Validation Report

Virginia, SPS-1
Task Order 15, CLIN 2
December 2 thru 4, 2008

List of Tables

List of Figures

1 Executive Summary

A visit was made to the Virginia 0100 on December 2 thru 4, 2008 for the purposes of conducting a validation of the WIM system located on US 29 at approximately 8 miles north of Danville on the US 29 Bypass. The SPS-1 is located in the righthand, southbound lane of a four-lane divided facility. The posted speed limit at this location is 65 mph. The LTPP lane is one of 2 lanes instrumented at this site. This report discusses the validation of the LTPP lane only. The validation procedures were in accordance with LTPP's SPS WIM Data Collection Guide dated August 21, 2001.

This site is located approximately 500 feet downstream from a previous location. This is the third validation visit to this location. The site was installed on November 1 to 4, 2006 by International Road Dynamics Inc..

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

The site is instrumented with bending plate sensors and iSINC electronics. It is installed in portland cement concrete, 424 feet long. The WIM sensors are 313 feet from the asphalt to concrete pavement transition. The LTPP Lane is identified as Lane number 1 by the controller.

The validation used the following trucks:

1) 5-axle tractor-trailer with a tractor having an air suspension and a trailer with a standard rear tandem and an air suspension loaded to 76,510 lbs., the "golden" truck.
2) 5-axle tractor semi-trailer with a tractor having an air suspension and a trailer with a standard rear tandem and an air suspension loaded to 65,250 lbs., the "partial" truck.

The validation speeds ranged from 52 to 64 miles per hour. The pavement temperatures ranged from 29 to 54 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 – 510100 – 04-Dec-2008

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	1.5 ± 5.0%	Pass
Tandem axles	±15 percent	1.2 ± 5.8%	Pass
GVW	±10 percent	1.0 ± 3.2%	Pass
Axle spacing	± 0.5 ft [150mm]	0.0 ± 0.1 ft	Pass

Prepared: ea *Checked: bko*

The pavement condition appeared to be satisfactory for conducting a performance evaluation. There were no distresses observed that would influence truck motions

significantly. A visual survey determined that there is no discernable bouncing or avoidance by trucks in the sensor area. Profile data was collected by the Regional Support Contractor on October 23, 2008. The upper threshold of the WIM index was not exceeded.

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

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

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

Prepared: ea *Checked: bko*

Upon our arrival at the site, we found the system parameters were not the same as we left them at the conclusion of our last validation on July 25, 2007. The sensors were remotely calibrated using the front axle values December 1, 2008 after equipment maintenance.

This site needs three years of data to meet the goal of five years of research quality data assuming that a sufficient quantity of data exists for 2008.

2 Corrective Actions Recommended

It was discovered on December 02, 2008 that the fastening bolts for both weigh pads were exposed. The bolts need to be cleaned and the silicon replaced around them before winter.

During the Post-Validation we were required to reset the system due to a "Class 14 downstream loop only" problem. IRD was contacted and recommended the reset. As this has not been the first time we have seen this problem, the Regions should be advised to review the number of Class 14 errors found within the data submitted to see if this is a significant problem.

3 Post Calibration Analysis

This final analysis is based on test runs conducted December 04, 2008 from early morning through late afternoon at test site 510100 on US 29. This SPS-1 site is at milepost 12.8 on the southbound, righthand lane 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 76,510 lbs., the "golden" truck.
2. 5-axle tractor semi-trailer with a tractor having an air suspension and a trailer with a standard rear tandem and an air suspension loaded to 65,250 lbs., the "partial" truck.

Each truck made a total of 20 passes over the WIM scale at speeds ranging from approximately 52 to 64 miles per hour. The desired speed range was achieved during this validation. Pavement surface temperatures were recorded during the test runs ranging from about 29 to 54 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.

The statistics in Table 3-1 indicates that the loading data meets the conditions for research quality data.

Table 3-1 - Post-Validation Results – 510100 – 04-Dec-2008

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	1.5 ± 5.0%	Pass
Tandem axles	±15 percent	1.2 ± 5.8%	Pass
GVW	±10 percent	1.0 ± 3.2%	Pass
Axle spacing	± 0.5 ft [150mm]	0.0 ± 0.1 ft	Pass

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The test runs were conducted primarily during the early morning and late afternoon, resulting in a reasonable range of pavement temperatures. The runs were conducted at various speeds to determine the effects of these variables on the performance of the WIM scale. To investigate these effects, the data set was split into three speed groups and three temperature groups. The distribution of runs by speed and temperature is illustrated in Figure 3-1. The figure indicates that the desired distribution of speed and temperature combinations was not achieved for this set of validation runs due to limits on the temperature range.

The three speed groups were divided as follows: Low speed – 52 to 57 mph, Medium speed – 58 to 61 mph and High speed – 62 + mph. The three temperature groups were created by splitting the runs between those at 29 to 36 degrees Fahrenheit for Low temperature, 37 to 46 degrees Fahrenheit for Medium temperature and 47 to 54 degrees Fahrenheit for High temperature.

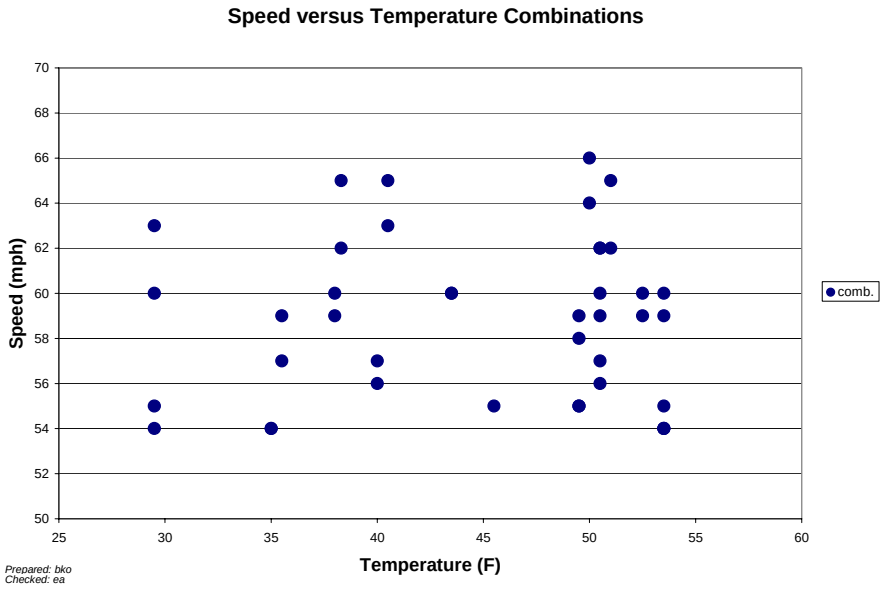

Figure 3-1 - Post-Validation Speed-Temperature Distribution – 510100 – 04-Dec-2008

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

Figure 3-2 shows the GVW Percent Error vs. Speed graph for the population as a whole. It can be seen from Figure 3-2 that the equipment generally overestimates GVW errors at all speeds. Variability in error is greater at low and medium speed when compared to high speed.

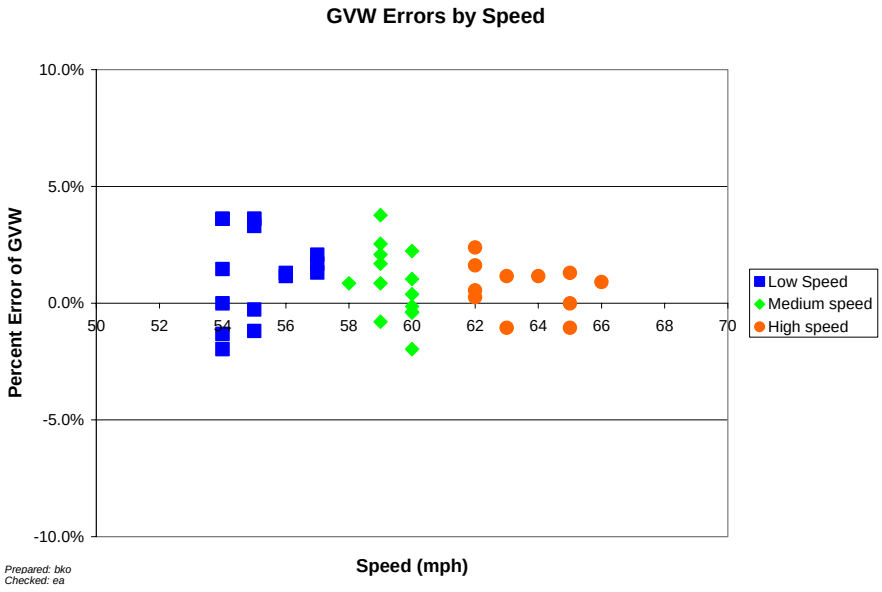

Figure 3-2 - Post-Validation GVW Percent Error vs. Speed – 510100 – 04-Dec-2008

Figure 3-3 shows the relationship between temperature and GVW percentage error. It can be seen from Figure 3-3 that the equipment generally overestimates GVW errors through the entire temperature range. Variability is greater at high temperature.

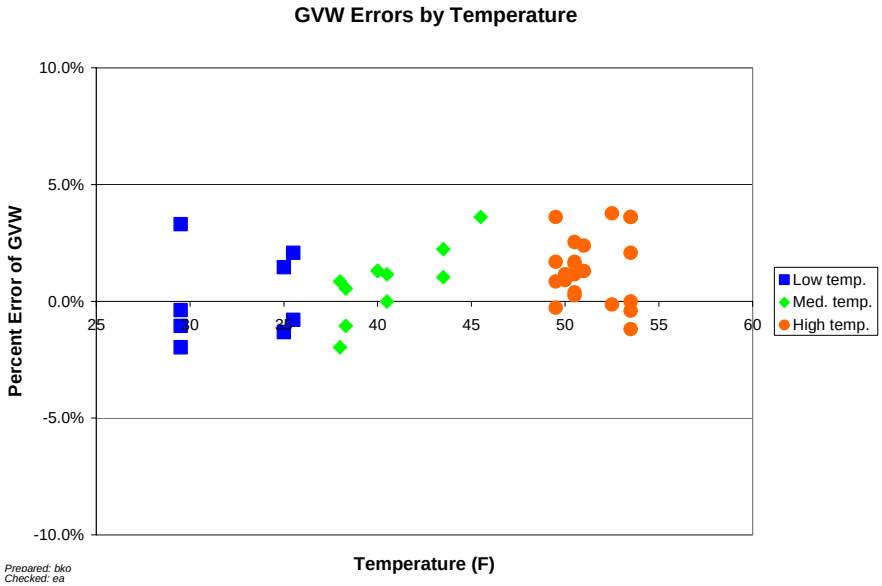

Figure 3-3 - Post-Validation GVW Percent Error vs. Temperature – 510100 – 04-Dec-2008

Figure 3-4 shows the relationship between the drive tandem spacing errors in feet and speeds. This graph is used as a potential indicator of classification errors due to failure to correctly identify spacings on a vehicle. Since the most common reference value is the

drive tandem on a Class 9 vehicle, this is the spacing evaluated and plotted for validations. There is no apparent relationship between speed and axle spacing measurements.

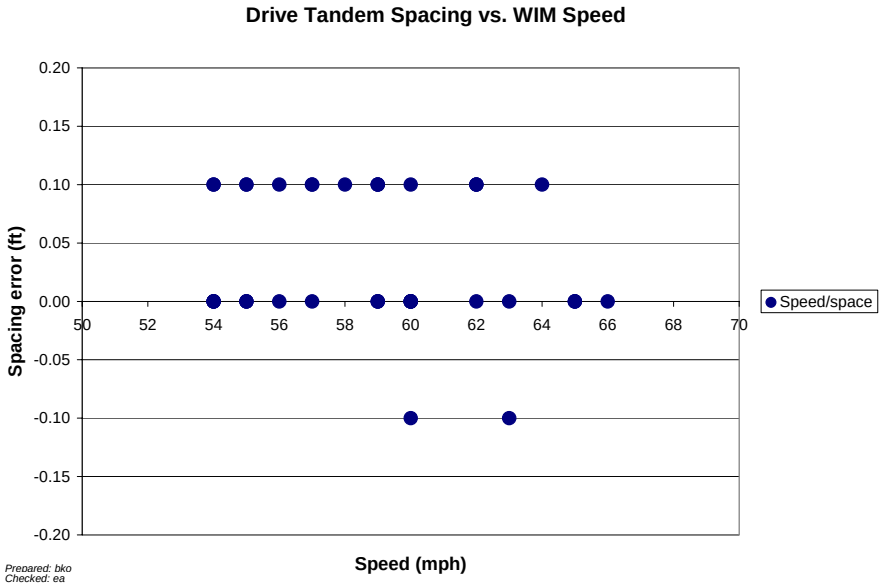

Figure 3-4 - Post-Validation Spacing vs. Speed – 510100 – 04-Dec-2008

3.1 Temperature-based Analysis

The three temperature groups were created by splitting the runs between those at 29 to 36 degrees Fahrenheit for Low temperature, 37 to 46 degrees Fahrenheit for Medium temperature and 47 to 54 degrees Fahrenheit for High temperature.

Table 3-2 - Post-Validation Results by Temperature Bin – 510100 – 04-Dec-2008

Element	95% Limit	Low Temperature 29 to 36 °F	Medium Temperature 37 to 46 °F	High Temperature 47 to 54 °F
Steering axles	±20 %	2.3 ± 6.1%	0.0 ± 5.0%	2.0 ± 4.8%
Tandem axles	±15 %	0.1 ± 6.4%	1.3 ± 6.2%	1.6 ± 5.7%
GVW	±10 %	0.2 ± 4.4%	0.8 ± 3.3%	1.4 ± 3.0%
Axle spacing	± 0.5 ft	0.0 ± 0.2 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft

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As it can be seen in Table 3-2 the equipment overestimates all weights through the observed temperature range.

