Validation Report

Washington, SPS-2
Task Order 19, CLIN 2
July 11 to 12, 2007

List of Tables

List of Figures

1 Executive Summary

This is the final validation report and reflects profile data collected by the Regional Support Contractor on July 19, 2007. Other than the update to this Executive Summary and Section 4.1 - Profile Analysis, there is no material change in this report from the Preliminary Validation Report submitted on July 26, 2007.

A visit was made to the Washington 0200 on July 11 to 12, 2007 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 for trucks at this location is 60 mph. 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 piezo classification sensors. The validation procedures were in accordance with LTPP's SPS WIM Data Collection Guide dated August 21, 2001.

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

This site meets all LTPP precision requirements except speed which is not considered sufficient to disqualify the site as having research quality data. The classification data is of research quality for Traffic Monitoring Guide Classes.

The site is instrumented with quartz piezo WIM sensors 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 70,120 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 steel leaf suspension loaded to 60,240 lbs., the "partial" truck.

The validation speeds ranged from 48 to 60 miles per hour. The pavement temperatures ranged from 101 to 126 degrees Fahrenheit. The desired speed range was achieved during this validation. The desired 30 degree Fahrenheit temperature range was not achieved.

Table 1-1 Post-Validation 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
GVW	±10 percent	-1.0 ± 4.7%	Pass
Speed	**±1 mph [2 km/hr]**	**0.1 ± 1.0 mph**	**Fail**
Axle spacing	± 0.5 ft [150mm]	0.0 ± 0.1 ft	Pass

Prepared: djw Reviewed: bko

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

Based on profile data collected at this site July 19, 2007 WIMIndex values have been computed. Nine of the values fall below the lower threshold values while the remaining fall within the threshold boundaries. 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 Reviewed: bko

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

2 Corrective Actions Recommended

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

In the seven and a half months since the last validation the site has drifted from producing research quality data to not producing research quality at the time of this validation. Given the nearly 100 degree Fahrenheit difference in temperature between the two validations and the temperature response of the equipment, this is perhaps not unexpected. It is recommended that the next validation be scheduled for a period when the potential temperatures are only somewhat above freezing.

3 Post Calibration Analysis

This final analysis is based on test runs conducted July 12, 2007 during the late morning to early evening hours at test site 530200 on US 395. This SPS-2 site is located 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 70,120 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 steel leaf suspension loaded to 60,240 lbs., the "partial" truck.

Each truck made a total of 20 passes over the WIM scale at speeds ranging from approximately 48 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 101 to 126 degrees Fahrenheit. The desired 30 degree Fahrenheit temperature range was not 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 – 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
GVW	±10 percent	-1.0 ± 4.7%	Pass
Speed	**±1 mph [2 km/hr]**	**0.1 ± 1.0 mph**	**Fail**
Axle spacing	± 0.5 ft [150mm]	0.0 ± 0.1 ft	Pass

Prepared: djw Reviewed: bko

The test runs were conducted primarily during the late morning to early evening hours under partly sunny 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 by speed and temperature is illustrated in Figure 3-1. The figure indicates that the desired distribution of speed and temperature combinations was not achieved for this set of validation runs.

The three speed groups were divided as follows: Low speed – 48 to 51 mph, Medium speed – 52 to 56 mph and High speed – 57 + mph. The three temperature groups were created by splitting the runs between those at 101 to 110 degrees Fahrenheit for Low temperature, 111 to 119 degrees Fahrenheit for Medium temperature and 120 to 126 degrees Fahrenheit for High temperature.

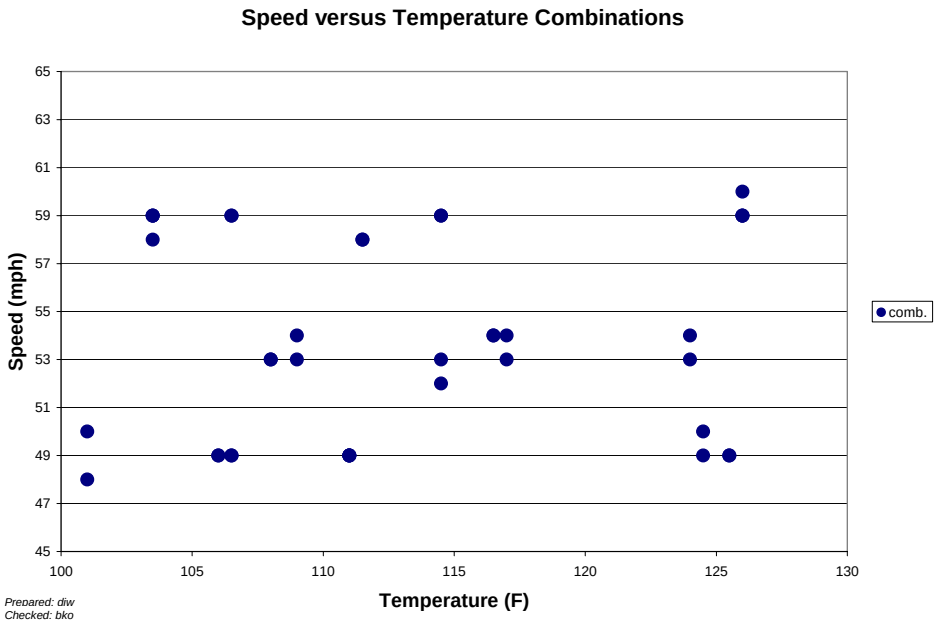


Figure 3-1 Post-Validation Speed-Temperature Distribution – 530200 – 12-Jul-2007

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 figure, it appears that the equipment estimates GVW fairly accurately and consistently throughout the entire speed range. Variability in error appears to be fairly consistent over the entire speed range.

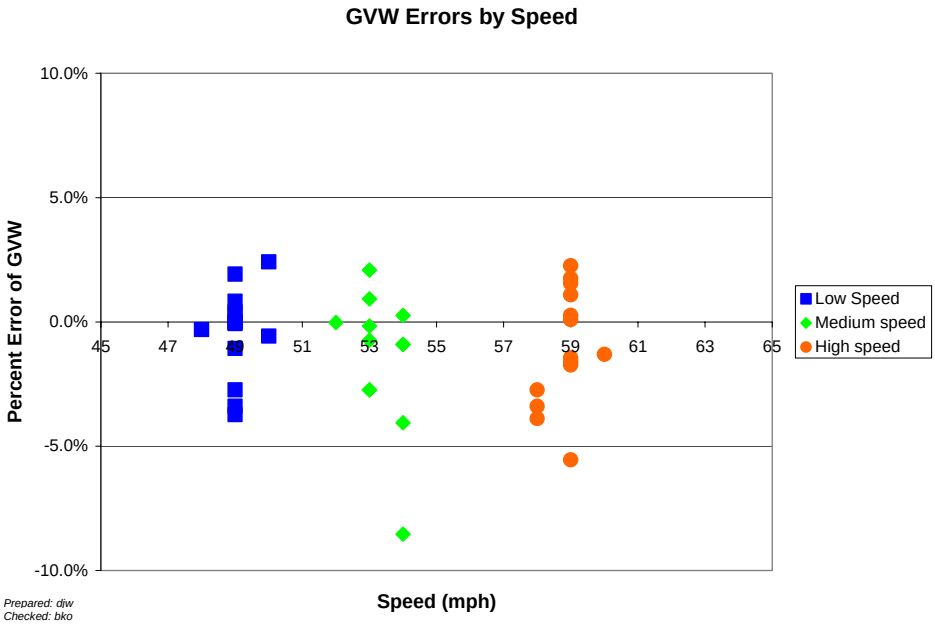


Figure 3-2 Post-validation GVW Percent Error vs. Speed – 530200 – 12-Jul-2007

Figure 3-3 shows the relationship between temperature and GVW percentage error. From the figure, it can be seen that the equipment presents a slight downward trend in weights as temperature increases.

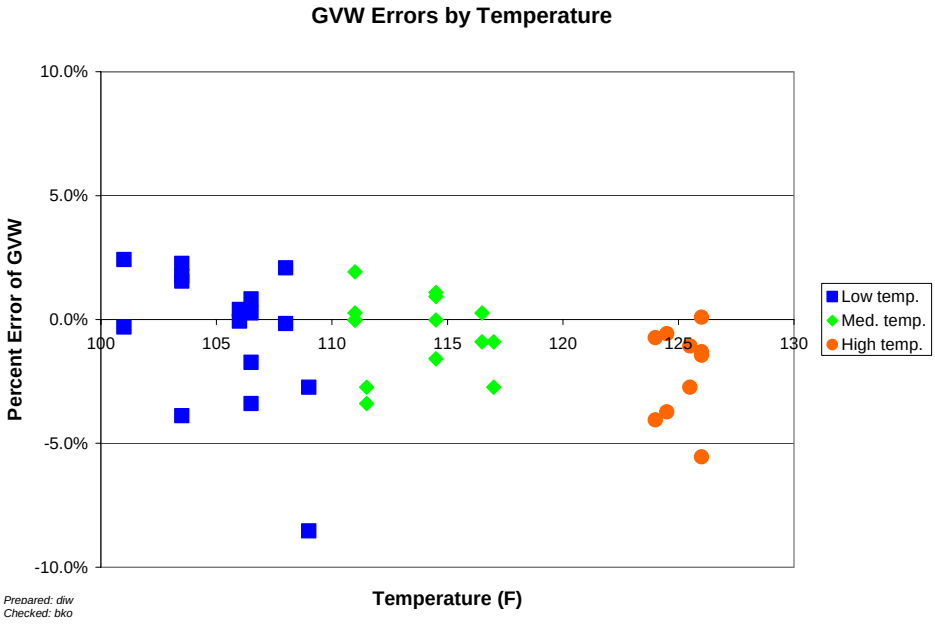


Figure 3-3 Post-Validation GVW Percent Error vs. Temperature – 530200 – 12-Jul-2007

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. The graph indicates that the errors in tandem spacings for the test trucks were not affected by changes in speed.

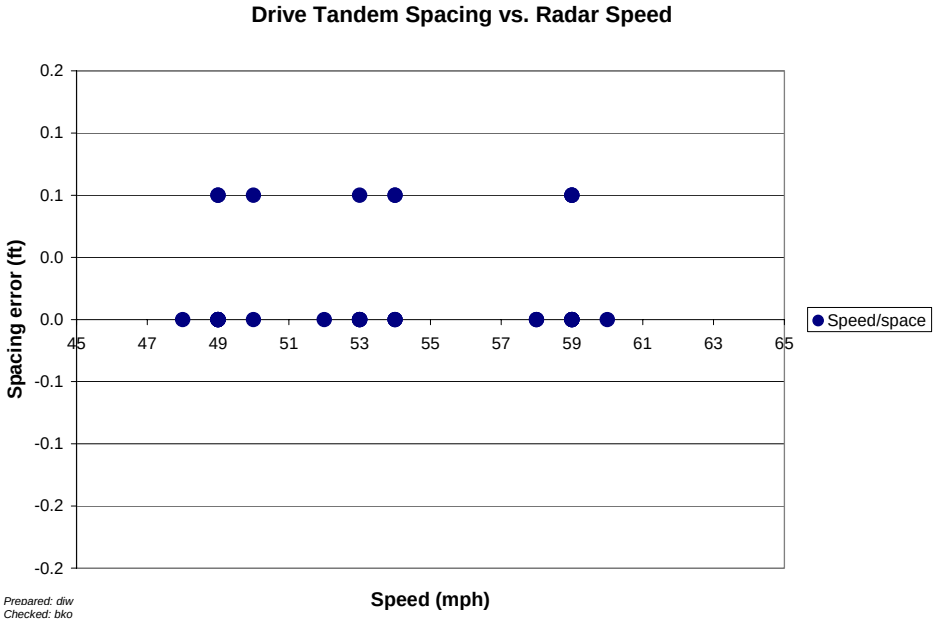


Figure 3-4 Post-Validation Spacing vs. Speed – 530200 – 12-Jul-2007

3.1 Temperature-based Analysis

The three temperature groups were created by splitting the runs between those at 101 to 110 degrees Fahrenheit for Low temperature, 111 to 119 degrees Fahrenheit for Medium temperature and 120 to 126 degrees Fahrenheit for High temperature.

Table 3-2 Post-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%
Speed	±1 mph	0.1 ± 1.4 mph	0.1 ± 0.8 mph	-0.1 ± 0.7 mph
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft

Prepared: djw Reviewed: bko

From Table 3-2, it appears that with the exception of steering axle weights at the lower temperatures the equipment generally underestimates all weights. The variability in weight errors appears to be higher at the lower temperatures.

Figure 3-5 is the distribution of GVW Errors versus Temperature by Truck graph. From the figure, it appears that mean GVW error for both the Golden truck (squares) and the Partial truck (diamonds) appear to go from an accurate estimation at the lower end of the range, to a slight underestimation at the upper end of the range.

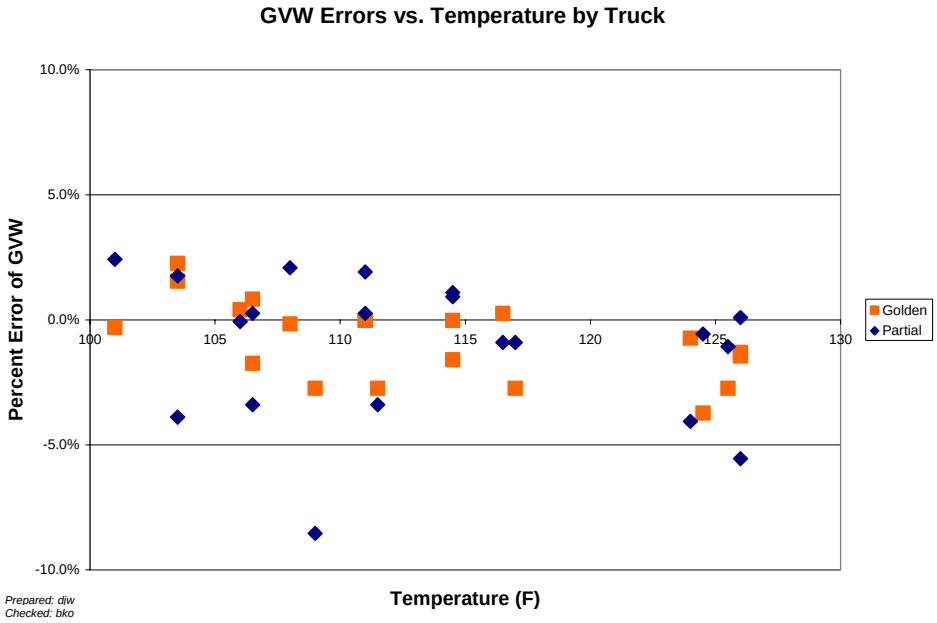


Figure 3-5 Post-Validation GVW Percent Error vs. Temperature by Truck – 530200 – 12-Jul-2007

Figure 3-6 shows the relation between steering axle errors and temperature. This graph is included due to the frequent use of steering axle weights of Class 9 vehicles for calibration. This site does not use auto-calibration. The steering axles in this graph are associated only with Class 9 vehicles.

