	135	5	Full Week	172	6	Full Week
2002	297	10	Full Week	117	4	Full Week
2003	358	12	Full Week	242	8	Full Week
2004	301	11	Full Week	237	8	Full Week
2005	267	9	Full Week	273	9	Full Week
2006	304	12	Full Week	205	8	Full Week
2007	268	9	Full Week	273	9	Full Week

Prepared: djw *Checked: bko*

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 5s, 9s and 13s 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 7-2 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 7-2 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 7-2 GVW Characteristics of Major sub-groups of Trucks – 530200 – 23-Apr-2008

Characteristic	Class 5	Class 9	Class 13
Percentage Overweights	0.2%	0.3%	0.4%
Percentage Underweights	1.9%	0.0%	0.3%
Unloaded Peak		44 kips	36 kips
Loaded Peak		80 kips	104 kips
Peak	12 kips		

Prepared: djw *Checked: bko*

The expected percentage of unclassified vehicles is 3.3%. 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 7-5. 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.

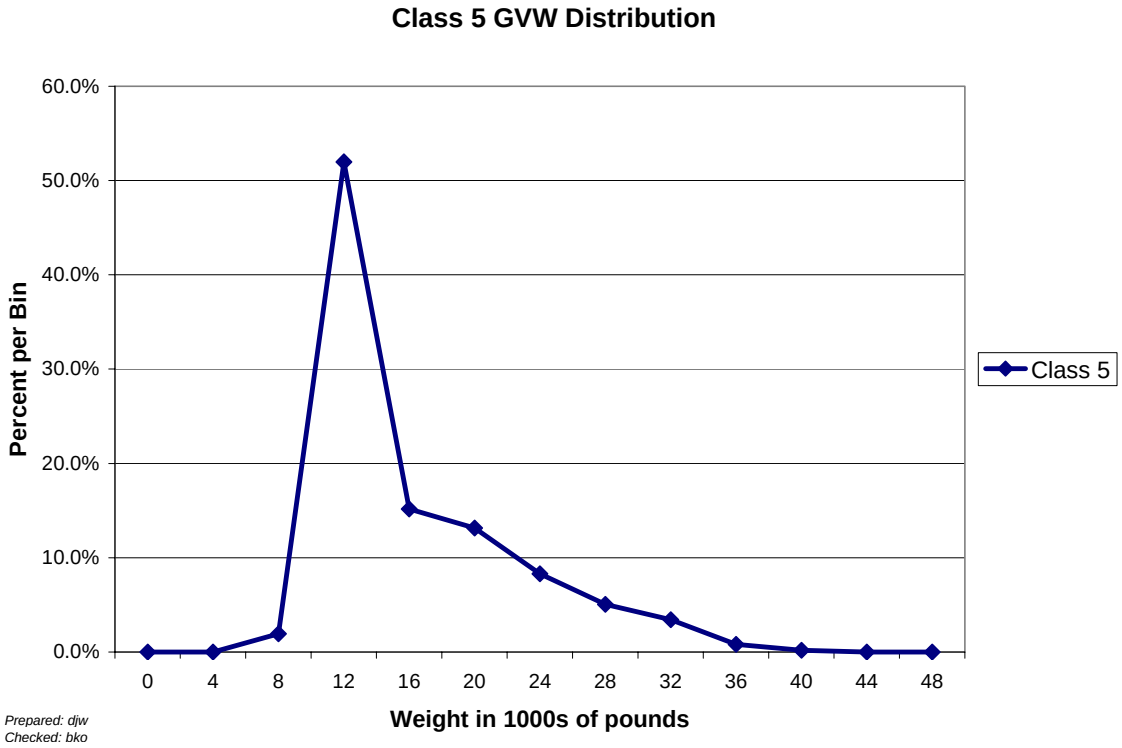


Figure 7-1 Expected GVW Distribution Class 5 – 530200 – 23-Apr-2008

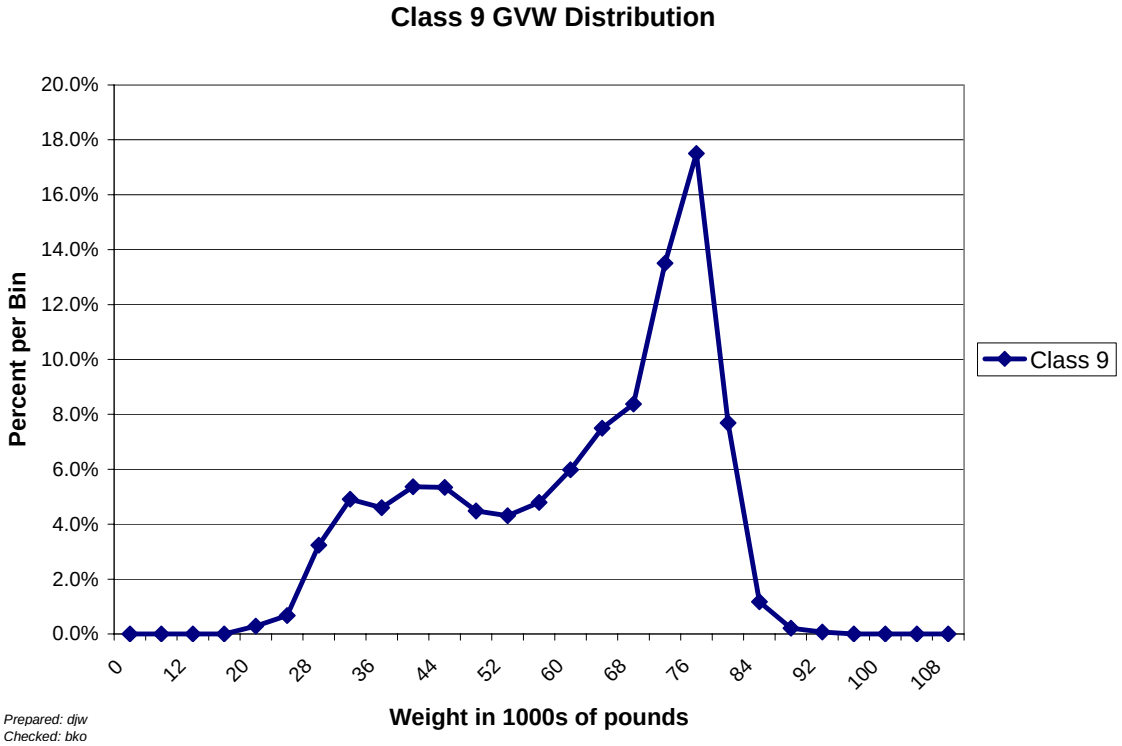


Figure 7-2 Expected GVW Distribution Class 9 – 530200 – 23-Apr-2008

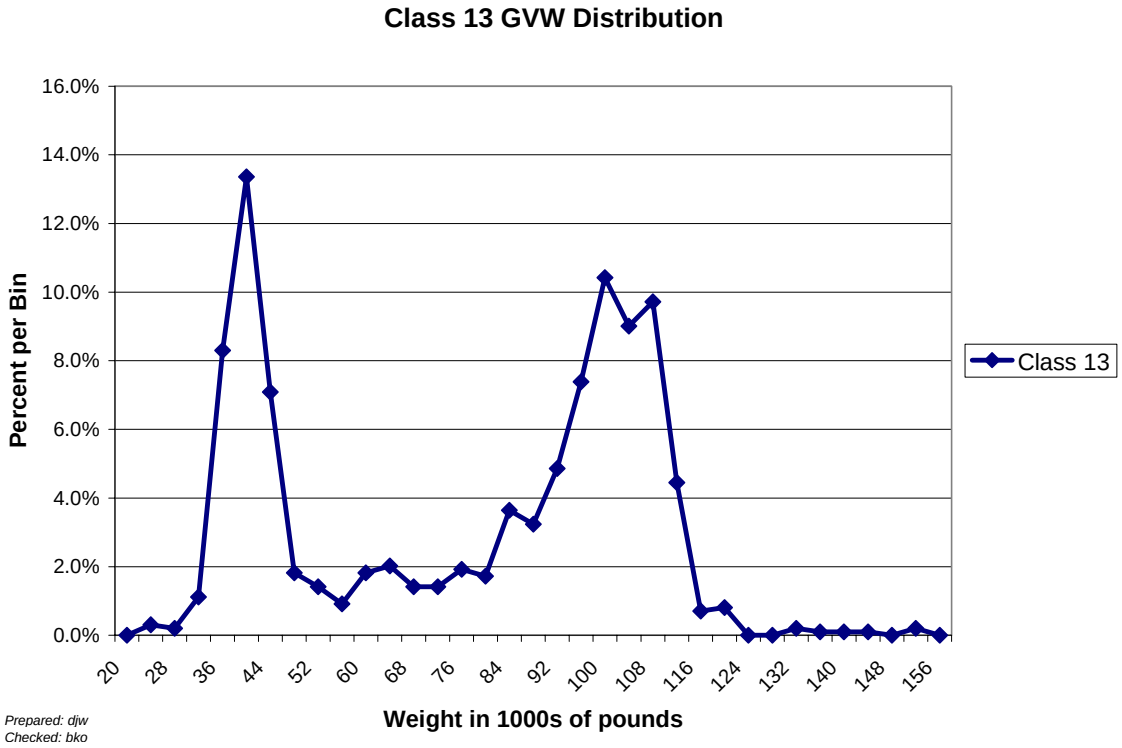


Figure 7-3 Expected GVW Distribution Class 13 – 530200 – 23-Apr-2008

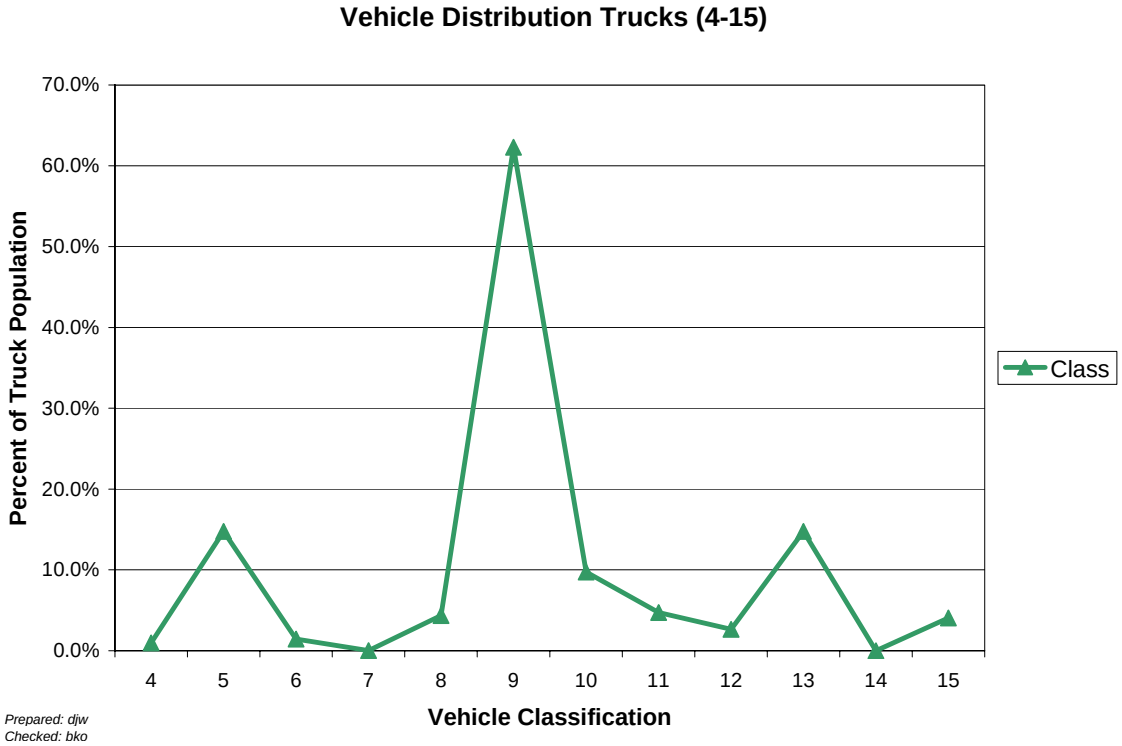


Figure 7-4 Expected Vehicle Distribution – 530200 – 23-Apr-2008

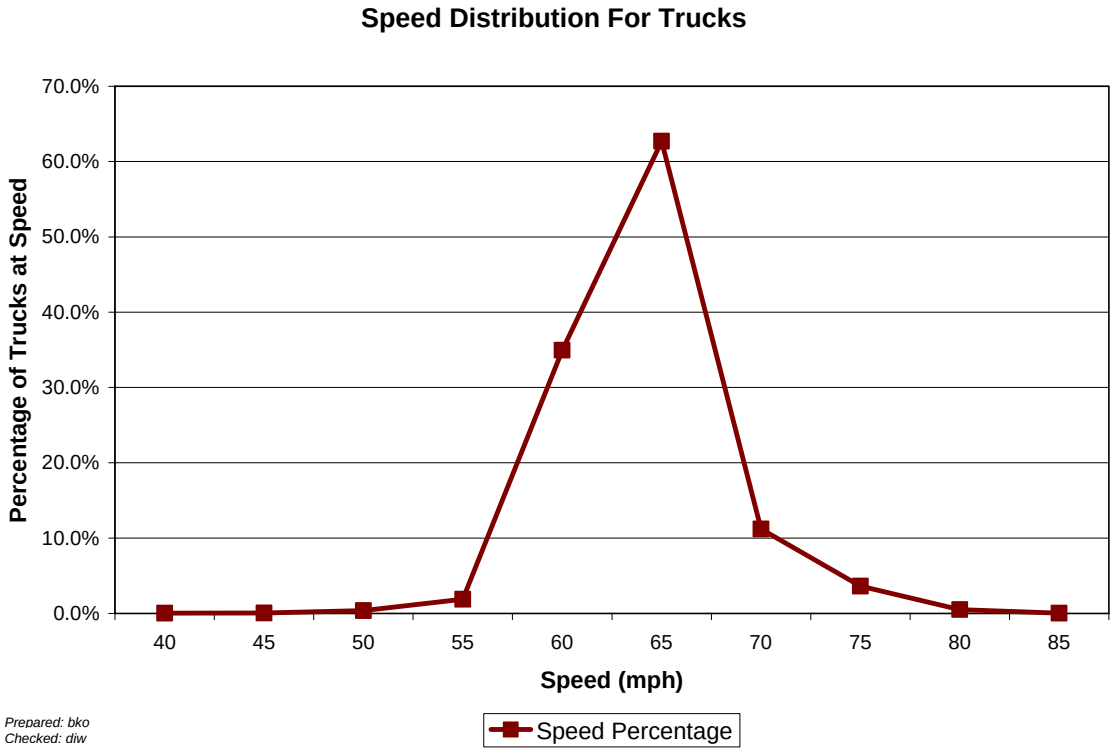


Figure 7-5 Expected Speed Distribution – 530200 – 23-Apr-2008

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 – Speed and Classification verification Pre-Validation (2 pages)
Sheet 20 – Speed and Classification verification – Post-Validation (2 pages)

Sheet 21 – Pre-Validation (3 pages)
Sheet 21 – Calibration Iteration 1 – (1 page)
Sheet 21 – Post-Validation (2 pages)

Calibration Iteration 1 Worksheets – (1 page)