Figure 3-5 is the distribution of GVW Errors versus Temperature by Truck graph. From Figure 3-5 it can be seen that partial truck (diamonds) is overestimated throughout the temperature range. The golden truck (squares) shows a reasonable estimation with a slight overestimation as the temperature increases. Variability in error is greater at high temperature. The variability is associated more closely with the differences in truck responses than with actual temperature differences.

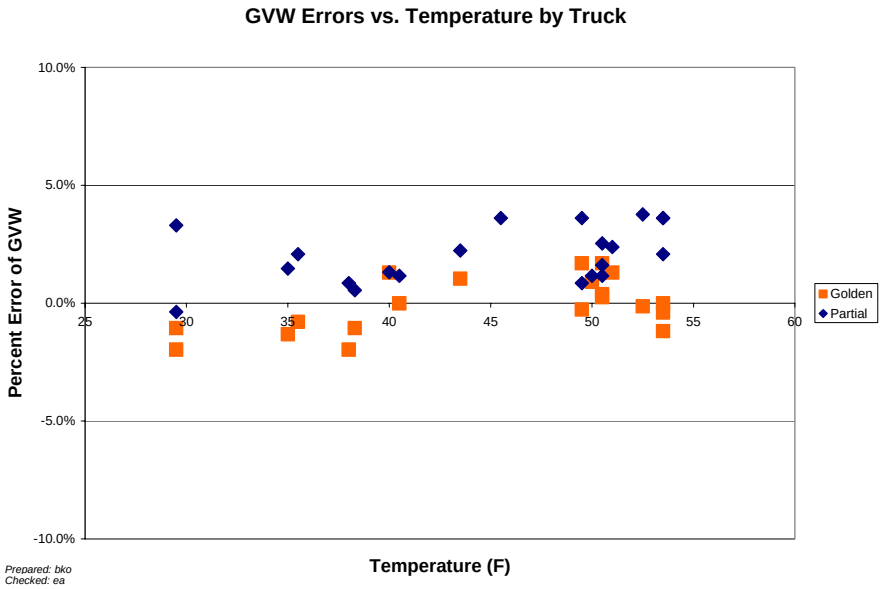

Figure 3-5 - Post-Validation GVW Percent Error vs. Temperature by Truck – 510100 – 04-Dec-2008

Figure 3-6 shows the relation between steering axle errors and temperature. This graph is included due to the frequent use of steering axle weights of Class 9 vehicles for calibration. This site does not use auto-calibration. The steering axles in this graph are associated only with Class 9 vehicles. As it can be seen in Figure 3-6, steering axle errors are generally overestimated. Variability in error is greater at low and high temperature.

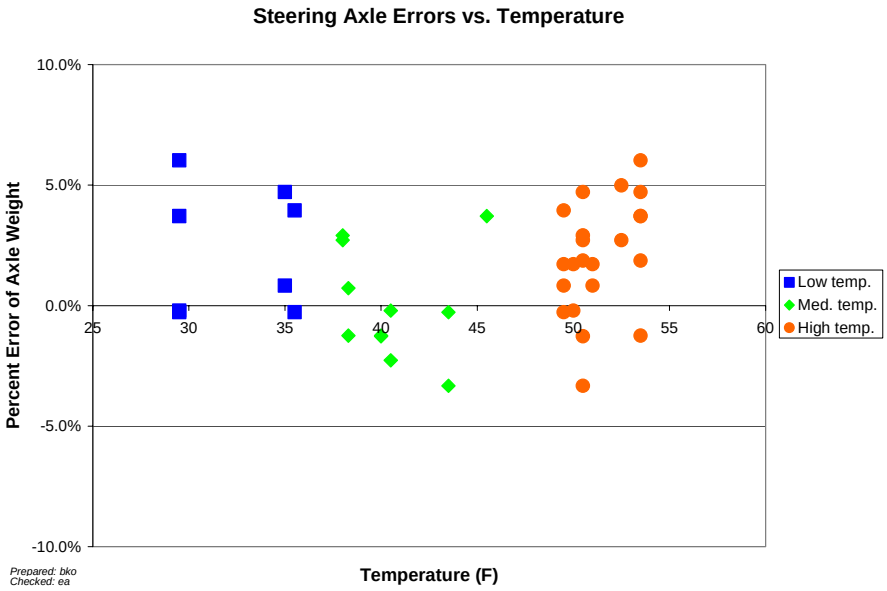

Figure 3-6 - Post-Validation Steering Axle Error vs. Temperature by Group – 510100 – 04-Dec-2008

3.2 Speed-based Analysis

The three speed groups were created using 52 to 57 mph for Low speed, 58 to 61 mph for Medium speed and 62+ mph for High speed.

Table 3-3 - Post-Validation Results by Speed Bin – 510100 – 04-Dec-2008

Element	95% Limit	Low Speed 52 to 57 mph	Medium Speed 58 to 61 mph	High Speed 62+ mph
Steering axles	±20 %	2.4 ± 5.6%	2.0 ± 4.8%	-0.3 ± 3.5%
Tandem axles	±15 %	1.5 ± 6.2%	0.9 ± 5.5%	1.1 ± 6.7%
GVW	±10 %	1.4 ± 4.0%	0.8 ± 3.3%	0.7 ± 2.4%
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft

Prepared: ea *Checked: bko*

From Table 3-3 it can be seen that the equipment overestimates all weights at all speeds with the exception of steering axle weights, which are underestimated on average at high speed.

From Figure 3-7 it can be seen that the partial truck (diamonds) is overestimated throughout the speed range. The golden truck (squares) is estimated with reasonable accuracy. Variability is greater at low and medium speed. There were no speed constraints on the trucks besides the grade of the site itself. The partial truck was not able to accelerate enough to reach the same high speeds as the golden truck.

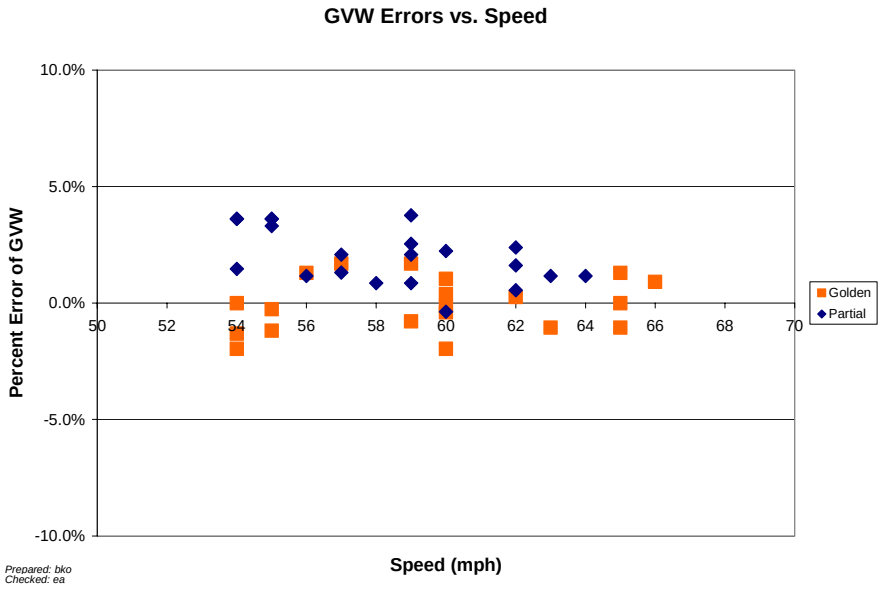

Figure 3-7 - Post-Validation GVW Percent Error vs. Speed by Truck – 510100 – 04-Dec-2008

Figure 3-8 shows the relationship between steering axle errors and speed. This graph is included due to the frequent use of steering axle weights of Class 9 vehicles for auto-calibration. This site does not use auto-calibration. The steering axles in this graph are associated only with Class 9. Figure 3-8 the equipment generally overestimates steering axle errors but there is less bias as the speed increases.

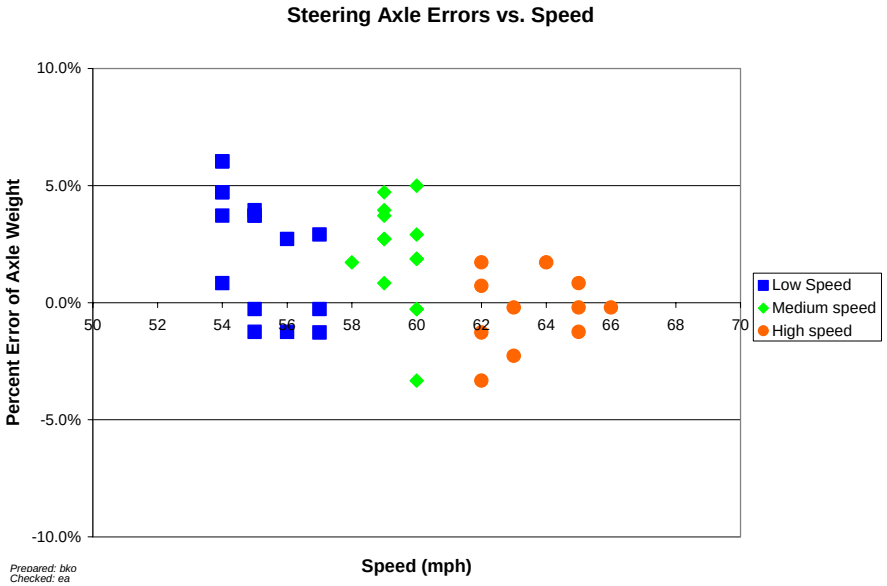

Figure 3-8 - Post-Validation Steering Axle Percent Error vs. Speed by Group – 510100 – 04-Dec-2008

3.3 Classification Validation

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

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

The second check is the ability of the algorithm to correctly distinguish between truck classes with no more than 2% errors in such classifications. Table 3-4 has the classification error rates by class. The overall misclassification rate is 2.0 percent. The misclassification is based on one truck (Class 6) identified as a bus (Class 4) by the WIM equipment.

Table 3-4 - Truck Misclassification Percentages for 510100 – 04-Dec-2008

Class	Percent Error	Class	Percent Error	Class	Percent Error
4	100	5	0	6	9
7	N/A				
8	0	9	0	10	N/A
11	N/A	12	N/A	13	0

Prepared: ea *Checked: bko*

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

Table 3-5 - Truck Classification Mean Differences for 510100 – 04-Dec-2008

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

Prepared: ea *Checked: bko*

These error rates are normalized to represent how many vehicles of the class are expected to be over or under-counted for every hundred of that class observed by the equipment. Thus a value of 0 means the class is identified correctly on average. A number between –1 and –100 indicates at least that number of vehicles either missed or not assigned to the class by the equipment. It is not possible to miss more than all of them or one hundred out of one hundred. Numbers 1 or larger indicate at least how many more

vehicles are assigned to the class than the actual "hundred observed". Classes marked Unknown (UNK) are those identified by the equipment but no vehicles of the type were seen by the observer. There is no way to tell how many vehicles of that type might actually exist. N/A means no vehicles of the class were recorded by either the equipment or the observer.

A limited investigation of the precision and bias of the speeds reported by the equipment was undertaken. Since the classification data met research quality standards, the observed bias and variability are thought to be more strongly related to radar speed precision than errors in the WIM equipment.

3.4 Evaluation by ASTM E-1318 Criteria

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

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

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

Prepared: ea *Checked: bko*

4 Pavement Discussion

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

4.1 Profile Analysis

The WIM site is a section of pavement that is 305 meters long with the WIM scale located at 274.5 meters from the beginning of the test section. An ICC profiler was used to collect longitudinal profiles of the test section with a sampling interval of 25 millimeters.

Profile data collected at the SPS WIM location by Stantec Consultants on October 23, 2008 were processed through the LTPP SPS WIM Index software, version 1.1. This WIM scale is installed on a rigid pavement.

A total of 16 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 Regional Support Contractor has completed 9 passes at the center of the lane, 3 passes shifted to the left side of the lane, and 3 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, version 1.0 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

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Table 4-2 shows the computed index values for 11 profiler passes for this WIM site. Five consistent runs were selected from the nine provided for use in presentation of the results. 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 and values below the lower index limits are presented in italics.

Table 4-2 - WIM Index Values – 510100 –23-Oct-2008

Profiler Passes			Pass 1	Pass 2	Pass 3	Pass 4	Pass 5	Ave.
Center	LWP	LRI (m/km)	0.800	0.729	0.815	0.699	0.748	0.758
		SRI (m/km)	0.695	0.492	0.786	0.503	0.593	0.614
		Peak LRI (m/km)	0.813	0.804	0.825	0.748	0.765	0.791
		Peak SRI (m/km)	*0.737*	0.812	0.826	*0.708*	0.777	0.772
	RWP	LRI (m/km)	0.844	0.931	0.993	0.837	0.853	0.892
		SRI (m/km)	0.622	0.778	0.756	0.547	0.666	0.674
		Peak LRI (m/km)	0.844	0.931	0.997	0.837	0.853	0.892
		Peak SRI (m/km)	0.865	1.129	0.964	0.791	0.873	0.924
Left Shift	LWP	LRI (m/km)	1.092	1.045	0.918			1.018
		SRI (m/km)	1.040	1.226	0.731			0.999
		Peak LRI (m/km)	1.110	1.067	0.996			1.058
		Peak SRI (m/km)	1.254	1.496	0.887			1.212
	RWP	LRI (m/km)	0.899	1.097	0.758			0.918
		SRI (m/km)	0.753	0.555	0.536			0.615
		Peak LRI (m/km)	0.899	1.103	0.872			0.958
		Peak SRI (m/km)	1.141	1.542	0.907			1.197
Right Shift	LWP	LRI (m/km)	0.918	0.866	0.869			0.884
		SRI (m/km)	0.950	1.019	1.015			0.995
		Peak LRI (m/km)	0.918	0.866	0.869			0.884
		Peak SRI (m/km)	1.234	1.211	1.226			1.224
	RWP	LRI (m/km)	0.891	0.835	0.845			0.857
		SRI (m/km)	0.739	0.885	*0.461*			0.695
		Peak LRI (m/km)	0.893	0.842	0.845			0.860
		Peak SRI (m/km)	0.915	1.056	0.865			0.945

Prepared: als *Checked: jrn*

From Table 4-2 it can be seen that three of the indices computed from the profiles are below the lower threshold values with the remainder of the indices falling between the upper and lower threshold values. These values indicate that the pavement roughness may or may not interfere with successful validation of the site. However, as the site was successfully validated no remediation recommendation is offered.

