Validation Report

Washington, SPS-2
Task Order 17, CLIN 2
November 28 to 29, 2006

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1 Executive Summary

A visit was made to the Washington 0200 on November 28 to 29, 2006 for the purposes of conducting a validation of the WIM system located on I-395, located 2 miles south of I-90, near Ritzville, Washington. The SPS-2 is located in the righthand, northbound lane of a four-lane divided facility. It is designated as lane number 1 by the controller. All lanes at this site are instrumented for WIM. The LTPP lane and the adjacent lane are instrumented with quartz sensors. The two lanes in the opposite direction are instrumented with piezo sensors. The validation procedures were in accordance with LTPP's SPS WIM Data Collection Guide dated August 21, 2001.

This is the first validation visit to this location. The site was installed on March, 1998 by the Washington DOT. An LTPP Assessment was performed on May 24, 2006.

This site meets LTPP precision requirements for loading data. The classification algorithm does not provide research quality classification information.

The site is instrumented with quartz piezo WIM sensors and IRD 1068 electronics. It is installed in portland cement concrete, 400 feet long.

The validation used the following trucks:

1) 5-axle tractor-trailer with a tractor having an air suspension and trailer with a standard rear tandem and air suspension loaded to 75,840 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 tapered leaf suspension loaded to 67,720 lbs., the "partial" truck.

The validation speeds ranged from 46 to 60 miles per hour. The pavement temperatures ranged from 16 to 27 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 – 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
GVW	±10 percent	0.3 ± 6.4%	Pass
Speed	±1 mph [2 km/hr]	N/A	N/A
Axle spacing	± 0.5 ft [150mm]	0.0 ± 0.1 ft	Pass

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; however, a moderate number of trucks appeared to track down the right side of the travel lane although they did not appear to avoid the WIM sensors.

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

This site needs 5 years of data to meet the goal of five years of research quality data.

2 Corrective Actions Recommended

The classification algorithm at this site needs to be changed to allow for the proper classification of several truck types with atypical axle spacings and lighter axle weights than is allowed by the installed algorithm. No other corrective actions are required at this site at this time.

3 Post Calibration Analysis

This final analysis is based on test runs conducted November 29, 2006 during the mid morning to early evening hours at test site 530200 on I-395. This SPS-2 site is at milepost 93 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 75,840 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 tapered leaf suspension loaded to 67,720 lbs., the “partial” truck.

Each truck made a total of 20 passes over the WIM scale at speeds ranging from approximately 46 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 16 to 27 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. Speed testing during post-validation was not performed since the speed error during pre-validation testing was 0.1 mph.

Table 3-1 Post-Validation 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
GVW	±10 percent	0.3 ± 6.4%	Pass
Speed	±1 mph [2 km/hr]	N/A	N/A
Axle spacing	± 0.5 ft [150mm]	0.0 ± 0.1 ft	Pass

The test runs were conducted primarily during the mid-morning to early evening hours, resulting in a 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 left as one temperature group. 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. Temperatures at this site during testing hours remained very low, without much increase throughout the day.

The three speed groups were divided as follows: Low speed – 46 to 51 mph, Medium speed – 52 to 58 mph and High speed – 59 + mph. The one temperature group was labeled the medium temperature range, with a range from 16 to 27 degrees Fahrenheit.

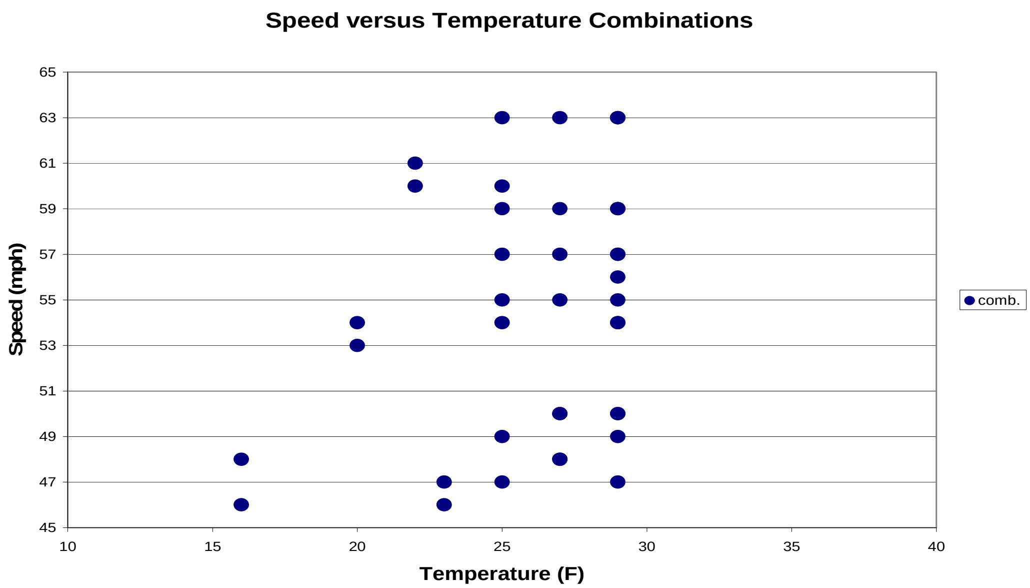

Figure 3-1 Post-Validation Speed-Temperature Distribution – 530200 – 29-Nov-2006

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.

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 lesser at medium speeds when compared with low and high speeds.

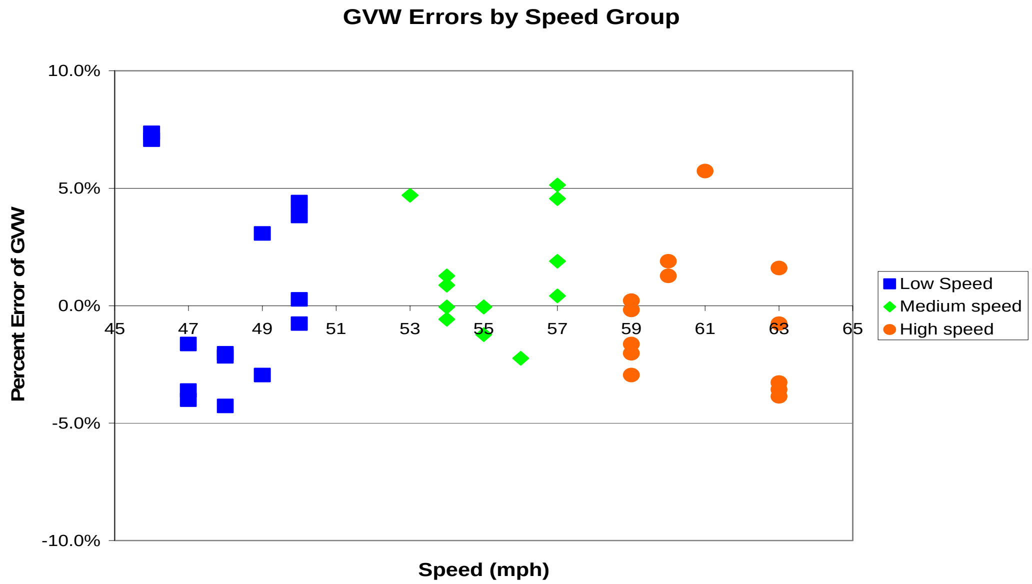

Figure 3-2 Post-validation GVW Percent Error vs. Speed – 530200 – 29-Nov-2006

Figure 3-3 shows a lack of a relationship between temperature and GVW percentage error, although the GVW estimation appears to decrease slightly as the temperature increases.

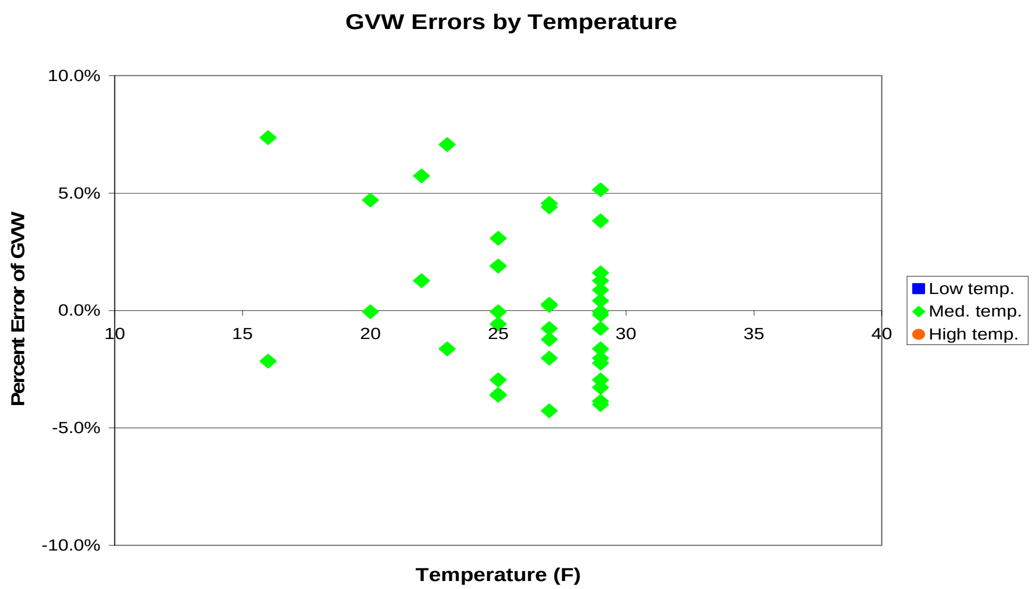

Figure 3-3 Post-Validation GVW Percent Error vs. Temperature – 530200 – 29-Nov-2006

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.

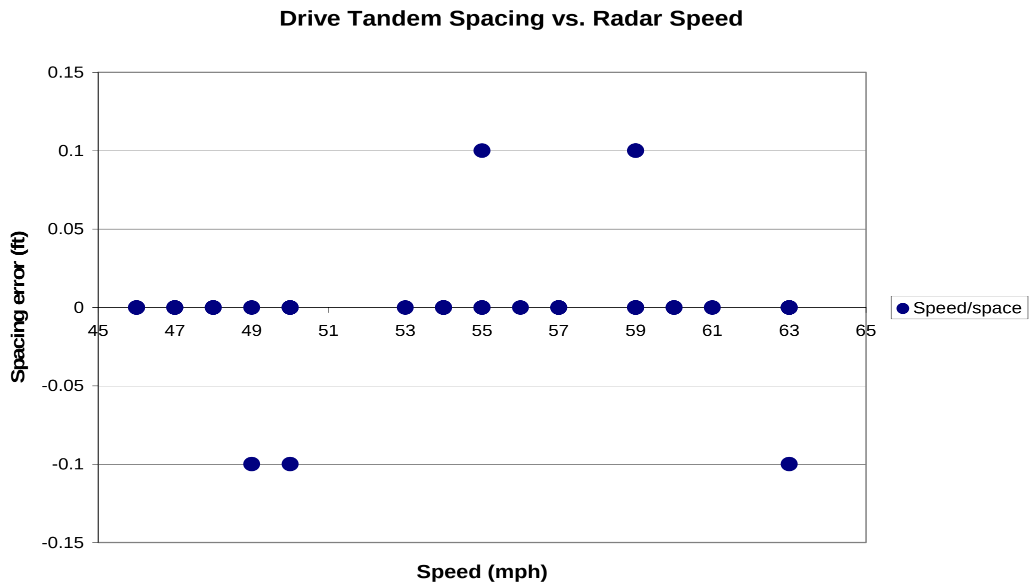

Figure 3-4 Post-Validation Spacing vs. Speed – 530200 – 29-Nov-2006

3.1 Temperature-based Analysis

The one temperature groups were created by defining all of the test runs as the Medium temperature range, from 16 to 27 degrees Fahrenheit.

Table 3-2 Post-Validation Results by Temperature Bin – 530200 – 29-Nov-2006

Element	95% Limit	Medium Temperature 16-27 °F
Steering axles	±20 %	-3.7 ± 11.5%
Tandem axles	±15 %	1.2 ± 8.4%
GVW	±10 %	0.3 ± 6.4%
Speed	±1 mph	N/A
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft

From Table 3-2, it appears that the equipment underestimates steering axle weights, and generally overestimates tandem and GVW weights. The variability in steering axles also appears to be greater than that of tandem and GVW errors.

Figure 3-5 is the distribution of GVW Errors versus Temperature by Truck graph. From the figure, it appears that mean error for the Golden truck (squares) was not particularly affected by temperature; however, GVW estimation for the Partial truck (diamonds) appears to go from an overestimation at the lower end of the range, to fairly accurate estimation at the upper end of the range.

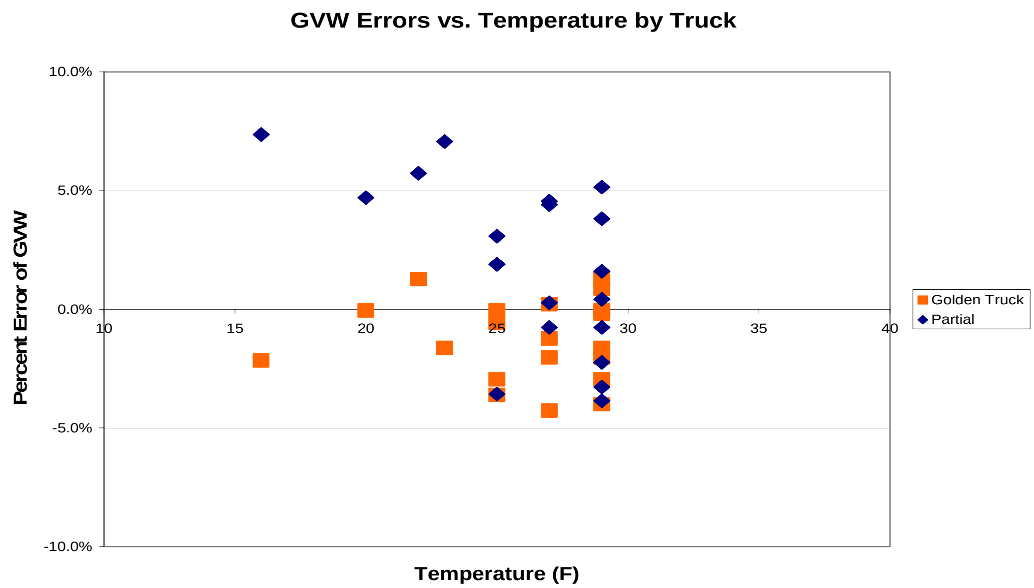

Figure 3-5 Post-Validation GVW Percent Error vs. Temperature by Truck – 530200 – 29-Nov-2006

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.

From the figure, it can be seen that the estimation of Steering axle weights transitions from an overestimation at the lower end of the range to an underestimation at the higher end.

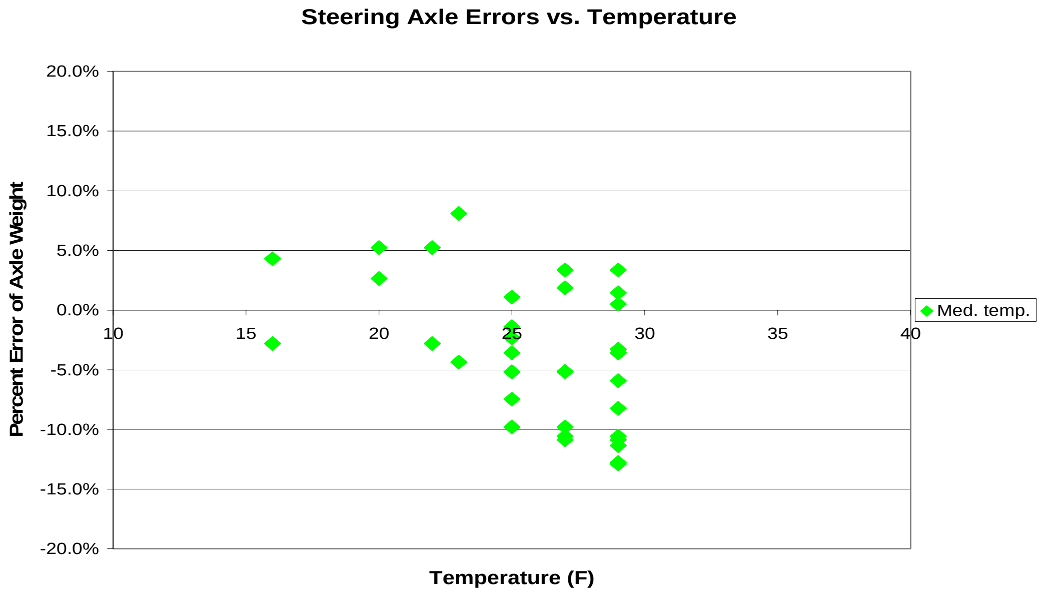

Figure 3-6 Post-Validation Steering Axle Error vs. Temperature by Group – 530200 – 29-Nov-2006

Figure 3-7 shows the relation between tandem axle errors and temperature. From the figure, it appears that temperature has no effect on tandem axle weight estimation for the Golden truck, however, the estimation of tandem axle weights for the Partial truck appear to decrease as temperature increases much like the GVW estimation for this truck.