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: Washington

SHRP ID: 530200

Figures

Photos

1. General Information

SITE ID: *530200*

LOCATION: *US-395, milepost 93.01, near Ritzville*

VISIT DATE: *April 22nd, 2008*

VISIT TYPE: *Validation*

2. Contact Information

POINTS OF CONTACT:

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

Highway Agency: *John Rosen, 360-570-2373, rosenj@wsdot.wa.gov*

Linda Pierce, 360-709-5470, piercel@wsdot.wa.gov

John Livingston, 360-709-5472, livingj@wsdot.wa.gov

Ken Lakey, 360-570-2374, lakeyk@wsdot.wa.gov

Hoang Nguyen, 360-570-2389, nguyehv@wsdot.wa.gov

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

FHWA Division Office Liaison: *Cathy Nicholas, 360-753-9412, cathy.nicholas@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: *April 22nd and 23rd, 2008, beginning at 9:00 a.m.*

TRUCK ROUTE CHECK: *Completed*

4. Site Location/ Directions

NEAREST AIRPORT: *Spokane International Airport*

DIRECTIONS TO THE SITE: *US-395, approximately 2 miles south of I-90.*

MEETING LOCATION: *On site at 9:00am, April 22nd, 2008.*

WIM SITE LOCATION: *US-395, milepost 93.01; GPS = N 47.0737°, W 118.4095°.*

WIM SITE LOCATION MAP: *See Figure 4.1*

Figure 4-1 – Site 530200 in Washington

5. Truck Route Information

ROUTE RESTRICTIONS: *None*

CERTIFIED SCALE LOCATION: *CAT Scales located at Petro Truck Stop, I-90 at exit 272 (Medical Lake Road), Spokane, WA; GPS = 47.5935° N, -117.5700.*

TRUCK ROUTE: *See Figure 5.1*

NB on I-395 1.8 miles, merge on to I-90 East for 2 miles, exit 221, left turn to I-395 SB ramp.

SB 5.0 miles on I-395 to PAHA/PACKARD exit, left to I-395 NB ramp.

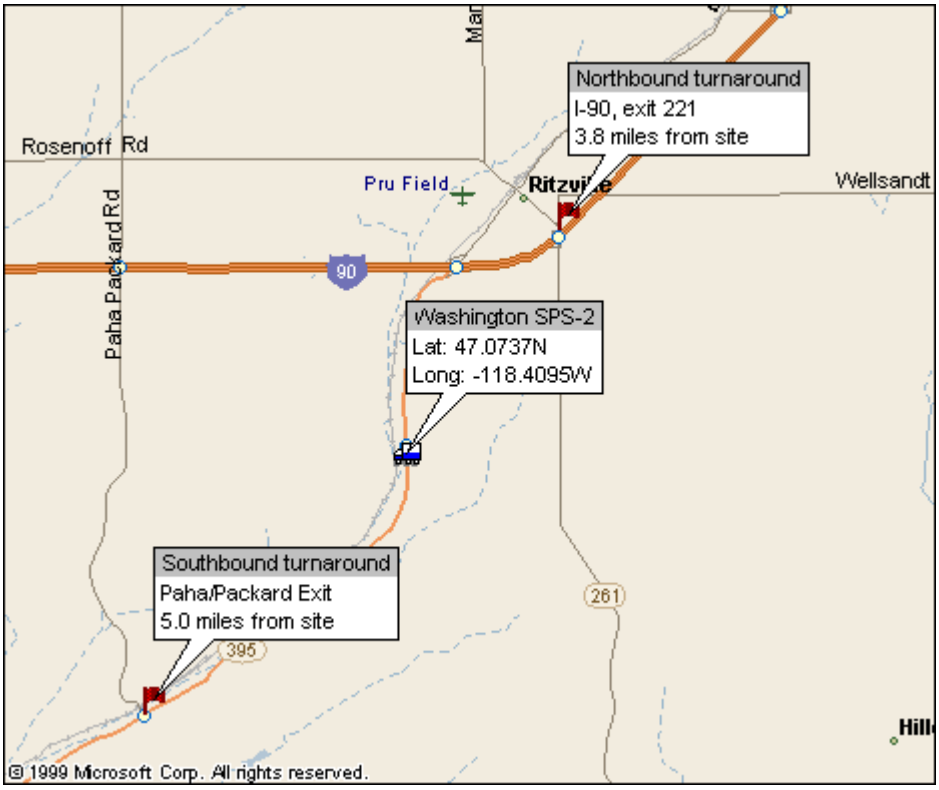


Figure 5-1 – Truck Route at 530200 in Washington

SB distance = 10.8 miles
NB distance = 8.4 miles

Total distance = 19.2 miles (21 minutes)

6. Sheet 17 – Washington (530200)

1.* ROUTE ____US-395___ MILEPOST __93.01__ LTPP DIRECTION - N S E W

2.* WIM SITE DESCRIPTION - Grade __1_____ % Sag vertical Y / N
Nearest SPS section upstream of the site ___0_2_0_5___
Distance from sensor to nearest upstream SPS Section ___ __0___ ___ ft
(site installed between station 4+00 and 5+00, 50' from end)

3.* LANE CONFIGURATION
Lanes in LTPP direction __2_ Lane width _1_2_ ft

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

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

Shoulder width __1_0__ ft

4.* PAVEMENT TYPE ___PCC_____

5.* PAVEMENT SURFACE CONDITION – Distress Survey
Date _____ Photo Filename: _____
Date _____ Photo Filename: _____
Date _____ Photo Filename: _____

6. * SENSOR SEQUENCE _____Loop – Kistler – Kistler -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 ___ ___ . ___ 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 _8_3__ ft
Distance from system __9_0__ ft
TYPE _____M_____

CABINET ACCESS controlled by LTPP / STATE / JOINT ?
Contact - name and phone number __Ken Lakey_ 360-570-2374_____
Alternate - name and phone number __Hoang Nguyen__360-570-2389___

11. * POWER

Distance to cabinet from drop ___1_6_0___ ft Overhead / underground / solar /
AC in cabinet?
Service provider __Big Ben Electric____ Phone number _____

12. * TELEPHONE

Distance to cabinet from drop ___1_6_0___ ft Overhead / underground / cell?
Service provider __Century Tel_____ Phone Number __800-533-4171_____

13.* SYSTEM (software & version no.)- ___IRD 1068_____
Computer connection – RS232 / Parallel port / USB / Other _____

14. * TEST TRUCK TURNAROUND time __21minutes__Distance _19.2__ mi.

15. PHOTOS FILENAME

Power source 53_0200_Power_Meter_04_22_08.jpg
Phone source 53_0200_Telephone_Source_04_22_08.jpg
Cabinet exterior 53_0200_Cabinet_Exterior_04_22_08.jpg
Cabinet interior 53_0200_Cabinet_Interior_04_22_08.jpg
Weight sensors 53_0200_Leading_WIM_Sensor_04_22_08.jpg
53_0200_Trailing_WIM_Sensor_04_22_08.jpg
Classification sensors _____
Other sensors 53_0200_Leading_Loop_Sensor_04_22_08.jpg
53_0200_Trailing_Loop_Sensor_04_22_08.jpg
Description Loops