The profile data evaluated was collected after the site installation. There is no profile data available for prior visits.

4.2 Distress Survey and Any Applicable Photos

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

4.3 Vehicle-pavement Interaction Discussion

A visual observation of the trucks as they approach, traverse and leave the sensor area did not indicate any visible motion of the trucks that would affect the performance of the

WIM scales. Trucks appear to track down the wheel path and daylight cannot be seen between the tires and any of the sensors for the equipment.

5 Equipment Discussion

The traffic monitoring equipment at this location includes bending plate sensors and iSINC electronics. The sensors are installed in a portland cement concrete pavement about 424 ft in length. The roadway outside this short section is asphalt.

On December 1, 2008, an SSM board and firmware was replaced and a remote calibration was performed using the front axle values. This resulted in a change in system parameters.

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

Upon our arrival at the site, we found the system parameters were not the same as we left them at the conclusion of our last validation on July 25, 2007. The sensors were remotely calibrated immediately prior to our arrival following equipment maintenance.

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

The operating system weight compensation parameters that were in place prior to the Pre-Validation are in Table 5-1.

Table 5-1 - Initial System Parameters - 510100 - 02-Dec-2008

Speed Bin	Left Sensor 1	Right Sensor 2
72 kph	3565	3565
88 kph	3565	3565
104 kph	3565	3565
121 kph	3565	3565
137 kph	3565	3565

Prepared: ea *Checked: bko*

5.2.1 Calibration Iteration 1

As a result of the Pre-Validation, where there was consistent overestimation throughout the speed range, the compensation factors were adjusted as shown in Table 5-2. All factors were adjusted the same amount as the difference between factors for the individual speed bins was very small.

Table 5-2 - Calibration Iteration 1 - Change in Parameters - 510100 - 03-Dec-2008

Speed Bins	Right Sensor 1	Change	Left Sensor 2	Change
72 kph	3422	-4.0%	3422	-4.0%
88 kph	3422	-4.0%	3422	-4.0%
104 kph	3422	-4.0%	3422	-4.0%
121 kph	3422	-4.0%	3422	-4.0%
137 kph	3422	-4.0%	3422	-4.0%

Prepared: ea *Checked: bko*

Table 5-3 shows the results for the calibration validation passes. The reduction in overestimation was considered sufficient to terminate calibration of the lane.

Table 5-3 - Calibration Iteration 1 – Results – 510100 – 03-Dec-2008 (01:45 PM)

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	0.6 ± 5.0%	Pass
Tandem axles	±15 percent	1.9 ± 4.7%	Pass
GVW	±10 percent	1.4 ± 1.5%	Pass
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	Pass

Prepared: ea *Checked: bko*

Figure 5-1 illustrates the GWV errors observed after calibration.

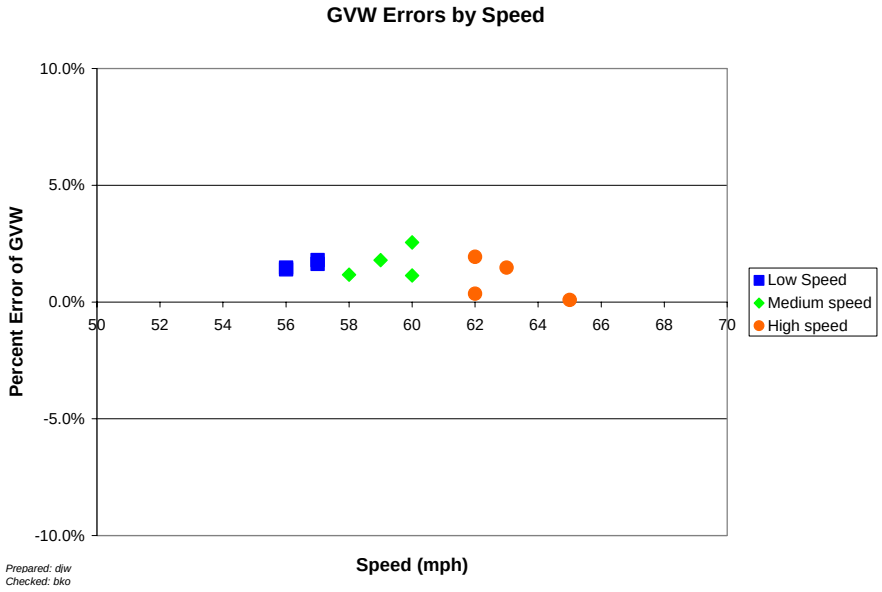

Figure 5-1 - Calibration Iteration 1 - GVW Percent Error vs. Speed Group – 510100 – 03-Dec-2008 (01:45 PM)

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 for this equipment installation. Table 5-4 has the information for

TRF_CALIBRATION_AVC for Sheet 16s submitted prior to this validation as well as the information for the current visit. The Sheet 16s available reflect only this contractor's validation visits.

Table 5-4 - Classification Validation History – 510100 – 04-Dec-2008

Date	Method	Mean Difference				Percent Unclassified
		Class 9	Class 8	Other 1	Other 2	
12/04/2008	Manual	0	0	CL 5: 0	CL 6: -9	0
12/02/2008	Manual	0	0	CL 5: 0	CL 6: 0	0
7/26/2007	Manual	0	0			0
7/24/2007	Manual	0	0			0
02/01/2007	Manual	0	0			0
01/30/2007	Manual	0	0			0

Prepared: ea *Checked: bko*

Table 5-5 has the information for TRF_CALIBRATION_WIM for Sheet 16s submitted prior to this validation as well as the information for the current visit for this equipment installation. The Sheet 16s available reflect only this contractor's validation visits.

Table 5-5 - Weight Validation History – 510100 – 04-Dec-2008

Date	Method	Mean Error and (SD)		
		GVW	Single Axles	Tandem Axles
12/03/2008	Test Trucks	1.0 (1.6)	1.5 (2.5)	1.2 (2.9)
12/02/2008	Test Trucks	4.2 (1.3)	0.8 (2.3)	5.1 (2.9)
7/26/2007	Test Trucks	0.1 (3.0)	-2.7 (5.1)	0.9 (4.5)
7/24/2007	Test Trucks	-0.4 (3.1)	-0.5 (4.2)	0.4 (5.5)
02/01/2007	Test Trucks	-0.8 (2.7)	-4.7 (2.6)	-0.1 (3.6)
01/30/2007	Test Trucks	0.7 (2.7)	-2.6 (3.2)	1.3 (3.5)

Prepared: ea *Checked: bko*

5.4 Projected Maintenance/Replacement Requirements

This site is scheduled for semi-annual maintenance under the installation contract.

It is recommended that the fastening nuts for both weigh pads be cleaned before winter and the silicon around them replaced. Figure 5-2 and Figure 5-3 illustrate show the some of the exposed nuts and the level of exposure to treatment chemicals for the frame fastenings in this lane.

Figure 5-2 - 510100 Example nut in leading WIM Sensor 2-Dec-2008

Figure 5-3 - 510100 Example nut in trailing WIM Sensor 2-Dec-2008

6 Pre-Validation Analysis

Upon our arrival at the site, we found the system parameters were not the same as we left them at the conclusion of our last validation on July 25, 2007. The sensors were remotely calibrated the day prior to our arrival following equipment maintenance.

The factors in place at the end of our last Validation visit and those found prior to validation are shown below.

Table 6-1 - Calibration Factor Change – 510100 – since 25-Jul-2007

	Left Sensors 1/3		Right Sensors 2/4	
	02-Dec-2008	25-Jul-2007	02-Dec-2008	25-Jul-2007
72 kph	3565	3700	3565	3700
88 kph	3565	3700	3565	3700
104 kph	3565	3700	3565	3700
121 kph	3565	3700	3565	3700
137 kph	3565	3700	3565	3700

Prepared: ea *Checked: bko*

This pre-validation analysis is based on test runs conducted December 2, 2008 during the late morning and afternoon at test site 510100 on US 29. This SPS-1 site is at milepost 12.8 on the southbound, righthand lane 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 76,840 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 an air suspension loaded to 65,580 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 51 to 65 miles per hour. The desired speed range was achieved during this validation. Pavement surface temperatures were recorded during the test runs ranging from about 38 to 50 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 6-2.

As shown by Table 6-2 this site passed the weight and spacing precision requirements for research quality data. The degree of bias for GVW was considered large enough to merit calibration iteration although the front axle estimate (the statistic used for remote calibration) was essentially unbiased.

Table 6-2 - Pre-Validation Results – 510100 – 02-Dec-2008

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	0.8 ± 4.7%	Pass
Tandem axles	±15 percent	5.1 ± 5.7%	Pass
GVW	±10 percent	4.2 ± 2.7%	Pass
Axle spacing	± 0.5 ft [150mm]	0.0 ± 0.1 ft	Pass

Prepared: ea *Checked: bko*

The test runs were conducted primarily from late morning to late afternoon hours, resulting in a very narrow range of pavement temperatures. The runs were 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 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 due to the limited temperature range.

The three speed groups were divided into 51 to 57 mph for Low speed, 58 to 62 mph for Medium speed and 63+ mph for High speed. The one temperature group between 38 to 50 degrees Fahrenheit was designated Medium temperature.

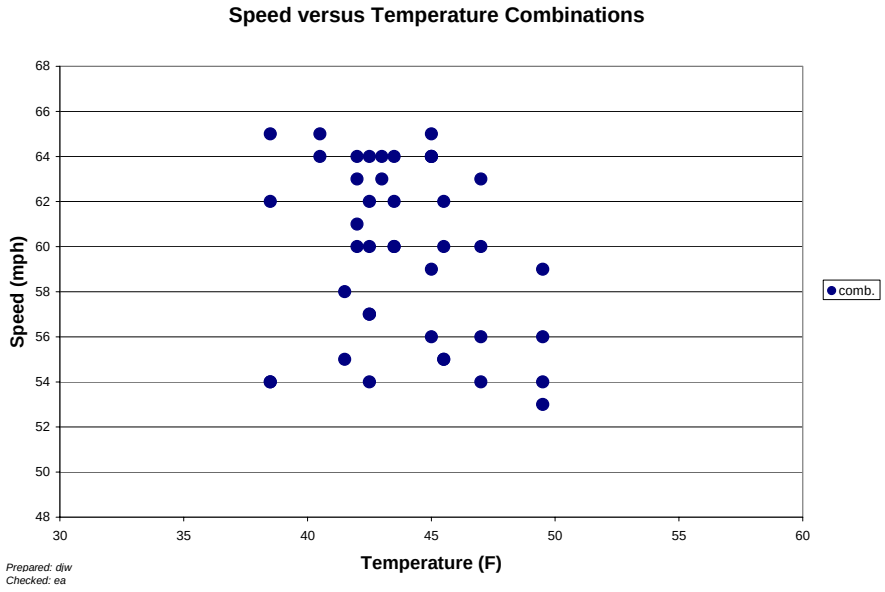

Figure 6-1 - Pre-Validation Speed-Temperature Distribution – 510100 – 02-Dec-2008

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

Figure 6-2 shows the GVW Percent Error vs. Speed graph for the population as a whole. It can be seen in Figure 6-2 that the equipment overestimates GVW errors at all speeds. Variability in error is similar throughout the entire speed range.

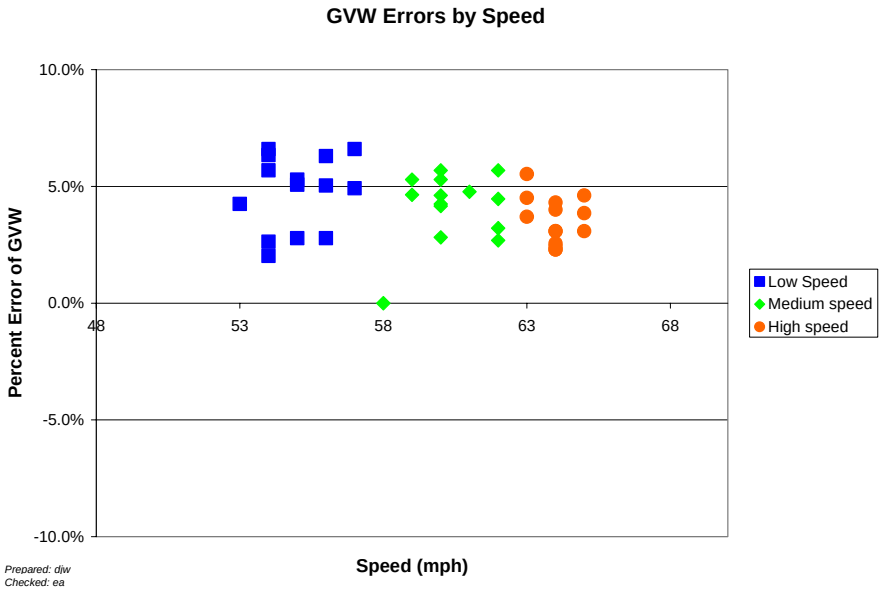

Figure 6-2 - Pre-Validation GVW Percent Error vs. Speed – 510100 – 02-Dec-2008

Figure 6-3 shows the relationship between temperature and GVW percentage error. Figure 6-3 shows that GVW errors are overestimated in the observed temperature range. Variability in error is consistent.