From the figure, it can be seen that the estimation of Steering axle weights is fairly accurate over the entire temperature range. Variability in error appears to be higher at the lower and upper ends of the temperature range.

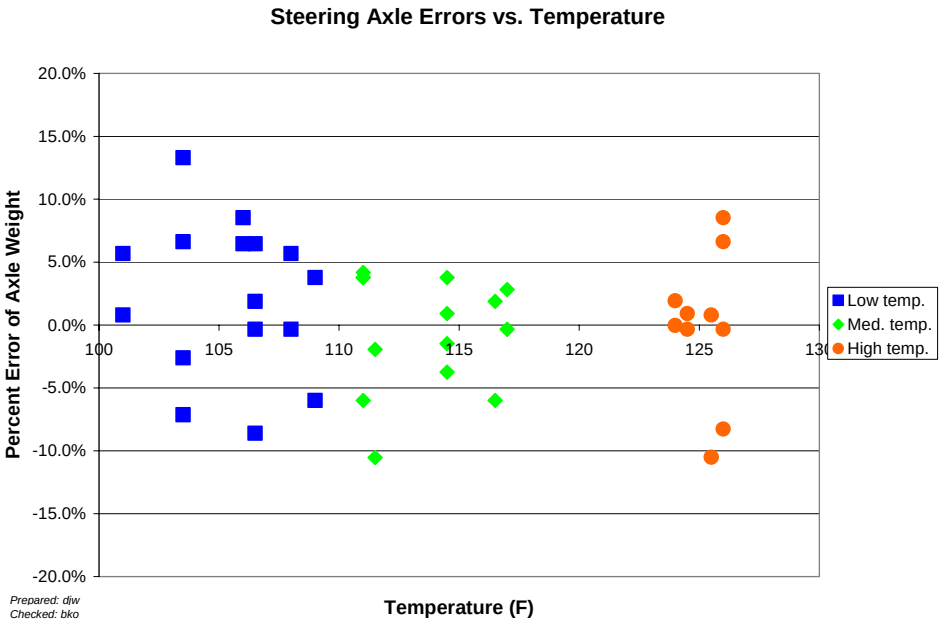


Figure 3-6 Post-Validation Steering Axle Error vs. Temperature by Group – 530200 – 12-Jul-2007

3.2 Speed-based Analysis

The three speed groups were divided using 48 to 51 mph for Low speed, 52 to 56 mph for Medium speed and 57+ mph for High speed.

Table 3-3 Post-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%
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%
Speed	±1 mph	0.1 ± 1.0 mph	0.0 ± 1.3 mph	0.1 ± 1.0 mph
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft

Prepared: djw Reviewed: bko

From Table 3-3, it can be seen that the equipment tends to estimate all weights fairly consistently throughout the entire speed range. Variability in weight error also appear to be reasonably consistent although steering axle error variability is much greater at the higher speeds when compared with low and medium speeds.

Figure 3-7 illustrates the tendency for the system to estimate GVW at all speeds with reasonable accuracy 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, excluding the affects of the outliers.

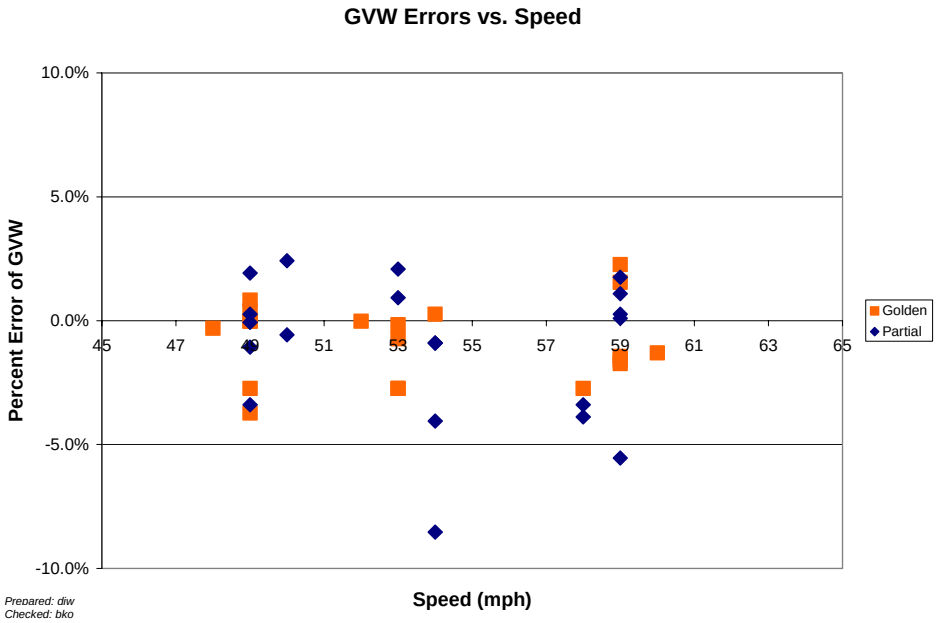


Figure 3-7 Post-Validation GVW Percent Error vs. Speed by Truck – 530200 – 12-Jul-2007

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.

From the figure, it appears that the WIM equipment estimates steering axle weights fairly consistently at all speeds but with high variability at the higher and lower speeds.

Figure 3-8 Post-Validation Steering Axle Percent Error vs. Speed by Group – 530200 – 12-Jul-2007

3.3 Classification Validation

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

The classification validation is intended to find gross errors in vehicle classification, not to validate the installed algorithm. A sample of *100 trucks* 100 trucks was collected at the site. Video was taken at the site to provide ground truth for the evaluation. Based on a 100 percent sample it was determined that there are 0 percent unknown vehicles and 0 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 .0 percent.

Table 3-4 Truck Misclassification Percentages for 530200 – 12-Jul-2007

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

Prepared: djw Reviewed: 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 – 12-Jul-2007

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

Prepared: djw Reviewed: 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.

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 Reviewed: 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 an IRD 1068 controller. These sensors are installed in a portland cement concrete pavement.

There were no changes in basic equipment operating condition since the validation on November 29, 2006.

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

The equipment required one-iteration of the calibration process between the initial 40 runs and the final 40 runs.

5.2.1 Calibration Iteration 1

For this equipment, there is a series of temperature designated weight compensation bin factors that affect all weight estimations by the equipment. All temperature compensation factors are adjusted to directly affect the weight reported by the WIM equipment. To reduce overestimation of weights these factors are reduced by the same percentage of the overestimation. If the weights are underestimated, these factors are increased by the same percentage as the mean error.

For this equipment, all temperature compensation factors were originally set at 1000, which resulted in no changes to the weights at all temperatures.

The results of the Pre-Validation from July 11, 2007 are illustrated in Figure 5-2. As shown, the equipment demonstrated a tendency to increasingly overestimate GVW as temperature increases. Scatter appeared to be fairly consistent at all speeds, with only a few outliers.

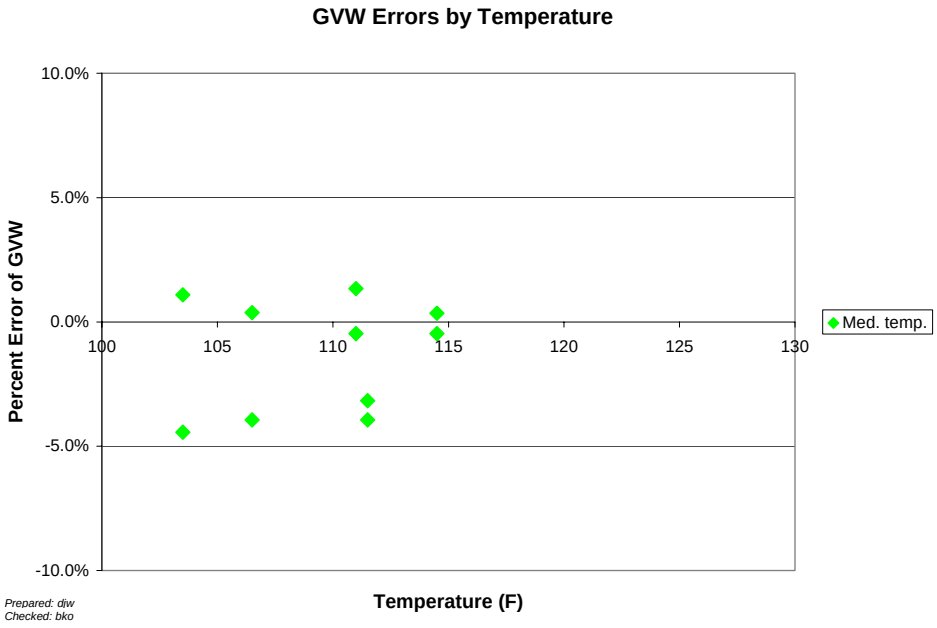


Figure 5-1 – Calibration Iteration 1 GVW Percent Error vs. Temperature – 530200 – 12-Jul-2007

As a result of the pre-validation temperature trend, all temperature compensation factors between 0 degrees and 140 degrees Fahrenheit were linearly decreased by 2% for each bin beginning with 12% at 140 degrees (1000 to 880) to 0 % at 0 degrees.

The results of the first iteration using the new temperature compensation factors are shown in Table 5-1 and Figure 5-1.

Table 5-1 Calibration Iteration 1 Results – 530200 – 12-Jul-2007 (10:10 AM)

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	-2.5 ± 12.1%	Pass
Tandem axles	±15 percent	-1.1 ± 5.1%	Pass
GVW	±10 percent	-1.3 ± 5.2%	Pass
Speed	**±1 mph**	**0.2 ± 1 mph**	**Fail**
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	Pass

Prepared: djw Reviewed: bko

Figure 5-2 shows that the temperature factor changes did not in influence the relationship of GVW errors with speed.

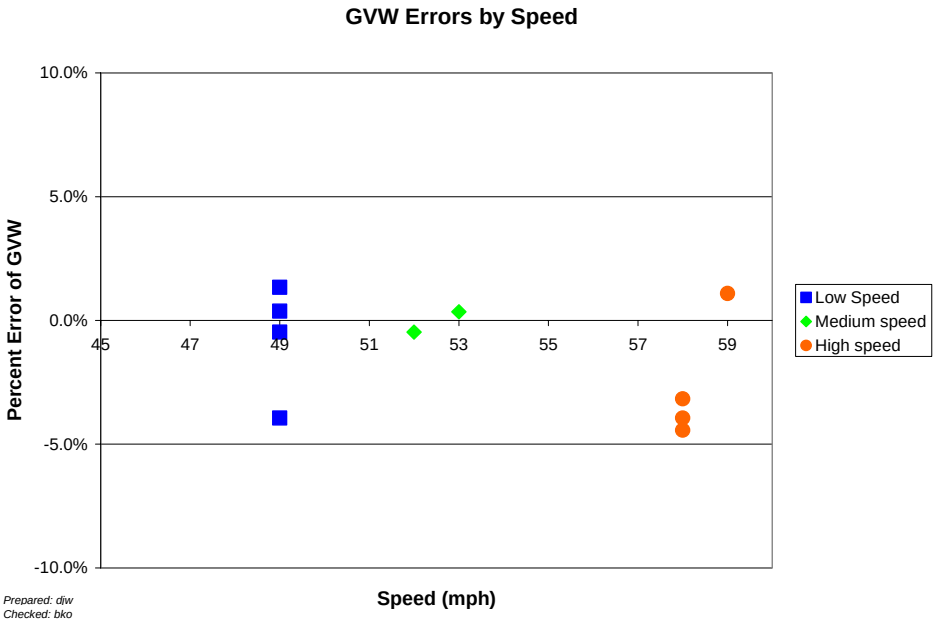


Figure 5-2 – Calibration Iteration 1 GVW Percent Error vs. Speed – 530200 – 12-Jul-2007 (10:10 AM)

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 found in TRF_CALIBRATION_AVC for Sheet 16s submitted prior to this validation as well as the information for the current visit.

Table 5-2 Classification Validation History – 530200 – 12-Jul-2007

Date	Method	Mean Difference				Percent Unclassified
		Class 9	Class 8	Other 1	Other 2	
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 Reviewed: bko

Table 5-3 has the information found in TRF_CALIBRATION_WIM for Sheet 16s submitted prior to this validation as well as the information for the current visit.

Table 5-3 Weight Validation History – 530200 – 12-Jul-2007

Date	Method	Mean Error and (SD)		
		GVW	Single Axles	Tandem Axles
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 (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 Reviewed: 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 July 11, 2007 in the afternoon and the following morning at 530200 on 2 miles south of I-90, near Ritzville. This SPS-2 site is at milepost 93.0 on US 395 in 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 70,450 lbs., the “golden” truck.
2. 5-axle tractor semi-trailer with a tractor having an air suspension and a trailer with a standard rear tandemand a 3 tapered steel leaf suspension loaded to 59,910 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 45 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 84 to 140degrees Fahrenheit. The desired 30 degree Fahrenheit temperature range was achieved. The computed values of 95% confidence limits of each statistic for the total population are in Table 6-1.