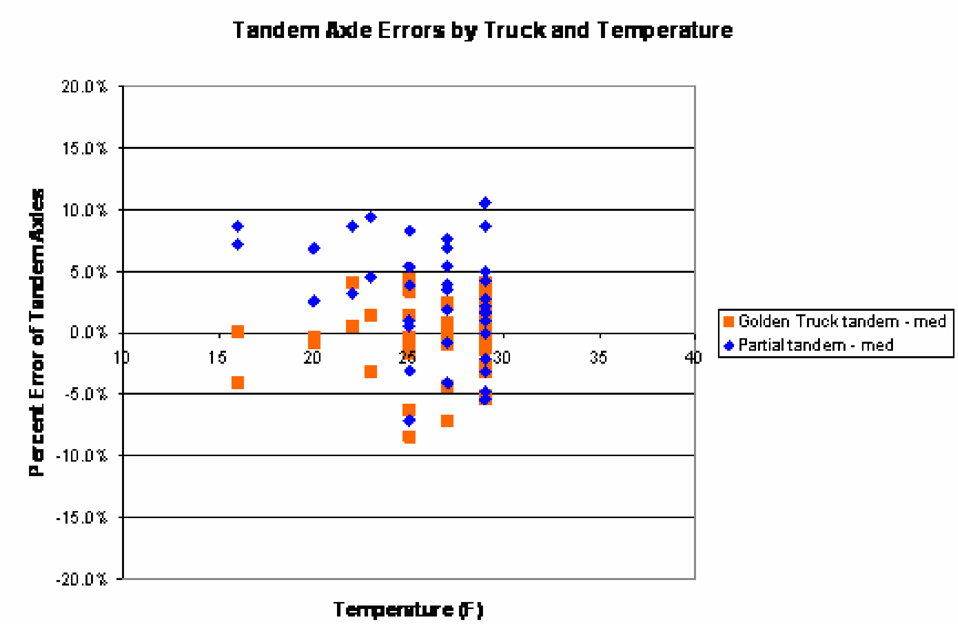

Figure 3-7 Post-Validation Tandem Axle Error vs. Temperature by Group – 530200 – 29-Nov-2006

3.2 Speed-based Analysis

The three speed groups were divided using 46 to 51 mph for Low speed, 52 to 58 mph for Medium speed and 59+ mph for High speed.

Table 3-3 Post-Validation Results by Speed Bin – 530200 – 29-Nov-2006

Element	95% Limit	Low Speed 46 to 51 mph	Medium Speed 52 to 58 mph	High Speed 59+ mph
Steering axles	±20 %	-3.4 ± 12.0%	-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	N/A	N/A	N/A
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft

From Table 3-3, it can be seen that the equipment tends to estimate all weights fairly consistently throughout the entire speed range. Steering axle weights appear to be underestimated at all speeds, with greater underestimation at the higher speeds. Variability in steering axle weight appears to be consistent throughout the entire speed range, while the spread in error for GVW and tandem weights appears to be lesser at the medium speeds when compared with the spread at low and high speeds.

Figure 3-8 illustrates the tendency for the system to overestimate GVW at all speeds for the population as a whole. However, it appears that the equipment overestimates GVW for the Partial truck while generally underestimating GVW for the Golden truck over the entire range of speeds. The variability of error for the population as a whole as well as for each truck appears to be fairly consistent throughout the entire speed range, although the spread in error for the Partial truck appears greater than the error spread for the Golden truck.

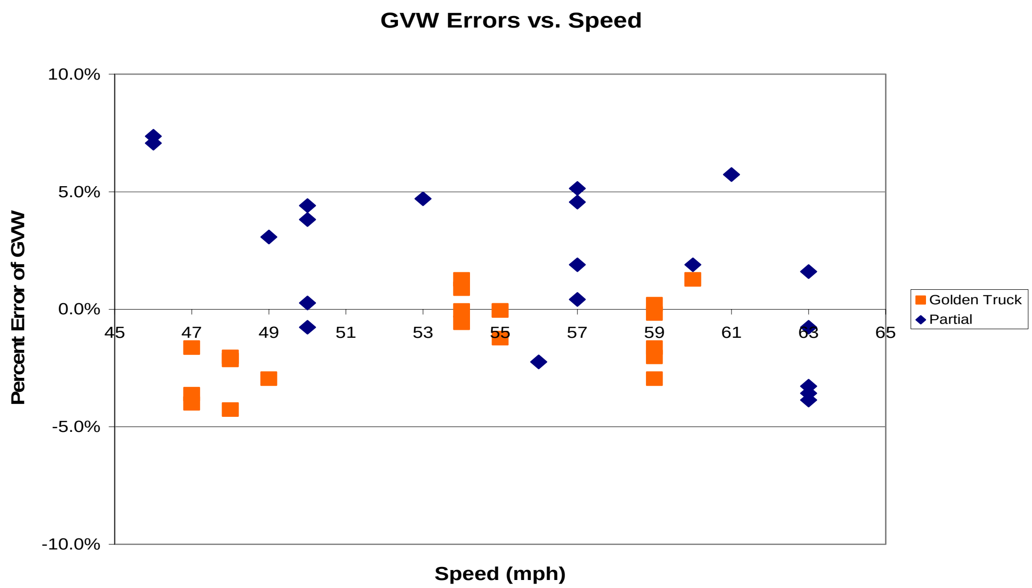

Figure 3-8 Post-Validation GVW Percent Error vs. Speed by Truck – 530200 – 29-Nov-2006

Figure 3-9 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 underestimates steering axle weights fairly consistently at all speeds.

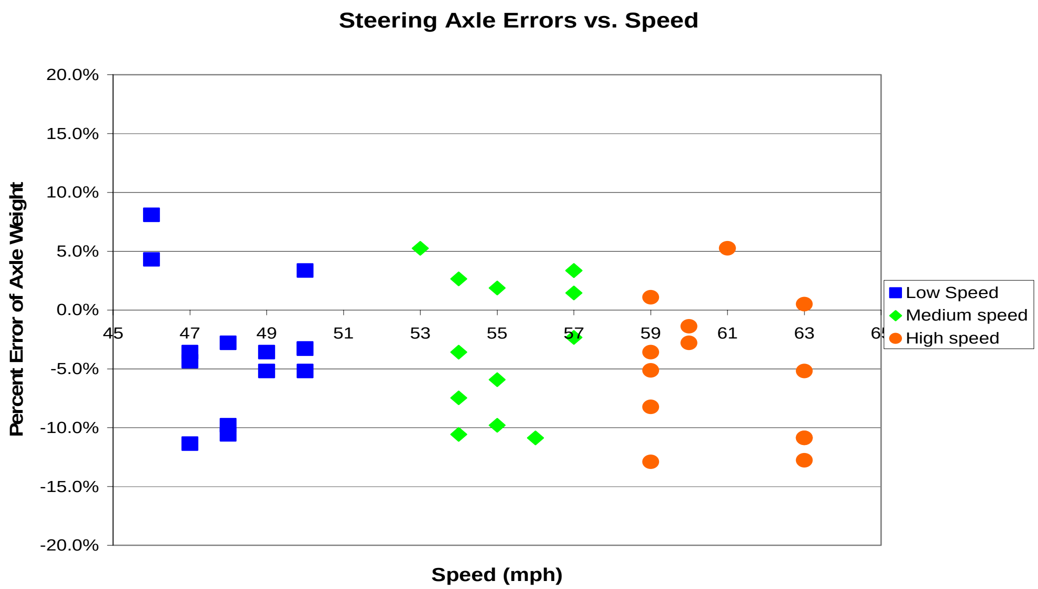

Figure 3-9 Post-Validation Steering Axle Percent Error vs. Speed by Group – 530200 – 29-Nov-2006

Figure 3-10 shows the differing tandem axle errors by truck over the speed range. From the figure, it can be seen that the equipment generally estimates the tandem axle weights accurately and consistently at the medium and high speeds for both trucks. At low speeds, it appears that the equipment overestimates the tandem axle weights of the Partial truck while underestimating the tandem axle weights of the Golden truck. The variability in error appears to be greater for the Partial truck at all speeds.

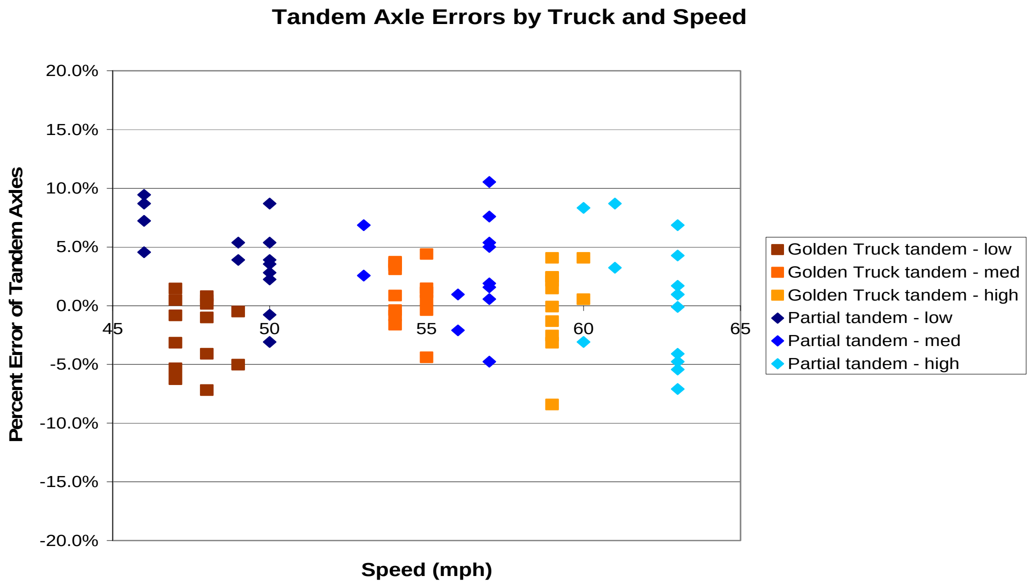

Figure 3-10 Post-Validation Tandem Axle Percent Error by Truck and Speed – 530200 – 29-Nov-2006

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 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 1 percent unclassified vehicles. The unclassified vehicle was a 6 axle, multiple tractor-trailer combination truck with a standard rear tandem on the second trailer.

The second check is the ability of the algorithm to correctly distinguish between truck classes with no more than 2% errors in such classifications. Table 3-4 has the classification error rates by class. The overall misclassification rate is 1. percent.

Table 3-4 Truck Misclassification Percentages for 530200 – 29-Nov-2006

Class	Percent Error	Class	Percent Error	Class	Percent Error
4	N/A	5	0	6	0
7	N/A				
8	50	9	0	10	0
11	N/A	12	0	13	0

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 – 29-Nov-2006

Class	Mean Difference	Class	Mean Difference	Class	Mean Difference
4	N/A	5	0	6	0
7	N/A				
8	-50	9	0	10	0
11	N/A	12	0	13	0

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 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. The large mean error rates for Class 8s in Table 3-5 reflect the small number of Class 8 vehicles (2 sampled), one of which was classified as a type 15 due to a shorter 1 axle 1 to 2 spacing (10.6’) than is allowed by the classification algorithm (11.0’).

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

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 June 7, 2006 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

Table 4-2 shows the computed index values for all 8 profiler passes for this WIM site. The average values over the passes in each path were also calculated when three or more passes were completed. These are shown in the 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 –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				

From Table 4-2 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.

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 and IRD 1068 electronics. These sensors are installed in a portland cement concrete pavement.

There were no changes in basic equipment operating condition since the assessment on May 24, 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 are 3 speed designated weight compensation factors that affect all weight estimations by the equipment and 1 dynamic factor that affects only the steering axle weight estimation. All 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, the original compensation factors were:

- 80 kph – 6.500298
- 100 kph – 6.500298
- 120 kph – 6.500298

The results of the Pre-Validation from November 28, 2006 are illustrated in Figure 5-1 and Figure 5-2, and Table 5-1. As shown, the equipment demonstrated a tendency to underestimate GVW and Steering axle weights at all speeds. Scatter appeared to be fairly consistent at all speeds, with only a few outliers.

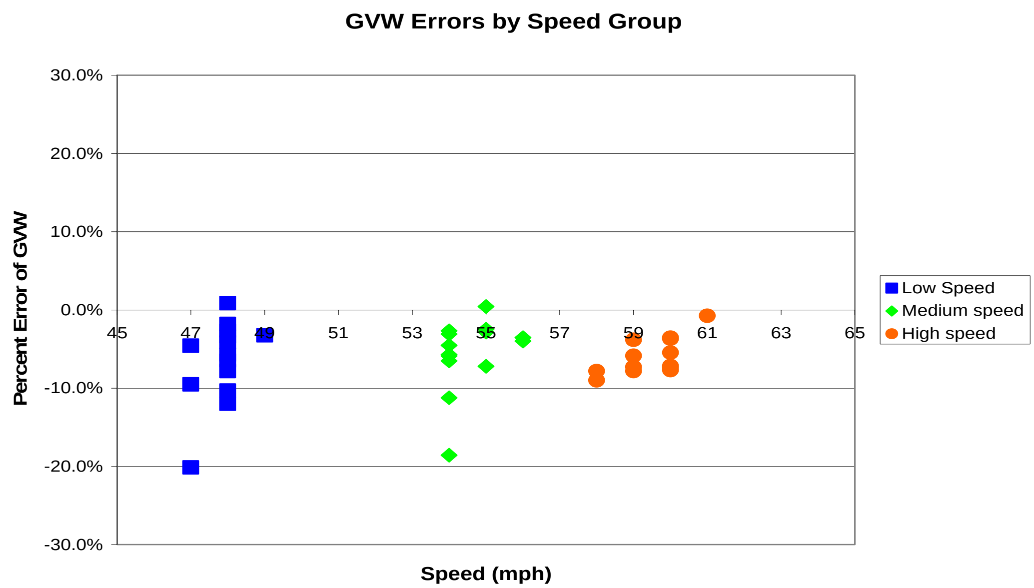

Figure 5-1 Pre-validation GVW Percent Error vs. Speed – 530200 – 28-Nov-2006

Figure 5-2 Pre-Validation Steering Axle Percent Error vs. Speed Group - 530200 – 28-Nov-2006

Table 5-1 Pre-Validation Results – 530200 – 28-Nov-2006

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	**+20 percent**	**-12.9 ± 7.3%**	**Fail**
Tandem axles	**+15 percent**	**-4.5 ± 11.7%**	**Fail**
GVW	**+10 percent**	**-6.0 ± 8.6%**	**Fail**
Speed	**+1 mph [2 km/hr]**	**0.0 ± 1.3 mph**	**Fail**
Axle spacing	+ 0.5 ft [150mm]	0.0 ± 0.1 ft	Pass

Table 5-1 illustrates the tendency to underestimate GVW by 6% and steering axle weights by 12.9%. As a result, the dynamic factor was increased by 8.4%, from 91 to 99 and all speed factors were increased by 3 percent, from 6.500298 to 6.6 90134. Changes were made by the state representative.