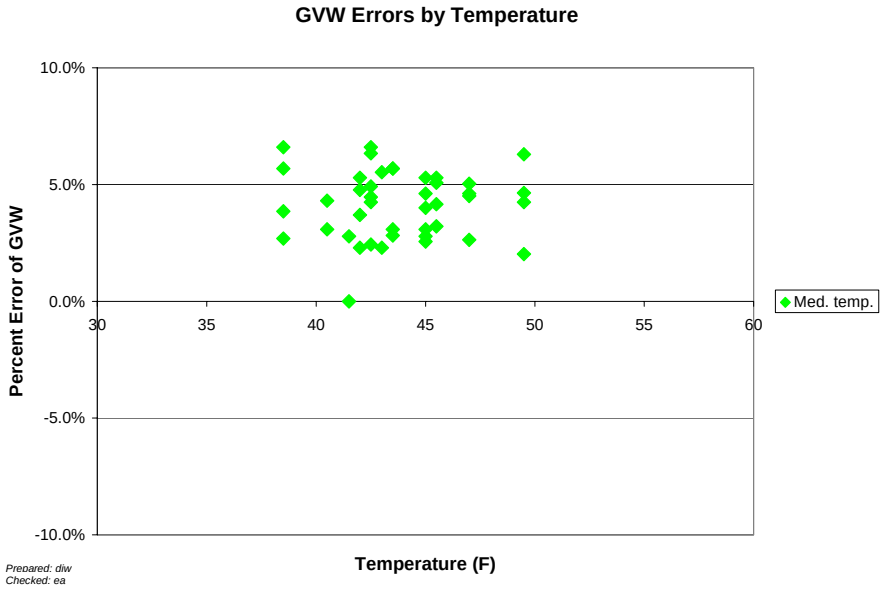

Figure 6-3 - Pre-Validation GVW Percent Error vs. Temperature – 510100 – 02-Dec-2008

Figure 6-4 shows the relationship between the drive tandem spacing errors in feet and speeds. This graph is used as a potential indicator of classification errors due to failure to correctly identify spacings on a vehicle. Since the most common reference value is the

drive tandem on a Class 9 vehicle, this is the spacing evaluated and plotted for validations. Figure 6-4 indicates that the errors in tandem spacing were not affected by changes in speed.

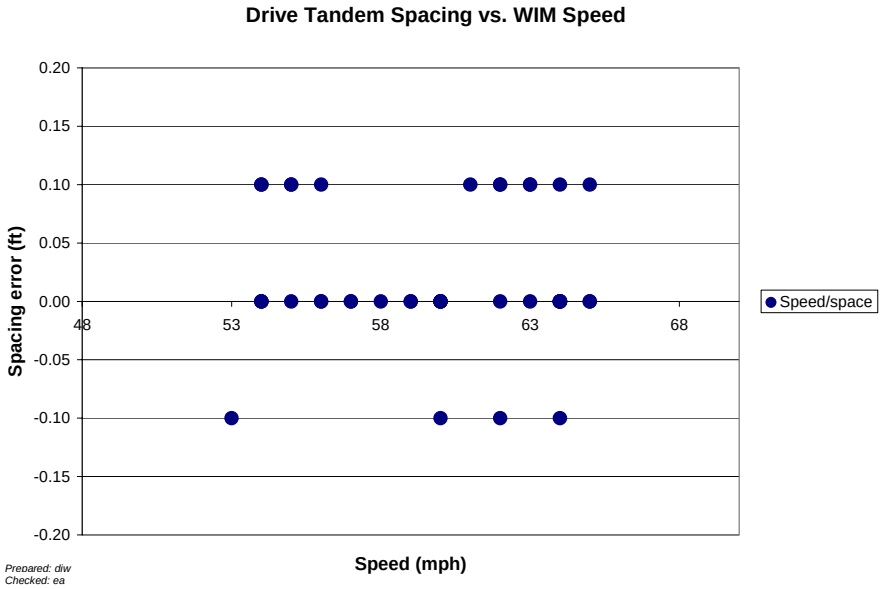

Figure 6-4 - Pre-Validation Spacing vs. Speed - 510100 – 02-Dec-2008

6.1 Temperature-based Analysis

The one temperature group was between 38 to 50 degrees Fahrenheit and was labeled Medium temperature.

Table 6-3 - Pre-Validation Results by Temperature Bin – 510100 – 02-Dec-2008

Element	95% Limit	Medium Temperature 38 to 50 °F
Steering axles	±20 %	0.8 ± 4.7%
Tandem axles	±15 %	5.1 ± 5.7%
GVW	±10 %	4.2 ± 2.7%
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft

Prepared: ea *Checked: bko*

From Table 6-3 it is shown that the equipment produces an overestimation of all weights at this temperature range.

Figure 6-5 shows the distribution of GVW Errors versus Temperature by Truck. Figure 6-5 shows the tendency of the equipment to overestimate GVW errors of both trucks. Variability in error is consistent throughout the temperature range.

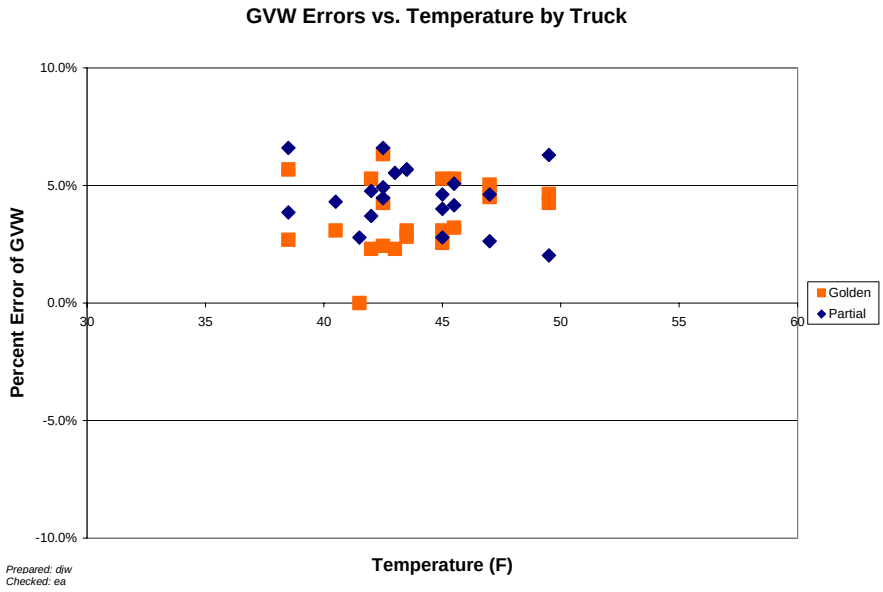

Figure 6-5 - Pre-Validation GVW Percent Error vs. Temperature by Truck – 510100 – 02-Dec-2008

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. It can been seen from Figure 6-6 that the equipment estimates steering axle errors with reasonable accuracy.

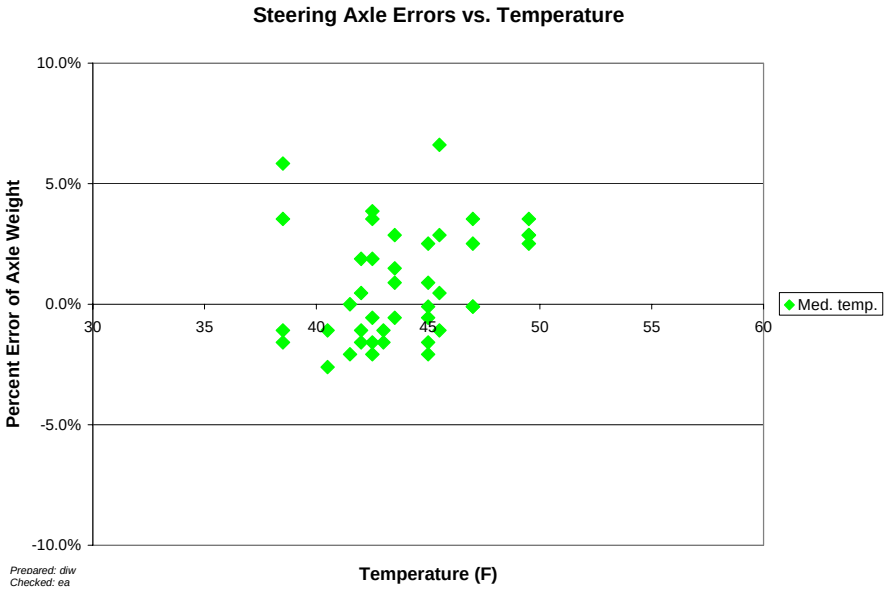

Figure 6-6 - Pre-Validation Steering Axle Error vs. Temperature by Group – 510100 – 02-Dec-2008

6.2 Speed-based Analysis

The speed groups were divided as follows: Low speed – 51 to 57 mph, Medium speed – 58 to 62 mph and High speed – 63+ mph.

Table 6-4 - Pre-Validation Results by Speed Bin – 510100 – 02-Dec-2008

Element	95% Limit	Low Speed 51 to 57 mph	Medium Speed 58 to 62 mph	High Speed 63+ mph
Steering axles	±20 %	2.3 ± 4.5%	1.0 ± 5.2%	-0.9 ± 2.7%
Tandem axles	±15 %	5.3 ± 4.8%	5.3 ± 6.5%	4.6 ± 6.3%
GVW	±10 %	4.7 ± 3.4%	4.4 ± 2.2%	3.5 ± 2.2%
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft

Prepared: ea *Checked: bko*

In Table 6-4 it is shown that the equipment produces an overestimation of all weights at all speeds with an exception of steering axles, which are underestimated at high speeds. Variability in error is similar throughout the speed range.

Figure 6-7 shows the tendency of the equipment to overestimate GVW for both trucks with a slight downward trend from low to high speeds. Variability in error is consistent throughout the speed range.

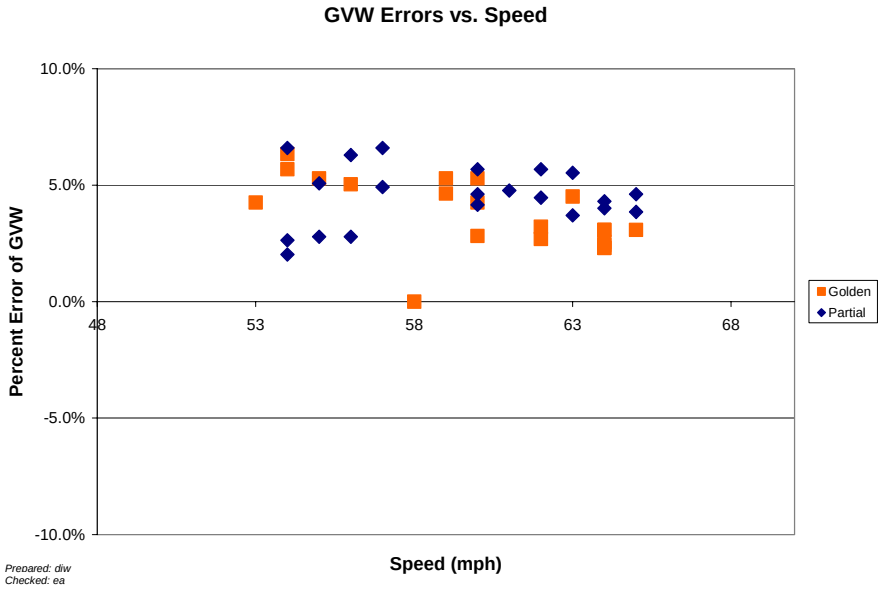

Figure 6-7 - Pre-Validation GVW Percent Error vs. Speed Group - 510100 –02-Dec-2008

Figure 6-8 shows the relation between steering axle errors and speed. This graph is included due to the frequent use of steering axle weights of Class 9 vehicles for calibration. This site does not use auto-calibration. The steering axles in this graph are associated only with Class 9 vehicles. It can be seen in Figure 6-8 that the equipment

mostly overestimates steering axle errors at all speeds with a downward trend from low to high speed. Variability in error is greater at low speeds when compared to high speeds.