Downstream direction at sensors on LTPP lane
53_0200_Downstream_04_22_08.jpg

Upstream direction at sensors on LTPP lane
53_0200_Upstream_04_22_08.jpg

COMMENTS _____Site phone # - 509-659-4100_____

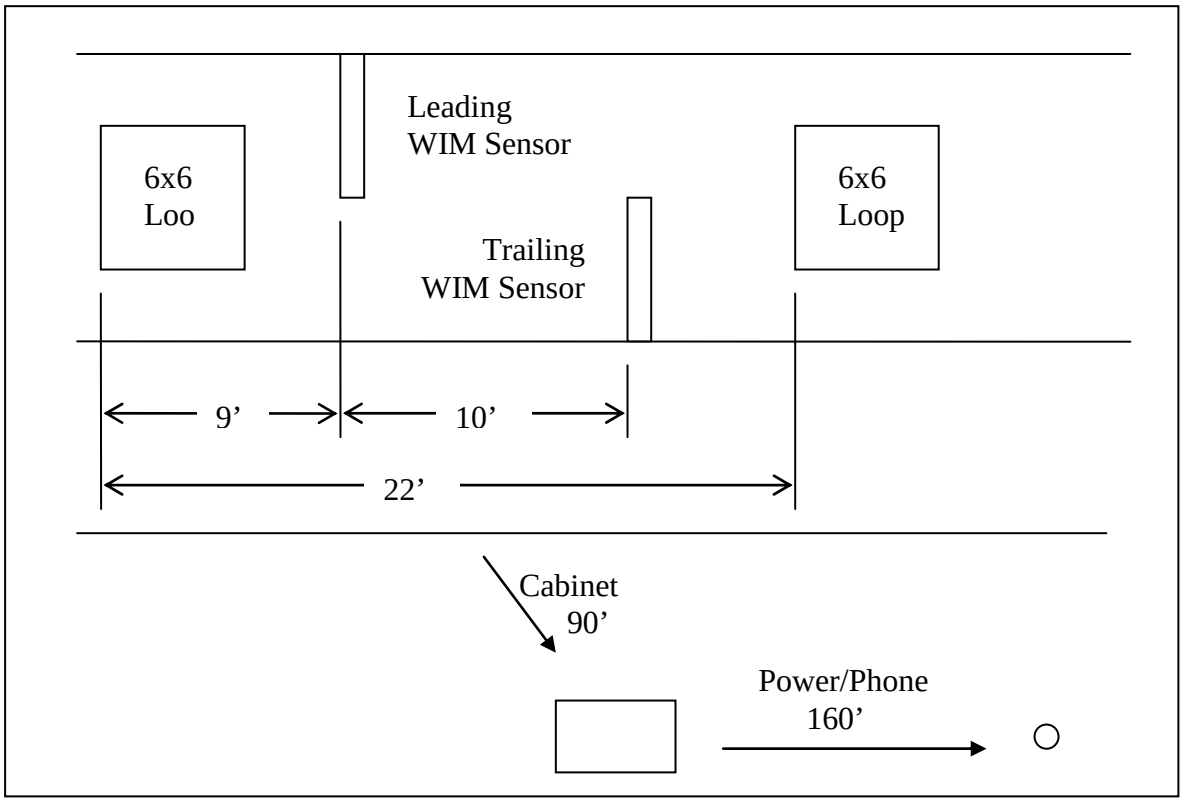
_____

_____all amenities 2 miles north in Ritzville, including La Quinta Inn, McDonalds, Subway, Shell Gas _____intermittent cell phone coverage_____

COMPLETED BY ____Dean J. Wolf_____

PHONE _301-210-5105_____ DATE COMPLETED _ 04_ _ / _22 _ _ / _2008 _ _

Sketch of equipment layout



Site Map

Figure 6-1 – Site Map of 530200 in Washington

Photo 1 - 53_0200_Upstream_04_22_08.jpg

Photo 2 - 53_0200_Downstream_04_22_08.jpg

Photo 3 - 53_0200_Power_Meter_04_22_08.jpg

Photo 4 - 53_0200_Telephone_Box_04_22_08.jpg

Photo 5 - 53_0200_Telephone_Source_04_22_08.jpg

Photo 6 - 53_0200_Cabinet_Exterior_04_22_08.jpg

Photo 7 - 53_0200_Cabinet_Interior_04_22_08.jpg

Photo 8 - 53_0200_Leading_WIM_Sensor_04_22_08.jpg

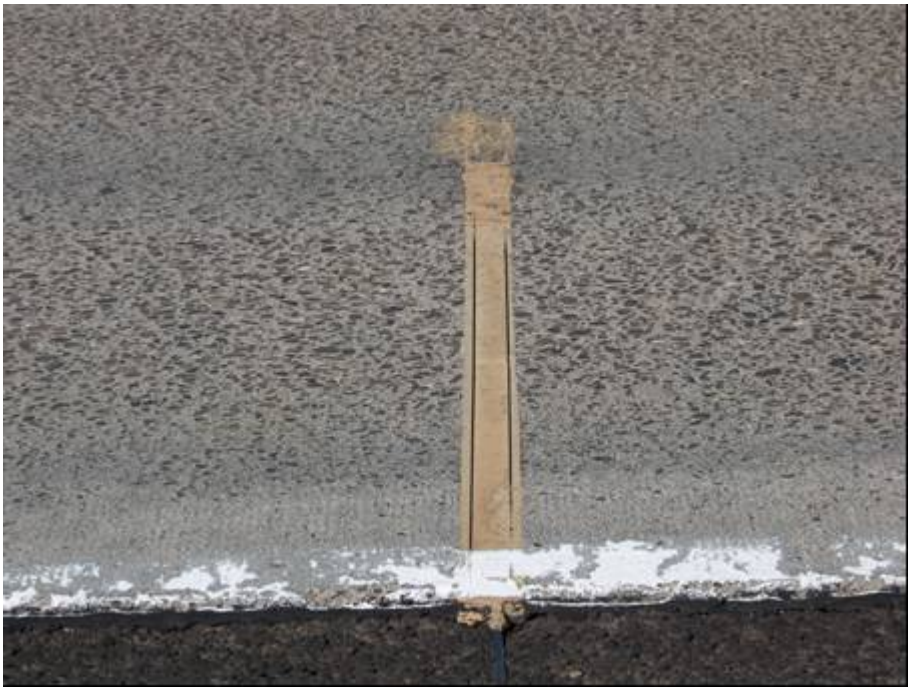


Photo 9 - 53_0200_Trailing_WIM_Sensor_04_22_08.jpg

Photo 10 - 53_0200_Leading_Loop_Sensor_04_22_08.jpg

Photo 11 - 53_0200_Trailing_Loop_Sensor_04_22_08.jpg

SHEET 18	STATE CODE [53]
LTPP MONITORED TRAFFIC DATA	SPS PROJECT ID [0200]
WIM SITE COORDINATION	DATE: (mm/dd/yyyy) 4/22/2008

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:

   IRD

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: TDO Ken Lakey Phone:(360) 570-2374

Agency: WSDOT

c. Data Processing and Pre-Visit Data –

Name: Tony Niemi Phone:(360) 570-2392

Agency: WSDOT

d. Construction schedule and verification –

Name: TDO John Rosen Phone:(360) 570-2373

Agency: WSDOT

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

Name: Doug Poss Phone:(509) 570-2390

Agency: Spokane Transfer

f. Traffic Control –

Name: TDO Matt Heathscott Phone:(360) 570-2390

Agency: _____

g. Enforcement Coordination –

Name: _____ Phone:_____

Agency: _____

h. Nearest Static Scale

Name: Petro Travel Center Location:I-90, exit 272, Spokane, WA

Phone: _____

SHEET 16 **LTPP MONITORED TRAFFIC DATA** **SITE CALIBRATION SUMMARY**	*STATE ASSIGNED ID [__ __ __ __] *STATE CODE [53] *SHRP SECTION ID [0200]

SITE CALIBRATION INFORMATION

1. * DATE OF CALIBRATION (MONTH/DAY/YEAR) [4/22/08]

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 ___ BENDING PLATES
   ___ CHANNELIZED ROUND PIEZO ___ LOAD CELLS _X_ 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	2
3		