Table 5-2 and Figure 5-3 illustrate the results of the first iteration.

Table 5-2 Calibration Iteration 1 Results – 530200 – 29-Nov-2006 (9:31:00 AM)

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	+20 percent	-2.3 ± 12.4%	Pass
Tandem axles	+15 percent	2.1 ± 8.9%	Pass
GVW	+10 percent	1.3 ± 7.6%	Pass
Speed	+1 mph	N/A	N/A
Axle spacing	+ 0.5 ft	0.0 ± 0.1 ft	Pass

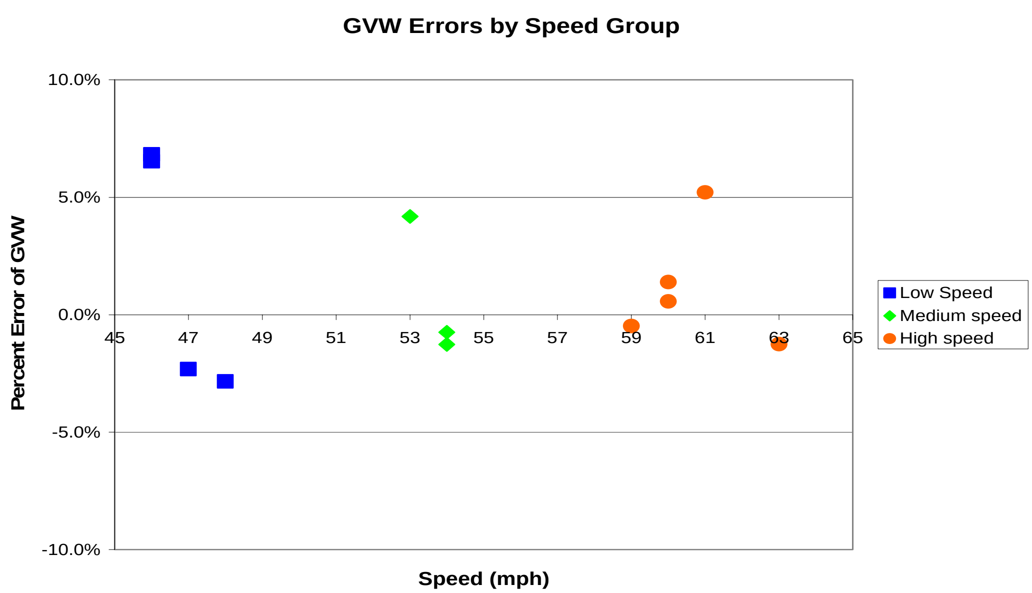

Figure 5-3 Calibration Iteration 1 GVW Percent Error vs. Speed Group – 530200 – 29-Nov-2006 (9:31:00 AM)

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 5-3 has the information that would be found in TRF_CALIBRATION_AVC for Sheet 16s submitted prior to this validation as well as the information for the current visit.

Table 5-3 Classification Validation History – 530200 – 29-Nov-2006

Date	Method	Mean Difference				Percent Unclassified
		Class 9	Class 8	Class 10	Other 2	
29-Nov-06	Manual	0	-50			1.0
28-Nov-06	Manual	0	-50			1.0
24-May-06	Manual	-2		-17		0.7

Table 5-4 has the information to be found in TRF_CALIBRATION_WIM for Sheet 16s for the current visit as well as information from other site validation activities.

Table 5-4 Weight Validation History – 530200 – 29-Nov-2006

Date	Method	Mean Error and (SD)		
		GVW	Single Axles	Tandem Axles
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)

5.4 Projected Maintenance/Replacement Requirements

The classification algorithm at this site should be reviewed and corrected to remedy classification errors with Class 8 vehicles noted previously. There are no other corrective maintenance actions required at this site at this time.

6 Pre-Validation Analysis

This pre-validation analysis is based on test runs conducted November 28, 2006 during the mid-morning to early afternoon hours at 530200 on 2 miles south of I-90. This SPS-2 site is at milepost 93 on I-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 76,370 lbs.

2. 5-axle tractor semi-trailer with a tractor having an air suspension and a trailer with standard rear tandem and tapered leaf suspension loaded to 68,010 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 47 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 14 to 23 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 6-1.

As shown in Table 6-1, the site failed all of the performance criteria for weight. As a result, it was determined that a calibration of the system was necessary.

Table 6-1 Pre-Validation Results – 530200 – 28-Nov-2006

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	**±20 percent**	**-12.9 ± 7.3%**	**Fail**
Tandem axles	**±15 percent**	**-4.5 ± 11.7%**	**Fail**
GVW	**±10 percent**	**-6.0 ± 8.6%**	**Fail**
Speed	**±1 mph [2 km/hr]**	**0.0 ± 1.3 mph**	**Fail**
Axle spacing	± 0.5 ft [150mm]	0 .0 ± 0.1 ft	Pass

The test runs were conducted primarily during the mid-morning to early evening hours, resulting in a 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 evaluated as one temperature group. 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 not achieved for this set of validation runs. Temperatures at this site during testing hours remained very low, without much increase throughout the day.

The three speed groups were divided into 47 to 51 mph for Low speed, 52 to 58 mph for Medium speed and 59+ mph for High speed. The one temperature group was created by leaving all of the test runs in one, Medium temperature group from 14 to 23 degrees Fahrenheit.

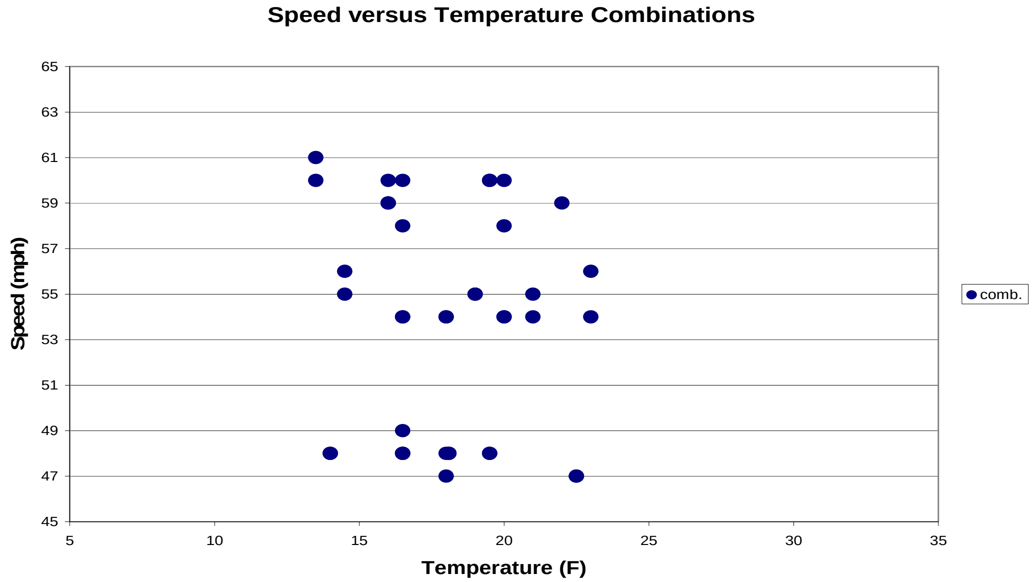

Figure 6-1 Pre-Validation Speed-Temperature Distribution – 530200 – 28-Nov-2006

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 appears to remain fairly consistent over the entire speed range with the exception of a few outliers.

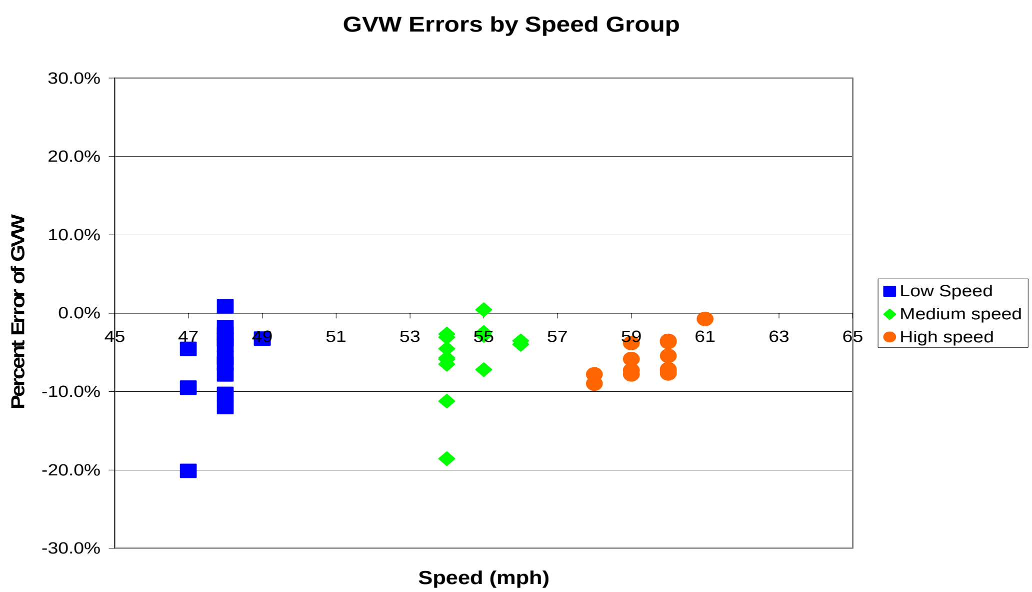

Figure 6-2 Pre-validation GVW Percent Error vs. Speed – 530200 – 28-Nov-2006

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

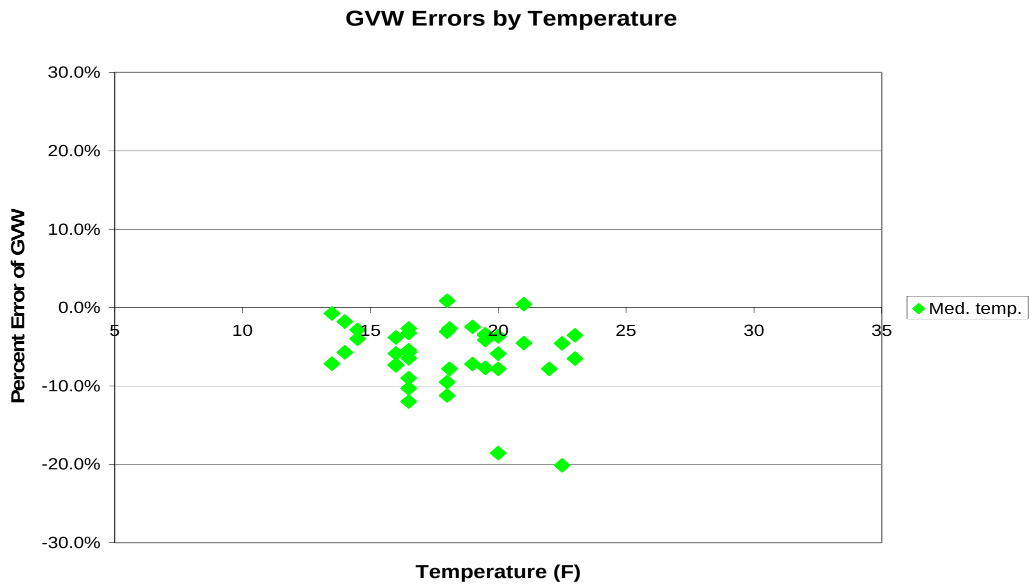

Figure 6-3 Pre-Validation GVW Percent Error vs. Temperature – 530200 – 28-Nov-2006

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.

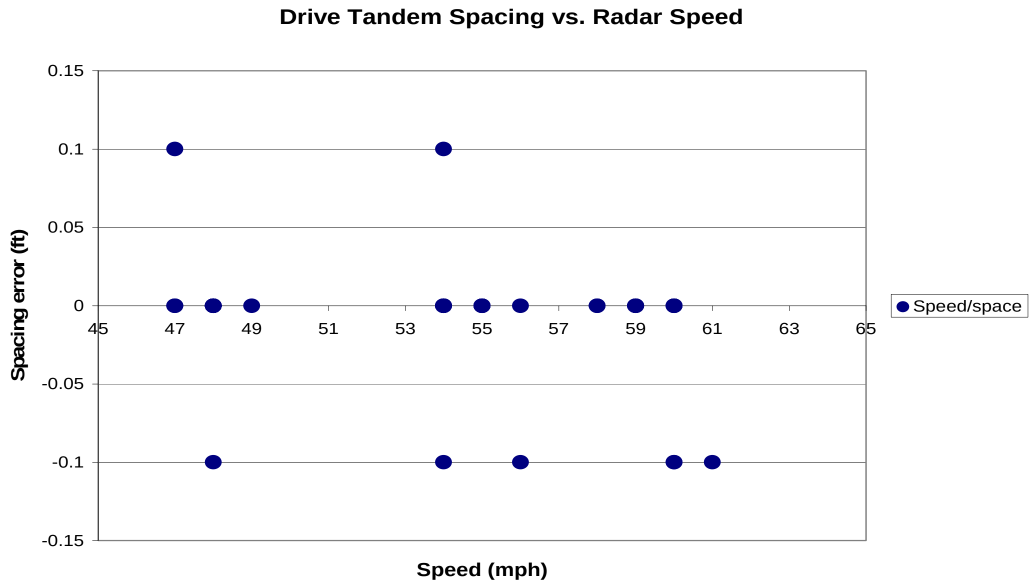

Figure 6-4 Pre-Validation Spacing vs. Speed - 530200 – 28-Nov-2006

6.1 Temperature-based Analysis

The one temperature group was created by combining all of the test runs into one Medium temperature group, from 14 to 23 degrees Fahrenheit.

Table 6-2 Pre-Validation Results by Temperature Bin – 530200 – 28-Nov-2006

Element	95% Limit	Medium Temperature 14-23 °F
Steering axles	±20 %	-12.9 ± 7.3%
Tandem axles	±15 %	-4.5 ± 11.7%
GVW	±10 %	-6.0 ± 8.6%
Speed	±1 mph	0.0 ± 1.3 mph
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft

From Table 6-2, it appears that the equipment underestimates all weights. The variability in tandem axle errors appears to be greater than that of GVW and steering axle errors.

Figure 6-5 shows the distribution of GVW Errors versus Temperature by Truck. The equipment appears to underestimate all weights at all temperatures for the population as a whole. The underestimation for the Golden truck (squares) appears to be greater than the underestimation of the Partial truck (diamonds). The variability in error for the Golden truck appears to increase as the temperature increases. The variability in error for the Partial truck appears to remain constant over the entire range and it appears that the variability is lesser when compared with the Golden truck.

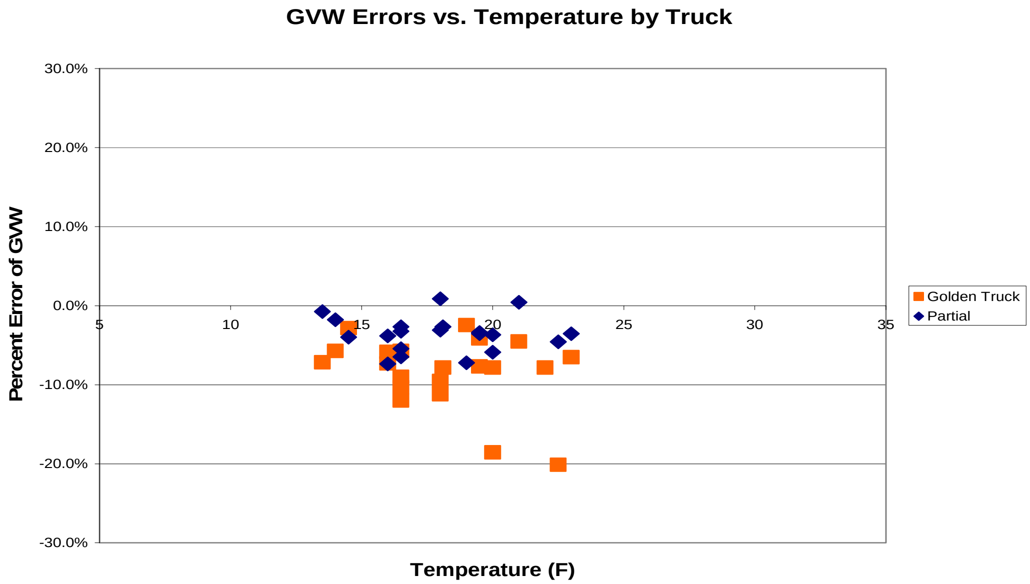

Figure 6-5 Pre-Validation GVW Percent Error vs. Temperature by Truck – 530200 – 28-Nov-2006

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 underestimated by the equipment over the temperature range.