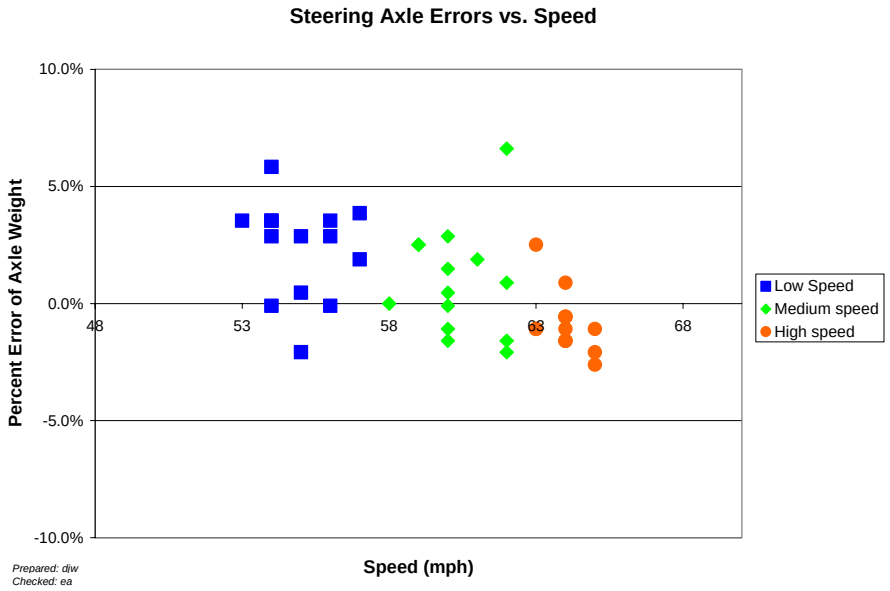

Figure 6-8 - Pre-Validation Steering Axle Percent Error vs. Speed Group - 510100 – 02-Dec-2008

6.3 Classification Validation

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

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

The second check is the ability of the algorithm to correctly distinguish between truck classes with no more than 2% errors in such classifications. Table 6-5 has the classification error rates by class. The overall misclassification rate is zero percent.

Table 6-5 - Truck Misclassification Percentages for 510100 – 02-Dec-2008

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

Prepared: ea *Checked: bko*

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

Table 6-6 - Truck Classification Mean Differences for 510100 – 02-Dec-2008

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

Prepared: ea *Checked: bko*

These error rates are normalized to represent how many vehicles of the class are expected to be over or under-counted for every hundred of that class observed by the equipment. Thus a value of 0 means the class is identified correctly on average. A number between –1 and –100 indicates at least that number of vehicles either missed or not assigned to the class by the equipment. It is not possible to miss more than all of them or one hundred out of one hundred. Numbers 1 or larger indicate at least how many more vehicles are assigned to the class than the actual "hundred observed". Classes marked Unknown (UNK) are those identified by the equipment but no vehicles of the type were seen the observer. There is no way to tell how many vehicles of that type might actually exist. N/A means no vehicles of the class were recorded by either the equipment or the observer.

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

6.4 Evaluation by ASTM E-1318 Criteria

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

Table 6-7 - Results of Validation Using ASTM E-1318-02 Criteria

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

Prepared: ea *Checked: bko*

6.5 Prior Validations

The last validation for this site was done July 25, 2007. It was the second validation of the site. The site was producing research quality data. Figure 6-9 shows the GVW Percent Error vs. Speed for the post validation runs. The site was validated with two trucks. The "Golden" truck was loaded to 74,610 lbs. The "partial" truck which had an air suspension tractor tandem and a 9 tapered steel leaf and a rocker bar suspension for the trailer axle. It was loaded to 64,880 lbs.

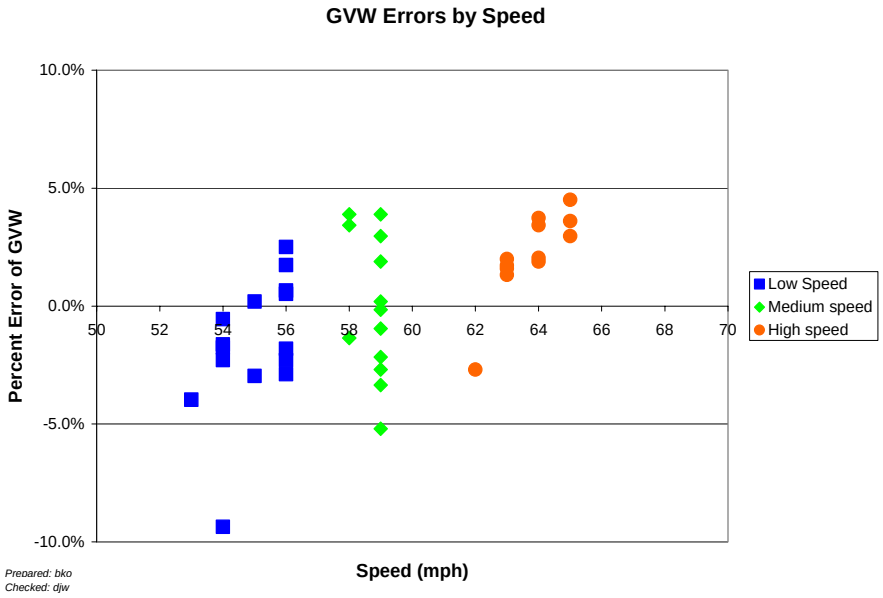

Figure 6-9 - Last Validation GVW Percent Error vs. Speed – 510100 – 25-Jul-2007

Table 6-8 shows the overall results from the last validation. Compared to the Pre-Validation results in Table 6-2 which shows an overestimation of all weights, Table 6-8 shows an underestimation for steering axles. The variability observed at the Pre-Validation was generally less than at the end of the last validation.

Table 6-8 - Last Validation Final Results – 510100 – 25-Jul-2007

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	-2.7 ± 10.3%	Pass
Tandem axles	±15 percent	0.9 ± 9.0%	Pass
GVW	±10 percent	0.1 ± 6.1%	Pass
Axle spacing	± 0.5 ft [150mm]	0.0 ± 0.2 ft	Pass

Prepared: ea *Checked: bko*

Table 6-9 has the results at the end of the last validation by temperature. As the temperature ranges do not overlap comments on changes due to temperature are not appropriate. Through this validation the equipment has been observed at temperature from 27 to 96 degrees Fahrenheit.

Table 6-9 – Last Validation Results by Temperature Bin – 510100 – 25-Jul-2007

Element	95% Limit	Low Temperature 71-80 °F	Medium Temperature 81-89 °F	High Temperature 90-96 °F
Steering axles	±20 %	-4.8 ± 11.5%	-1.5 ± 9.4%	-1.5 ± 12.0%
Tandem axles	±15 %	0.1 ± 11.4%	1.0 ± 7.5%	1.7 ± 8.7%
GVW	±10 %	-1.0 ± 8.1%	0.5 ± 5.7%	0.9 ± 4.4%
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	0.0 ± 0.4 ft	0.0 ± 0.1 ft

Prepared: ea *Checked: bko*

Table 6-10 has the results of the prior post validation by speed groups. As compared to the Pre-Validation, Table 6-10 shows an underestimation of all weights at low speed with larger variability.

Table 6-10 - Last Validation Results by Speed Bin – 510100 – 25-Jul-2007

Element	95% Limit	Low Speed 53-56 mph	Medium Speed 57-61 mph	High Speed 62+ mph
Steering axles	±20 %	-7.0 ± 11.8%	0.6 ± 5.8%	-1.0 ± 4.7%
Tandem axles	±15 %	-0.1 ± 11.1%	0.3 ± 9.1%	2.7 ± 5.4%
GVW	±10 %	-1.6 ± 6.1%	0.0 ± 6.5%	2.2 ± 4.1%
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft	0.0 ± 0.5 ft

Prepared: ea *Checked: bko*

7 Data Availability and Quality

As of December 2, 2008 this site does not have at least 5 years of research quality data. Research quality data is defined to be at least 210 days in a year of data of known calibration meeting LTPP's precision requirements.

Data that has validation information available has been reviewed in light of the patterns present in the two weeks immediately following a validation/calibration activity. A determination of research quality data is based on the consistency with the validation pattern. Data that follows consistent and rational patterns in the absence of calibration information may be considered nominally of research quality pending validation information with which to compare it. Data that is inconsistent with expected patterns and has no supporting validation information is not considered research quality.

The amount and coverage for the site is shown in Table 7-1. It includes only data for this sensor installation since no validation data is available for previous installations. 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 only 2007 has a sufficient quantity to be considered a complete year of data. In the absence of validation information for prior installations it can be seen that at least three additional years of research quality data are needed to meet

the goal of a minimum of 5 years of research weight data assuming that 210 days of data are received for 2008.

Table 7-1 - Amount of Traffic Data Available 510100 – 02-Dec-2008

Year	Classification Days	Months	Coverage	Weight Days	Months	Coverage
2007	325	12	Full Week	332	12	Full Week
2008	194	7	Full Week	194	7	Full Week

Prepared: ea *Checked: bko*

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

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

Table 7-2 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 – 510100 – 04-Dec-2008

Characteristic	Class 9	Class 5
Percentage Overweights	0 %	0 %
Percentage Underweights	0 %	0 %
Unloaded Peak	32,000 lbs	
Loaded Peak	72,000 lbs	
Peak		12,000 lbs

Prepared: ea *Checked: bko*

The expected percentage of unclassified vehicles is one percent. 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 7-3. These are based on data collected immediately after the validation and may not be wholly representative of the population at the site. They should however provide a sense of the statistics expected when SPS comparison data is computed for the post-validation period.

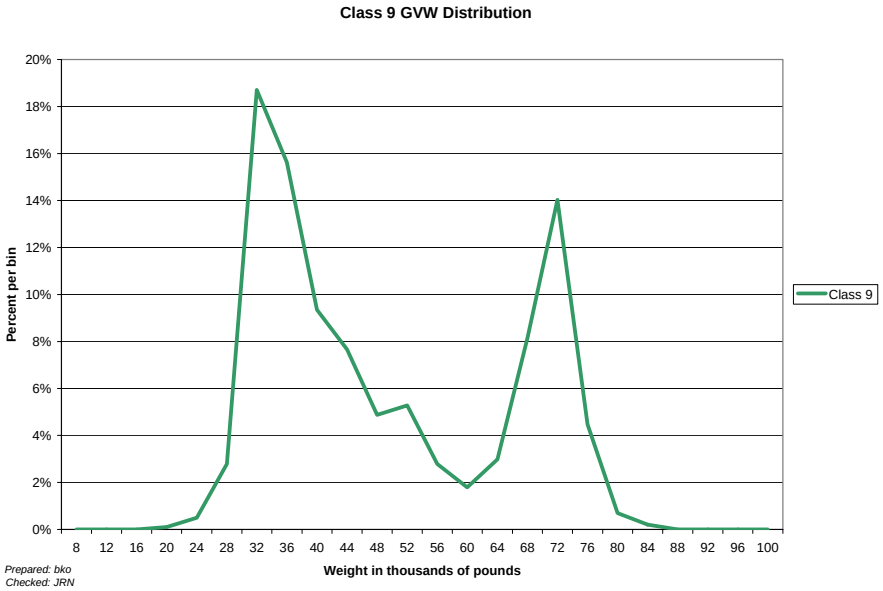

Figure 7-1 - Expected GVW Distribution Class 9 – 510100 – 04-Dec-2008

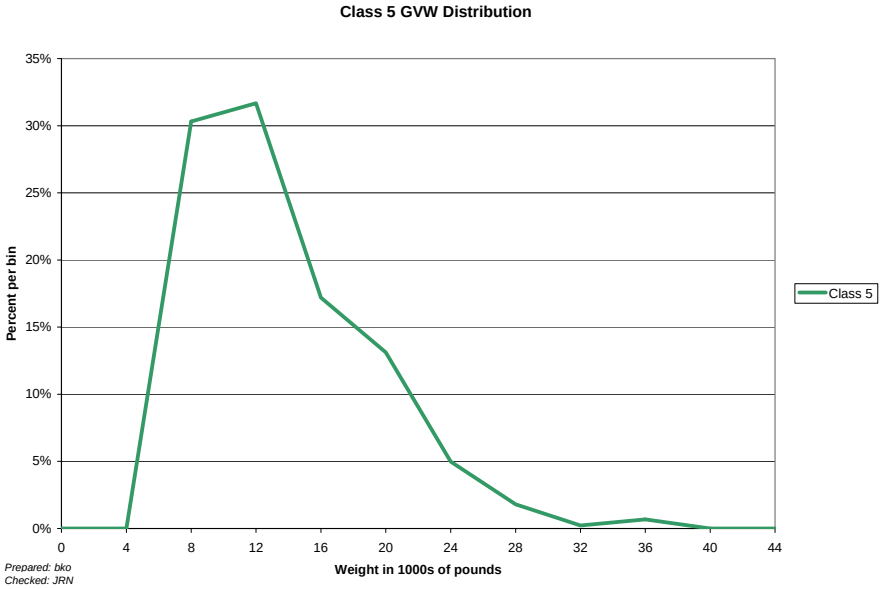

Figure 7-2 - Expected GVW Distribution Class 5 – 510100 – 04-Dec-2008

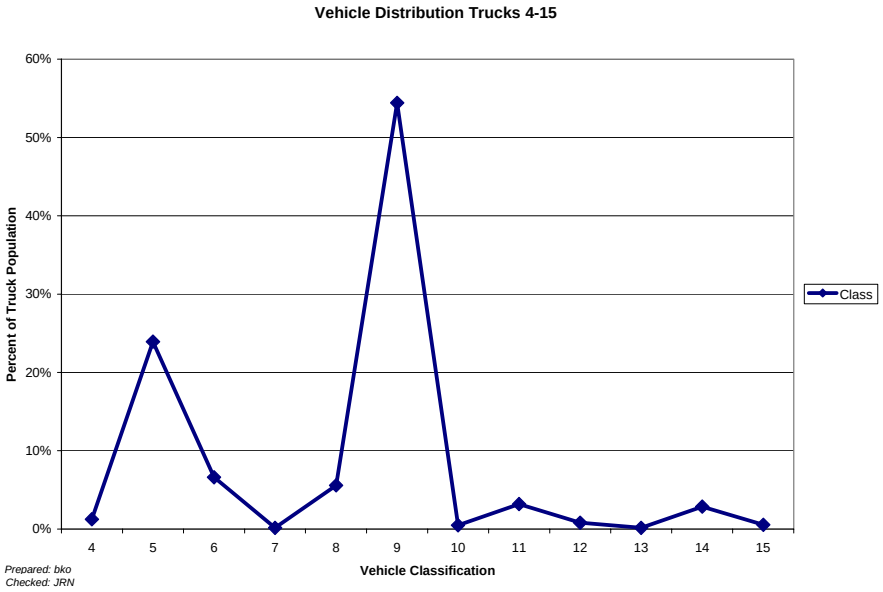

Figure 7-3 - Expected Vehicle Distribution – 510100 – 04-Dec-2008

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 (4 pages)

Sheet 20 – 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 (2 pages)

Calibration Iteration 1 Worksheet – (1 page)

Test Truck Photographs (6 pages)

LTPP Mod 3 Classification Scheme (1 page)

Final System Parameters (1 page)

9 Updated Handout Guide and Sheet 17

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

10 Updated Sheet 18

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

11 Traffic Sheet 16(s)

Sheet 16s for the Pre-Validation and Post-Validation conditions are attached following the current Sheet 18 information at the very end of the report.