7. SUMMARY CALIBRATION RESULTS (EXPRESSED AS A PERCENT)
   MEAN DIFFERENCE BETWEEN ---
   DYNAMIC AND STATIC GVW -3.3 STANDARD DEVIATION 2.3
   DYNAMIC AND STATIC SINGLE AXLES -2.8 STANDARD DEVIATION 4.6
   DYNAMIC AND STATIC DOUBLE AXLES -3.2 STANDARD DEVIATION 3.6

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

9. DEFINE THE SPEED RANGES USED (MPH) _____ 50 55 60 _____ __ __ _____ _____
   _____ _____ _____ _____ _____ _____ _____ _____ _____ _____

10. CALIBRATION FACTOR (AT EXPECTED FREE FLOW SPEED) 6.690078

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 ____ -2 FHWA CLASS _10_ ____ ____ -4
   *** FHWA CLASS 8 ____ 25 FHWA CLASS ____ ____ ____ _____
   FHWA CLASS ____ ____ ____ _____
   FHWA CLASS ____ ____ ____ _____
   *** PERCENT "UNCLASSIFIED" VEHICLES: ____ 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 [53] *SHRP SECTION ID [0200]

SITE CALIBRATION INFORMATION

1. * DATE OF CALIBRATION (MONTH/DAY/YEAR) [4/23/2008]

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 ___ BENDING PLATES
   ___ CHANNELIZED ROUND PIEZO ___ LOAD CELLS _X_ 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	2
	3		

7. SUMMARY CALIBRATION RESULTS (EXPRESSED AS A PERCENT)
   MEAN DIFFERENCE BETWEEN ---
   DYNAMIC AND STATIC GVW ___1.2 STANDARD DEVIATION ___3.4
   DYNAMIC AND STATIC SINGLE AXLES ___3.2 STANDARD DEVIATION ___4.8
   DYNAMIC AND STATIC DOUBLE AXLES ___1.0 STANDARD DEVIATION ___4.8

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

9. DEFINE THE SPEED RANGES USED (MPH) _____ _50_ __55__ __60_ _____ __ __ _____ _____
   _____ _____ _____ _____ _____ _____ _____ _____ _____ _____

10. CALIBRATION FACTOR (AT EXPECTED FREE FLOW SPEED) ___6.890780___

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 ____ 2 FHWA CLASS _10_ ____ ____ -11
   *** FHWA CLASS 8 ____ 33 FHWA CLASS ____ ____ ____ _____
   FHWA CLASS ____ ____ ____ _____
   FHWA CLASS ____ ____ ____ _____
   *** PERCENT "UNCLASSIFIED" VEHICLES: ____ 1.0

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

APPENDIX A

Sheet 19	* STATE_CODE	5 3
LTPP Traffic Data	* SPS PROJECT ID	0 2 0 0
*CALIBRATION TEST TRUCK # 1	* DATE	09/22/08

Rev. 08/31/01

mike 311 1530

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:

ECOLOGY BLOCKS IN BOX VAN TRAILER

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 12.7 B to C 9.3 C to D 32.6

D to E 9.1 E to F _____

Wheelbase (measured A to last) _____ Computed 53.7

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	~~11~~R 75R29.5	2 FULL LEAF
B	11R29.5	AIR
C	11R 22.5	"
D	75R22.5	"
E	75R22.5	"
F	_____	_____

Sheet 19	* STATE_CODE	5 3
LTPP Traffic Data	* SPS PROJECT ID	0 2 0 0
*CALIBRATION TEST TRUCK # 1	* DATE	9/22/08

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PART II

Day 1

*b) Average Pre-Test Loaded weight 71540
*c) Post Test Loaded Weight 70920
*d) Difference Post Test – Pre-test -620

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	11080	13800	13800	16930	16930		71540
2	11100	13790	13790	16930	16930		71540
3							
Average	11090	13795	13795	16930	16930		71540

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	10740	13650	13650	16440	16440		70920
2							
3							
Average	10740	13650	13650	16440	16440		70920

Measured By D.W. Verified By R.P. Weight date 9/22/08

Sheet 19	* STATE CODE	5 3
LTPP Traffic Data	* SPS PROJECT ID	0 2 0 0
*CALIBRATION TEST TRUCK # 1	* DATE	4/23/08

Rev. 08/31/01

Day 2

7.2 *b) Average Pre-Test Loaded weight 71470

*c) Post Test Loaded Weight 70830

*d) Difference Post Test – Pre-test -640

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	11080	13750	13750	16440	16440		71460
2	11100	13730	13730	16460	16460		71480
3							
Average	11090	13740	13740	16450	16450		71470

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	10660	13640	13640	16440	16440		70620
2	10660	13640	13640	16450	16450		~~70830~~ 70840 Bad
3							
Average	10660	13640	13640	16445	16445		70830

Measured By DJW Verified By RP Weight date 4/23/08

Sheet 19	* STATE_CODE	5 3
LTPP Traffic Data	* SPS PROJECT ID	0 2 0 0
*CALIBRATION TEST TRUCK # 2	* DATE	

Rev. 08/31/01

Mark 30/238

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:

STEER RODS ON FLATBED TRAILER

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 12.8 B to C 4.3 C to D 29.9

D to E 4.0 E to F _____

Wheelbase (measured A to last) _____ Computed 50.5

13. *Kingpin Offset From Axle B (units) 1.3 (_____)

(+ is to the rear)

SUSPENSION

Axle	14. Tire Size	15.* Suspension Description (leaf, air, no. of leaves, taper or flat leaf, etc.)
A	11R22.5	2 FULL LEAF
B	"	AIR
C	"	"
D	"	3 TAPERED LEAF
E	"	"
F		

Sheet 19	* STATE_CODE	5 3
LTPP Traffic Data	* SPS PROJECT ID	0 2 0 0
*CALIBRATION TEST TRUCK # 2	* DATE	9/22/08

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PART II

Day 1

*b) Average Pre-Test Loaded weight 63880
*c) Post Test Loaded Weight 63210
*d) Difference Post Test – Pre-test -670

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	11420	13180	13080	13050	13050		63880
2	11520	13120	13020	13060	13060		63880
3							
Average	11470	13150	13050	13055	13055		63880

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	11200	12960	12960	13050	13050		63220
2	11040	13030	13030	13050	13050		63200
3							
Average	11120	12995	12995	13050	13050		63210

Measured By D.W. Verified By R.P. Weight date 9/22/08

Sheet 19	* STATE CODE	5 3
LTPP Traffic Data	* SPS PROJECT ID	0 2 0 0
*CALIBRATION TEST TRUCK # 2	* DATE	4/23/08

Rev. 08/31/01

Day 2

7.2 *b) Average Pre-Test Loaded weight 63220

*c) Post Test Loaded Weight 62610

*d) Difference Post Test – Pre-test -610

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	11020	13020	13020	13080	13080		63220
2	11140	12980	12980	13060	13060		63220
3							
Average	11080	13000	13000	13070	13070		63220

Table 6.2. Raw data – Axle scales –

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10600						
2	10700						
3							
Average	106						

Table 7.2 Raw data – Axle scales – post-test

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10600	12960	12960	13060	13060		62640
2	10700	12880	12880	13060	13060		62580
3							
Average	10650	12920	12920	13060	13060		62610

Measured By DW Verified By RP Weight date _____

Sheet 20	* STATE_CODE	53
LTPP Traffic Data	*SPS PROJECT_ID	0200
Speed and Classification Checks * 1 of* 2	* DATE	04/22/2008