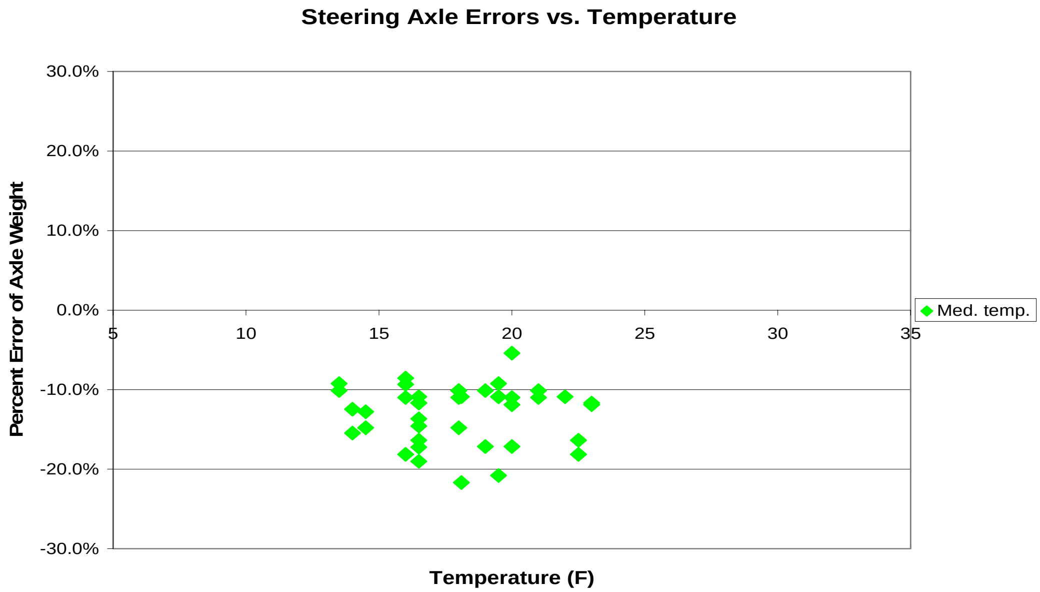

Figure 6-6 Pre-Validation Steering Axle Error vs. Temperature by Group – 530200 – 28-Nov-2006

Figure 6-7 shows the relation between tandem axle errors and temperature. From the figure, it appears that temperature has no effect on tandem axle weight estimation for the Partial truck. The underestimation of tandem axle weights for the Golden truck appears to increase as temperature increases within this range much like the GVW estimation for this truck.

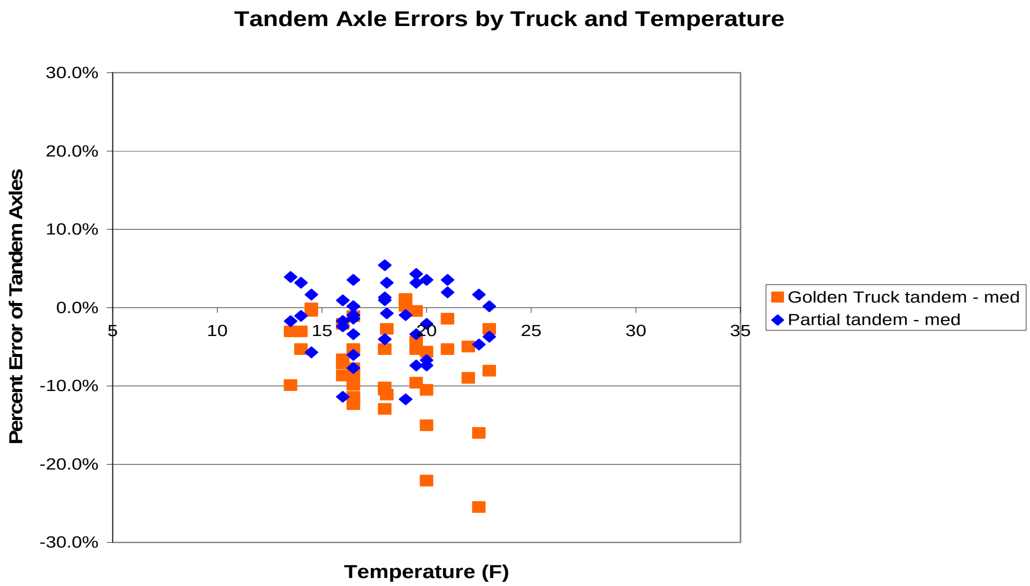

Figure 6-7 Pre-Validation Tandem Axle Error vs. Temperature by Group – 530200 – 28-Nov-2006

6.2 Speed-based Analysis

The speed groups were divided as follows: Low speed – 47 to 51 mph, Medium speed – 52 to 58 mph and High speed – 59+ mph.

Table 6-3 Pre-Validation Results by Speed Bin – 530200 – 28-Nov-2006

Element	95% Limit	Low Speed 47 to 51 mph	Medium Speed 52 to 58 mph	High Speed 59+ mph
Steering axles	±20 %	-14.8 ± 8.7%	-12.8 ± 5.2%	-11.0 ± 7.4%
Tandem axles	±15 %	-4.7 ± 14.3%	-3.9 ± 12.2%	-4.8 ± 9.5%
GVW	±10 %	-6.5 ± 11.4%	-5.6 ± 10%	-5.9 ± 5.2%
Speed	±1 mph	-0.2 ± 1.3 mph	-0.1 ± 1.2 mph	0.4 ± 1.4 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 underestimation of steering axle weights appears to decrease as the speed increases. For tandem weights and GVW, the underestimation appears to remain fairly consistent over the entire speed range. Variability in errors for all weights appears to be greatest at low speeds. GVW error spread decreases dramatically at the higher speeds, while tandem axle error spread appears to decrease at a lesser rate as speed increases.

Figure 6-8 illustrates the tendency of the equipment to underestimate GVW for both trucks at all speeds. The underestimation and variability in error appear to be greater for the Golden truck when compared with the Partial truck.

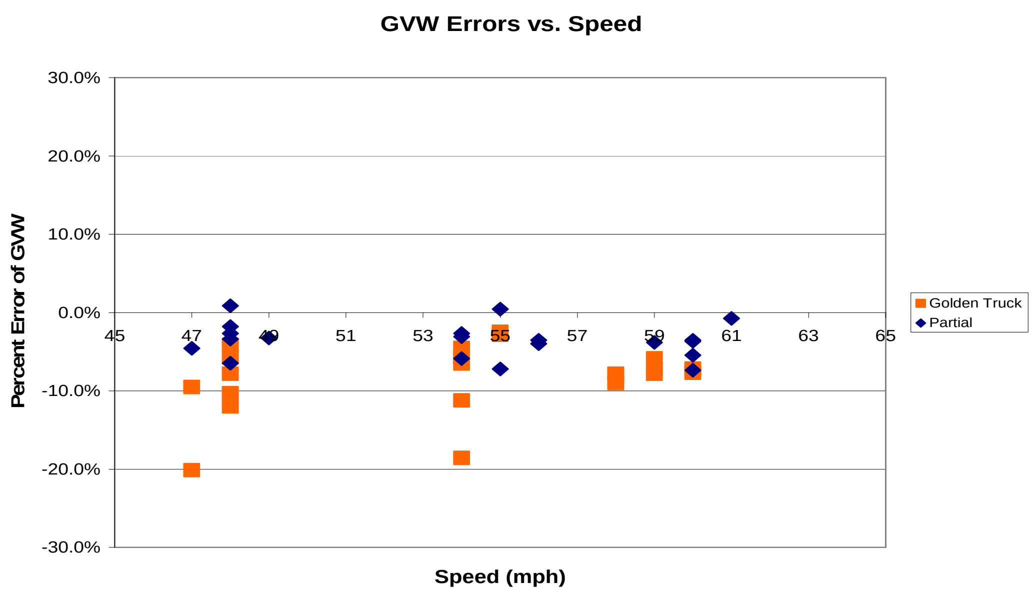

Figure 6-8 Pre-Validation GVW Percent Error vs. Speed Group - 530200 –28-Nov-2006

Figure 6-9 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.

From the figure, it appears that the equipment underestimates steering axle weights at all speeds. The underestimation appears to decrease slightly as speed increases. Variability in error appears to remain fairly constant over the entire speed range.

Figure 6-9 Pre-Validation Steering Axle Percent Error vs. Speed Group - 530200 – 28-Nov-2006

Figure 6-10 shows the differing tandem axle errors by truck over the speed range. From the figure, it can be seen that the equipment generally underestimates the tandem axle weights at all speeds. The underestimation and variability in error appears to be greater for the Golden truck when compared with the Partial truck.

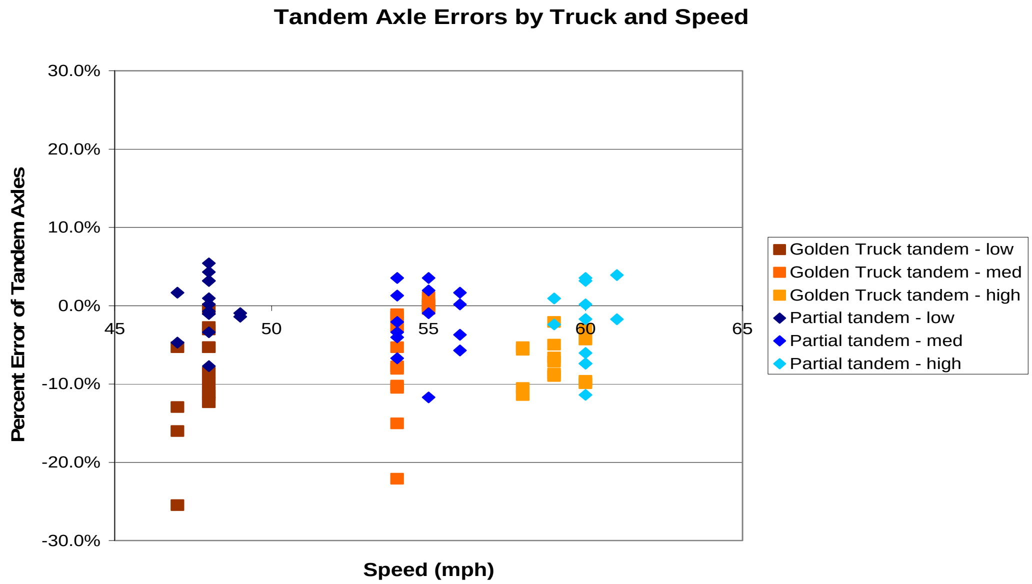

Figure 6-10 Pre-Validation Tandem Axle Percent Error by Truck and Speed – 530200 – 29-Nov-2006

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 100 trucks was collected at the site. The classification identification is to identify gross errors in classification, not to 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 1.0 percent unclassified vehicles. The single unclassified vehicle was a Class 8 Vehicle that was classified as a Class 15 because of a slightly light (3,400 lbs) fourth axle when the minimum axle weight for a Class 8 for the algorithm at this site is 3,500 lbs.

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 1. percent.

Table 6-4 Truck Misclassification Percentages for 530200 – 28-Nov-2006

Class	Percent Error	Class	Percent Error	Class	Percent Error
4	N/A	5	N/A	6	0
7	0				
8	50	9	0	10	0
11	0	12	0	13	0

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 – 28-Nov-2006

Class	Mean Difference	Class	Mean Difference	Class	Mean Difference
4	N/A	5	N/A	6	0
7	0				
8	-50	9	0	10	0
11	0	12	0	13	0

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. The large mean error rates for Class 8s in Table 6-5 reflect the small number of Class 8 vehicles (2 observed), one of which was classified as a type 15 due to a light fourth axle (3,400 lbs) which is 1,000 lighter than what is allowed for a Class 8 vehicle by the classification algorithm.

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%	95%	Pass
Axle Groups	± 15%	95%	Pass
GVW	± 10%	88%	Fail

6.5 Prior Validations

There has been no prior LTPP validation of this site.

7 Data Availability and Quality

As of November 28, 2006 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, years 1999, and 2002 through 2005 have a sufficient quantity to be considered complete years of classification data. Only years 2003 through 2005 have sufficient weight data. Review of the information provided for the 2004 site validation indicates that the criteria for research quality data were not met due to the variability of the single axle errors. There is insufficient information from the January 2006 validation to determine if the site was providing research quality at that time. As a result at least 5 additional years of research quality data are needed to meet the goal of a minimum of 5 years of research weight data.

Table 7-1 Amount of Traffic Data Available 530200 – 28-Nov-2006

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	194	7	Full Week	199	7	Full Week

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, Class 9s and Class 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 – 29-Nov-2006

Characteristic	Class 5	Class 9	Class 10
Percentage Overweights	0.0%	0.1%	3.2%
Percentage Underweights	N/A	0.4%	0.5%
Unloaded Peak		36,000 lbs	36,000 lbs
Loaded Peak		76,000 lbs	100,000 lbs
Peak	8,000 lbs		

The expected percentage of unclassified vehicles is 0.9. 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 Sheet 16.