As shown in Table 6-1, this site failed all of the performance criteria for weight except Steering axles. A calibration of the equipment was determined to be required in order to bring the weights to within LTPP specification for research quality data.

Table 6-1 Pre-Validation Results – 530200 – 11-Jul-2007

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	6.2 ± 13.3%	Pass
Tandem axles	**±15 percent**	**12.7 ± 6.4%**	**Fail**
GVW	**±10 percent**	**11.7 ± 5.0%**	**Fail**
Speed	**±1 mph [2 km/hr]**	**0.0 ± 1.1 mph**	**Fail**
Axle spacing	± 0.5 ft [150mm]	0.0 ± 0.1 ft	Pass

Prepared: djw Reviewed: bko

The test runs were conducted primarily during the evening and early morning hours, resulting in a very narrow 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 45 to 52 mph for Low speed, 53 to 56 mph for Medium speed and 57+ mph for High speed. The three temperature groups were created by splitting the runs between those at 84 to 119 degrees Fahrenheit for Low temperature, 120 to 129 degrees Fahrenheit for Medium temperature and 130 to 140 degrees Fahrenheit for High temperature.

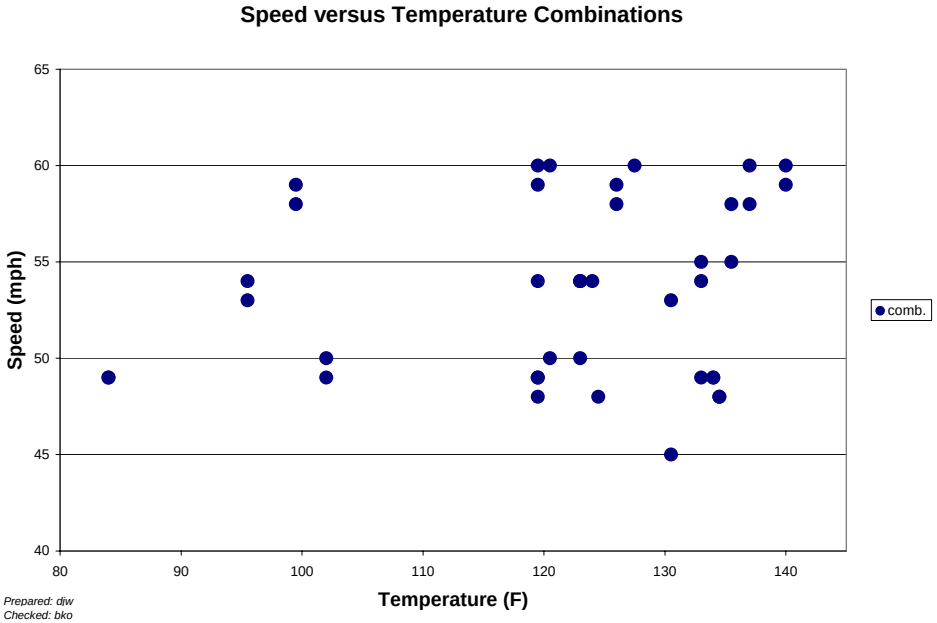


Figure 6-1 Pre-Validation Speed-Temperature Distribution – 530200 – 11-Jul-2007

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 overestimate GVW at all speeds. Variability appears to remain fairly consistent over the entire speed range.

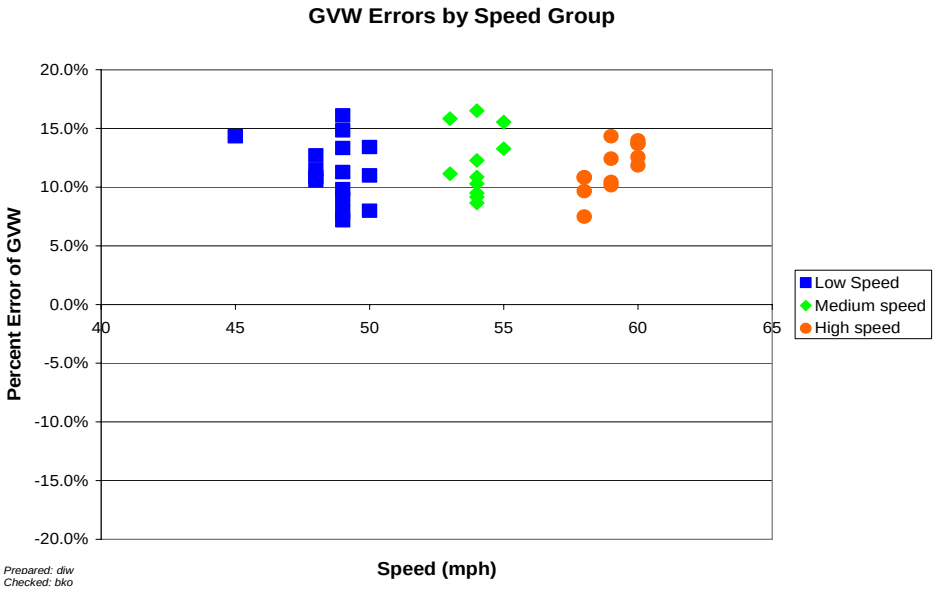


Figure 6-2 Pre-validation GVW Percent Error vs. Speed – 530200 – 11-Jul-2007

Figure 6-3 shows the relationship between temperature and GVW percentage error. As can be seen in the figure, the equipment demonstrates the tendency to increasingly overestimate GVW as the temperature increases.

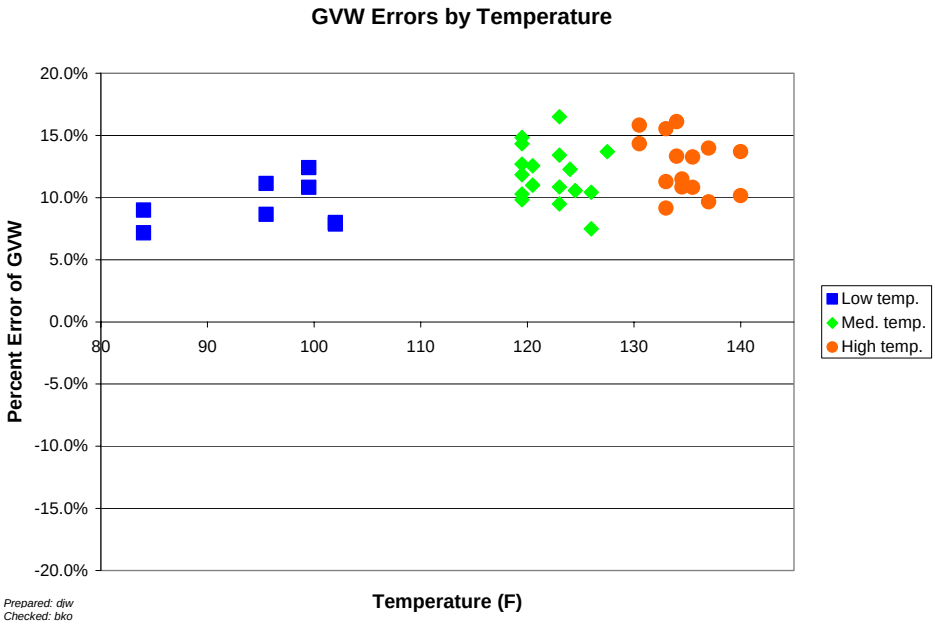


Figure 6-3 Pre-Validation GVW Percent Error vs. Temperature – 530200 – 11-Jul-2007

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

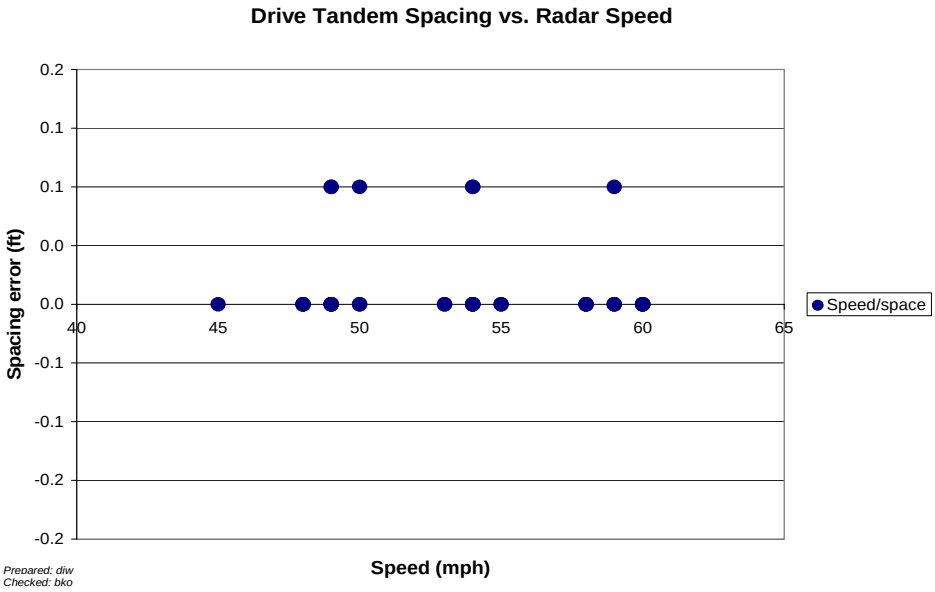


Figure 6-4 Pre-Validation Spacing vs. Speed - 530200 – 11-Jul-2007

6.1 Temperature-based Analysis

The three temperature groups were created by splitting the runs between those at 84 to 119 degrees Fahrenheit for Low temperature, 120 to 129 degrees Fahrenheit for Medium temperature and 130 to 140 degrees Fahrenheit for High temperature.

Table 6-2 Pre-Validation Results by Temperature Bin – 530200 – 11-Jul-2007

Element	95% Limit	Low Temperature 84-119 °F	Medium Temperature 120-129 °F	High Temperature 130-140 °F
Steering axles	±20 %	5.3 ± 18.0%	7.9 ± 10.3%	4.9 ± 16.4%
Tandem axles	±15 %	10.1 ± 3.2%	12.6 ± 6.5%	14.0 ± 6.4%
GVW	±10 %	9.4 ± 4.4%	11.9 ± 4.8%	12.6 ± 4.9%
Speed	±1 mph	0.3 ± 1.1 mph	0.0 ± 0.7 mph	-0.2 ± 1.5 mph
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft

Prepared: djw Reviewed: bko

From Table 6-2, it appears that the equipment overestimates all weights. The variability in tandem axle and GVW errors appear to be reasonably consistent over the entire temperature range although the variability in steering axle error appears to be much greater at the lower and upper temperatures.

Figure 6-5 shows the distribution of GVW Errors versus Temperature by Truck. The equipment appears to overestimate all weights at all temperatures for the population as a whole. The tendency for the equipment to increasingly overestimate GVW as the temperature increases is apparent for both trucks. The variability in error for both trucks also appears to be similar throughout the entire temperature range.

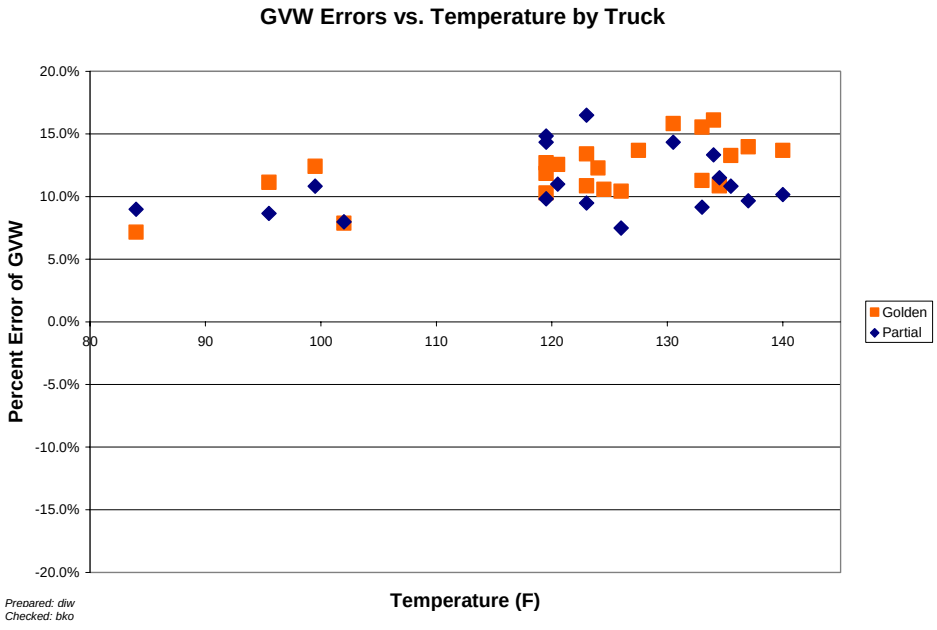


Figure 6-5 Pre-Validation GVW Percent Error vs. Temperature by Truck – 530200 – 11-Jul-2007

Figure 6-6 shows the relation between steering axle errors and temperature. This graph is included due to the frequent use of steering axle weights of Class 9 vehicles for auto-calibration. This site does not use auto-calibration. The steering axles in this graph are associated only with Class 9 vehicles. The figure shows that steering axle weights are consistently overestimated by the equipment over the temperature range.