Rev. 08/31/2001

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
57	8	1494	60	8	62	5	1755	65	8
57	5	1495	59	5	64	5	1758	65	9
59	9	1517	62	9	62	9	1771	62	9
57	10	1529	58	10	63	10	1775	64	10
66	9	1536	69	9	61	9	1776	63	9
59	9	1537	59	9	60	9	1781	61	9
66	5	1556	67	5	57	10	1791	59	10
63	13	1555	64	13	64	9	1797	64	9
62	9	1557	62	9	64	9	1807	65	9
60	9	1603	65	9	60	9	1811	61	9
60	9	1608	61	9	62	9	1816	60	9
59	8	1614	60	8	59	9	1836	60	9
62	9	1615	63	9	55	9	1841	54	9
62	5	1654	57	5	59	9	1850	62	9
61	9	1660	64	9	57	5	1863	58	5
64	9	1665	64	9	61	6	1866	61	6
62	9	1671	68	9	60	9	1868	61	9
65	9	1676	68	9	63	9	1875	64	9
56	9	1680	58	9	60	8	1885	62	8
59	9	1689	60	9	62	9	1887	63	9
60	9	1697	59	9	60	6	1896	63	6
59	9	1709	62	9	63	9	1898	60	9
60	9	1711	63	9	54	5	1900	55	5
62	9	1713	63	9	57	9	1908	59	9
58	9	1738	59	9	62	9	1910	62	9

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Recorded by R.P. Direction NB Lane 1 Time from 9:30 to 10:50

Sheet 20	* STATE_CODE	53
LTPP Traffic Data	*SPS PROJECT_ID	0200
Speed and Classification Checks * 2 of* 2	* DATE	09/22/2008

Rev. 08/31/2001

START HERE ↓

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
59	9	2050	61	9	61	10	1911	62	10
63	10	2052	63	10	59	13	1912	62	13
62	13	2064	63	13	61	13	1913	60	13
64	13	2089	65	13	59	10	1918	61	10
58	13	2092	57	13	60	10	1921	60	10
60	9	2101	60	9	59	10	1932	62	10
63	5	2121	63	5	58	10	1934	60	10
65	13	2122	64	13	59	9	1936	60	9
64	13	2123	64	13	68	5	1938	67	5
58	9	2125	57	9	59	10	1949	59	10
64	10	2126	63	10	62	10	1945	62	10
60	9	2155	60	9	59	10	1948	60	10
63	9	2156	61	9	60	9	1955	62	9
60	9	2157	59	9	61	10	1956	61	10
62	9	2159	62	9	62	10	1957	62	10
55	8	2160	53	5	65	10	1961	65	10
62	9	2163	61	9	60	13	2012	61	13
71	5	2170	71	5	62	9	2015	58	9
60	11	2177	62	11	62	9	2019	63	9
60	9	2182	60	9	57	10	2022	59	10
60	10	2186	61	10	64	9	2023	64	9
58	9	2191	55	9	60	10	2024	60	10
62	10	2208	62	10	64	10	2029	63	10
63	12	2215	63	10	65	8	2038	64	5
60	10	2220	61	10	62	9	2043	62	9

END HERE ↑

Recorded by R.P. Direction NB Lane 1 Time from 10:50 to 11:40

Sheet 20	* STATE_CODE 53
LTPP Traffic Data	*SPS PROJECT_ID 0200
Speed and Classification Checks * 1 of* 2	* DATE 04/23/2008

Rev. 08/31/2001

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	
59	11	943	62	11	59	10	1121	61	10	
64	10	946	66	10	56	9	1122	59	9	
59	9	971	61	9	60	5	1136	63	4	*
61	9	975	63	9	57	8	1140	56	5	*
64	9	984	66	9	66	5	1195	69	4	*
60	9	986	62	9	61	9	1198	62	9	
59	9	991	61	9	61	12	1201	62	12	
58	9	994	60	9	62	9	1203	64	9	
60	9	995	61	9	56	10	1217	63	10	
62	9	1029	63	9	61	9	1218	63	9	
61	9	1036	63	9	65	9	1237	66	9	
62	13	1051	64	13	64	10	1239	65	10	
62	9	1052	65	9	57	13	1245	59	13	
59	9	1064	60	9	63	9	1259	66	9	
58	9	1065	60	9	63	9	1261	65	9	
58	10	1066	59	10	60	9	1262	61	9	
59	13	1076	62	13	62	9	1285	64	9	
64	11	1077	64	11	62	9	1288	63	9	
60	8	1091	61	8	60	13	1296	63	10	*
57	10	1092	58	10	60	9	1309	62	9	
60	13	1095	62	10	59	9	1312	59	9	
57	13	1097	59	13	55	9	1313	57	9	
60	5	1105	61	5	60	9	1316	63	9	
60	9	1110	61	9	63	10	1321	64	10	
62	10	1120	63	10	60	10	1323	63	10	

Recorded by RR Direction NB Lane 1 Time from 8:15 to 9:20

Sheet 20	* STATE_CODE 53
LTPP Traffic Data	*SPS PROJECT_ID 0200
Speed and Classification Checks * 2 of* 2	* DATE 04/23/2008

Rev. 08/31/2001

	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
*	55	9	1325	59	6	61	10	1567	61	10
	59	9	1337	60	9	58	9	1571	60	9
	60	13	1342	62	13	59	10	1586	60	10
	61	9	1344	61	9	62	8	1587	62	8
	63	12	1347	64	12	59	5	1594	60	5
	59	9	1362	60	9	59	13	1597	57	13
	62	9	1384	63	9	60	9	1609	61	9
	62	9	1386	64	9	59	9	1616	61	9
	59	5	1395	61	5	62	9	1634	64	9
	59	9	1417	62	9	63	10	1636	64	10
	63	9	1422	65	9	59	9	1638	58	9
	63	13	1442	65	13	61	9	1639	61	9
	64	13	1495	65	13	60	9	1641	61	9
	66	9	1452	68	9	60	9	1642	63	9
	70	5	1453	70	5	62	9	1643	63	9
*	59	15	1469	61	13	59	9	1646	61	9
	62	9	1485	64	9	60	9	1647	60	9
	60	9	1490	60	9	59	9	1648	60	9
	59	9	1504	61	9	59	10	1684	61	10
	68	9	1505	59	9	59	8	1685	61	8
	62	9	1511	63	9	61	12	1686	62	12
	60	9	1548	60	9	60	10	1692	61	10
	57	10	1549	59	10	65	9	1710	67	9
	58	10	1552	59	10	65	5	1714	69	5
	65	5	1563	67	5	60	9	1721	62	9

Recorded by RR Direction NB Lane 1 Time from 9:23 to 10:20

Sheet 21	* STATE_CODE	53
LTPP Traffic Data	*SPS PROJECT_ID	0200
WIM System Test Truck Records 1 of 3	* DATE	09/22/2008

Rev. 08/31/2001

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
50.5	50	2	1	9:36	1459	98	11.6	13.0	12.9	10.7	13.5		61.7	12.8	9.2	29.3	9.0	
	98	1	1	9:39	1491	97	10.7	13.8	13.7	15.0	15.0		68.2	12.6	9.2	32.6	9.0	
55.5	54	2	2	9:55	1585	53	11.2	13.3	13.3	11.5	13.7		63.1	12.8	9.3	29.9	9.0	
	53	1	2	9:59	1612	52	11.9	14.2	13.5	16.0	16.4		71.5	12.6	9.3	32.6	9.0	
53.5	60	2	3	10:15	1696	59	11.8	12.7	12.9	11.6	13.9		63.0	12.9	9.2	29.9	9.0	
	59	1	3	10:19	1721	57	11.7	13.7	13.7	14.6	14.9		68.5	12.6	9.2	32.9	9.0	
54.5	50	2	4	10:35	1820	47	11.6	13.0	12.7	11.8	14.0		63.1	12.7	9.2	29.2	9.0	
	98	1	4	10:40	1853	97	11.0	13.7	13.8	15.3	14.7		68.5	12.7	9.3	32.5	9.1	
69.0	54	2	5	10:55	1946	54	11.4	13.0	12.1	12.5	14.2		64.2	12.7	9.2	29.3	9.0	
	59	2	6	11:19	2068	58	10.5	13.2	13.1	11.8	13.7		62.9	12.8	9.3	29.4	9.0	
74.5	58	1	5	11:21	2105	57	10.8	13.5	13.6	14.4	15.0		67.3	12.7	9.3	32.6	9.1	
	98	2	7	11:39	2199	98	11.0	12.9	13.0	12.1	13.6		62.7	12.8	9.2	29.3	9.0	
83.5	95	1	6	11:40	2232	96	10.3	13.5	13.1	14.9	15.0		66.8	12.7	9.3	32.6	9.1	
	53	2	8	11:59	2338	53	10.9	13.1	12.8	12.7	12.8		63.1	12.9	9.3	29.3	9.0	
70.0	52	1	7	12:00	2362	52	11.0	12.3	13.3	16.0	15.6		69.2	12.7	9.2	32.5	9.0	
	58	2	9	12:14	2450	58	10.9	12.9	12.7	12.2	13.5		62.2	12.8	9.3	29.4	9.0	