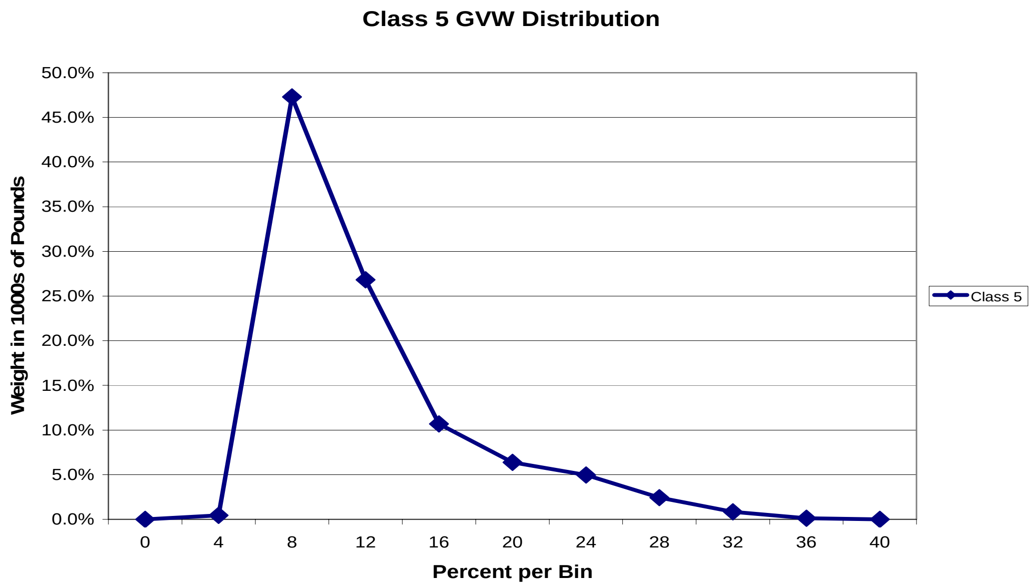

Figure 7-1 Expected GVW Distribution Class 5 – 530200 – 29-Nov-2006

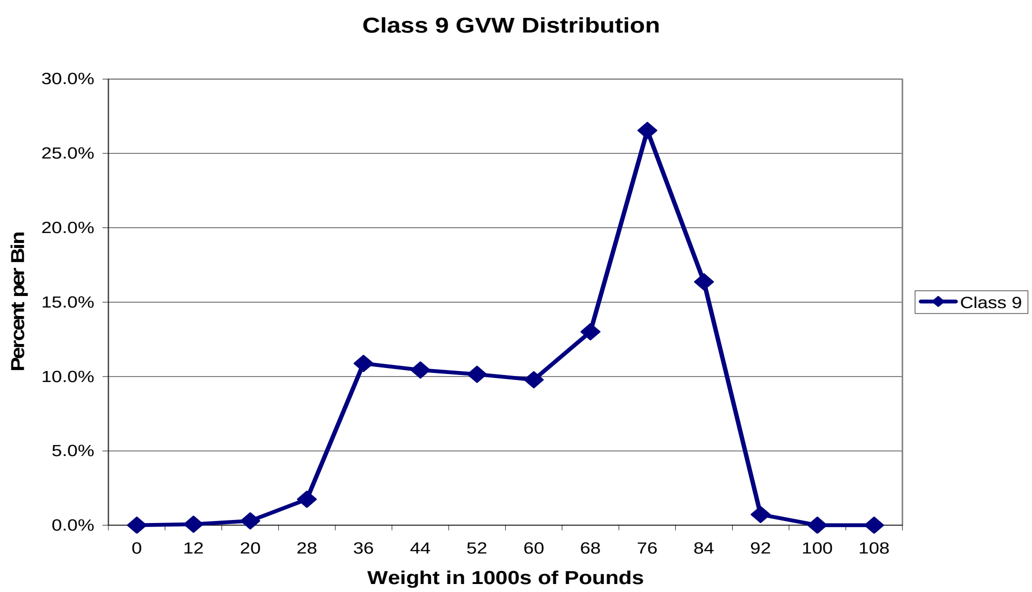

Figure 7-2 Expected GVW Distribution Class 9 – 530200 – 29-Nov-2006

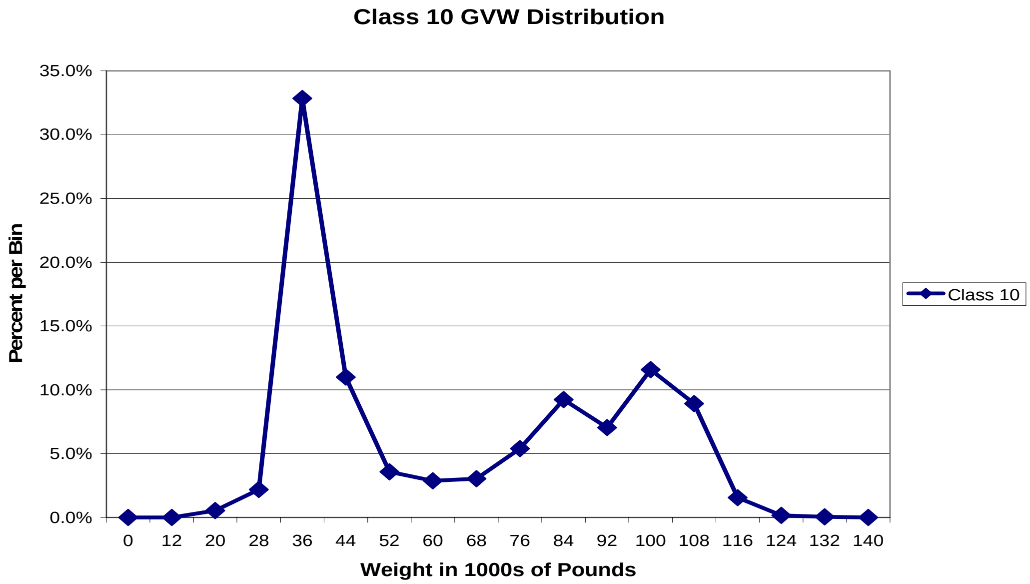

Figure 7-3 Expected GVW Distribution Class 10 – 530200 – 29-Nov-2006

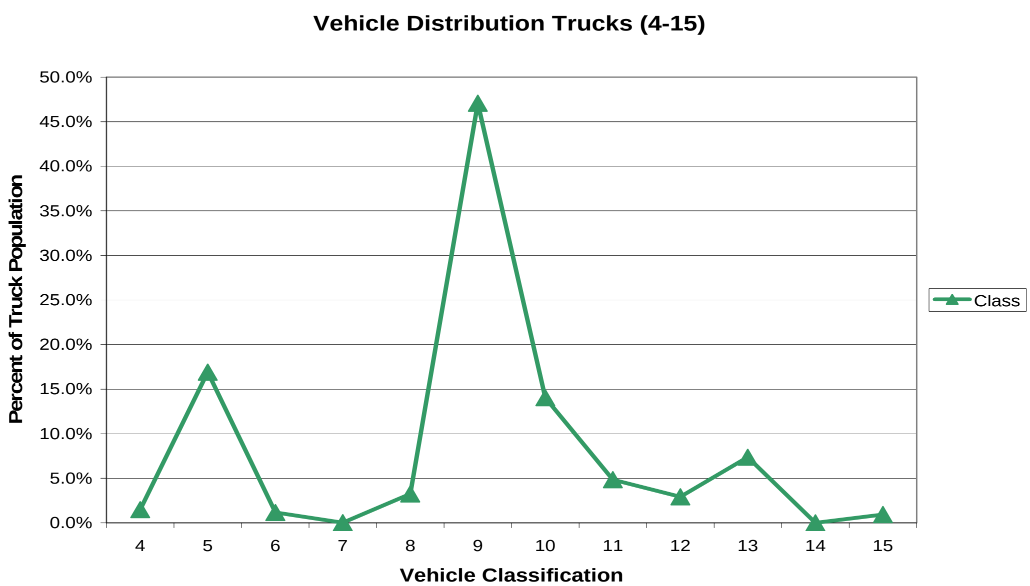

Figure 7-4 Expected Vehicle Distribution – 530200 – 29-Nov-2006

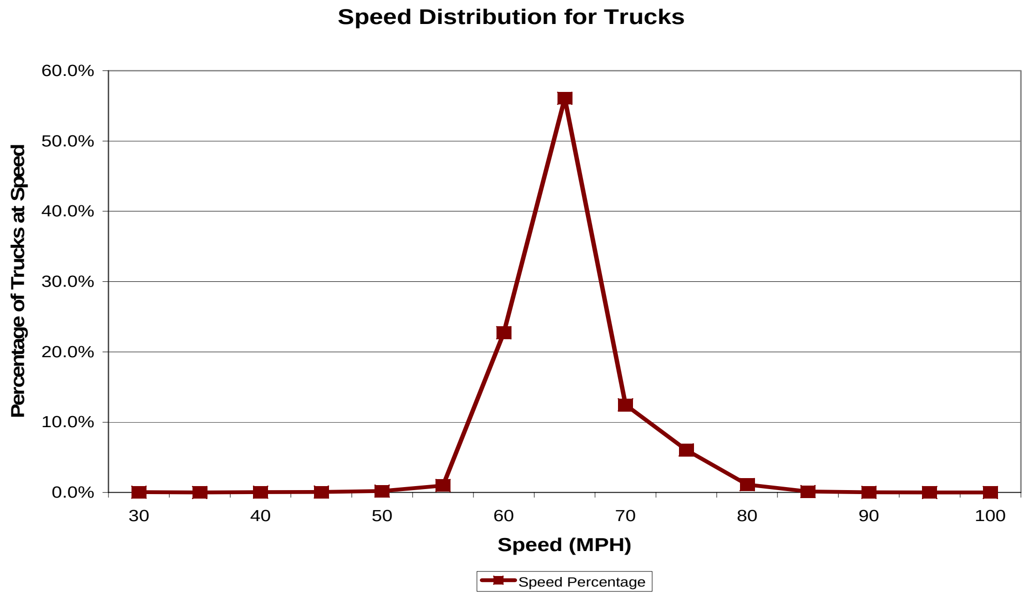

Figure 7-5 Expected Speed Distribution – 530200 – 29-Nov-2006

8 Data Sheets

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

Sheet 19 – Truck 1 – 3S2 loaded air suspension (4 pages)
Sheet 19 – Truck 2 – 3S2 partially loaded air suspension tractor, leaf suspension trailer (4 pages)

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

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

Calibration Iteration 1 Worksheets – (1 page)

Installed Classification Scheme – (1 page)

Final System Parameters – (1 page)

Truck Photographs – (6 pages)

9 Updated Handout Guide and Sheet 17

A copy of the handout has been included following page 35. 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

1. General Information

SITE ID: *530200*

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

VISIT DATE: *November 28, 2006*

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, 360-561-3409, 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: *November 28 and 29, 2006.*

TRUCK ROUTE CHECK: *Completed at Assessment, May, 2006.*

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 beginning at 9:00 a.m.*

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

WIM SITE LOCATION MAP: *See Figure 4.1*

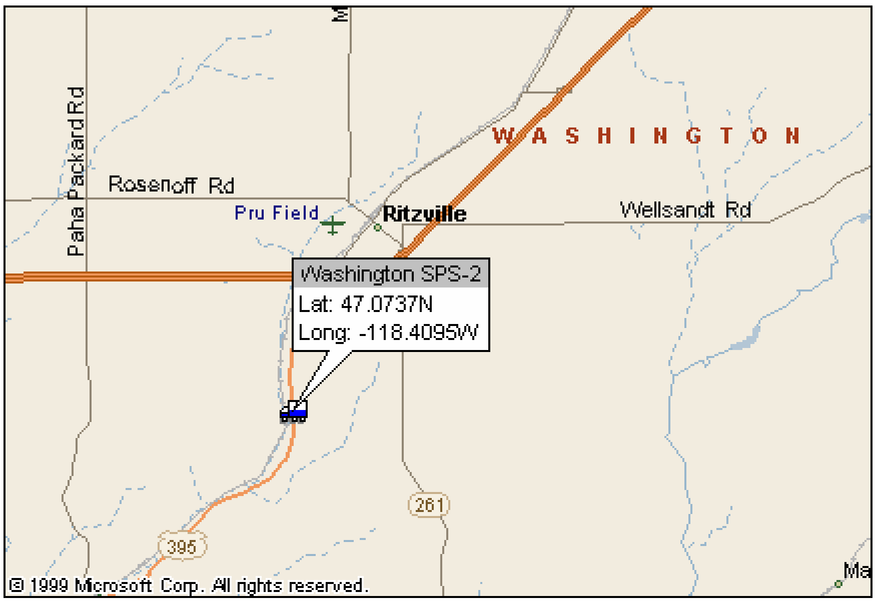

Figure 4-1 – Site 530200 in Washington

5. Truck Route Information

ROUTE RESTRICTIONS: *None*

SCALE LOCATION: *Petro Travel Center; I-90, exit 272; Spokane, Washington; GPS = N 47.2115°, W 118.2242.*

Figure 5-1 – Truck Scale Location for 530200 in Washington

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.

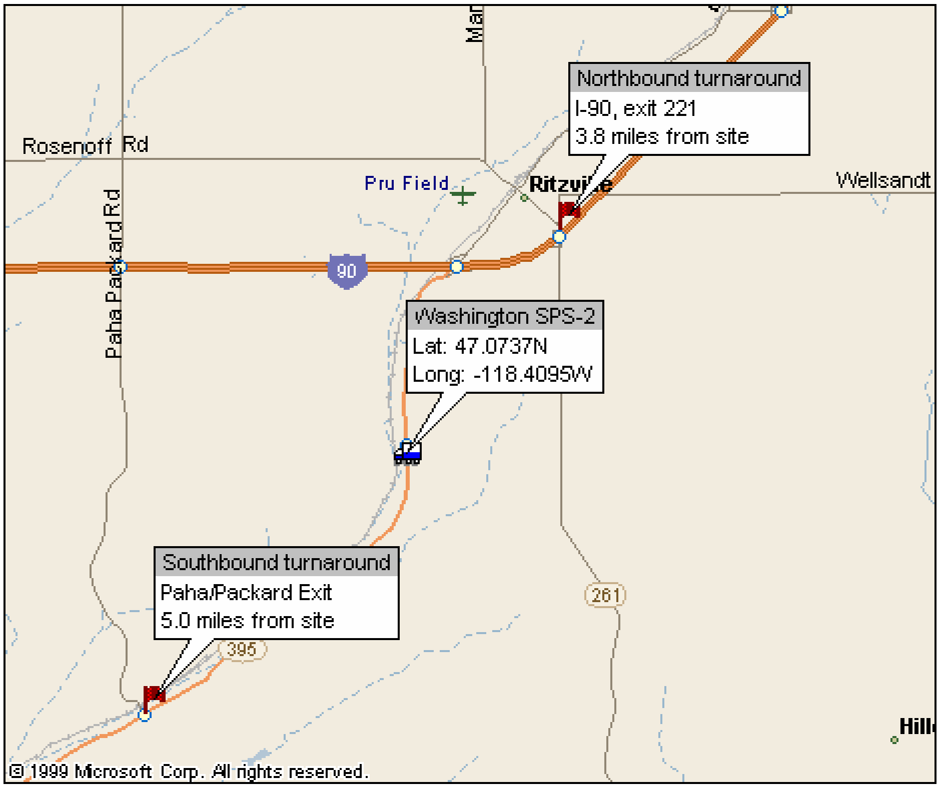

Figure 5-2 – Truck Route at 530200 in Washington

SB distance = 10.8 miles
NB distance = 8.4 miles

Total distance = 19.2 miles (21 minutes)

6. Sheet 17 – Washington (530200)

1.* ROUTE ____I-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 -		Shoulder -	
	1 – painted		1 – curb and gutter
	2 – physical barrier		2 – paved AC
	3 – grass		3 – paved PCC
	4 – none		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 / under ground / 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 _ Power_Service_Box_TO_17_53_2.83_0200_11_28_06.jpg __
Phone source _ Telephone_Service_Box_TO_17_53_2.83_0200_11_28_06.jpg
Cabinet exterior _ Cabinet_Exterior_Box_TO_17_53_2.83_0200_11_28_06.jpg __
Cabinet interior _ Cabinet_Interior_Box_TO_17_53_2.83_0200_11_28_06.jpg _
Weight sensors _ Leading_WIM_Sensor_TO_17_53_2.83_0200_11_28_06.jpg
_
Trailing_WIM_Sensor_Box_TO_17_53_2.83_0200_11_28_06.jpg
Classification sensors ____
Other sensors Leading_Loop_Sensor_Box_TO_17_53_2.83_0200_11_28_06.jpg
_ Trailing_Loop_Sensor_Box_TO_17_53_2.83_0200_11_28_06.jpg ______
Description ____Loop Sensors_________________________________
Downstream direction at sensors on LTPP lane
________ Downstream_TO_17_53_2.83_0200_11_28_06.jpg ______________
Upstream direction at sensors on LTPP lane
________ Upstream_TO_17_53_2.83_0200_11_28_06.jpg _________________