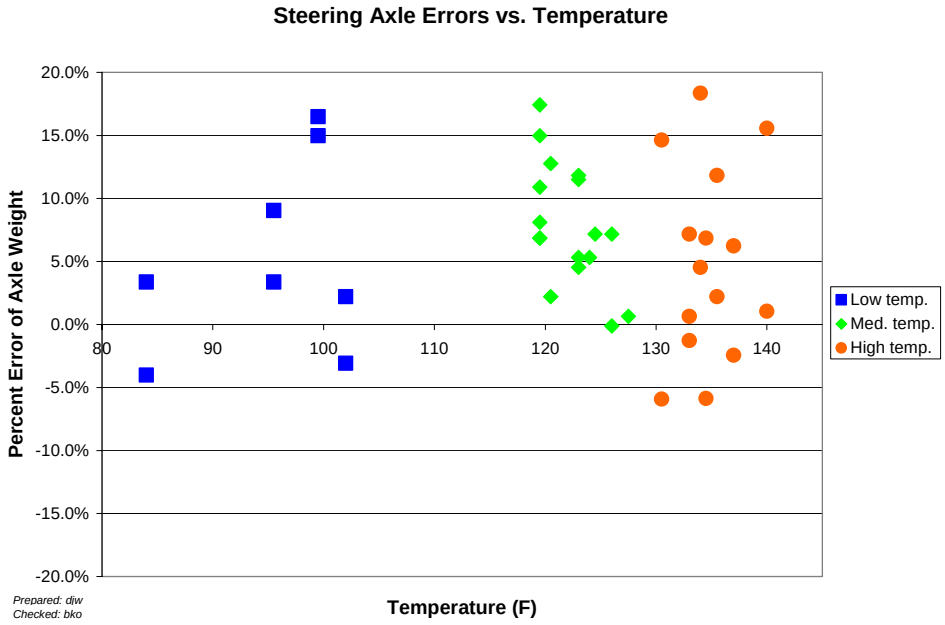


Figure 6-6 Pre-Validation Steering Axle Error vs. Temperature by Group – 530200 – 11-Jul-2007

6.2 Speed-based Analysis

The speed groups were divided as follows: Low speed – 45 to 52 mph, Medium speed – 53 to 56 mph and High speed – 57+ mph.

Table 6-3 Pre-Validation Results by Speed Bin – 530200 – 11-Jul-2007

Element	95% Limit	Low Speed 45 to 52 mph	Medium Speed 53 to 56 mph	High Speed 57+ mph
Steering axles	±20 %	5.3 ± 16.5%	6.6 ± 10.9%	7.1 ± 14.3%
Tandem axles	±15 %	12.5 ± 7.3%	13.0 ± 6.3%	12.5 ± 6.2%
GVW	±10 %	11.4 ± 5.6%	12.1 ± 6.3%	11.7 ± 4.4%
Speed	±1 mph	0.1 ± 0.9 mph	-0.3 ± 1.8 mph	0.1 ± 0.6 mph
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft

From Table 6-3, it can be seen that the overestimation of all weights appears to be reasonably consistent over the entire speed range. Variability in errors for all weights also appears to be reasonably consistent throughout the entire speed range.

Figure 6-7 illustrates the tendency of the equipment to overestimate GVW for both trucks at all speeds.

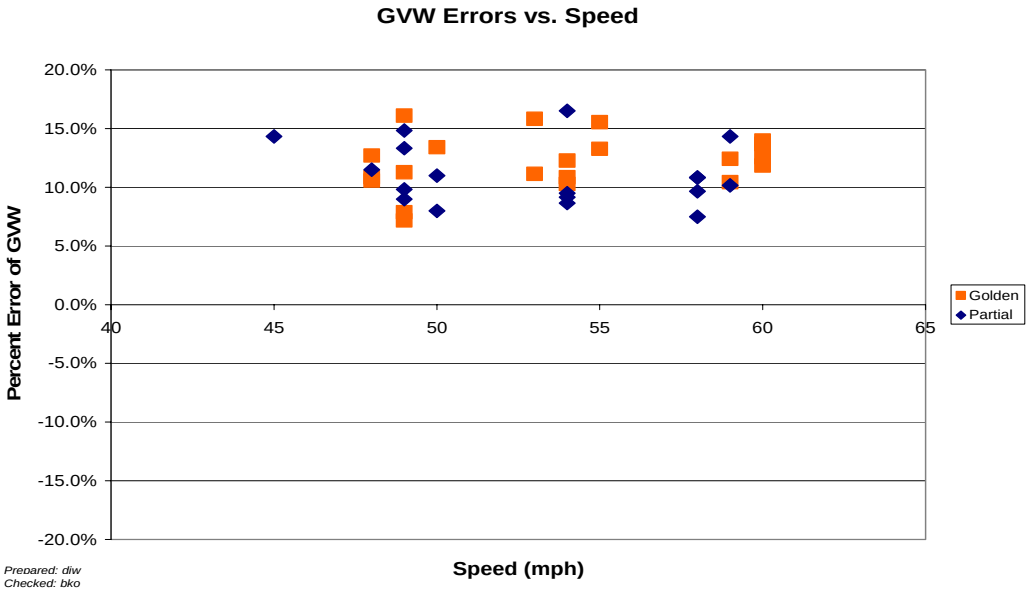


Figure 6-7 Pre-Validation GVW Percent Error vs. Speed Group - 530200 –11-Jul-2007

Figure 6-8 shows the relation 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.

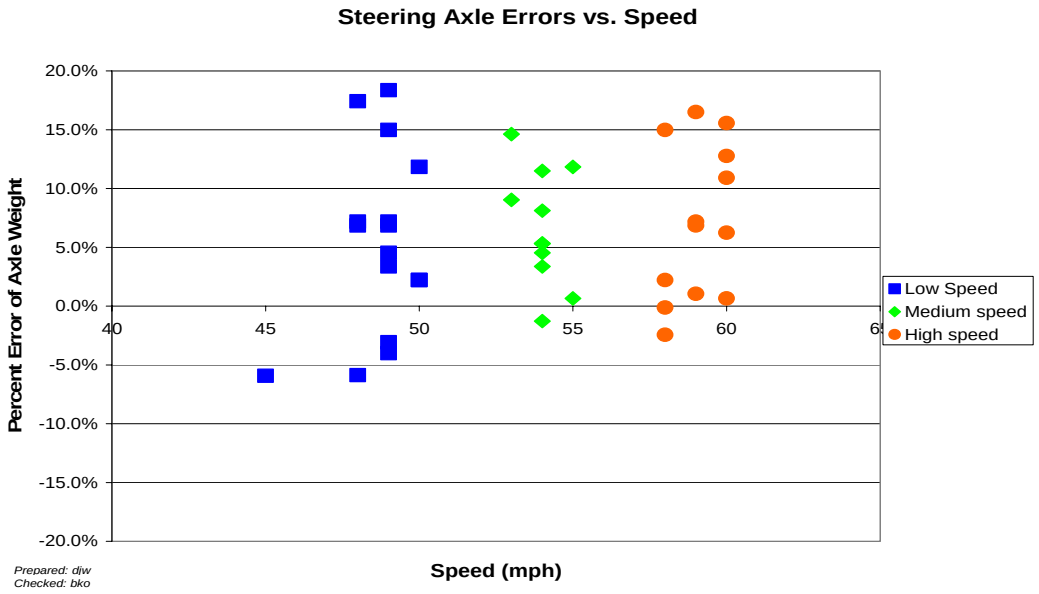


Figure 6-8 Pre-Validation Steering Axle Percent Error vs. Speed Group - 530200 – 11-Jul-2007

From the figure, it appears that the equipment overestimates steering axle weights at all speeds. Variability in error appears to be greater at the lower speeds.

6.3 Classification Validation

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

The classification validation is intended to find gross errors in vehicle classification, not to validate the installed algorithm. A sample of was collected at the site. The classification identification is to identify gross errors in classification, not validate the classification algorithm. Video was taken at the site to provide ground truth for the evaluation. Based on a 100 percent sample it was determined that there are 0 percent unknown vehicles and 0 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 0 percent.

Table 6-4 Truck Misclassification Percentages for 530200 – 11-Jul-2007

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

Prepared: djw Reviewed: bko

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

Table 6-5 Truck Classification Mean Differences for 530200 – 11-Jul-2007

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

Prepared: djw Reviewed: 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 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.

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 not 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

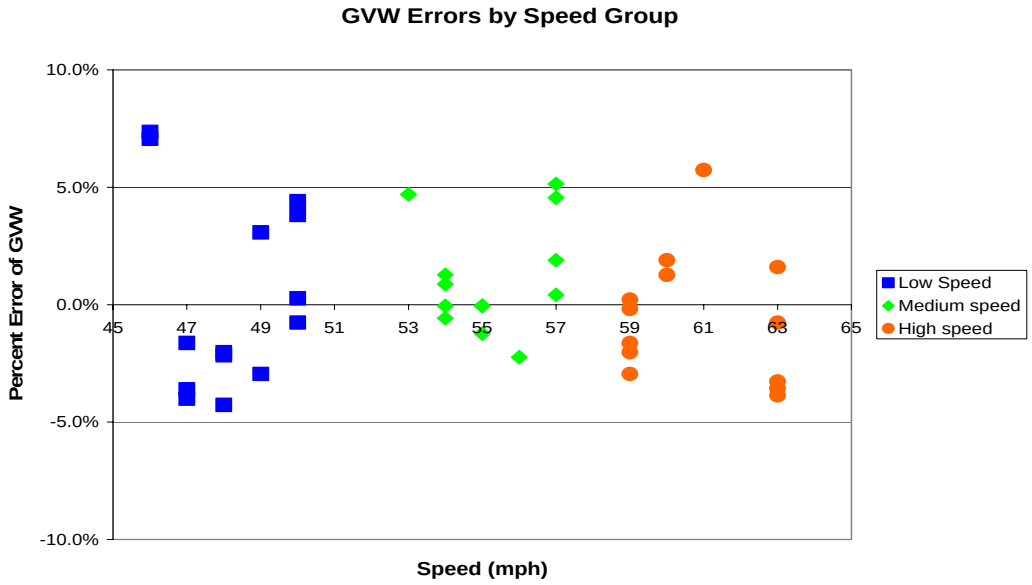
Characteristic	Limits for Allowable Error	Percent within Allowable Error	Pass/Fail
Single Axles	± 20%	100%	Pass
Axle Groups	**± 15%**	**72.5%**	**Fail**
GVW	**± 10%**	**25%**	**Fail**

Prepared: djw Reviewed: bko

6.5 Prior Validations

The last validation for this site was performed on November 29, 2006. It was the first 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 75,840 lbs. The "partial" truck which had

air suspension on the tractor tandem and steel tapered leaf suspension on the trailer tandem was loaded to 67,720 lbs.



Prepared: djw Reviewed: bko

Figure 6-9 Last Validation GVW Percent Error vs. Speed – 530200 – 29-Nov-2006

Table 6-7 shows the overall results from the last validation. In the seven and a half months since the last validation the site has drifted from producing research quality data to not producing research quality at the time of the validation. Given the nearly 100 degree Fahrenheit difference in temperature between the two validations and the temperature response of the equipment, this is perhaps not unexpected.

Table 6-7 Last Validation Final Results – 530200 – 29-Nov-2006

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	-3.7 ± 11.5%	Pass
Tandem axles	±15 percent	1.2 ± 8.4%	Pass
Gross vehicle weights	±10 percent	0.3 ± 6.4%	Pass
Speed	±1 mph [2 km/hr]	0.0 ± 0.0 mph	Pass
Axle spacing	± 0.5 ft [150 mm]	0.0 ± 0.1 ft	Pass

Prepared: djw Reviewed: bko

Table 6-8 has the results at the end of the last validation by temperature. Temperatures at this site during testing hours remained very low, without much increase throughout the day. Through this validation the equipment has been observed at temperature from 14 to 140 degrees Fahrenheit.

Table 6-8 Last Validation Results by Temperature Bin – 530200 – 29-Nov-2006

Element	95% Limit	Medium Temperature 16 - 29°F
Steering axles	±20 %	-3.7 ± 11.5%
Tandem axles	±15 %	1.2 ± 8.4%
GVW	±10 %	0.3 ± 6.4%
Speed	±1 mph	0.0 ± 0.0 mph
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft

Prepared: djw Reviewed: bko

Table 6-9 has the results of the prior post validation by speed groups.

Table 6-9 Last Validation Results by Speed Bin – 530200 – 29-Nov-2006

Element	95% Limit	Low Speed 46 – 51 mph	Medium Speed 52 - 58 mph	High Speed 59+ mph
Steering axles	±20 %	-3.4 ± 12%	-2.5 ± 12.8%	-5.1 ± 12.5%
Tandem axles	±15 %	1.1 ± 9.5%	1.9 ± 7.2%	0.5 ± 9.1%
GVW	±10 %	0.3 ± 8.8%	1.1 ± 5.1%	-0.6 ± 6.0%
Speed	±1 mph	0.0 ± 0.0 mph	0.0 ± 0.0 mph	0.0 ± 0.0 mph
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft

Prepared: djw Reviewed: bko

7 Data Availability and Quality

As of July 11, 2007 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 2005 have a sufficient quantity to be considered complete years of classification data and years 2003 through 2005 have a sufficient quantity to be considered complete years of weight data. Together with the previously gathered calibration information 5 additional years of research quality data are needed to meet the goal of a minimum of 5 years of research weight data.

Table 7-1 Amount of Traffic Data Available 530200 – 11-Jul-2007

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

Prepared: djw Reviewed: 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 10s constitute more than 10 percent of the truck population. Based on the data collected from the end of the last calibration iteration 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 RSC 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 – 12-Jul-2007

Characteristic	Class 5	Class 9	Class 10
Percentage Overweights	Unknown	0.0%	0.0%
Percentage Underweights	Unknown	0.0%	0.5%
Unloaded Peak		44 kips	44 kips
Loaded Peak		76 kips	92 kips
Peak	12 kips		

Prepared: djw Reviewed: bko

The expected percentage of unclassified vehicles is 1.2%. This is based on the percentage of unclassified vehicles in the post-validation data download.

The graphical screening comparison figures are found in Figure 7-2 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 Sheet 16.