POST-VISIT HANDOUT GUIDE FOR SPS WIM FIELD VALIDATION

STATE: Virginia

SHRP ID: 510100

Additional Lane: 510199

Figures

Photos

1. General Information

SITE ID: *510100 and 510199*

LOCATION: *US-29 Bypass, milepost 12.8, near Danville*

VISIT DATE: *December 2, 2008*

VISIT TYPE: *Validation*

2. Contact Information

POINTS OF CONTACT:

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

Highway Agency: *Mohamed Elfino, 804-328-3173,*
Mohamed.elfino@vdot.virginia.gov

Richard Bush, 804-786-7006,
Richard.bush@vdot.virginia.gov

Hamlin Williams, 804-786-0134,
Hamlin.williams@vdot.virginia.gov

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

FHWA Division Office Liaison: *Lorenzo Casanova, 804-775-3362,*
Lorenzo.casanove@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: Beginning *December 2, 2008.*

TRUCK ROUTE CHECK: *Completed at Calibration.*

4. Site Location/ Directions

NEAREST AIRPORT: *Piedmont Triad International Airport, Greensboro, NC*

DIRECTIONS TO THE SITE: *US-29 Bypass, approximately 8 miles north of Danville.*

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

WIM SITE LOCATION: *US-29 bypass, milepost 12.8; GPS = 36.6599° N, -79.3656° W.*

WIM SITE LOCATION MAP: *See Figure 4.1*

Figure 4-1 – Sites 510100 and 510199 in Virginia

5. Truck Route Information

ROUTE RESTRICTIONS: *None*

SCALE LOCATION: *9181 US-29, Blairs, VA; approximately 4 miles north of the site; GPS = 36.7163° N, -79.3793° W.*

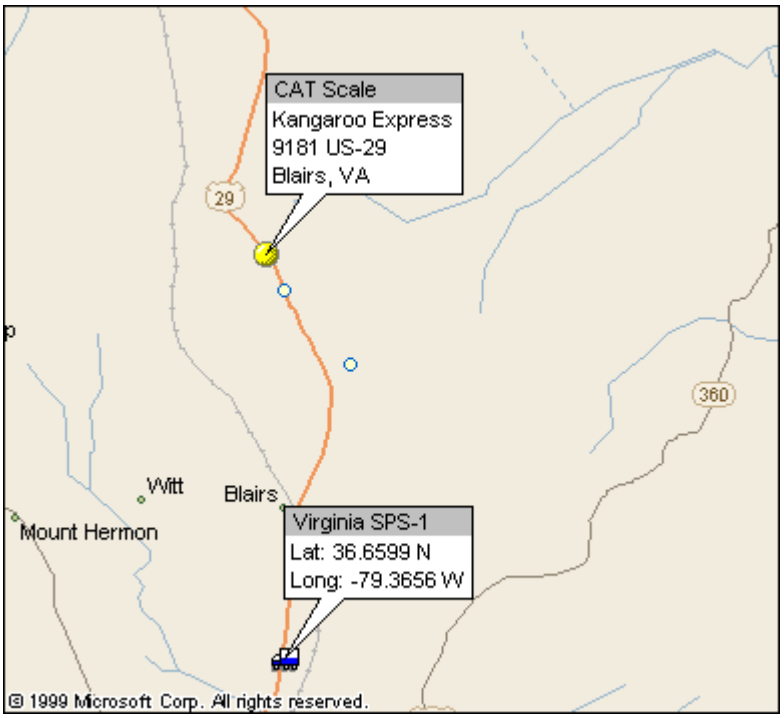

Figure 5-1 – Truck Scale Location for 510100 and 510199 in Virginia

TRUCK ROUTE: *See Figure 5.2*

NB on US-29 to Blairs/Danville exit (2.7 miles)
SB on US-29 to Halifax exit (3.1 miles)

Total miles – 11.6 miles – 14 minutes

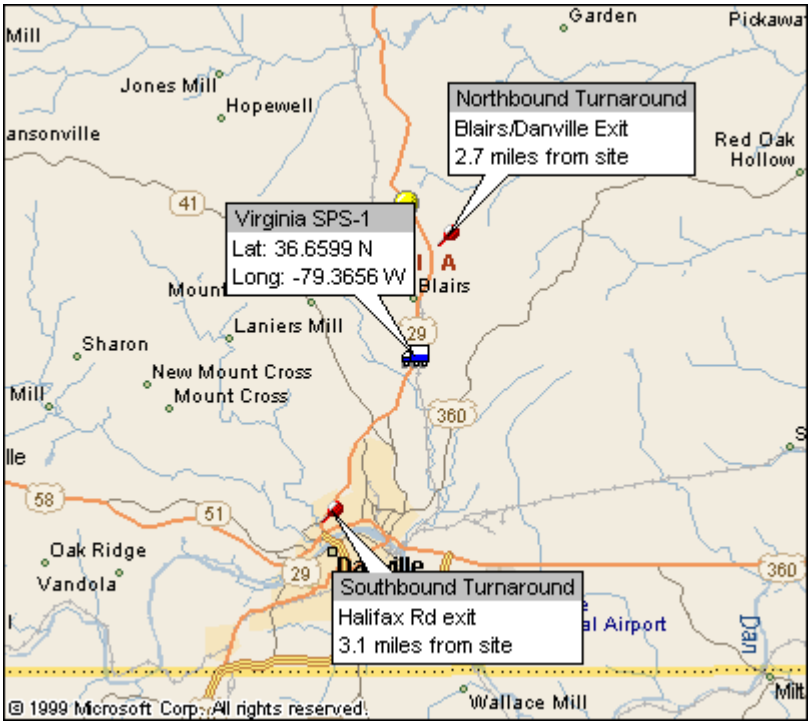

Figure 5-2 – Truck Route at 510100 and 510199 in Virginia

6. Sheet 17 – Virginia (510100)

1.* ROUTE _US-29 Bypass__ MILEPOST __12.8__ LTPP DIRECTION - N S E W

2.* WIM SITE DESCRIPTION - Grade _< 1____ % Sag vertical Y / N
Nearest SPS section upstream of the site _5_1_0_1 0_4__
Distance from sensor to nearest downstream SPS Section ___ _3_9_5___ ft

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

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

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

Shoulder width __1_1__ ft

4.* PAVEMENT TYPE ___PCC_____

5.* PAVEMENT SURFACE CONDITION – Distress Survey
Date: 12/2/2008 Filename: ___51_0100_Upstream_12_2_08.jpg_____
Date: 12/2/2008 Filename: __51_0100_Downstream_12_2_08.jpg _____
Date: 12/2/2008 Filename: __ 51_0199_Upstream_12_2_08.jpg _____
Date: 12/2/2008 Filename: __ 51_0199_Downstream_12_2_08.jpg

6. * SENSOR SEQUENCE _____Loop – Bending Plate – Bending Plate – Loop___

7. * REPLACEMENT AND/OR GRINDING __ __ __ / __ __ / __ __ __ __
REPLACEMENT AND/OR GRINDING __ __ __ / __ __ / __ __ __ __
REPLACEMENT AND/OR GRINDING __ __ __ / __ __ / __ __ __ __

8. RAMPS OR INTERSECTIONS
Intersection/driveway within 300 m upstream of sensor location Y / N
distance _____
Intersection/driveway within 300 m downstream of sensor location Y / N
distance ____
Is shoulder routinely used for turns or passing? Y / N

9. DRAINAGE (*Bending plate and load cell systems only)*
1 – Open to ground
2 – Pipe to culvert
3 – None

Clearance under plate ___ __ 4 . 0 __ in
Clearance/access to flush fines from under system Y / N

10. * CABINET LOCATION

Same side of road as LTPP lane Y / N Median Y/ N Behind barrier Y / N
Distance from edge of traveled lane _2_7__ ft
Distance from system __4_1__ ft
TYPE ____336 Short_____

CABINET ACCESS controlled by LTPP / STATE / JOINT ?
Contact - name and phone number _Hamlin Williams__804-786-7006___
Alternate - name and phone number __Roy Czinku__306-653-6627___

11. * POWER

Distance to cabinet from drop __ _4 __ __ ft Overhead / underground / solar / AC in cabinet?
Service provider _____ Phone number _____

12. * TELEPHONE

Distance to cabinet from drop __ _4 __ __ ft Overhead / under ground / cell?
Service provider _____ Phone Number _____

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

14. * TEST TRUCK TURNAROUND time __14 minutes__Distance _11.6__ mi.

15. PHOTOS FILENAME

Power source _51_0100_Power_Cabinet_12_2_08.jpg
Phone source _51_0100_Telephone_Service_Drop_10_28_08.jpg
Cabinet exterior _51_0100_Cabinet_Exterior_12_2_08.jpg
Cabinet interior _51_0100_Cabinet_Interior_Back_12_2_08.jpg
_51_0100_Cabinet_Interior_Front_12_2_08.jpg
Weight sensors _51_0100_Leading_WIM_Sensor_12_2_08.jpg
_51_0100_Trailing_WIM_Sensor_12_2_08.jpg
_51_0199_Leading_WIM_Sensor_12_2_08.jpg
_51_0199_Trailing_WIM_Sensor_12_2_08.jpg
Other sensors _51_0100_Leading_Loop_12_2_08.jpg
_51_0100_Trailing_Loop_12_2_08.jpg
_51_0199_Leading_Loop_12_2_08.jpg
_51_0199_Trailing_Loop_12_02_08.jpg
Description _Loop Sensors_____

Downstream direction at sensors on LTPP lane:
51_0100_Downstream_12_2_08.jpg
51_0199_Downstream_12_2_08.jpg
Upstream direction at sensors on LTPP lane:
51_0100_Upstream_12_2_08.jpg
51_0199_Upstream_12_2_08.jpg