COMMENTS ______Site phone # - 509-659-4100_____________________________

____

________all amenities 2 miles north in Ritzville, including La Quinta Inn, McDonalds, Subway, Shell Gas ____

COMPLETED BY ____Dean J. Wolf__________________

PHONE _301-210-5105______ DATE COMPLETED _1_1_ /_2_8_ / _2_0_0_6__

Sketch of equipment layout

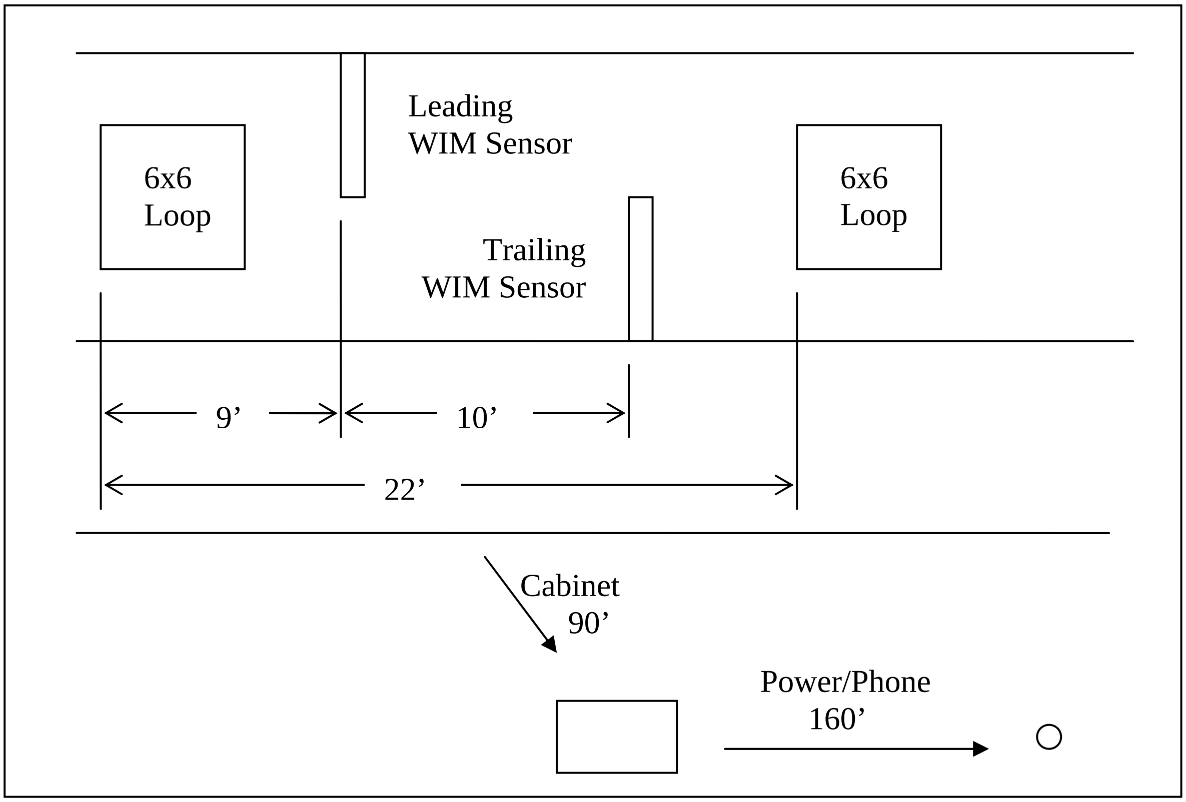

Figure 6-1 - Equipment Layout at SPS-2 site in Washington

Site Map

Figure 6-2 – Site Map for SPS-2 site in Washington

Figure 6-3 – Power_Service_Box_TO_17_53_2.83_0200_11_28_06.jpg

Figure 6-4 – Telephone_Box_TO_17_53_2.83_0200_11_28_06.jpg

Figure 6-5 – Cabinet_Exterior_TO_17_53_2.83_0200_11_28_06.jpg

Figure 6-6 – Cabinet_Interior_TO_17_53_2.83_0200_11_28_06.jpg

Figure 6-7 – Leading_WIM_Sensor_TO_17_53_2.83_0200_11_28_06.jpg

Figure 6-8 – Leading_Loop_Sensor_TO_17_53_2.83_0200_11_28_06.jpg

Figure 6-9 – Trailing_WIM_Sensor_TO_17_53_2.83_0200_11_28_06.jpg

Figure 6-10 – Trailing_Loop_Sensor_TO_17_53_2.83_0200_11_28_06.jpg

Figure 6-11 – Upstream_TO_17_53_2.83_0200_11_28_06.jpg

Figure 6-12 – Downstream_TO_17_53_2.83_0200_11_28_06.jpg

SHEET 18	STATE CODE [_5_3_]
LTPP MONITORED TRAFFIC DATA	SPS PROJECT ID [_0_2_0_0_]
WIM SITE COORDINATION	DATE: (mm/dd/yyyy) _1_1_ /_2_8_ / _2_0 _0_6_

Rev. 05/25/04

1. DATA PROCESSING –
   a. Down load –
      x State only
      □ LTPP read only
      □ LTPP download
      □ LTPP download and copy to state

   b. Data Review –
      x State per LTPP guidelines
      □ State – □ Weekly □ Twice a Month □ Monthly □ Quarterly
      □ LTPP

   c. Data submission –
      x State – □ Weekly □ Twice a month x Monthly □ Quarterly
      □ LTPP

2. EQUIPMENT –
   a. Purchase –
      x State
      □ LTPP

   b. Installation –
      □ Included with purchase
      □ Separate contract by State
      x State personnel
      □ LTPP contract

   c. Maintenance –
      □ Contract with purchase – Expiration Date _______
      □ Separate contract LTPP – Expiration Date _______
      □ Separate contract State – Expiration Date _______
      x State personnel

   d. Calibration –
      □ Vendor
      x State
      x LTPP

   e. Manuals and software control –
      x State
      □ LTPP

   f. Power –
      i. Type –
         □ Overhead
         x Underground
         □ Solar
      ii. Payment –
         x State
         □ LTPP
         □ N/A

g. Communication –
   i. Type –
      x Landline
      □ Cellular
      □ Other
   ii. Payment –
      x State
      □ LTPP
      □ N/A

3. PAVEMENT –
a. Type –
   x Portland Concrete Cement
   □ Asphalt Concrete

b. Allowable rehabilitation activities –
   □ Always new
   □ Replacement as needed
   □ Grinding and maintenance as needed
   x Maintenance only
   □ No remediation

c. Profiling Site Markings –
   □ Permanent
   x Temporary

4. ON SITE ACTIVITIES –
a. WIM Validation Check - advance notice required ___2____ □ days x weeks

b. Notice for straightedge and grinding check - 2 □ days x weeks
   i. On site lead –
      □ State
      x LTPP

   ii. Accept grinding –
      □ State
      x LTPP

c. Authorization to calibrate site –
      x State only
      □ LTPP

d. Calibration Routine –
      □ LTPP – □ Semi-annually □ Annually
      x State per LTPP protocol – □ Semi-annually □ Annually
      □ State other – ___________________________

e. Test Vehicles
   i. Trucks –
      1st – Air suspension 3S2 ☐ State x LTPP
      2nd – __3S2 __________ ☐ State x LTPP
      3rd – ________________ ☐ State ☐ LTPP
      4th – ________________ ☐ State ☐ LTPP
   ii. Loads – ☐ State x LTPP
   iii. Drivers – ☐ State x LTPP

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

   _______International Road Dynamics (IRD)_______________________________

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

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

i. Traffic Control Required – ☐Yes x No

j. Enforcement Coordination Required – ☐Yes x No

5. SITE SPECIFIC CONDITIONS –
   a. Funds and accountability –

   __N/A____

   b. Reports –

   __N/A____

   c. Other –

   __N/A____

   d. Special Conditions –

   __N/A____

SHEET 18	STATE CODE [_5_3_]
LTPP MONITORED TRAFFIC DATA	SPS PROJECT ID [_0_2_0_0_]
WIM SITE COORDINATION	DATE: (mm/dd/yyyy) _1_1_ / _2_8_ / _2_0_0_6_

Rev. 05/25/04

6. CONTACTS –

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

Name: ___TDO Ken Lakey_______ Phone: ___360-570-2374________

Agency: __WSDOT______________________________________

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: ________________________ Phone: _________________

Agency: ___LTPP_______________________________________

f. Traffic Control –

Name: ____TDO_Matt Heathscott___ Phone:_360-570-2390_________

Agency: ____

g. Enforcement Coordination –

Name: __N/A______________________ 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 [_P_C_7_] *STATE CODE [_5_3_] *SHRP SECTION ID [_0_2_0_0_]

SITE CALIBRATION INFORMATION

1. * DATE OF CALIBRATION (MONTH/DAY/YEAR) [_1_1_ / _2_8_ / _2_0_0_6_]

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

__2_0__ 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 ___ ___- 6 . 0 __ STANDARD DEVIATION __ 4 . 2 __
DYNAMIC AND STATIC SINGLE AXLES ___ __- 1 2 . 9__ STANDARD DEVIATION __ 3 . 6 __
DYNAMIC AND STATIC DOUBLE AXLES ___ ___ - 4 . 5__ STANDARD DEVIATION __ 5 . 9 __

8. ___3____ NUMBER OF SPEEDS AT WHICH CALIBRATION WAS PERFORMED

9. DEFINE THE SPEED RANGES USED (MPH) ______ _50 , 55 , 65 ___ ______ ______ ______ ______ ______
______ ______ ______ ______ ______ ______ ______ ______ ______ ______

10. CALIBRATION FACTOR (AT EXPECTED FREE FLOW SPEED) ___ ___ __6.500298___

11.** IS AUTO-CALIBRATION USED AT THIS SITE? (Y/N) _N___
IF YES, LIST AND DEFINE AUTO-CALIBRATION VALUE: ________________________________

CLASSIFIER TEST SPECIFICS***

12.*** METHOD FOR COLLECTING INDEPENDENT VOLUME MEASUREMENT BY VEHICLE CLASS:
___ VIDEO _x_ MANUAL ___ PARALLEL CLASSIFIERS

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

14. MEAN DIFFERENCE IN VOLUMES BY VEHICLES CLASSIFICATION:
*** FHWA CLASS 9 ____ __0 ____ FHWA CLASS ____ ____ ____ ____ ____
*** FHWA CLASS 8 ____ _-50____ FHWA CLASS ____ ____ ____ ____ ____
FHWA CLASS ____ ____ ____ ____ ____
FHWA CLASS ____ ____ ____ ____ ____
*** PERCENT "UNCLASSIFIED" VEHICLES: ____ ___1 . 0 ____

PERSON LEADING CALIBRATION EFFORT: _Dean J. Wolf, MACTEC Engineering & Consulting, Inc.___________
CONTACT INFORMATION: 301-210-5105 rev. November 9, 1999

SHEET 16 LTPP MONITORED TRAFFIC DATA SITE CALIBRATION SUMMARY	*STATE ASSIGNED ID [_P_C_7_] *STATE CODE [_5_3_] *SHRP SECTION ID [_0_2_0_0_]

SITE CALIBRATION INFORMATION

1. * DATE OF CALIBRATION (MONTH/DAY/YEAR) [_1_1_ / _2_9_ / _2_0_0_6_]

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

__2_0__ 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 ___ ___- 0 . 3 __ STANDARD DEVIATION __ 3 . 2 __
DYNAMIC AND STATIC SINGLE AXLES ___ ___- 3 . 7 __ STANDARD DEVIATION __ 5 . 7 __
DYNAMIC AND STATIC DOUBLE AXLES ___ ___ 1 . 2 __ STANDARD DEVIATION __ 4 . 2 __

8. ___3____ NUMBER OF SPEEDS AT WHICH CALIBRATION WAS PERFORMED

9. DEFINE THE SPEED RANGES USED (MPH) ______ _50 , 55 , 65 ___ ______ ______ ______ ______ ______
______ ______ ______ ______ ______ ______ ______ ______ ______ ______

10. CALIBRATION FACTOR (AT EXPECTED FREE FLOW SPEED) ___ ___ __6.690134___

11.** IS AUTO-CALIBRATION USED AT THIS SITE? (Y/N) _N___
IF YES, LIST AND DEFINE AUTO-CALIBRATION VALUE: ______________________________

CLASSIFIER TEST SPECIFICS***

12.*** METHOD FOR COLLECTING INDEPENDENT VOLUME MEASUREMENT BY VEHICLE CLASS:
___ VIDEO _x_ MANUAL ___ PARALLEL CLASSIFIERS

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

14. MEAN DIFFERENCE IN VOLUMES BY VEHICLES CLASSIFICATION:
*** FHWA CLASS 9 ____ _0___ ____ FHWA CLASS ____ ____ ____ ____ ____
*** FHWA CLASS 8 ____ _-50 _ ____ FHWA CLASS ____ ____ ____ ____ ____
FHWA CLASS ____ ____ ____ ____ ____
FHWA CLASS ____ ____ ____ ____ ____
*** PERCENT “UNCLASSIFIED” VEHICLES: ____ ___1 . 0 ____

PERSON LEADING CALIBRATION EFFORT: _Dean J. Wolf, MACTEC Engineering & Consulting, Inc.___________
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	1 1 / 2 8 / 2 0 0 6

Rev. 08/31/01

PART I.

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

AXLES - units - lbs / 100s lbs / kg

	3. Empty Truck Axle Weight	4.* Pre-Test Average Loaded Axle Weight	5.* Post-Test Average Loaded Axle Weight	6.* Measured D)irectly or C)alculated?
A		12970	12700	D / C
B		15570	15210	D / C
C		15570	15210	D / C
D		16480	16090	D / C
E		16480	16090	D / C
F				D / C

GVW (same units as axles)

7. a) Empty GVW ________

*b) Average Pre-Test Loaded weight 77060
*c) Post Test Loaded Weight 75310
*d) Difference Post Test – Pre-test 1750

GEOMETRY

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

9. a) * Make: Freightliner b) * Model: FLD-Day

10.* Trailer Load Distribution Description:

palletized boxes distributed evenly along trailer

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

b). Trailer Tare Weight (units): ________

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Sheet 19	* STATE_CODE	5 3
LTPP Traffic Data	* SPS PROJECT ID	0 2 0 0
*CALIBRATION TEST TRUCK # 1	* DATE	1 1 / 2 8 / 2 0 0 6

Rev. 08/31/01

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

A to B 12.8 B to C 4.3 C to D 32.5

D to E 4.1 E to F ______

Wheelbased (measured A to last) ______ Computed 53.7

13. *Kingpin Offset From Axle B (units) +0.6 (______)
(+ 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	leaf, 1 full, 1 taper
B	11R22.5	air
C	11R22.5	air
D	295/75R 22.5	air
E	295/75R 22.5	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	5 3
LTPP Traffic Data	* SPS PROJECT ID	0 2 0 0
*CALIBRATION TEST TRUCK # 1	* DATE	1 1 / 2 8 / 2 0 0 6

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		II -I		III -II		IV -III		V -IV		V	
V -VI		VI- VII		VII- VIII		VIII- IX		IX`		X	
										XI	
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		II -I		III -II		IV -III		V -IV		V	
V -VI		VI- VII		VII- VIII		VIII- IX		IX`		X	
										XI	
Avg.											

Sheet 19	* STATE_CODE 5 3
LTPP Traffic Data	* SPS PROJECT ID 0 2 0 0
*CALIBRATION TEST TRUCK # 1	* DATE 1 1 / 2 8 / 2 0 0 6

Rev. 08/31/01

Table 4 . Axle and GVW computations -

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

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	12920	15590	15590	16470	16470	–	77040
2	13000	15550	15550	16490	16490	–	77080
3	12980	15560	15560	16480	16480	–	77060
Average	12970	15570	15570	16480	16480	–	77060
post	12640	15270	15270	16260	16260		75700

Table 6. Raw data – Axle scales – pre - day 2

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	13020	15440	15440	16230	16230		76360
2	13020	15440	15440	16240	16240		76380
3	13020	15440	15440 ~~16230~~	16230	16230		76360
Average	13020	15440	15440	16230	16230		76370

Table 7. Raw data – Axle scales – post-test day 2

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	12620	15260	15260	16090	16090		75320
2	12720	15200	15200	16090	16090		75300
3	12760	15180	15180	16090	16090		75300
Average	12700	15210	15210	16090	16090		75310

Measured By _______________ Verified By _______________

Sheet 19	* STATE_CODE	5 3
LTPP Traffic Data	* SPS PROJECT ID	0 2 0 0
*CALIBRATION TEST TRUCK # 2	* DATE	1 1 / 2 8 / 2 0 0 6

Rev. 08/31/01

PART I.