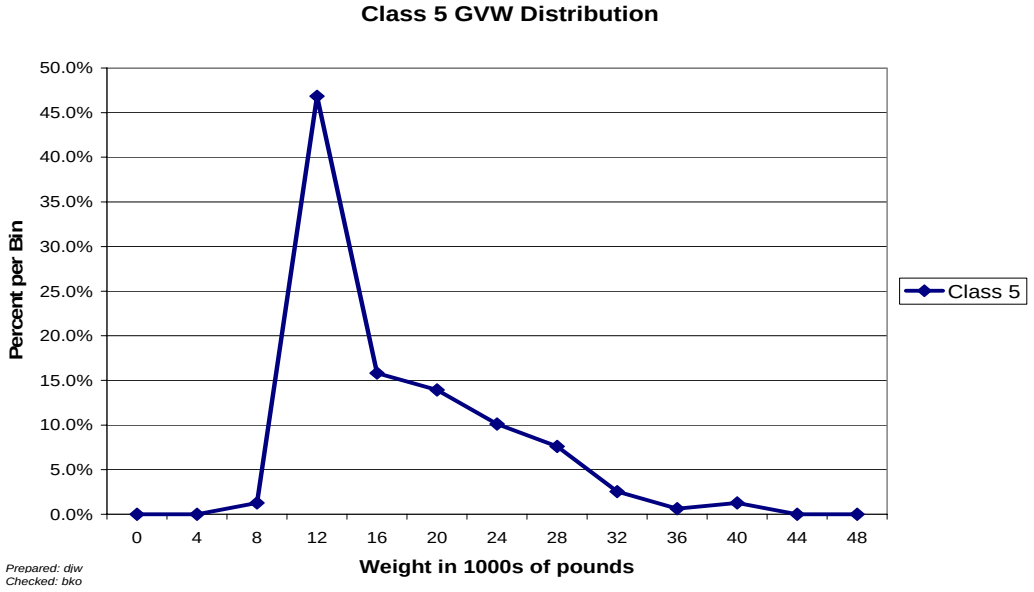


Figure 7-1 Expected GVW Distribution Class 5 – 530200 – 12-Jul-2007

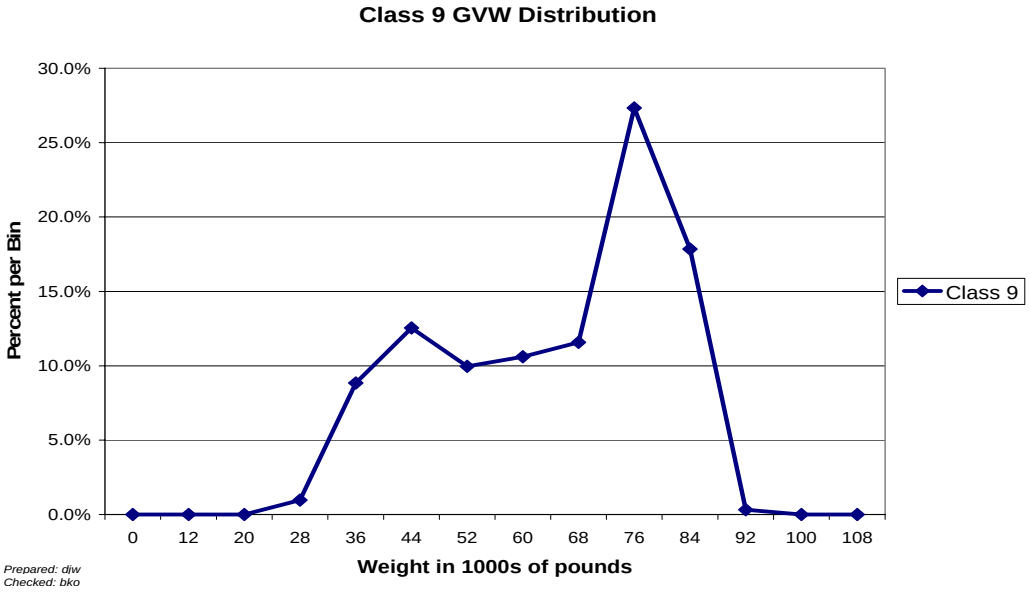


Figure 7-2 Expected GVW Distribution Class 9 – 530200 – 12-Jul-2007

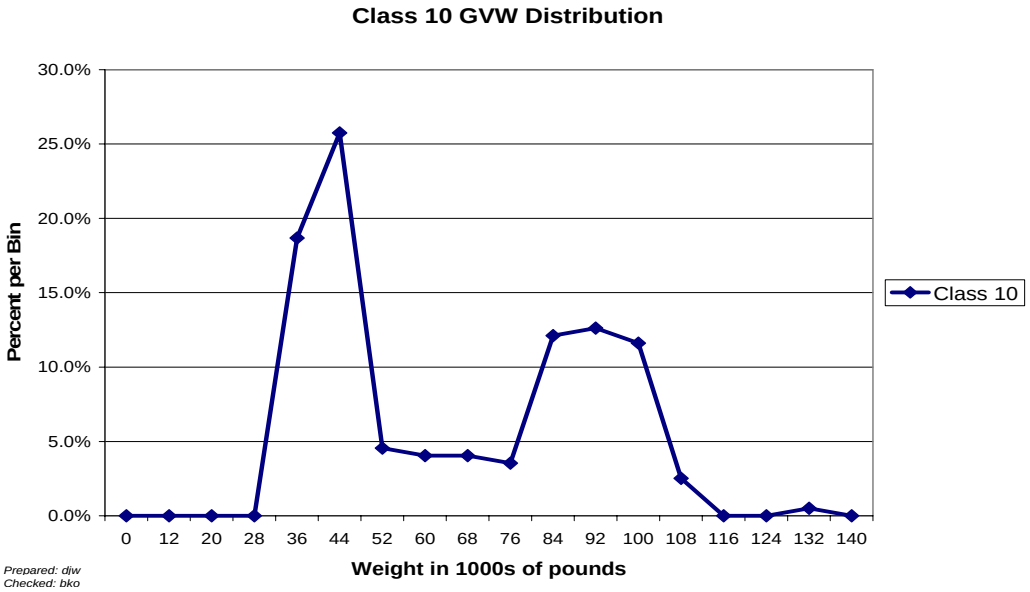


Figure 7-3 Expected GVW Distribution Class 10 – 530200 – 12-Jul-2007

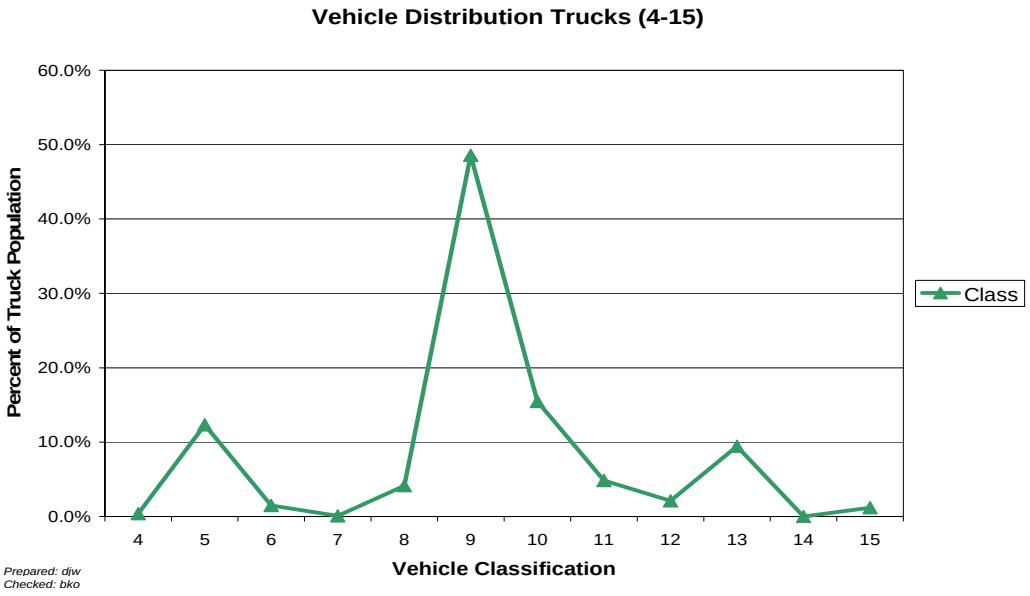


Figure 7-4 Expected Vehicle Distribution – 530200 – 12-Jul-2007

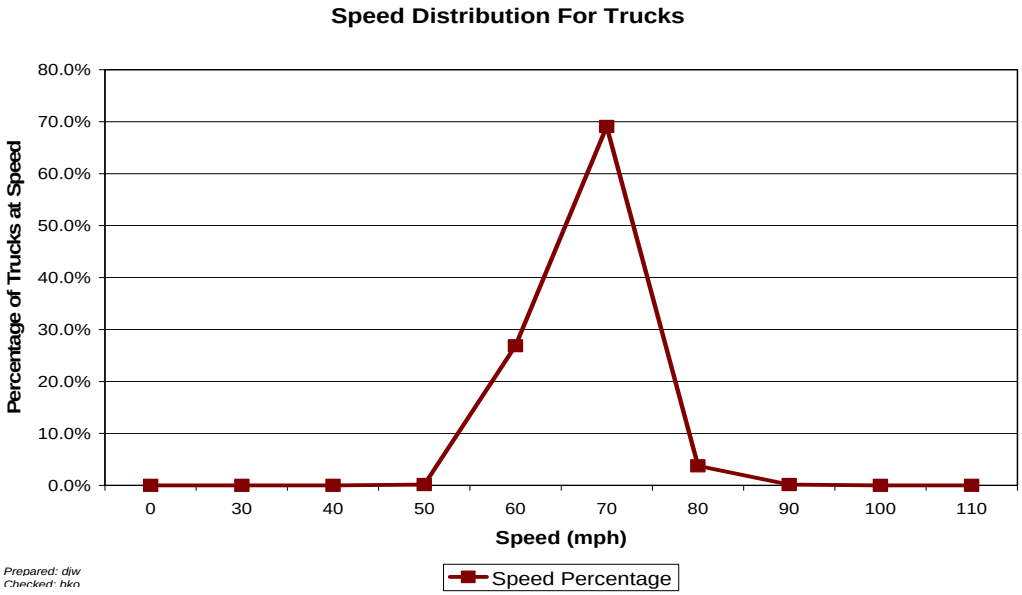


Figure 7-5 Expected Speed Distribution – 530200 – 12-Jul-2007

8 Data Sheets

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

Sheet 19 – Truck 1 – 3S2 loaded air suspension (7 pages)
Sheet 19 – Truck 2 – 3S2 partially loaded (6 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.

APPENDIX A

Sheet 19	* STATE_CODE	53
LTPP Traffic Data	* SPS PROJECT ID	0200
*CALIBRATION TEST TRUCK # 1	* DATE	7/11/07

Rev. 08/31/01

TRUCK # 301
TRAILER # 5301
GERRY - 509 - 844-6748

PART I.

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

AXLES - units - lbs / 100s lbs / kg

	3. Empty Truck Axle Weight	4.* Pre-Test Average Loaded Axle Weight (day 1)	5.* Post-Test Average Loaded Axle Weight (day 1)	6.* Measured D)irectly or C)alculated?
A	_____	10880	10580	(D) / C
B	_____	13883	13810	(D) / C
C	_____	13883	13810	(D) / C
D	_____	16020	16010	(D) / C
E	_____	16020	16010	(D) / C
F	_____	_____	_____	C

GVW (same units as axles)

Day 1

7. a) Empty GVW 0 *b) Average Pre-Test Loaded weight 70687
*c) Post Test Loaded Weight 70220
*d) Difference Post Test – Pre-test -467

GEOMETRY

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

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

10.* Trailer Load Distribution Description:

CONCRETE BLOCKS ALONG TRAILER

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

b). Trailer Tare Weight (units): _____

Sheet 19	* STATE_CODE	53
LTPP Traffic Data	* SPS PROJECT ID	0200
*CALIBRATION TEST TRUCK # 1	* DATE	07-11-07

Rev. 08/31/01

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

A to B 13.8 B to C 4.3 C to D ~~32.2~~ 32.5

D to E ~~4.2~~ 4.1 E to F 0

Wheelbased (measured A to last) _____ Computed 53.7

13. *Kingpin Offset From Axle B (units) _____ (+1.4) ?

(+ 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 TAPERED STEEL LEAF
B	11R22.5	AIR
C	~~11~~R22.5	AIR
D	~~11~~R22.5	AIR
E	11R22.5	AIR
F		

16. Cold Tire Pressures (psi) – from right to left

Steering Axle	Axle B	Axle C	Axle D	Axle E

Sheet 19	* STATE_CODE	53
LTPP Traffic Data	* SPS PROJECT ID	0200
*CALIBRATION TEST TRUCK # 1	* DATE	7-11-07

Rev. 08/31/01

PART II

Table 1. Axle and GVW computations - pre-test

Axle A		Axle B		Axle C		Axle D		Axle E		GVW	
I	0	II -I	0	III -II	0	IV -III	0	V -IV	0	V	0
V -VI	0	VI-VII	0	VII-VIII	0	VIII-IX	0	IX`	0	X	0
										XI	0
Avg.											

Table 2. Raw Axle and GVW measurements

Axles	Meas.	Pre-test Weight			Post-test Weight
A	I				
A + B	II				
A + B + C	III				
A + B + C + D	IV				
A + B + C + D + E (1)	V				
B + C + D + E	VI				
C + D + E	VII				
D + E	VIII				
E	IX				
A + B + C + D + E (2)	X				
A + B + C + D + E (3)	XI				

Table 3. Axle and GVW computations - post -test

Axle A		Axle B		Axle C		Axle D		Axle E		GVW	
I	0	II -I	0	III -II	0	IV -III	0	V -IV	0	V	0
V -VI	0	VI-VII	0	VII-VIII	0	VIII-IX	0	IX`	0	X	0
										XI	0
Avg.											

Sheet 19	* STATE_CODE	53
LTPP Traffic Data	* SPS PROJECT ID	0200
*CALIBRATION TEST TRUCK # 1	* DATE	07-18-07

Rev. 08/31/01

Table 4 . Axle and GVW computations -

Axle A		Axle B		Axle C		Axle D		Axle E		GVW	
I	0	II -I	0	III -II	0	IV -III	0	V -IV	0	V	0
V -VI	0	VI-VII	0	VII-VIII	0	VIII-IX	0	IX`	0	X	0
										XI	0
Avg.											