64200200022 SPSWIM_TRF_sheet_21.doc Recorded by R.P Checked by

TO_24_53_2.104_0200 PRE VALIDATION

Sheet 21	* STATE_CODE	5 3
LTPP Traffic Data	*SPS PROJECT_ID	0 2 0 0
WIM System Test Truck Records 2 of 3	* DATE	04/22/2008

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
66.5	55	1	8	12:20	2487	57	11.1	13.0	13.0	14.8	14.9		66.9	12.7	4.2	32.6	4.1	
	48	2	10	12:34	2574	48	10.5	13.1	13.0	12.2	13.7		62.6	12.9	4.3	29.3	4.0	
80.5	48	1	9	12:42	2632	47	11.3	13.3	13.2	15.0	14.5		67.3	12.6	4.2	32.4	4.0	
	53	2	11	12:59	2713	54	11.3	13.0	12.7	12.0	13.7		62.6	12.8	4.3	29.3	4.0	
95.0	52	1	10	13:02	2769	52	10.5	13.4	12.7	15.6	15.4		67.6	12.7	4.3	32.6	4.1	
88.0	55	1	11	13:55	3135	56	10.2	13.3	12.9	15.2	15.1		66.6	12.7	4.3	32.5	4.1	
	58	2	12	13:58	3152	58	10.2	13.1	13.0	11.2	13.2		60.7	12.7	4.3	29.3	4.0	
76.5	48	1	12	14:15	3281	47	10.7	12.9	13.1	15.0	14.4		66.1	12.6	4.2	32.5	4.1	
	49	2	13	14:18	3299	48	10.9	12.8	12.7	12.2	13.9		62.4	12.8	4.3	29.3	4.0	
70.0	49	1	13	14:35	3420	52	10.8	13.4	13.2	14.9	15.1		67.3	12.7	4.3	32.5	4.0	
	53	2	14	14:39	3442	54	10.9	13.1	13.6	11.9	13.7		63.3	12.8	4.3	29.5	4.0	
75.0	58	1	14	14:56	3573	57	10.4	13.5	13.5	16.0	15.2		68.6	12.6	4.2	32.4	4.0	
	59	2	15	15:00	3599	59	10.3	13.3	12.9	11.7	13.2		61.4	12.8	4.3	29.4	4.0	
85.5	46	1	15	15:17	3749	46	10.5	13.3	12.5	15.1	14.4		65.8	12.7	4.3	32.5	4.1	
	49	2	16	15:20	3764	47	11.2	13.1	12.8	11.9	14.2		63.2	12.8	4.3	29.2	4.0	
80.5	51	1	16	15:38	3917	51	9.6	13.6	13.3	15.9	16.4		68.7	12.6	4.3	32.4	4.0	

Recorded by R.P.

Checked by

Sheet 21	* STATE_CODE 53
LTPP Traffic Data	*SPS PROJECT_ID 0200
WIM System Test Truck Records 3 of 3	* DATE 04/22/2008

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
	51	2	17	1540	3935	53	10.700	13.3	13.1	12.3	13.5		62.8	12.8	4.3	29.4	4.1	
80.0	56	1	17	1558	4051	56	10.0	13.7	13.7	15.3	15.4		67.9	12.6	4.3	32.6	4.0	
	58	2	18	1600	4069	58	10.2	12.9	12.9	12.0	13.6		61.6	12.7	4.3	29.3	4.0	
79.5	47	1	18	1618	4193	47	10.5	13.4	13.4	15.7	19.6		67.5	12.8	4.2	32.5	4.1	
	49	2	19	1620	4205	48	10.5	13.0	13.1	12.1	14.0		62.6	12.9	4.3	29.4	4.0	
76.5	53	1	19	1637	4353	52	10.2	13.8	13.6	15.8	15.8		69.3	12.6	4.2	32.5	4.0	
	52	2	20	1640	4371	53	10.6	12.3	12.5	10.2	13.2		58.8	12.8	4.3	29.3	4.0	
71.0	58	1	20	1658	4488	57	11.3	13.6	13.7	14.9	15.1		68.6	12.7	4.2	32.6	4.1	
		~~2~~	~~21~~															

Recorded by R.P.

Checked by

Sheet 21	* STATE_CODE 53
LTPP Traffic Data	*SPS PROJECT_ID 0200
WIM System Test Truck Records 1 of 1	* DATE 04/23/2008

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
48.0	51	2	1	8:32	1034	49	11.6	13.9	13.6	11.9	14.4		65.4	12.7	4.2	29.2	4.0	
	50	1	1	8:33	1093	49	12.0	15.0	14.2	16.7	16.4		74.3	12.7	4.3	32.8	4.1	
48.5	55	2	2	8:52	1142	55	11.5	13.4	13.2	9.9	12.8		60.8	12.7	4.3	29.3	4.0	
	56	1	2	8:53	1155	54	11.6	14.6	14.4	16.5	16.4		73.4	12.7	4.3	32.7	4.1	
48.0	60	2	3	9:11	1253	59	11.7	13.4	13.7	12.9	14.6		66.2	12.7	4.2	29.4	4.0	
	60	1	3	9:14	1275	59	12.0	14.7	14.0	16.4	15.6		72.7	12.7	4.3	32.7	4.1	
48.0	51	2	4	9:30	1374	50	11.7	13.9	13.9	12.1	14.2		65.8	12.7	4.2	29.4	4.0	
	50	1	4	9:33	1389	50	11.6	14.1	14.2	15.7	15.8		71.4	12.8	4.3	32.6	4.0	
~~50.0~~	~~53~~	~~2~~	~~5~~	~~9:50~~	~~1503~~	~~55~~	~~10.4~~	~~11.9~~	~~12.1~~	~~9.3~~	~~11.8~~		~~55.6~~	~~12.7~~	~~4.2~~	~~29.2~~	~~3.9~~	OFF SCALE
50.0	55	1	5	9:52	1524	55	11.8	14.8	14.9	15.3	16.9		72.8	12.8	4.3	32.8	4.1	
51.5	61	2	5	10:09	1646	59	11.2	13.2	12.3	11.9	12.8		61.3	12.7	4.3	29.3	4.0	
51.5	60	1	6	10:11	1659	59	11.2	14.4	14.1	16.1	15.6		71.4	12.7	4.3	32.7	4.1	

Recorded by RL

Checked by

Sheet 21	* STATE_CODE	5 3
LTPP Traffic Data	*SPS PROJECT_ID	0 2 0 0
WIM System Test Truck Records 1 of 2	* DATE	0 4 / 2 3 / 2 0 0 8