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

AXLES - units / lbs / 100s lbs / kg

	3. Empty Truck Axle Weight	4.* Pre-Test Average Loaded Axle Weight	5.* Post-Test Average Loaded Axle Weight	6.* Measured D)irectly or C)alculated?
A		~~11260~~ 11410	10360	D / C
B		13430	13500	D / C
C		13430	13500	D / C
D		15030	15010	D / C
E		15030	15010	D / C
F				D / C

GVW (same units as axles)

7. a) Empty GVW ______________

*b) Average Pre-Test Loaded weight 68330
*c) Post Test Loaded Weight 67380
*d) Difference Post Test – Pre-test 950

GEOMETRY

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

9. a) * Make: Frietliner b) * Model: FLD - Day

10.* Trailer Load Distribution Description:

Concrete drain pipes distributed evenly along trailer

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

b). Trailer Tare Weight (units): ______________

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Sheet 19	* STATE_CODE	5 3
LTPP Traffic Data	* SPS PROJECT ID	0 2 0 0
*CALIBRATION TEST TRUCK # 2	* DATE	1 1 / 2 8 / 2 0 0 6

Rev. 08/31/01

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

A to B 12.8 B to C 4.2 C to D 30.1

D to E 4.1 E to F ______

Wheelbased (measured A to last) ______ Computed 51.3

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

SUSPENSION

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

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

Steering Axle	Axle B	Axle C	Axle D	Axle E

PART II

Table 1. Axle and GVW computations - pre-test

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

Sheet 19	* STATE_CODE	5 3
LTPP Traffic Data	* SPS PROJECT ID	0 2 0 0
*CALIBRATION TEST TRUCK # 2	* DATE	1 1 / 2 8 / 2 0 0 6

Rev. 08/31/01

Table 4 . Axle and GVW computations -

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

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	11360	13470	13470	15020	15020	—	68340
2	11420	13400	13400	15070	15070	—	68360
3	11460	13430	13430	14990	14990	—	68300
Average	11410	13430	13430	15030	15030	—	68330
POST	11060	13320	13320	14990	14990		67680

Table 6. Raw data – Axle scales – pre day 2

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10880	13590	13590	15000	15000		68060
2	10720	13620	13620	15040	15040		68040
3	10600	13710	13710	15020	15020		68060
Average	10730	13640	13640	15020	15020		68050

Table 7. Raw data – Axle scales – post-test - day 2

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10360	13500	13500	15010	15010		67380
2							
3							
Average	10360	13500	13500	15010	15010		67380

Measured By ____________ Verified By ____________

6420060018_SPSWIM_TO_17_53_2.83_0200_Truck_2_Sheet_19.doc

Sheet 20	* STATE_CODE 53
LTPP Traffic Data	*SPS PROJECT_ID 0200
Speed and Classification Checks * 1 of* ___	* DATE 11 / 28 / 2006

Rev. 08/31/2001….

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
62	13	~~64~~ 1173	61	13	61	9	1469	~~9~~ 62	9
65	13	1179	65	13	54	10	1516	~~59~~ 54	10
65	13	1192	65	13	65	9	1542	64	9
48	9	1197	48	9	62	9	1766	61	9
48	9	1208	48	9	62	13	1800	62	13
59	10	1228	59	10	64	13	1811	63	13
57	9	1235	57	9	58	11	1839	59	11
64	13	1241	64	13	60	8	1880	61	8
61	13	1252	61	13	63	9	1883	62	9
58	13	1258	58	13	65	9	1891	65	9
57	9	1282	57	9	62	9	1916	62	9
57	10	1284	56	10	64	9	1923	64	9
62	9	1302	62	9	64	9	1930	64	9
60	10	1307	61	10	65	9	2012	65	9
57	9	1317	57	9	64	13	2022	64	13
55	13	1318	56	13	54	9	2055	54	9
64	9	1340	64	9	67	9	2093	66	9
63	11	1344	64	11	65	9	2096	64	9
61	15	1366	61	8	57	5	2104	57	5
60	9	1392	60	9	59	13	2123	59	13
64	10	1399	63	10	63	9	2129	63	9
56	13	1414	58	13	59	9	2133	60	9
61	13	1420	61	13	65	9	2164	64	9
62	10	1429	62	10	64	9	2166	63	9
61	13	1454	59	13	60	9	2167	58	9

Five+ tee 3.6 2.4 3.5 3.4 6.7 4.9 5.2 .04

Recorded by [signature] Direction N Lane 1 Time from 9:30 to 12:22

Sheet 20	* STATE_CODE 53
LTPP Traffic Data	*SPS PROJECT_ID 0200
Speed and Classification Checks * 2 of* ___	* DATE 11 / 28 / 2006

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	2221	60	9	60	6	2698	59	6
60	9	2233	60	9	60	5	2709	60	5
60	9	2234	59	9	59	5	2717	59	5
60	9	2247	61	9	58	9	2754	58	9
49	9	2252	49	9	65	13	2764	64	13
60	9	2340	60	9	59	13	2814	59	13
62	9	2341	62	9	60	9	2820	61	9
61	13	2350	62	13	62	10	2823	62	10
64	12	2362	63	12	60	12	2835	~~12~~ 60	~~60~~ 12
55	9	2367	54	9	62	13	2840	~~13~~ 60	~~60~~ 13
55	13	2375	56	13	60	10	2843	~~10~~ 60	~~60~~ 10
59	9	2451	59	9	52	13	2853	53	13
59	9	2454	59	9	65	9	2860	64	9
62	9	2465	62	9	63	9	2863	64	9
62	9	2477	61	9	61	10	2873	60	10
64	9	2483	63	9	61	10	2880	63	10
61	5	2500	62	5	64	9	2901	64	9
62	9	2506	62	9	62	10	2903	61	10
64	6	2508	63	6	63	13	2916	62	13
60	9	2517	60	9	65	9	2917	64	9
62	9	2652	63	9	60	9	2925	60	9
67	5	2666	67	5	61	9	2927	61	9
62	9	2675	62	9	62	9	2950	62	9
62	9	2677	62	9	65	5	2957	65	5
66	9	2689	65	9	65	9	2958	65	9

7,

Recorded by ______ Direction N Lane 1 Time from 12:23 to 2:45

6420060018_SPSWIM_TO_17_53_2.83_Pre_Val_Sheet_20.doc

Sheet 20	* STATE_CODE 5 3
LTPP Traffic Data	*SPS PROJECT_ID 0 2 0 0
Speed and Classification Checks * 1 of* 2	* DATE 1 1 / 2 9 / 2 0 0 6

Rev. 08/31/2001....

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
	13	1637	60	13		8	1985		8
	9	1662	62	9		9	2007		9
—	9	1666	—	9		9	2008		9
	9	1669		9		9	2010		9
	9	1671		9		5	2029		5
	9	1679		9		9	2058		9
	13	1682		13		13	2064		13
	13	1686		13		10	2069		10
	13	1692		13		13	2082		13
	13	1773		13		9	2087		9
	9	1798		9		9	2095		9
	5	1834		5		9	2096		9
	13	1849		13		9	2102		9
	9	1867		9		9	2104		9
	5	1870		5		9	2109		9
	9	1876		9		9	2117		9
	10	1881		10		9	2118		9
	9	1884		9		9	2127		9
	9	1901		9		9	2128		9
	13	1926		13		9	2141		9
	9	1927		9		9	2142		9
	9	1929		9		13	2160		13
	9	1938		9		13	2162		13
	6	1939		6		9	2172		9
	9	1969		9		9	2183		9

Recorded by Ambie Direction N Lane 1 Time from 10:30 to 12:42

Sheet 20	* STATE_CODE 53
LTPP Traffic Data	*SPS PROJECT_ID 0200
Speed and Classification Checks * 2 of* 2	* DATE 11 / 29 / 2006

Rev. 08/31/2001….

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
	9	2190		9		5	2440		~~9~~ 5
	9	2191		9		9	2442		9
	13	2207		13		9	2444		9
	6	2209		6		5	2450		5
	9	2305		9		9	2454		9
	5	2320		5		9	2458		9
	9	2323		9		5	2465		5
	13	2329		~~9~~ 13		9	2467		9
	9	2330		9		6	2474		6
	9	2335		9		9	2476		9
	12	2346		12		9	2480		9
	9	2348		9		9	2485		9
	9	2365		9		9	2488		9
	9	2367		9		15	2490		8
	9	2403		9		13	2492		13
	9	2407		9		9	2496		9
	10	2409		10		9	2497		9
	5	2411		5		13	2520		13
	13	2412		13		6	2527		6
	9	2413		9		13	2529		13
	10	2414		10		10	2552		10
	12	2417		12		10	2562		10
	10	2424		10		9	2573		9
	5	2427		5		9	2575		9
	5	2428		5		9	2590		9

Recorded by Debbie Direction N Lane 1 Time from 12:47 to 1:47

6420060018_SPSWIM_TO_17_53_2.83_Post_Val_Sheet_20.doc

Truck-1-71060 -
Truck-2-68330 -

Sheet 21	* STATE_CODE 53
LTPP Traffic Data	*SPS PROJECT_ID 0200
WIM System Test Truck Records 1 of 3	* DATE 11 / 28 / 2006

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
14	48	1	1	9:37 14	1197	48	11.2	15.3	14.6	15.8	15.2	-	72.	12.9	4.3	33.1	4.1	
14	48	2	1	9:39:41	1208	47	9.5	13.8	13.8	13.4	16.3	-	66.8	12.9	4.3	30.3	4.0	
14.5	55	1	2	9:58:45	1323	55	10.9	15.6	15.2	16.8	15.8	-	74.2	13.0	4.3	33.0	4.1	
14.5	56	2	2	10:01:02	1334	55	9.8	13.6	13.6	13.1	15.2	-	65.3	13.0	4.3	30.4	4.0	
16	59	1	3	10:19:41	1444	59	11.6	15.6	14.6	14.8	15.1	-	71.9	13.1	4.3	33.0 ~~30.3~~	4.0	
16	59	2	3	10:23:57	1470	60	9.2	13.6	13.4	12.7	16.6	-	65.4	13.0	4.3	30.5	4.0	
18	47	1	4	10:40:22	1560	47	11.5	14.8	14.4	14.5	14.0		69.1	12.9	4.3	32.9	4.1	
18	48	2	4	10:44:04	1582	48	10.1	13.8	14.4	13.7	16.6		68.6	13.1	4.3	30.5	4.0	
19	55	1	5	11:01:07	1671	55	10.6	15.7	15.2	16.7	16.4		74.5	12.9	4.3	32.8	4.1	
19	55	2	5	11:04:27	1696	55	10.1	13.6	12.9	11.9	14.6		63.1	12.9	4.3	30.5	4.0	
19.5	60	1	6	11:21:29	1816	60	11.4	15.0	14.5	14.7	14.9		70.5	12.9	4.3	33.1	4.0	
19.5	60	2	6	11:24:30	1829	60	10.2	13.6	14.0	12.2	15.6		65.6	13.0	4.3	30.5	4.0	
19.5	48	1	7	11:41:53	1935	48	11.4	15.6	15.1	15.7	15.3		73.2	13.0	4.3	32.9	4.1	
19.5	48	2	7	11:44:47	1949	49	8.9 ~~10.2~~	14.1 ~~12.0~~	13.8 ~~11~~	13.1	15.9		65.7	12.9	4.3	30.3	4.0	
20	54	1	8	12:02:07	2055	54	10.6	13.3	12.9	12.6	12.9		62.2	12.8	4.3	32.7	4.1	?
20	54	2	8	12:05:17	2074	54	9.9	13.4	12.8	12.8	15.2		64.0	12.9	4.3	30.3	4.1	

Recorded by Ambic

Checked by [signature]

Sheet 21	* STATE_CODE 53
LTPP Traffic Data	*SPS PROJECT_ID 0200
WIM System Test Truck Records 2 of 3	* DATE 11 / 28 / 2006

Rev. 08/31/2001

State Temp water ✱ 40

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53

53

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
20	58	1	9	12:21:58	2167	60	12.1	14.9	14.2	13.9	15.4		70.4	12.9	4.3	33.1	4.0	
20	60	2	9	12:25:16	2190	60	10.0	14.0	13.7	12.6	15.2		65.5	12.9	4.2	30.6	4.1	
18.1	48	1	10	12:42:09	2287	48	11.4	15.4	14.6	14.6	14.5		70.4	12.9	4.3	33.2	4.1	
18.1	48	2	10	12:45:29	2302	47	8.8	13.5	14.1	13.3	16.5		66.2	12.8	4.2	30.1	4.0	
16.5	54	1	11	13:02:20	2387	54	11.4	15.4	15.1	15.1	15.1		72.0	12.8	4.2	32.8	4.1	
16.5	54	2	11	13:05:39	2400	55	9.6	14.1	13.6	13.2	15.8		66.2	12.9	4.3	30.5	4.0	
16.5	58	1	12	13:22:21	2489	59	11.3	15.0	14.2	14.6	14.4		69.5	12.8	4.3	33.1	4.1	
16.5	60	2	12	13:27:01	2517	60	9.3	13.3	13.5	12.6	15.6		64.3	12.8	4.2	30.3	4.0	
16.5	48	1	13	13:43:33	2608	47	10.7	14.2	13.6	14.0	14.7		67.2	12.8	4.3	32.9	4.0	
16.5	48	2	13	13:47:01	2633	47	9.1	13.7	13.1	12.4	15.3		63.6	12.9	4.3	30.4	4.1	
21	54	1	14	14:03:45	2740	54	11.5	15.4	15.0	15.1	15.9		72.9	12.9	4.3	32.9	4.0	
21	55	2	14	14:06:49	2759	54	10.0	14.0	13.7	13.6	17.0		68.3	13.1	4.3	30.6	4.1	
13.5	60	1	15	14:23:48	2867	60	11.5	15.3	14.6	14.3	15.2		70.9	12.9	4.3	33.0	4.0	
13.5	60	2	15	14:26:44	2882	62	10.2	14.2	13.6	12.8	16.7		67.5	13.1	4.2	30.6	4.1	
22.5	47	1	16	14:43:17	2989	47	10.7	13.2	12.7	12.4	12.0		61.0	12.9	4.4	33.2	4.1	
22.5	47	2	16	14:47:45	3015	47	9.2	13.7	13.5	13.5	15.1		64.9	13.0	4.3	30.4	4.1	

Recorded by Ambie

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6420060018_SPSWIM_TO_17_53_2.83_Pre_Val_Sheet_21.doc

Sheet 21	* STATE_CODE 53
LTPP Traffic Data	*SPS PROJECT_ID 0200
WIM System Test Truck Records 3 of 3	* DATE 11 / 28 / 2006

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
23	54	1	17	15:04:00	3104	54	11.3	15.4	14.6	15.1	15.0		71.4	12.9	4.4	33.1	4.1	
23	56	2	17	15:07:39	3126	55	9.9	13.0	13.8	13.6	15.3		65.6	12.9	4.2	30.3	4.0	
22	59	1	18	15:24:15	3240	59	11.4	14.9	14.4	14.4	15.4		70.4	12.8	4.3	32.9	4.0	
16.5	49	2	18	15:48:00	3383	49	9.7	13.7	13.3	13.4	16.2		65.8	12.9	4.3	30.3	4.0	
16.5	48	1	19	15:44:29	3353	48	11.3	14.6	13.6	14.2	14.8		68.5	13.0	4.3	33.0	4.1	
18.0	54	1	20	16:04:10	3482	54	10.9	14.2	13.4	14.4	15.0		67.8	12.8	4.3	32.9	4.1	
18.0	54	2	19	16:08:02	3505	54	10.0	13.6	13.5	13.5	15.3		65.9	12.9	4.3	30.3	4.1	
16	59	1	21	16:25:05	3615	59	11.7	14.9	13.9	15.0	15.4		70.8	13.0	4.3	33.1	4.1	
16	60	2	20	16:27:40	3625	60	10.0	13.6	12.7	11.8	14.8		63.0	13.0	4.3	30.5	4.1	