Day 2

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10720	13860	13860	16000	16000		70440
2	10760	13820	13820	16010	16010		70420
3	10760	13830	13830	16010	16010		70440
Average	~~10750~~ 10747	~~13840~~ 13837	~~13840~~ 13837	~~16010~~ 16007	~~16010~~ 16007		~~70430~~ 70433

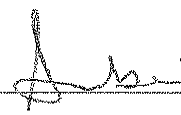
70430
69800
- 630

Table 6. Raw data – Axle scales –

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1							
2							
3							
Average	~~0~~						

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10260	13810	13810	15960	15960		69800
2							
3							
Average	10260	13810	13810	15960	15960		69800

Measured By AW Verified By  Weight date 7/12/07

Sheet 19	* STATE_CODE	53
LTPP Traffic Data	* SPS PROJECT ID	0200
*CALIBRATION TEST TRUCK # 1	* DATE	07-11-07

Rev. 08/31/01

Day 1

7.2 *b) Average Pre-Test Loaded weight 70690 70687
*c) Post Test Loaded Weight 70220 70220
*d) Difference Post Test – Pre-test -470 -467

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10880	13890	13890	16020	16020		70700
2	10900	13870	13870	16020	16020		70680
3	10860	13890	13890	16020	16020		70680
Average	10880	~~13880~~ 13883	~~13880~~ 13883	16020	16020		~~70690~~ 87

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	10580	13810	13810	16010	16010		70220
2							
3							
Average	10580	13810	13810	16010	16010		70220

Measured By DJW Verified By [signature] Weight date 7-11-07

Sheet 19	* STATE_CODE	53
LTPP Traffic Data	* SPS PROJECT ID	0200
*CALIBRATION TEST TRUCK # 1	* DATE	4-12-07

Rev. 08/31/01

Day ___

7..3 *b) Average Pre-Test Loaded weight _____

*c) Post Test Loaded Weight _____

*d) Difference Post Test – Pre-test _____

Table 5.3. Raw data – Axle scales – pre-test

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

Table 6.3. Raw data – Axle scales –

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

Table 7.3. Raw data – Axle scales – post-test

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

Measured By _____ Verified By _____ Weight date _____

Sheet 19	* STATE_CODE	53
LTPP Traffic Data	* SPS PROJECT ID	0200
*CALIBRATION TEST TRUCK # 1	* DATE	07-18-07

Rev. 08/31/01

Table 4 . Axle and GVW computations -

Axle A		Axle B		Axle C		Axle D		Axle E		GVW	
I	0	II -I	0	III -II	0	IV -III	0	V -IV	0	V	0
V -VI	0	VI-VII	0	VII-VIII	0	VIII-IX	0	IX`	0	X	0
										XI	0
Avg.											

Day 2

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10720	13860	13860	16000	16000		70440
2	10760	13820	13820	16010	16010		70420
3	10760	13830	13830	16010	16010		70440
Average	10750	13840	13840	16010	16010		70430

Duplicate

70430
69800
- 630

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	10260	13810	13810	15960	15960		69800
2							
3							
Average	10260	13810	13810	15960	15960		69800

Duplicate

Measured By [signature] Verified By [signature] Weight date 7/12/07

Sheet 19	* STATE_CODE	53
LTPP Traffic Data	* SPS PROJECT ID	0200
*CALIBRATION TEST TRUCK # 2	* DATE	07-11-07

Rev. 08/31/01

truck # - 479782
trailer # - 238
Mike - 509-481-0193

PART I.

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

AXLES - units - lbs / 100s lbs / kg

	3. Empty Truck Axle Weight	4.* Pre-Test Average Loaded Axle Weight (day 1)	5.* Post-Test Average Loaded Axle Weight (day 2)	6.* Measured D)irectly or C)alculated?
A	_____	8780	8440	(D) / C
B	_____	13630	13520	(D) / C
C	_____	13630	13520	(D) / C
D	_____	12063	12090	(D) / C
E	_____	12063	12090	(D) / C
F	_____	_____	_____	D / C

GVW (same units as axles)

Day 1

7. a) Empty GVW 0

*b) Average Pre-Test Loaded weight 60167
*c) Post Test Loaded Weight 59660
*d) Difference Post Test – Pre-test -507

GEOMETRY

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

9. a) * Make: INTERNATIONAL b) * Model: 8600

10.* Trailer Load Distribution Description:

CONCRETE BLOCKS LOADED OVER EACH TANDEM

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

b). Trailer Tare Weight (units): _____

Sheet 19	* STATE_CODE	53
LTPP Traffic Data	* SPS PROJECT ID	0200
*CALIBRATION TEST TRUCK # 2	* DATE	7-11-07

Rev. 08/31/01

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

A to B 11.7 B to C 4.3 C to D 30.6

D to E 4.1 E to F 0

Wheelbased (measured A to last) _____ Computed 50.7

13. *Kingpin Offset From Axle B (units) _____ (+2.2)
(+ 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	11R22.5	AIR
C	11R22.5	"
D	8R24.5	3 TAPERED LEAF
E	11R22.5	"
F		

16. Cold Tire Pressures (psi) – from right to left

Steering Axle	Axle B	Axle C	Axle D	Axle E

Sheet 19	* STATE_CODE	53
LTPP Traffic Data	* SPS PROJECT ID	0200
*CALIBRATION TEST TRUCK # 2	* DATE	7-11-07

Rev. 08/31/01

PART II

Table 1. Axle and GVW computations - pre-test

Axle A		Axle B		Axle C		Axle D		Axle E		GVW	
I	0	II -I	0	III -II	0	IV -III	0	V -IV	0	V	0
V -VI	0	VI-VII	0	VII-VIII	0	VIII-IX	0	IX`	0	X	0
										XI	0
Avg.											

Table 2. Raw Axle and GVW measurements

Axles	Meas.	Pre-test Weight			Post-test Weight
A	I				
A + B	II				
A + B + C	III				
A + B + C + D	IV				
A + B + C + D + E (1)	V				
B + C + D + E	VI				
C + D + E	VII				
D + E	VIII				
E	IX				
A + B + C + D + E (2)	X				
A + B + C + D + E (3)	XI				

Table 3. Axle and GVW computations - post -test

Axle A		Axle B		Axle C		Axle D		Axle E		GVW	
I	0	II -I	0	III -II	0	IV -III	0	V -IV	0	V	0
V -VI	0	VI-VII	0	VII-VIII	0	VIII-IX	0	IX`	0	X	0
										XI	0
Avg.											

Sheet 19	* STATE_CODE	53
LTPP Traffic Data	* SPS PROJECT ID	0200
*CALIBRATION TEST TRUCK # 2	* DATE	7-11-07

Rev. 08/31/01

Table 4 . Axle and GVW computations -

Axle A		Axle B		Axle C		Axle D		Axle E		GVW	
I	0	II -I	0	III -II	0	IV -III	0	V -IV	0	V	0
V -VI	0	VI-VII	0	VII-VIII	0	VIII-IX	0	IX`	0	X	0
										XI	0
Avg.											

60170
59660
- 510

Day 1

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	8780	13650	13650	12050	12050		60180
2	8780	13610	13610	12080	12080		60160
3	8780	13630	13630	12060	12060		60160
Average	8780	13630	13630	12060	~~12060~~ 12063		~~60170~~ 60167

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	8440	13520	13520	12090	12090		59660
2							
3							
Average	8440	13520	13520	12090	12090		59660

Measured By DJW Verified By [signature] Weight date 7/11/07

Sheet 19	* STATE_CODE	53
LTPP Traffic Data	* SPS PROJECT ID	0200
*CALIBRATION TEST TRUCK # 2	* DATE	7-12-07

Rev. 08/31/01

Day 2

7.2 *b) Average Pre-Test Loaded weight 60600

*c) Post Test Loaded Weight 59990

*d) Difference Post Test – Pre-test -700

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	9080	13690	13690	12070	12070		66600
2	9060	13710	13710	12060	12060		60600
3	9040	13710	13710	12050	12050		60560
Average	90600	~~13700~~ 13703	~~13700~~ 13703	12060	12060		~~60600~~ 60587

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	8600	13580	13580	12070	12070		59900
2							
3							
Average	8600	13580	13580	12070	12070		59900

Measured By RJW Verified By [signature] Weight date 07-12-07

Sheet 19	* STATE_CODE	53
LTPP Traffic Data	* SPS PROJECT ID	0200
*CALIBRATION TEST TRUCK #__	* DATE	7-11-07

Rev. 08/31/01

Day __

7..3 *b) Average Pre-Test Loaded weight _____

*c) Post Test Loaded Weight _____

*d) Difference Post Test – Pre-test _____

Table 5.3. Raw data – Axle scales – pre-test

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

Table 6.3. Raw data – Axle scales –

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

Table 7.3. Raw data – Axle scales – post-test

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

Measured By _____ Verified By _____ Weight date _____

Sheet 20	* STATE_CODE	53
LTPP Traffic Data	*SPS PROJECT_ID	0200
Speed and Classification Checks * 1 of* 2	* DATE	07/11/2007

Rev. 08/31/2001....

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
61	9	358	62	9	65	10	588	65	10
61	9	359	62	9	62	9	605	62	9
60	9	361	62	9	59	9	621	59	9
65	9	413	65	9	58	9	623	58	9
62	9	418	63	9	64	9	673	64	9
62	10	428	63	10	60	9	681	61	9
62	9	434	63	9	62	9	685	62	9
54	9	441	54	9	64	9	687	65	9
54	9	449	54	9	62	13	698	62	13
62	6	465	63	6	62	9	707	62	9
61	9	492	63	9	64	10	708	65	10
62	9	496	62	9	64	13	720	65	13
67	9	504	67	9	63	13	722	63	13
63	9	515	63	9	64	9	739	64	9
60	9	519	61	9	64	9	742	65	9
59	9	522	59	9	62	9	753	62	9
61	9	523	61	9	53	9	760	53	9
60	13	531	60	13	61	9	763	62	9
59	12	542	59	12	64	9	783	64	9
60	10	560	61	10	65	9	790	64	9
64	13	564	64	13	64	9	794	64	9
61	9	567	61	9	62	12	801	63	12
62	10	570	62	10	50	9	809	49	9
62	10	571	62	10	49	9	837	49	9
60	10	584	61	10	60	9	851	61	9

Recorded by Janice Direction NB Lane 1 Time from 11:35 to 12:28

Sheet 20	* STATE_CODE 53
LTPP Traffic Data	*SPS PROJECT_ID 0200
Speed and Classification Checks * 2 of* 2	* DATE 07 / 11 / 2007

Rev. 08/31/2001....

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
60	11	882	60	11	63	9	1507	63	9
63	9	898	62	9	62	9	1511	62	9
62	9	902	62	9	62	9	1518	62	9
60	11	957	61	11	65	12	1521	65	12
64	13	978	65	13	53	9	1539	55	9
67	9	984	68	9	53	9	1543	54	9
54	9	990	55	9	57	9	1698	57	9
65	13	1003	65	13	62	10	1709	62	10
58	9	1007	58	9	61	9	1717	60	9
64	13	1014	64	13	60	9	1742	60	9
63	9	1016	63	9	58	9	1744	58	9
59	9	1170	59	9	63	9	1774	62	9
72	9	1266	72	9	62	9	1815	63	9
64	9	1288	65	9	59	6	1836	60	6
62	9	1298	63	9	59	13	1845	60	13
70	9	1303	70	9	62	13	1869	63	13
67	9	1309	67	9	57	9	1885	58	9
63	9	1311	63	9	62	9	1889	62	9
62	9	1323	62	9	64	9	1893	64	9
63	9	1331	64	9	62	9	1909	62	9
60	9	1355	60	9	63	9	1951	63	9
62	9	1356	60	9	62	13	1962	63	13
61	13	1358	60	13	63	9	1966	63	9
65	10	1364	65	10	65	9	1981	64	9
64	9	1416	64	9	59	13	2000	59	13

Recorded by Andrie Direction NB Lane 1 Time from 12:34 to 14:38

checked

Sheet 20	* STATE_CODE	53
LTPP Traffic Data	*SPS PROJECT_ID	0200
Speed and Classification Checks * 1 of* 2	* DATE	07/12/2007

Rev. 08/31/2001....

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
63	9	6667	64	9	60	10	1060	59	10
64	10	672	64	10	60	9	1098	61	9
58	9	685	58	9	64	9	1100	64	9
61	9	690	62	9	60	9	1107	60	9
59	9	910	59	9	60	9	1131	60	9
63	10	741	64	10	65	9	1141	64	9
58	9	754	58	9	64	9	1153	64	9
59	10	756	60	10	62	9	1175	63	9
59	9	764	59	9	61	8	1183	61	8
58	9	775	63 58	9	52	9	1185	52	9
65	10	825	65	10	54	9	1186	53	9
64	10	826	64	10	60	9	1192	60	9
65	10	827	64	10	62	9	1231	61	9
62	9	846	61	9	62	9	1264	62	9
62	9	847	62	9	57	9	1274	56	9
63	9	882	63	9	60	13	1280	60	13
67	9	884	68	9	60	9	1295	60	9
64	12	922	64	12	67	10	1302	66	10
61	12	950	61	12	60	6	1304	60	6
64	13	955	63	13	67	11	1308	67	11
50	9	978	49	9	60	9	1330	60	9
49	9	980	49	9	59	11	1337	60	11
55	8	982	55	8	65	13	1343	64	13
64	9	1054	64	9	65	9	1358	64	9
62	9	1055	62	9	63	9	1368	64	9

Recorded by [signature] Direction NB Lane DriveTime from 10:01 to 10:51

checked

Sheet 20	* STATE_CODE	53
LTPP Traffic Data	*SPS PROJECT_ID	0200
Speed and Classification Checks * 2 of* 2	* DATE	07/12/2007

Rev. 08/31/2001....