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
50.0	50	2	6	10:29	1780	50	10.9	14.5	19.4	12.9	14.8		67.5	12.8	4.3	29.4	4.1	
50.0	50	1	7	10:30	1793	49	10.2	13.1	12.9	16.3	15.1		67.7	12.7	4.3	32.5	4.0	
56.5	53	2	7	10:48	1921	55	11.6	13.9	13.6	10.9	14.8		66.9	12.8	4.2	29.3	4.0	
56.5	56	1	8	10:51	1940	54	11.6	14.1	13.5	16.1	15.9		71.1	12.7	4.3	32.5	4.0	
57.0	61	2	8	11:07	2062	59	11.7	13.8	14.1	13.1	14.9		67.7	12.9	4.2	29.3	4.0	
57.0	60	1	9	11:10	2075	59	11.4	13.7	13.2	15.4	15.0		68.7	12.7	4.3	32.6	4.1	
53.0	50	2	9	11:26	2207	50	11.8	13.4	13.5	11.6	14.6		64.9	12.8	4.2	29.3	4.0	
53.0	51	1	10	11:28	2216	50	11.6	14.4	14.2	17.3	16.2		73.8	12.6	4.2	32.5	4.0	
55.0	58	2	10	11:46	2327	55	11.9	13.7	13.9	12.7	14.9		67.2	12.8	4.3	29.4	4.0	
55.0	57	1	11	11:47	2335	55	11.1	13.3	13.1	14.9	15.3		67.7	12.7	4.3	32.7	4.0	
69.5	59	2	11	12:45	2722	59	10.3	13.3	13.6	11.9	14.9		64.0	12.8	4.3	29.4	4.0	
69.5	60	1	12	12:47	2729	59	11.4	14.9	13.8	15.7	15.7		71.4	12.8	4.3	32.7	4.0	
76.5	51	2	12	13:05	2843	50	10.8	13.6	13.3	12.5	14.1		64.2	12.8	4.3	29.4	4.0	
76.5	51	1	13	13:06	2861	50	11.4	14.2	13.7	15.9	15.9		71.1	12.7	4.3	32.7	4.1	
65.5	55	2	13	13:24	2987	55	10.4	13.5	13.7	12.6	13.8		64.0	12.8	4.3	29.2	4.0	
65.5	56	1	14	13:26	3001	55	10.7	13.8	14.3	14.4	15.3		68.5	12.6	4.2	32.7	4.1	

Recorded by R.P. Checked by

Sheet 21	* STATE_CODE 53
LTPP Traffic Data	*SPS PROJECT_ID 0200
WIM System Test Truck Records 2 of 2	* DATE 04/23/2008

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
63.5	59	2	14	13:43	3143	59	10.8	13.0	13.0	12.2	15.1	1	64.2	12.9	4.2	29.2	3.9	
63.5	58	1	15	13:45	3158	58	11.4	14.1	14.0	15.7	15.3		70.4	12.6	4.2	32.4	4.1	
63.0	51	2	15	14:03	3269	49	10.8	13.2	13.7	12.3	14.9		69.3	12.9	4.2	29.2	4.0	
63.0	51	1	16	14:05	3285	50	11.1	14.1	13.7	17.1	16.3		72.3	12.7	4.3	32.6	4.1	
78.0	55	2	16	14:22	3396	55	10.8	14.1	13.3	11.9	12.0		62.2	12.9	4.3	29.3	4.0	
78.0	54	1	17	14:24	3412	54	10.5	13.3	13.0	15.4	14.9		67.0	12.6	4.3	32.5	4.0	
69.5	61	2	17	14:41	3554	59	11.4	13.7	13.3	12.2	14.6		65.2	12.8	4.3	29.3	4.0	
69.5	60	1	18	14:43	3570	59	11.1	13.5	13.2	16.2	15.3		69.3	12.6	4.3	32.6	4.0	
74.0	50	2	18	15:01	3700	50	10.2	14.0	12.7	12.7	14.8		64.4	12.8	4.3	29.3	4.0	
~~74.0~~	~~51~~	~~1~~	~~19~~	~~15:03~~	~~3715~~	~~50~~	~~9.5~~	~~10.9~~	~~10.4~~	~~12.8~~	~~12.9~~		~~56.7~~	~~12.7~~	~~4.3~~	~~32.8~~	~~4.1~~	
71.0	55	2	19	15:20	3886	55	11.9	13.7	13.5	12.3	14.3		65.2	12.7	4.3	29.3	4.0	
71.0	55	1	19	15:22	3918	54	11.1	14.2	14.0	15.9	15.5		70.6	12.6	4.3	32.6	4.1	
71.0	60	2	20	15:40	4065	60	10.1	13.1	13.5	12.3	14.3		63.3	12.8	4.3	29.4	4.1	
71.0	59	1	20	15:43	4102	58	11.4	13.7	14.2	15.6	15.3		70.3	12.8	4.3	32.5	4.0	

- OFF SCALE

Recorded by _____ Checked by _____

Calibration Worksheet

Site: 530200

Calibration Iteration 1 Date 4/13/08

Beginning factors:

Speed Point (mph)	Name	Left Sensor (1) / 3	Right Sensor (2) / 4
Overall			
Front Axle	dynamic	99	
Distance	axle distance	119	
1 – (80)	bin 1	6.690078	6.690078
2 – (100)	bin 2	6.690078	6.690078
3 – (120)	bin 3	6.690078	6.690078
4 – ( )			
5 – ( )			

Errors:

	Speed Point 1 (50)	Speed Point 2 (55)	Speed Point 3 (60)	Speed Point 4 ( )	Speed Point 5 ( )
F/A	-2.0	-2.8	-3.6		
Tandem	-3.7	-2.1	-3.7		
GVW	-3.6	-2.3	-3.9		

Adjustments:

	Raise	Lower	Percentage
Overall	☐	☐	
Front Axle	☐	☐	
Speed Point 1	☒	☐	3.0
Speed Point 2	☒	☐	3.0
Speed Point 3	☒	☐	3.0
Speed Point 4	☐	☐	
Speed Point 5	☐	☐	

End factors:

Speed Point (mph)	Name	Left Sensor (1) / 3	Right Sensor (2) / 4
Overall			
Front Axle	dynamic	99	
Distance	axle distance	119	
1 – (90)	bin 2	6.890780	6.890780
2 – (108)	bin 2	6.890780	6.890780
3 – (120)	bin 3	6.890780	6.890780
4 – ( )			
5 – ( )			

TEST VEHICLE PHOTOGRAPHS FOR SPS WIM VALIDATION

April 22, 2008

STATE: Washington

SHRP ID: 530200

Photo 1 53_0200_Truck_1_Tractor_04_22_08.jpg

Photo 2 53_0200_Truck_1_Trailer_04_22_08.jpg

Photo 3 53_0200_Truck_1_Suspension_1_04_22_08.jpg

Photo 4 53_0200_Truck_1_Suspension_2_04_22_08.jpg

Photo 5 53_0200_Truck_1_Suspension_3_04_22_08.jpg

Photo 6 53_0200_Truck_2_Tractor_04_22_08.jpg

Photo 7 53_0200_Truck_2_Trailer_04_22_08.jpg

Photo 8 53_0200_Truck_2_Suspension_1_04_22_08.jpg

Photo 9 53_0200_Truck_2_Suspension_2_04_22_08.jpg

Photo 10 53_0200_Truck_2_Suspension_3_04_22_08.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

Washington SPS-2 (Lane 1)

Validation Visit – April 22, 2008

Calibration factors for sensor #1:

	23 April 2008	22 April 2008	12 July 2007
80 kph:	6.890780	6.690078	6.691444
100 kph:	6.890780	6.690078	6.691444
120 kph:	6.890780	6.690078	6.691444

Calibration factor for sensor #2

	23 April 2008	22 April 2008	12 July 2007
80 kph:	6.890780	6.690078	6.691444
100 kph:	6.890780	6.690078	6.691444
120 kph:	6.890780	6.690078	6.691444