Recorded by ____________ Checked by ____________

6420060018_SPSWIM_TO_17_53_2.83_Pre_Val_Sheet_21.doc

6.825313
~~6.826667~~
Truck 2 - 68050 - 10730

Sheet 21	* STATE_CODE 53
LTPP Traffic Data	*SPS PROJECT_ID 0200
WIM System Test Truck Records of	* DATE 11 / 29 / 2006

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
16	48	1	1	9:31:51	1133	48	12.5	15.6	15.1	15.9	15.1	-	74.2	12.9	4.3	33.0	4.1	
16	46	2	1	9:33:54	1145	46	11.0	14.6	14.9	14.6	17.6	-	72.7	13.0	4.3	30.8	4.0	
20	54	1	2	9:52:28	1256	54	13.2	15.5	14.9	16.0	16.2	-	75.8	12.9	4.3	32.7	4.1	
20	53	2	2	9:54:28	1271	53	11.1	14.4	14.6	14.3	16.5	-	70.9	13.0	4.3	30.7	4.0	
22	60	1	3	10:12:27	1367	60	12.5	16.0	15.9	15.9	16.6	-	76.8	12.9	4.3	33.0	4.1	
22	61	2	3	10:14:42	1383	61	11.1	14.9	14.6	14.1	16.9	-	71.6	13.1	4.3	30.9	4.1	
23	47	1	4	10:32:38	1476	47	12.3	15.7	15.4	16.0	15.3	-	74.6	13.0	4.3	33.1	4.1	
23	46	2	4	10:34:52	1482	46	11.4	14.8	14.9	14.9	16.5	-	72.5	13.1	4.3	30.9	4.1	
25	54	1	5	10:52:46	1574	54	11.9	16.1	15.6	15.6	16.2	-	75.4	12.9	4.3	32.8	4.0	
25	60	2	5	10:54:54	1585	60	10.4	14.8	14.6	13.3	15.8	-	69.0	13.1	4.3	30.9	4.1	
27	59	1	6	11:13:08	1699	59	12.2	15.8	15.6	16.8	15.5	-	76.0	12.9	4.4	33.0	4.1	
27	63	2	6	11:14:59	1710	63	9.4	14.2	14.8	13.5	15.3	-	67.2	12.8	4.3	30.7	4.1	
27	48	1	7	11:32:49	1788	48	11.6	15.6	15.3	15.1	14.9	-	72.6	12.9	4.3	32.9	4.1	
27	50	2	7	11:35:06	1800	50	10.9	14.1	14.5	14.5	16.7	-	70.7	13.0	4.3	30.8	4.0	
29	55	1	8	11:52:39	1889	55	12.1	15.8	15.2	16.5	16.3	-	75.8	12.9	4.3	33.0	4.1	
29	57	2	8	11:54:37	1903	57	10.9	14.7	13.8	12.8	15.8	-	68	13.0	4.3	30.7	4.1	

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6.825313
~~6.826667~~

Truck-2-68050-10730

Sheet 21	* STATE_CODE 53
LTPP Traffic Data	*SPS PROJECT_ID 0200
WIM System Test Truck Records ___ of ___	* DATE 11/29/2006

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
16	48	1	1	9:31:57	1133	48	12.5	15.6	15.1	15.9	15.1	-	74.2	12.9	4.3	33.0	4.1	
16	46	2	1	9:33:54	1145	46	11.0	14.6	14.9	14.6	17.6	-	72.7	13.0	4.3	30.8	4.0	
20	54	1	2	9:52:28	1256	54	13.2	15.5	14.9	16.0	16.2	-	75.8	12.9	4.3	32.7	4.1	
20	53	2	2	9:54:28	1271	53	11.1	14.4	14.6	14.3	16.5	-	70.9	13.0	4.3	30.7	4.0	
22	60	1	3	10:12:27	1367	60	12.5	16.0	15.9	15.9	16.6	-	76.8	12.9	4.3	33.0	4.1	
22	61	2	3	10:14:42	1383	61	11.1	14.9	14.6	14.1	16.9	-	71.6	13.1	4.3	30.9	4.1	
23	47	1	4	10:32:38	1476	47	12.3	15.7	15.4	16.0	15.3	-	74.6	13.0	4.3	33.1	4.1	
23	46	2	4	10:34:32	1482	46	11.4	14.8	14.9	14.9	16.5	-	72.5	13.1	4.3	30.9	4.1	
25	54	1	5	10:52:46	1574	54	11.9	16.1	15.6	15.6	16.2	-	75.4	12.9	4.3	32.8	4.0	
25	60	2	5	10:54:54	1585	60	10.4	14.8	14.6	13.3	15.8	-	69.0	13.1	4.3	30.9	4.1	
27	59	1	6	11:13:08	1699	59	12.2	15.8	15.6	16.8	15.5	-	76.0	12.9	4.4	33.0	~~3~~4.1	
27	63	2	6	11:14:59	1710	63	9.4	14.2	14.8	13.5	15.3	-	67.2	12.8	4.3	30.7	4.1	
27	48	1	7	11:32:49	1788	48	11.6	15.6	15.3	15.1	14.9	-	72.6	12.9	4.3	32.9	4.1	
27	50	2	7	11:35:06	1800	50	10.9	14.1	14.5	14.5	16.7	-	70.7	13.0	4.3	30.8	4.0	
29	55	1	8	11:52:39	1889	55	12.1	15.8	15.2	16.5	16.3	-	75.8	12.9	4.3	33.0	~~3~~4.1	
29	57	2	8	11:54:37	1903	57	10.9	14.7	13.8	12.8	15.8	-	68	13.0	4.3	30.7	4.1	

Recorded by [signature]

Checked by [signature]

1-19

Sheet 21	* STATE_CODE 53
LTPP Traffic Data	*SPS PROJECT_ID 0200
WIM System Test Truck Records 2 of 3	* DATE 11 / 29 / 2006

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
29	59	1	9	12:12:13	2014	59	12.4	15.9	15.5	16.6	15.3	—	75.7	12.9	4.3	32.9	4.1	
29	63	2	9	12:16:19	2035	63	9.4	13.6	13.8	13.1	15.5		65.5	13.0	4.3	30.9	4.1	
29	47	1	10	12:32:07	2128	47	11.4	15.8	15.0	15.5	15.1		72.8	12.8	4.3	33.1	4.1	
29	50	2	10	12:35:31	2142	50	10.2	13.7	14.2	13.6	15.5		67.2	13.0	4.2	30.7	4.0	
29	54	1	11	12:52:19	2243	54	12.4	15.8	15.8	16.4	16.2		76.5	12.9	4.3	32.9	4.1	
29	56	2	11	12:54:56	2257	56	9.4	13.4	14.0	14.0	15.4		66.2	12.9	4.3	30.9	4.1	
29	59	1	12	13:11:35	2348	59	11.2	16.4	15.5	16.0	15.5		74.6	12.9	4.3	33.0	4.1	
29	63	2	12	13:13:59	2367	63	10.6	14.1	14.2	13.4	16.6		68.8	13.0	4.3	31.0	4.0	
29	49	1	13	13:31:48	2485	49	12.4	15.3	15.2	15.9	14.8		73.6	12.9	4.3	33.0	4.1	
29	50	2	13	13:33:52	2497	50	10.2	14.8	14.7	13.8	16.9		70.3	13.0	4.3	30.9	4.1	
29	54	1	14	13:51:15	2624	54	11.5	16.2	15.6	17.0	16.5		76.8	12.9	4.3	33.2	4.1	
29	57	2	14	13:53:17	2630	57	10.7	15.2	14.8	13.8	16.7		71.2	13.1	4.3	30.9	4.1	
29	59	1	15	14:10:41	2729	59	11.8	15.9	15.4	15.8	15.5		74.3	12.9	4.3	33.0	4.1	
29	63	2	15	14:12:23	2747	63	9.2	13.9	13.7	13.5	14.9		65.1	12.9	4.3	30.7	4.1	
27	48	1	16	14:29:59	2856	48	11.5	15.7	15.1	15.8	16.2		74.3	12.9	4.3	33.0	4.1	
27	50	2	16	14:32:01	2865	50	10.0	13.9	14.2	14.3	15.5		67.9	13.0	4.3	30.8	4.1	

Recorded by [signature]   Checked by [signature]

Sheet 21	* STATE_CODE 53
LTPP Traffic Data	*SPS PROJECT_ID 0200
WIM System Test Truck Records 3 of 3	* DATE 11 / 29 / 2006

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
27	55	1	17	14:49:08	2972	55	13.1	15.8	15.0	15.8	15.1		74.9	12.9	4.4	33.0	4.1	
27	57	2	17	14:51:33	2995	57	10.9	14.9	14.3	14.3	16.3		70.8	13.1	4.3	31.0	4.1	
25	59	1	18	15:08:22	3096	59	13.0	15.8	15.3	14.3	15.3		73.6	12.8	4.4	33.0	4.1	
25	63	2	18	15:10:29	3113	63	10.0	13.4	14.0	12.3	15.6		65.3	13.1	4.2	30.8	4.1	
25	47	1	19	15:28:13	3233	47	12.4	15.1	15.3	15.5	14.8		73.1	12.9	4.3	32.9	4.1	
25	49	2	19	15:30:18	3245	49	10.0	14.1	14.5	14.3	16.9		69.8	12.9	4.2	30.7	4.0	
25	55	1	20	15:50:44	3399	55	11.6	16.3	15.7	16.4	15.8		75.8	12.9	4.3	32.7	4.0	
25	57	2	20	15:52:28	3408	57	10.3	14.5	14.1	13.1	17.1		69.0	12.9	4.3	30.9	4.0	

Recorded by ____________ Checked by ____________

3.11.2. Iteration 1 Worksheet

Date 11/29/06

Beginning factors:

Speed Point (mph)	Name	Value
Overall		
Front Axle		
1 – (80 kph)	50 mph	6.500298
2 – (100 kph)	63 mph	6.500298
3 – (120 kph)	75 mph	6.500298
4 – ( )	dynamic	91
5 – ( )		

Errors (Pre-Validation):

	Speed Point 1 (80)	Speed Point 2 ( )	Speed Point 3 (100)	Speed Point 4 ( )	Speed Point 5 (120)
F/A	-15 %		-13 %		-10 %
Tandem	-5 %		-3 %		-5 %
GVW	-5 %		-5 %		-5 %

Adjustments:

	Raise	Lower	Percentage
Overall	☐	☐	
Front Axle	☑	☐	8.4 %
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	Value
Overall		
Front Axle		
1 – (80 kph)	50 mph	6.690134
2 – (180 kph)	63 mph	6.690134
3 – (120 kph)	75 mph	6.690134
4 – ( )	dynamic	99
5 – ( )		

Task Leader Initials: DJW

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									
2	Passenger Car	2	6.00-10.10								0.10-3.00	
3	Other (Pickup/Van)	2	10.11-23.09								1.00-7.99	
4	Bus	2	23.10-40.00								1.00-7.99	
5	2D Single Unit	2	6.00-23.09								12.00 >	
2	Car w/ 1 Axle Trailer	3	6.00-10.10	6.00-25.00							8.00 >	2.5
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							1.00-11.99	
5	2D w/ 1 Axle Trailer	3	6.00-23.09	6.30-30.00							20.00 >	
6	3 Axle Single Unit	3	6.00-23.09	2.50-6.29							12.00-19.99	2.5
8	Semi, 2S1	3	6.00-23.09	11.00-45.00							12.00 >	3.5
2	Car w/ 2 Axle Trailer	4	6.00-10.10	6.00-30.00	1.00-11.99						20.00 >	3.5
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						1.00-11.99	
7	4 Axle Single Unit	4	6.00-23.09	2.50-6.29	2.50-12.99						12.00-19.99	2.5
8	Semi, 3S1	4	6.00-26.00	2.50-6.29	13.00-50.00						12.00 >	3.5
8	Semi, 2S2	4	6.00-26.00	8.00-45.00	2.50-20.00						20.00 >	5.0
3	Other w/ 3 Axle Trailer	5	10.11-23.09	6.00-25.00	1.00-11.99	1.00-11.99					20.00 >	3.5
5	2D w/ 3 Axle Trailer	5	6.00-23.09	6.30-35.00	1.00-25.00	1.00-11.99					1.00-11.99	
7	5 Axle Single Unit	5	6.00-23.09	2.50-6.29	2.50-6.29	2.50-6.30					12.00-19.99	2.5
9	Semi, 3S2	5	6.00-30.00	2.50-6.29	6.30-65.00	2.50-11.99					12.00 >	3.5
9	Truck+FullTrailer (3-2)	5	6.00-30.00	2.50-6.29	6.30-50.00	12.00-27.00					20.00 >	5.0
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 >	3.5
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

Calibration factor for sensor #2:

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

Dynamic: 99

TEST TRUCK PHOTOS FOR SPS WIM FIELD VALIDATION

STATE: Washington

SHRP ID: 530200

Figures

Figure 1 – Truck_1_Tractor_TO_17_53_2.83_0200.jpg

Figure 2 – Truck_1_Trailer_TO_17_53_2.83_0200.jpg

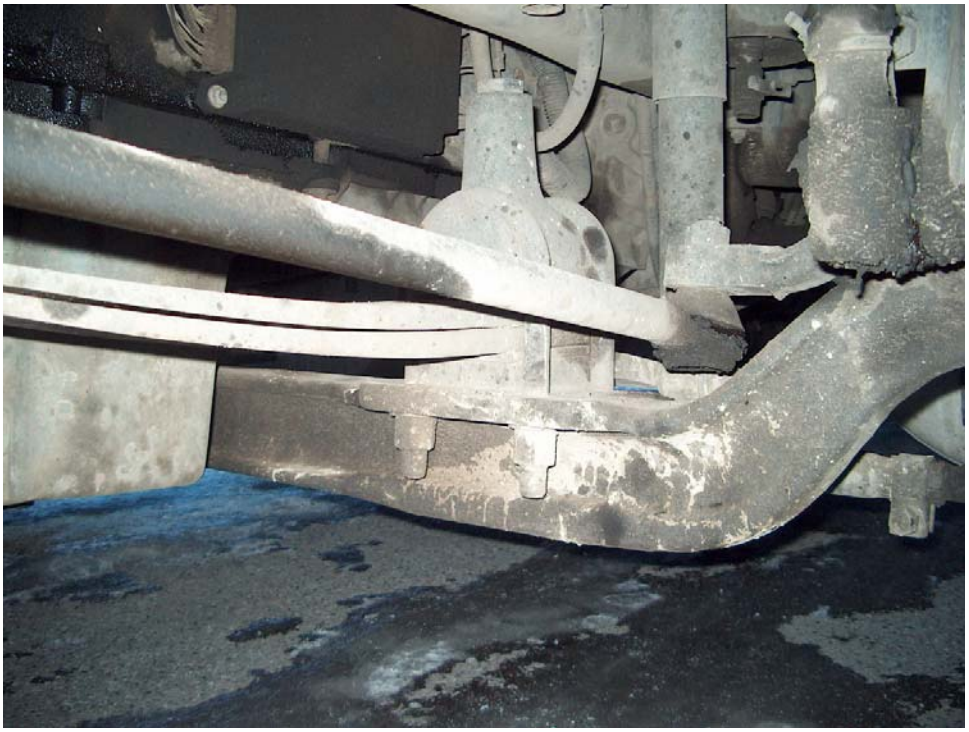

Figure 3 – Truck_1_Suspension_1_TO_17_53_2.83_0200.jpg

Figure 4 – Truck_1_Suspension_2_TO_17_53_2.83_0200.jpg

Figure 5 – Truck_1_Suspension_3_TO_17_53_2.83_0200.jpg

Figure 6 – Truck_2_Tractor_TO_17_53_2.83_0200.jpg

Figure 7 – Truck_2_Trailer_TO_17_53_2.83_0200.jpg

Figure 8 – Truck_2_Suspension_1_TO_17_53_2.83_0200.jpg

Figure 9 – Truck_2_Suspension_2_TO_17_53_2.83_0200.jpg

Figure 10 – Truck_2_Suspension_3_TO_17_53_2.83_0200.jpg