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
58	9	1394	58	9	59	9	2393	60	9
58	9	1398	58	9	59	9	2398	59	9
66	9	1429	65	9	62	9	2418	62	9
62	9	1431	63	9	62	9	2420	62	9
63	9	1614	62	9	64	10	2447	62	10
49	9	1624	49	9	60	10	2459	60	10
49	9	1627	49	9	62	9	2469	63	9
60	13	1630	60	13	62	9	2478	63	9
60	10	2122	60	10	61	9	2501	61	9
58	10	2123	59	10	65	9	2562	64	59
59	8	2133	59	8	59	9	2566	59	9
60	9	2149	60	9	60	12	2579	60	12
53	9	2175	53	9	60	9	2586	60	9
54	9	2178	54	9	68	13	2596	68	13
63	9	2221	64	9	64	9	2597	64	9
60	9	2246	60	9	59	9	2599	59	9
62	9	2251	61	9	64	10	2603	64	10
61	9	2288	60	9	49	9	2608	49	9
59	9	2306	60	9	50	9	2611	50	9
59	6	2313	59	6	62	9	2631	62	9
62	9	2315	62	9	64	6	2637	64	6
64	9	2318	64	9	62	10	2640	62	10
55	10	2337	56	10	61	8	2650	61	8
64	9	2345	64	9	60	9	2661	60	9
64	13	2361	64	13	62	9	2663	62	9

Recorded by Andrie Direction NB Lane Drive Time from 11:12 to 13:13

Checked

Sheet 21	* STATE_CODE	53
LTPP Traffic Data	*SPS PROJECT_ID	0200
WIM System Test Truck Records 1 of 2	* DATE	07/11/2007

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
119.5	48	1	1	11:24	258	6.3/6.3	7.9/8.0	8.1/8.0	8.8/8.7	8.7/8.6	48	—	79.4	13.1/47	4.3	33.2	4.2	
119.5	49	2	1	11:25	262	49	5.0/4.9	7.8/7.7	7.4/7.3	6.1/6.1	6.8/6.7	—	65.8	11.8	4.4	30.8	4.1	
123.0	54	1	2	11:45	441	54	11.3	15.1	15.6	17.5	18.5		78.1	13.0	4.3	33.0	4.1	
123.0	54	2	2	11:46	449	54	9.6	16.4	15.3	13.1	15.4		69.8	11.8	4.4	31.0	4.1	
126.0	59	1	3	12:06	621	59	11.5	15.6	15.6	17.5	17.6		77.8	13.0	4.3	32.9	4.1	
126.0	58	2	3	12:06	623	58	9.6	15.1	14.8	12.1	13.8		64.4	11.7	4.3	30.7	4.0	
134	49	1	4	12:26	809	50	12.7	15.7	15.9	19.3	28.3		81.8	13.1	4.3	33.1	4.2	
134	49	2	4	12:28	857	49	9.0	15.6	15.1	12.8	15.4		67.9	11.8	4.3	30.9	4.1	
135.5	55	1	5	12:46	990	54	12.0	15.5	15.7	17.9	18.7		79.8	13.0	4.3	33.0	4.1	
135.5	58	2	5	12:48	1007	58	8.8	15.3	14.6	13.2	14.5		66.4	11.7	4.3	30.8	4.1	
OK! 140.0	60	1	6	13:06	1161	60	12.4	16.0	16.1	17.7	18.0		80.1	13.0	4.3	32.9	4.1	
140	59	2	6	13:07	1170	59	8.7	16.1	14.8	11.4	15.1		66.0	11.8	4.4	30.9	4.0	
134.5	48	1	7	13:28	1371	48	10.1	16.1	15.8	18.7	17.4		78.1	13.0	4.3	33.1	4.1	
134.5	48	2	7	13:29	1372	48	9.2	14.6	14.8	12.8	15.4		66.8	11.7	4.3	30.6	4.1	
133	55	1	8	13:49	1539	53	10.8	16.6	16.2	18.6	19.2		81.4	13.0	4.3	33.1	4.1	
133	54	2	8	13:49	1543	53	8.5	15.5	14.5	12.5	18.5		65.4	11.8	4.3	30.7	4.1	

Recorded by _____ Checked by _____

135.5 60 1 6 13:06 1161 60 12.4 16.0 16.1 17.7 18.0 80.1 13.0 4.3 32.9 4.1

Sheet 21	* STATE_CODE	53
LTPP Traffic Data	*SPS PROJECT_ID	0200
WIM System Test Truck Records 2 of 2	* DATE	07/11/2007

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
137.0	60	1	9	14:09	1742	60	11.4	16.4	15.9	18.4	18.2		80.3	13.0	4.3	32.9	4.1	
137.0	58	2	9	14:09	1744	58	8.4	16.4	14.8	12.0	14.0		65.7	11.7	4.3	30.7	4.0	
133.0	49	1	X10	14:53	2143	49	11.5	16.2	15.7	18.0	17.0		78.4	13.0	4.3	33.1	4.1	
130.5	53	1	110	15:14	2356	53	12.3	15.9	16.2	18.8	18.4		81.6	13.0	4.3	33.1	4.1	
130.5	45	2	10	15:18	2396	45	8.1 ~~4.8~~	16.0 ~~4.3~~	15.3	14.4	14.7		68.5	11.8	4.3	30.7	4.1	
127.5	60	1	12	15:57	2777	60	10.8	16.3	16.3	18.6	18.2		80.1	13.0	4.3	33.0	4.2	
124.5	48	1	13	16:18	2986	49	11.5	16.0	15.9	17.6	17.0		77.9	13.0	4.3	33.0	4.1	
124	54	1	14	16:38	3184	54	11.3	16.0	15.8	17.8	18.0		79.1	12.9	4.3	33.0	4.2	
120.5	50	2	11	16:53	3320	49	8.8	15.3	14.7	13.4	14.3		66.5	11.8	4.3	30.7	4.1	
120.5	60	1	15	16:58	3351	60	12.1	15.8	15.7	18.3	17.5		79.3	13.0	4.3	33.2	4.2	
123.0	54	2	12	17:14	3482	54	9.0	15.0	15.1	11.6	14.9		65.6	11.7	4.4	30.8	4.0	
123.0	50	1	16	17:18	3516	50	12.0	15.9	18.8	18.5	17.7		79.9	13.0	4.3	33.1	4.1	
119.5	59	2	13	17:34	3657	59	9.2	16.1	15.4	12.6	15.2		68.5	11.8	4.3	30.9	4.1	
119.5	54	1	170	17:38	3690	54	11.6	15.6	15.2	17.6	17.7		77.7	13.1	4.3	33.2	4.2	
119.5	49	2	14	17:58	3860	49	9.2	15.5	15.6	13.6	14.8		68.8	11.8	4.4	30.8	4.1	
119.5	60	1	18	17:59	3874	60	11.9	16.0	16.2	17.5	17.2		78.8	13.1	4.3	33.1	4.2	

Recorded by _____ Checked by _____

Sheet 21	* STATE_CODE	53
LTPP Traffic Data	*SPS PROJECT_ID	0200
WIM System Test Truck Records 1 of 1	* DATE	07/12/2007

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
84	49	1	~~18~~ 19	8:26	65	49	10.3	15.6	15.0	17.6	17.0		75.5	13.0	4.3	33.0	4.1	
84	49	2	~~15~~	8:26	68	49	8.9	15.7	14.6	12.1	14.0		65.3	11.8	4.3	30.7	4.0	
95.5	53	1	~~19~~ 20	8:47	17	54	11.7	15.2	15.7	17.7	18.2		78.3	13.0	4.3	33.1	4.1	
95.5	54	2	16	8:47	22	54	8.9	15.6	14.5	12.1	14.3		65.1	11.8	4.3	30.9	4.1	
99.5	59	1	21	9:08	185	59	12.5	15.6	15.3	18.4	17.3		79.2	13.1	4.3	32.9	4.1	
99.5	58	2	17	9:08	189	59	9.9	15.1	14.6	12.3	14.5		66.4	11.8	4.3	30.7	4.1	
102	49	1	22	9:29	380	49	10.4	15.5	15.4	17.8	17.0		76.0	13.0	4.3	33.2	4.1	
102	50	2	18	9:29	381	50	8.8	15.1	14.7	12.2	13.9		64.7	11.8	4.4	30.7	4.1	

Recorded by _____ Checked by _____

Sheet 21	* STATE_CODE	53
LTPP Traffic Data	*SPS PROJECT_ID	0200
WIM System Test Truck Records 1 of 1	* DATE	07/12/2007

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
103.5	59	1	1	10:10	764	59	11.2	14.2	14.3	15.6	16.0		71.2	13.0	4.3	32.9	4.1	
103.5	58	2	1	10:11	775	58	8.2	13.6	12.9	10.4	12.7		57.9	11.7	4.3	30.9	4.1	
111	49	1	2	10:31	978	50	10.9	14.2	13.7	15.8	15.5		70.1	13.0	4.3	33.1	4.1	
111	49	2	2	10:31	980	49	9.2	14.2	13.5	11.4	13.1		61.4	11.9	4.4	31.0	4.1	
114.5	52	1	3	10:52	1185	52	10.9	14.0	14.0	15.8	15.4		70.1	13.0	4.3	33.0	4.1	
114.5	53	2	3	10:52	1186	54	8.7	14.3	13.6	11.0	13.3		60.8	11.8	4.4	30.8	4.0	
111.5	58	1	4	11:12	1394	58	10.3	13.6	13.6	15.3	15.4		68.2	13.0	4.3	33.1	4.1	
111.5	58	2	4	11:13	1398	58	7.9	13.6	12.9	10.7	13.0		58.2	11.7	4.3	30.8	4.1	
106.5	49	1	5	11:33	1624	49	10.7	14.2	14.0	16.1	15.7		70.7	13.0	4.3	33.1	4.1	
106.5	49	2	5	11:34	1627	49	8.8	13.2	12.7	10.4	13.0		58.2	11.8	4.3	30.8	4.1	
117	53	1	6	12:26	2175	53	10.8	13.0	13.1	15.4	15.9		68.2	13.0	4.3	33.0	4.1	
117	54	2	6	12:26	2178	54	8.8	14.0	13.0	10.7	13.3		59.7	11.8	4.4	30.8	4.0	
126	60	1	7	12:47	2393	59	11.2	13.5	13.5	15.9	15.1		69.2	13.0	4.3	33.1	4.1	
126	59	2	7	12:47	2398	59	8.8	13.9	13.4	11.0	13.1		60.3	11.8	4.4	31.1	4.1	

Recorded by _____ Checked by _____

21

Sheet 21	* STATE_CODE	53
LTPP Traffic Data	*SPS PROJECT_ID	0200
WIM System Test Truck Records 1 of 2	* DATE	07/12/2007

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
117	53	1	6	12:26	2175	53	10.8	13.0	13.1	15.4	15.9		68.2	13.0	4.3	33.0	4.1	
117	54	2	6	12:26	2178	54	8.8	14.0	13.0	10.7	13.3		59.7	11.8	4.4	30.8	4.0	
126	60	1	7	12:47	2393	59	11.2	13.5	13.5	15.9	15.1		69.2	13.0	4.3	33.1	4.1	
126	59	2	7	12:47	2398	59	8.8	13.9	13.4	11.0	13.1		60.3	11.8	4.4	31.1	4.1	
124.5	49	1	8	13:07	2608	49	10.6	13.9	13.4	15.0	14.5		67.5	13.0	4.3	33.0	4.1	
124.5	50	2	8	13:08	2611	50	8.8	13.0	13.7	11.2	13.3		59.9	11.9	4.4	31.0	4.1	
124	53	1	9	13:28	2833	53	10.5	14.1	13.3	15.9	15.9		69.6	12.9	4.3	32.9	4.1	
124	54	2	9	13:28	2838	54	9.0	13.2	12.8	10.1	12.6		57.8	11.7	4.4	30.8	4.0	
126.0	59	1	10	13:51	3102	59	11.4	13.7	13.7	15.1	15.1		69.1	13.0	4.3	33.0	4.1	
126.0	59	2	10	13:54	3145	59	8.1	12.5	13.0	10.5	12.9		56.9	11.8	4.3	30.9	4.1	
125.5	49	1	11	14:12	3362	49	9.4	13.7	13.6	16.1	15.3		68.2	13.0	4.3	33.1	4.1	
125.5	49	2	11	14:13	3382	49	8.9	13.6	12.8	11.8	12.5		59.6	11.6	4.3	30.3	4.0	
116.5	54	1	12	14:32	3622	54	10.7	14.1	13.9	15.2	16.5		70.3	13.0	4.3	33.1	4.1	
116.5	54	2	12	14:32	3637	54	8.3	13.8	13.1	11.4	13.1		59.7	11.8	4.3	30.8	4.0	
114.5	59	1	13	14:52	3870	59	10.6	13.8	13.9	15.5	15.3		69.0	13.0	4.3	33.0	4.1	
114.5	59	2	13	14:52	3872	59	8.5	14.3	13.5	11.5	13.2		60.9	11.8	4.3	30.9	4.1	

Recorded by _____ Checked by _____

use Cal 1 for 1st 10 runs

Sheet 21	* STATE CODE	53
LTPP Traffic Data	*SPS PROJECT ID	0200
WIM System Test Truck Records 2 of 2	* DATE	07/12/2007