COMMENTS _____

_____ concrete section = 425 feet _____

_____ leading edge of leading loop is 313 feet from approaching transition _____

COMPLETED BY ____Dean J. Wolf_____

PHONE _301-210-5105_____ DATE COMPLETED _ 12_ _ /_ 2_ _ / _2_0_0_8__

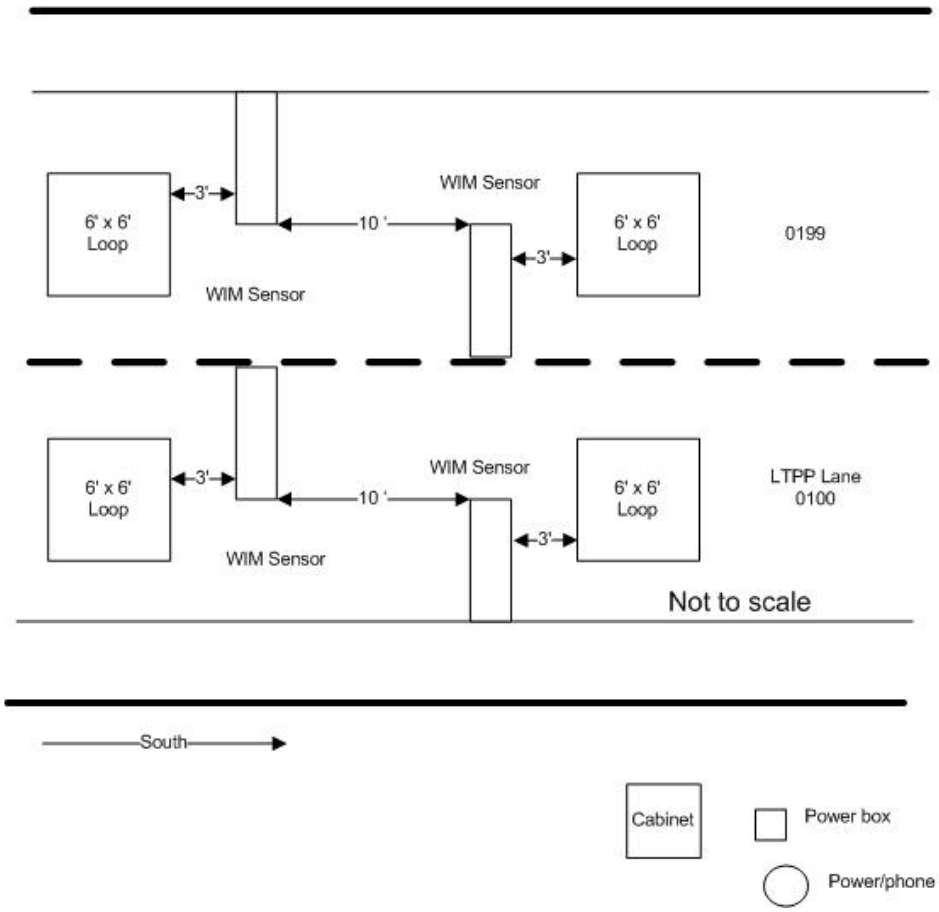

Figure 6-1 – Site Equipment Layout for 510100 and 510199 in Virginia

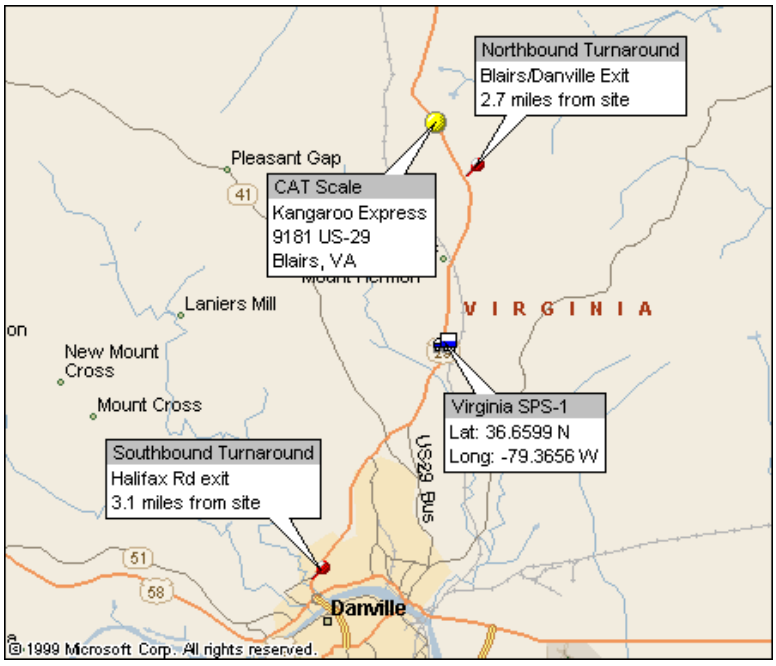

Figure 6-2 – Site Map for 510100 and 510199 in Virginia

Photo 1 - 51_0100_Upstream_12_2_08.jpg

Photo 2 - 51_0100_Downstream_12_2_08.jpg

Photo 3 - 51_0199_Upstream_12_2_08.jpg

Photo 4 - 51_0199_Downstream_12_2_08.jpg

Photo 5 - 51_0100_Power_Cabinet_12_2_08.jpg

Photo 6 - 51_0100_Power_Service_Meter_12_2_08.jpg

Photo 7 - 51_0100_Telephone_Service_Drop_12_2_08.jpg

Photo 8 - 51_0100_Cabinet_Exterior_12_2_08.jpg

Photo 9 - 51_0100_Cabinet_Interior_Front_12_2_08.jpg

Photo 10 - 51_0100_Cabinet_Interior_Back_12_2_08.jpg

Photo 11 - 51_0100_Leading_WIM_Sensor_12_2_08.jpg

Photo 12 - 51_0100_Trailing_WIM_Sensor_12_2_08.jpg

Photo 13 - 51_0199_Leading_WIM_Sensor_12_2_08.jpg

Photo 14 - 51_0199_Trailing_WIM_Sensor_12_2_08.jpg

Photo 15 - 51_0100_Leading_Loop _12_02_08.jpg

Photo 16 - 51_0100_Trailing_Loop _12_2_08.jpg

Photo 17 - 51_0199_Leading_Loop_ 12_02_08.jpg

Photo 18 - 51_0199_Trailing_Loop_12_02_08.jpg

SHEET 18	STATE CODE [51]
LTPP MONITORED TRAFFIC DATA	SPS PROJECT ID [0 1 0 0]
WIM SITE COORDINATION	DATE: (mm/dd/yyyy) 12/2/2008

Rev. 05/15/07

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

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

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

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

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

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

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

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

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

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

g. Communication –

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

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

3. PAVEMENT –

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

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

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

4. ON SITE ACTIVITIES –

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

b. Notice for straightedge and grinding check - __4_ ☐ days ☒ weeks

i. On site lead –
- ☒ State
- ☐ LTPP

ii. Accept grinding –
- ☒ State
- ☐ LTPP

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

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

e. Test Vehicles

i. Trucks –

1st – Air suspension 3S2 ☐ State ☒ LTPP

2nd – 3S2 different weight/suspension ☐ State ☒ LTPP

3rd – _____ ☐ State ☐ LTPP

4th – _____ ☐ State ☐ LTPP

ii. Loads – ☐ State ☐ LTPP

iii. Drivers – ☐ State ☐ LTPP

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

_____

g. Access to cabinet

i. Personnel Access –

☐ State only

☒ Joint

☐ LTPP

ii. Physical Access –

☒ Key

☐ Combination

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

i. Traffic Control Required – ☐Yes ☒No

j. Enforcement Coordination Required – ☐Yes ☒No

5. SITE SPECIFIC CONDITIONS –

a. Funds and accountability – _____

b. Reports – _____

c. Other – _____

d. Special Conditions – _____

6. CONTACTS –

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

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

Agency: IRD

b. Maintenance (equipment) –

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

Agency: IRD

c. Data Processing and Pre-Visit Data –

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

Agency: IRD

d. Construction schedule and verification –

Name: Don French Phone:(434) 947-6559

Agency: Lynchburg District, VA DOT

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

Name: Ed Foust Phone:(434) 799-6743

Agency: Thompson Trucking, Inc.

f. Traffic Control –

Name: Don French Phone:(434) 947-6559

Agency: Lynchburg District, VA DOT

g. Enforcement Coordination –

Name: _____ Phone:_____

Agency: _____

h. Nearest Static Scale

Name: Kangaroo Express Location:9181 US 29, Blairs, VA

Phone: _____

SHEET 16 **LTPP MONITORED TRAFFIC DATA** **SITE CALIBRATION SUMMARY**	*STATE ASSIGNED ID [__ __ __ __] *STATE CODE [51] *SHRP SECTION ID [0100]

SITE CALIBRATION INFORMATION

1. * DATE OF CALIBRATION (MONTH/DAY/YEAR) [12/2/2008]

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

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

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

5. EQUIPMENT MANUFACTURER ___IRD/ PAT Traffic

WIM SYSTEM CALIBRATION SPECIFICS**

6.**CALIBRATION TECHNIQUE USED:
   ____ TRAFFIC STREAM -- ____STATIC SCALE (Y/N) _X_ TEST TRUCKS

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

   __ 20 __ PASSES PER TRUCK

	TRUCK	TYPE	SUSPENSION
TYPE PER FHWA 13 BIN SYSTEM	1	9	1
SUSPENSION: 1 - AIR; 2 - LEAF SPRING	2	9	1
3 - OTHER (DESCRIBE)	3		

7. SUMMARY CALIBRATION RESULTS (EXPRESSED AS A PERCENT)
   MEAN DIFFERENCE BETWEEN ---
   DYNAMIC AND STATIC GVW ___4.2 STANDARD DEVIATION ___1.3
   DYNAMIC AND STATIC SINGLE AXLES ___0.8 STANDARD DEVIATION ___2.3
   DYNAMIC AND STATIC DOUBLE AXLES ___5.1 STANDARD DEVIATION ___2.9

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

9. DEFINE THE SPEED RANGES USED (MPH) _____ _55_ __60__ __65_ ____ __ __ _____ _____
   _____ _____ _____ _____ _____ _____ _____ _____ _____ _____

10. CALIBRATION FACTOR (AT EXPECTED FREE FLOW SPEED) ___3565___

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 _5_ ____ ____ 0
   *** FHWA CLASS 8 ____ 0 FHWA CLASS _6_ ____ ____ 0
   FHWA CLASS ___ ____ ____ _____
   FHWA CLASS ____ ____ ____ _____
   *** PERCENT "UNCLASSIFIED" VEHICLES: ____ 0.0

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

SHEET 16 **LTPP MONITORED TRAFFIC DATA** **SITE CALIBRATION SUMMARY**	*STATE ASSIGNED ID [__ __ __ __] *STATE CODE [51] *SHRP SECTION ID [0100]

SITE CALIBRATION INFORMATION

1. * DATE OF CALIBRATION (MONTH/DAY/YEAR) [12/4/2008]

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

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

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

5. EQUIPMENT MANUFACTURER ___IRD/ PAT Traffic_____

WIM SYSTEM CALIBRATION SPECIFICS**

6.**CALIBRATION TECHNIQUE USED:
   ___ TRAFFIC STREAM -- ___STATIC SCALE (Y/N) _X_ TEST TRUCKS

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

   __ 20__ PASSES PER TRUCK

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

TRUCK	TYPE	SUSPENSION
1	9	1
2	9	1
3		

7. SUMMARY CALIBRATION RESULTS (EXPRESSED AS A PERCENT)
   MEAN DIFFERENCE BETWEEN ---
   DYNAMIC AND STATIC GVW 1.0 STANDARD DEVIATION 1.6
   DYNAMIC AND STATIC SINGLE AXLES 1.5 STANDARD DEVIATION 2.5
   DYNAMIC AND STATIC DOUBLE AXLES 1.2 STANDARD DEVIATION 2.9

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

9. DEFINE THE SPEED RANGES USED (MPH) _____ ___ 55 60 65 __ __ _____ _____
   _____ _____ _____ _____ _____ _____ _____ _____ _____ _____

10. CALIBRATION FACTOR (AT EXPECTED FREE FLOW SPEED) 3422

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 5 ____ ____ 0
   *** FHWA CLASS 8 ____ 0 FHWA CLASS 6 ____ ____ -9
   FHWA CLASS ___ ____ ____ _____
   FHWA CLASS ___ ____ ____ _____
   *** PERCENT "UNCLASSIFIED" VEHICLES: ____ 0.0

PERSON LEADING CALIBRATION EFFORT: Dean J. Wolf, MACTEC
CONTACT INFORMATION: 301-210-5105 rev. November 9, 1999

APPENDIX A

Sheet 19	* STATE_CODE	51
LTPP Traffic Data	* SPS PROJECT ID	0100 / 0199
*CALIBRATION TEST TRUCK # 1	* DATE	12/2/08

Rev. 08/31/01

PART I.

1.* FHWA Class 9 2.* Number of Axles 5 Number of weight days 3

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

GEOMETRY

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

9. a) * Make: INTERNATIONAL b) * Model: 9900 I

10.* Trailer Load Distribution Description:

GRAVEL LOADED OVER TRAILER

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

b). Trailer Tare Weight (units): _____

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

A to B 15.0 B to C 4.4 C to D 21.6

D to E 4.4 E to F _____

Wheelbase (measured A to last) _____ Computed 45.4

13. *Kingpin Offset From Axle B (units) + 2.2 (_____)

(+ is to the rear)

SUSPENSION

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

Sheet 19	* STATE_CODE	51
LTPP Traffic Data	* SPS PROJECT ID	0100 / 0199
*CALIBRATION TEST TRUCK # 2	* DATE	12/2/08

Rev. 08/31/01

PART II

Day 1

*b) Average Pre-Test Loaded weight 77130
*c) Post Test Loaded Weight 76540
*d) Difference Post Test – Pre-test -590

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	9980	15790	15790	17780	17780		77120
2	9880	15880	15880	17750	17750		77140
3							
Average	9930	15835	15835	17765	17765		77130

Table 6. Raw data – Axle scales –

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

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	9560	15770	15770	17710	17710		76520
2	9600	15760	15760	17720	17720		76560
3							
Average	9580	15765	15765	17715	17715		76540

Measured By dgw Verified By EA. Weight date 12/2/08

Sheet 19	* STATE_CODE	51
LTPP Traffic Data	* SPS PROJECT ID	0100 / 0199
*CALIBRATION TEST TRUCK # _1_	* DATE	12/3/08

Rev. 08/31/01

Day 2

7.2 *b) Average Pre-Test Loaded weight 77030

*c) Post Test Loaded Weight 76430

*d) Difference Post Test – Pre-test -600

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10000	15750	15750	17770	17770		77040
2	9900	15850	15850	17710	17710		77020
3							
Average	9950	15800	15800	17740	17740		77030

Table 6.2. Raw data – Axle scales –

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

Table 7.2 Raw data – Axle scales – post-test

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	9580	15710	15710	17720	17720		76440
2	9560	15710	15710	17720	17720		76420
3							
Average	9570	15710	15710	17720	17720		76430

Measured By JW Verified By SH. Weight date 12/3/08

Sheet 19	* STATE_CODE	51
LTPP Traffic Data	* SPS PROJECT ID	0100 / 0199
*CALIBRATION TEST TRUCK #_1_	* DATE	12/4/08

Rev. 08/31/01

Day 3

7..3 *b) Average Pre-Test Loaded weight 76960

*c) Post Test Loaded Weight 76320

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

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	9920	15810	15810	17720	17720		76960
2	9900	15810	15810	17710	17710		76940
3							
Average	9910	15810	15810	17715	17715		76960

Table 6.3. Raw data – Axle scales –

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

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	9440	15780	15780	17670	17670		76340
2	9560	15650	15650	17720	17720		76300
3							
Average	9500	15715	15715	17695	17695		76320

Measured By JW Verified By SA Weight date 12/4/08

Sheet 19	* STATE_CODE	51
LTPP Traffic Data	* SPS PROJECT ID	0100 / 0199
*CALIBRATION TEST TRUCK # 2	* DATE 12/2/08	

Rev. 08/31/01

PART I.