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
111	49	1	14	15:24	4264	49	10.9	14.1	13.7	15.8	15.6		70.1	13.1	4.3	33.1	4.1	
111	49	2	14	15:24	4267	49	8.3	13.5	13.2	11.3	14.1		60.4	11.8	4.3	30.7	4.0	
109	53	1	15	15:44	4543	53	10.9	13.4	13.1	15.4	15.4		68.2	13.0	4.3	33.0	4.1	
109	54	2	15	15:44	4544	53	8.3	12.1	12.1	10.2	12.4		55.1	11.8	4.3	30.5	3.9	
106.5	59	1	16	16:04	4783	59	9.6	13.3	13.6	17.0	15.3		68.9	13.0	4.3	33.0	4.2	
106.5	59	2	16	16:04	4784	60	9.4	14.0	13.5	10.8	12.8		60.4	11.9	4.4	31.1	4.1	
106	49	1	17	16:30	5097	48	11.4	13.4	13.8	16.2	15.6		70.4	13.1	4.3	33.1	4.1	
106	49	2	17	16:30	5099	50	9.4	13.4	13.2	11.2	13.0		60.2	11.8	4.4	30.9	4.1	
108	53	1	18	16:50	5338	52	11.1	13.6	13.8	16.0	15.5		70.0	13.0	4.3	33.0	4.2	
108	53	2	18	16:50	5340	54	8.8	13.9	13.9	11.3	13.6		61.5	11.8	4.3	30.9	4.0	
103.5	59	1	19	17:10	5571	60	11.9	14.0	~~15.8~~ 14.0	15.8	15.9		71.7	13.1	4.3	33.0	4.1	
103.5	59	2	19	17:10	5572	59	8.6	14.6	13.7	10.8	13.7		61.3	11.7	4.4	31.0	4.1	
101	48	1	20	17:29	5762	48	11.1	13.8	13.7	15.7	15.6		69.9	13.0	4.3	33.1	4.2	
101	50	2	20	17:29	5763	50	8.9	13.6	13.8	12.2	13.2		61.7	11.8	4.3	30.8	4.1	

Recorded by _____ Checked by _____

3.11.2. Iteration 1

☑ Start Factors –

Speed Factor	Sensor 1	Sensor 2	Sensor 3	Sensor 4
1 50	6.69144	6.69144		
2 62	"	"		
3 75	"	"		
4 dynamic	99	90		
5				
Spacing Factor				

☑ Errors (from first 40) –

	50	55	60		
Axle	+5.3	+6.6	+7.9		
Tandem	+12.5	+13.0	+12.5		
GVW	+11.4	+12.1	+11.7		
Spacing	0.0				

☐ Calculations (if required) –

Speed Factor	Raise	Lower	Percent
1 dynamic	☑	☐	5 %
2	☐	☐	
3	☐	☐	
4	☐	☐	
5	☐	☐	
Spacing Factor	☐	☐	

changed temp comp. factors, bins 12-39 from 1000 for all to progressive by 1% for each 2 bins (i.e. 990 for 12,13 / 980 for 38 & 39)

☐ New Calibration Factors –

Speed Factor	Sensor 1	Sensor 2	Sensor 3	Sensor 4
1 dynamic	105	105		
2				
3				
4				
5				
Spacing Factor				

Task Leader Initials: _____

TEST VEHICLE PHOTOGRAPHS FOR SPS WIM VALIDATION

Visit Date: July 11, 2007

STATE: WA

SHRP ID: 0200

Photo 1 - 530200_Truck_1_Tractor_2007_07_12.jpg

Photo 2 - 530200_Truck_1_Trailer_2007_07_12.jpg

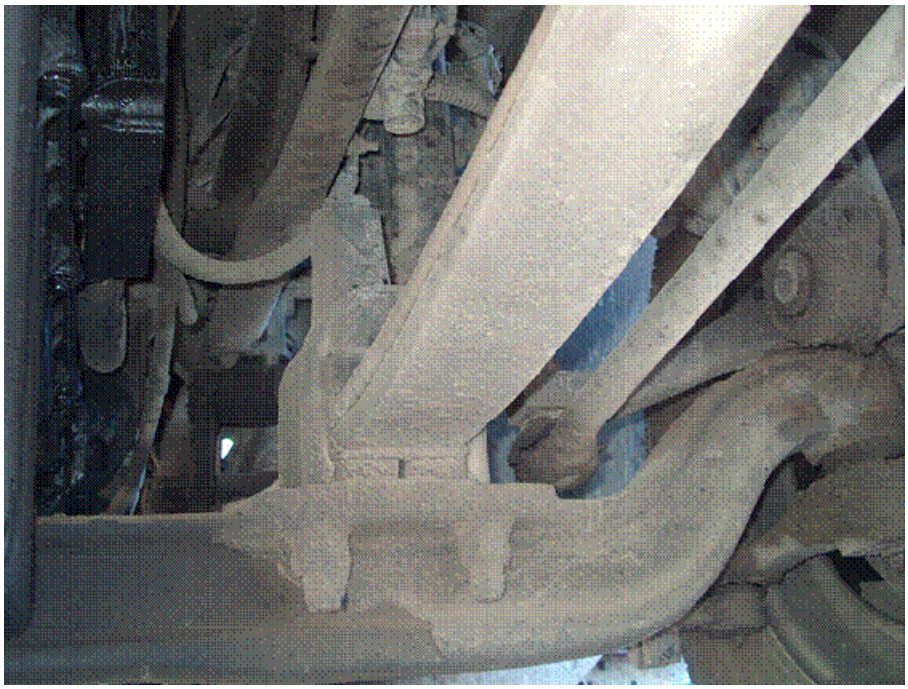


Photo 3 - 530200_Truck_1_Suspension_1_2007_07_12.jpg

Photo 4 - 530200_Truck_1_Suspension_2_2007_07_12.jpg

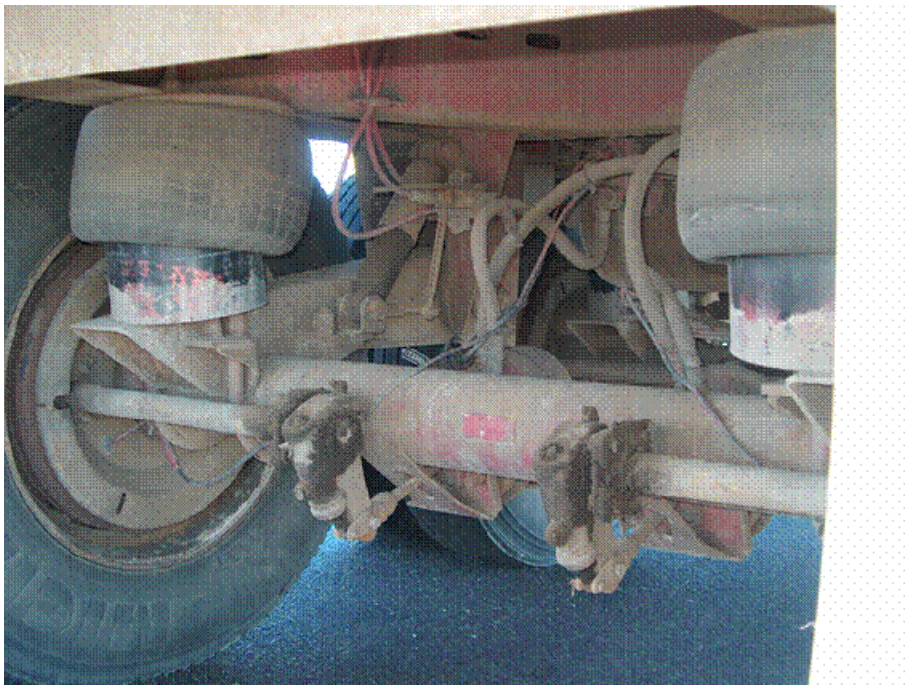


Photo 5 - 530200_Truck_1_Suspension_3_2007_07_12.jpg

Photo 6 - 530200_Truck_2_Tractor_2007_07_12.jpg

Photo 7 - 530200_Truck_2_Trailer_2007_07_12.jpg

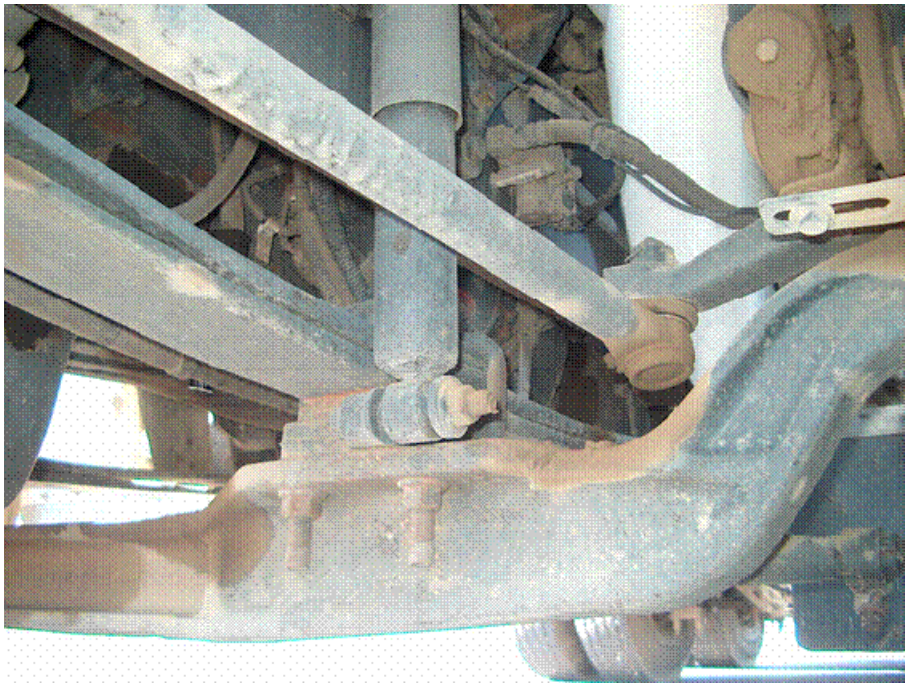


Photo 8 - 530200_Truck_2_Suspension_1_2007_07_12.jpg

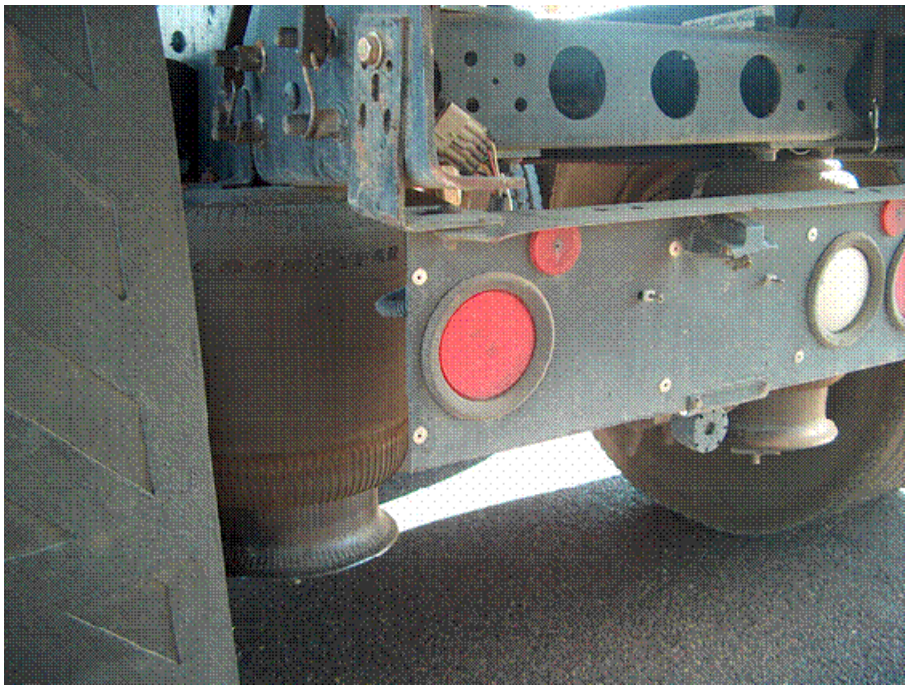


Photo 9 - 530200_Truck_2_Suspension_2_2007_07_12.jpg

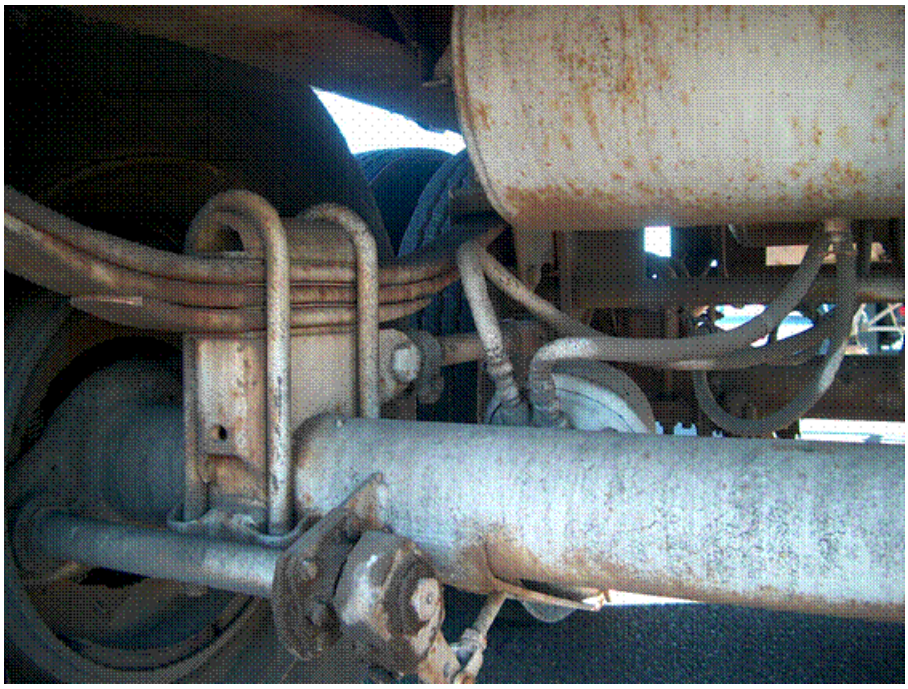


Photo 10 - 530200_Truck_2_Suspension_3_2007_07_12.jpg

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

Validation Visit – 29 November 2006

Loop separation: From leading edge to leading edge is: 264"

Axle separation is: 120"

Leading edge of the first loop to the first axle sensor: 107"
Leading edge of the first loop to the second axle sensor: 227"

Calibration factor for sensor #1:

80 kph:	6.690134
100 kph:	6.690134
120 kph:	6.690134
threshold:	25

6.691444 not changed 7/12/07

Calibration factor for sensor #2:

80 kph:	6.690134
100 kph:	6.690134
120 kph:	6.690134
threshold:	25

Dynamic: 99 → Changed to 105