1.* FHWA Class 9 2.* Number of Axles 5 Number of weight days 3

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

GEOMETRY

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

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

10.* Trailer Load Distribution Description:

GRAVEL LOADED FLAT TRAILER

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

b). Trailer Tare Weight (units): _____

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

A to B 14.6 B to C 4.2 C to D 21.0

D to E 4.3 E to F _____

Wheelbase (measured A to last) _____ Computed 44.1

13. *Kingpin Offset From Axle B (units) 1.8 (_____)

(+ is to the rear)

SUSPENSION

Axle	14. Tire Size	15.* Suspension Description (leaf, air, no. of leaves, taper or flat leaf, etc.)
A	11 R 22.5	8 FULL LEAF
B	11 R 22.5	AIR
C	11 R 22.5	AIR
D	11 R 24.5	AIR
E	11R 24.5	AIR
F		

Sheet 19	* STATE_CODE	51
LTPP Traffic Data	* SPS PROJECT ID	0100 / 0199
*CALIBRATION TEST TRUCK # 2	* DATE	12/2/08

Rev. 08/31/01

PART II

Day 1

*b) Average Pre-Test Loaded weight 65920
*c) Post Test Loaded Weight 65230
*d) Difference Post Test – Pre-test -690

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10280	11020	11020	16800	16800		65920
2	10280	11030	11030	16790	16790		65920
3							
Average	10280	11025	11025	16795	16795		65920

Table 6. Raw data – Axle scales –

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

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	9900	10970	10970	16690	16690		65220
2	9980	10920	10920	16710	16710		65240
3							
Average	9940	10945	10945	16700	16700		65230

Measured By djw Verified By [illegible] Weight date 12/2/08

Sheet 19	* STATE_CODE	51
LTPP Traffic Data	* SPS PROJECT ID	0100 / 0199
*CALIBRATION TEST TRUCK #_2_	* DATE	12/3/08

Rev. 08/31/01

Day 2

7.2 *b) Average Pre-Test Loaded weight 65610

*c) Post Test Loaded Weight 65040

*d) Difference Post Test – Pre-test -570

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10220	10990	10990	16700	16700		65600
2	10200	11010	11010	16700	16700		65620
3							
Average	10210	11000	11000	16700	16700		65610

Table 6.2. Raw data – Axle scales –

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

Table 7.2 Raw data – Axle scales – post-test

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	9880	10880	10880	16700	16700		65040
2	9880	10880	10880	16700	16700		65040
3							
Average	9880	10880	10880	16700	16700		65040

Measured By KJW Verified By EA. Weight date 12/3/08

Sheet 19	* STATE_CODE	51
LTPP Traffic Data	* SPS PROJECT ID	0100 / 0199
*CALIBRATION TEST TRUCK # 2	* DATE	12/4/08

Rev. 08/31/01

Day 3

7..3 *b) Average Pre-Test Loaded weight 65720

*c) Post Test Loaded Weight 65110

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

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10280	11040	11040	16670	16670		65700
2	10300	11060	11060	16660	16660		65740
3							
Average	10290	11050	11050	16665	16665		65720

Table 6.3. Raw data – Axle scales –

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

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	9940	10920	10920	16670	16670		65120
2	10000	10860	10860	16690	16690		65100
3							
Average	9970	10890	10890	16680	16680		65110

Measured By djw Verified By GPH Weight date 12/4/08

Sheet 20	* STATE_CODE	51
LTPP Traffic Data	*SPS PROJECT_ID	0100
Speed and Classification Checks * 1 of* 2	* DATE	12/02/2008

Rev. 08/31/2001

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
61	9	3704	61	9	70	6	3847	69	6
62	9	3705	64	9	65	9	3851	64	9
53	9	3225	53	9	60	6	3854	60	6
60	9	3233	58	9	63	9	3857	62	9
63	9	3730	63	9	50	6	3897	52	6
66	6	3731	66	6	66	9	3911	67	9
60	9	3737	61	9	61	11	3915	61	11
63	5	3740	61	5	64	9	3918	64	9
52	5	3745	52	5	65	9	3921	64	9
65	9	3751	65	9	59	5	3924	59	5
65	9	3755	65	9	64	9	3928	63	9
64	9	3756	64	9	54	9	3947	53	9
62	8	3757	63	8	61	8	3958	61	8
65	8	3758	65	8	62	9	3968	62	9
67	9	3763	66	9	56	9	3970	55	9
59	9	3764	59	9	66	5	3971	66	5
61	9	3765	63	9	64	9	3976	64	9
63	9	3769	62	9	65	9	3977	64	9
55	9	3771	56	9	63	9	3985	62	9
68	9	3778	67	9	66	9	3988	66	9
60	9	3783	60	9	69	9	3990	70	9
59	9	3786	58	9	64	9	4020	62	9
66	9	3824	64	9	67	6	4023	68	6
63	9	3842	62	9	62	8	4035	62	8
60	6	3846	59	6	54	9	4037	53	9

Recorded by MARK Z Direction S Lane 1 Time from 11:25 to 1235

Sheet 20	* STATE_CODE	51
LTPP Traffic Data	*SPS PROJECT_ID	0100
Speed and Classification Checks * 2 of* 2	* DATE	12/02/2003

Rev. 08/31/2001

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
64	9	4047	62	9	63	9	4198	63	9
64	9	4049	62	9	70	5	4200	70	5
68	8	4058	67	8	60	9	4211	59	9
63	9	4061	61	9	67	9	4214	66	9
63	9	4125	62	9	60	9	4216	61	9
62	6	4126	62	6	66	9	4224	66	9
64	9	4147	62	9	65	9	4251	66	9
60	5	4150	60	5	61	9	4258	60	9
62	9	4151	62	9	65	9	4272	65	9
65	8	4152	65	8	65	5	4275	65	5
62	9	4153	62	9	65	5	4279	63	5
65	9	4155	65	9	53	5	4289	52	5
67	8	4159	67	8	62	9	4294	62	9
57	6	4161	57	6	61	9	4297	59	9
65	9	4163	64	9	62	9	4298	61	9
62	6	4166	62	6	62	6	4301	62	6
62	9	4168	61	9	64	9	4303	64	9
61	6	4174	61	6	65	9	4308	65	9
65	9	4178	65	9	61	9	4325	61	9
62	6	4184	60	6	60	9	4327	58	9
62	6	4185	64	6	64	9	4329	64	9
60	9	4187	61	9	72	6	4332	72	6
74	9	4188	74	9	69	6	4336	69	6
67	9	4193	67	9	65	5	4354	63	5
67	9	4197	65	9	59	5	4358	58	5

Recorded by MARK Direction S Lane 1 Time from 12:36 to 1:46

Sheet 20	* STATE_CODE	51
LTPP Traffic Data	*SPS PROJECT_ID	0100
Speed and Classification Checks * 1 of* 2	* DATE	12/04/2008

Rev. 08/31/2001

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	
~~62~~	~~9~~	~~12459~~	~~60~~	~~9~~	48	8	12606	47	8	
59	6	12465	59	6	57	8	12611	55	8	
68	5	12482	68	5	65	9	12616	64	9	
65	8	12517	64	8	64	9	12617	63	9	
48	5	12519	48	5	64	9	12642	62	9	
67	8	12520	65	8	66	4	12650	65	6	*24.0 FT.
59	9	12523	58	9	58	9	12654	58	9	
67	9	12527	66	9	60	9	12662	59	9	
61	5	12533	60	5	60	9	12671	~~60~~	~~9~~	
52	5	12535	49	5	67	5	12673	67	5	
61	9	12540	61	~~9~~ 6	6	6	12674	58	6	
56	9	12542	55	9	65	6	12675	63	6	
64	6	12545	63	6	65	8	12680	65	8	
65	9	12547	64	9	62	9	12692	64	9	
66	9	12552	65	9	64	5	12696	65	5	
65	9	12553	65	9	62	9	12699	61	9	
59	5	12576	~~65~~ 59	~~9~~ 5	64	9	12702	62	9	
60	9	12579	60	9	67	9	12703	67	9	
60	6	12581	59	6	60	9	12704	~~59~~	9	
54	5	12587	55	5	55	8	12719	54	~~8~~	
54	~~9~~	12588	53	9	60	9	12727	60	9	
65	~~9~~	12591	65	9	60	9	12740	59	9	
66	9	12597	65	9	50	5	12746	50	5	
58	9	12599	60	9	62	9	12762	60	9	
62	9	12603	60	9	48	~~9~~ 5	12767	48	~~9~~ 5	

Recorded by MARK Z Direction S Lane 1 Time from ~~8:18 AM~~ 8:18 AM to 9:22 AM

Sheet 20	* STATE_CODE	51
LTPP Traffic Data	*SPS PROJECT_ID	0100
Speed and Classification Checks * 2 of* 2	* DATE	12/04/2008

Rev. 08/31/2001

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
64	6	12772	64	6	52	9	12885	52	9
41	13	12775	34	13	61	6	12888	61	6
40	9	12776	38	9	66	6	12890	66	6
37	5	12778	35	5	67	6	12893	67	6
69	9	12780	68	9	61	9	12899	59	9
66	9	12782	65	9	62	9	12907	61	9
55	9	12783	55	9	61	6	12908	59	6
63	9	12784	61	9	65	9	12915	65	9
65	9	12785	64	9	69	9	06	69	9
54	5	12787	53	5	73	5	09	73	5
69	5	12788	68	5	70	9	15	70	9
64	9	12790	63	9	54	9	17	53	9
66	8	12797	66	8	65	9	19	65	9
68	5	12799	66	5	65	9	34	63	9
65	9	12803	64	9	62	9	39	63	9
64	9	12804	62	9	55	9	44	54	9
64	9	12806	63	9	61	9	55	59	9
64	9	12830	64	9	65	9	63	64	9
67	9	12837	67	9	64	9	67	62	9
67	5	12838	67	5	65	9	69	65	9
52	5	12857	52	5	57	5	76	56	5
70	5	12863	69	5	55	9	84	55	9
63	9	12870	63	9	62	9	88	61	9
68	9	12875	67	9	65	9	90	64	9
65	8	12877	65	8	65	9	91	64	9

Recorded by MARK Z Direction S Lane 1 Time from 9:22 AM to 10:20 AM

Sheet 21	* STATE_CODE	51
LTPP Traffic Data	*SPS PROJECT_ID	0100
WIM System Test Truck Records 1 of 3	* DATE	12/02/2008

Rev. 08/31/2001

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
38.5	53	2	1	1031	3533	54	52/55	64/71	53/62	81/96	81/94		69.9	14.6	4.3	21.0	4.3	
38.5	51	1	1	1031	3535	54	47/54	74/91	73/94	84/10.2	86/102		81.2	15.0	4.4	21.6	4.4	
42.5	54	2	2	10:47	3602	57	51/54	54/66	55/67	81/94	81/95		69.9	14.6	4.2	21.0	4.3	
42.5	52	1	2	10:47	3603	54	49/52	78/92	76/94	87/99	86/103		81.7	15.0	4.4	21.6	4.4	
43.5	59	2	3	11:02	3651	60	52/52	64/64	57/64	81/93	78/91		69.3	14.6	4.2	21.0	4.3	
43.5	59	1	3	11:02	3653	60	48/51	76/91	69/89	84/10.1	82/97		79.0	14.9	4.3	21.6	4.4	
49.5	54	2	4	11:32	3788	56	51/53	53/67	55/66	79/98	79/95		69.7	14.6	4.3	21.0	4.3	
49.5	58	1	4	11:33	3789	59	47/53	76/93	73/94	84/10.1	86/97		80.4	15.0	4.4	21.6	4.4	
49.5	54	2	5	11:17	3722	54	53/51	54/66	52/58	75/93	77/89		66.9	14.5	4.3	21.0	4.3	
49.5	53	1	5	11:17	3725	53	51/50	80/89	73/88	86/10.1	83/10.0		80.1	14.9	4.3	21.6	4.4	
47	59	2	6	11:47	3859	60	51/50	56/64	55/64	78/96	78/93		68.6	14.6	4.2	21.0	4.3	
47	61	1	6	11:47	3863	63	46/54	74/94	76/91	82/10.3	82/10.9		80.3	15.0	4.4	21.6	4.4	
47	52	2	7	12:02	3935	54	51/50	55/62	55/57	80/92	80/91		67.3	14.5	4.2	21.0	4.3	
47	53	1	7	12:02	3937	56	47/54	76/94	70/91	88/10.4	83/10.0		80.7	15.0	4.4	21.6	4.4	
45	54	2	8	12:17	4002	56	50/51	58/60	57/58	81/90	77/91		67.4	14.5	4.2	21.0	4.3	
45	56	1	8	12:17	4005	59	48/52	79/94	76/92	83/100	86/99		80.9	14.9	4.4	21.6	4.3	

Recorded by MARK Z

Checked by

Sheet 21	* STATE_CODE	51
LTPP Traffic Data	*SPS PROJECT_ID	0100
WIM System Test Truck Records 2 of 3	* DATE	12/02/2008

Rev. 08/31/2001

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
45.5	58	2	9	12:32	4862	60	50/50	59/63	58/59	81/91	80/93		68.3	14.5	4.2	20.9	4.3	
45.5	62	1	9	12:32	4864	62	48/56	75/84	67/75	79/10.2	79/10.0		79.3	15.0	4.4	21.5	4.3	
45.5	54	2	10	12:47	4130	55	53/51	56/67	52/62	80/94	72/95		68.9	14.6	4.3	21.0	4.3	
45.5	~~54~~	1	10	12:47	4131	55	46/52	76/93	74/94	84/10.4	84/10.1		80.9	15.0	4.4	21.6	4.4	
~~41.5~~	~~58~~	~~2~~	~~11~~	~~13:27~~	~~4822~~	~~58~~	~~45/49~~	~~70/93~~	~~65/96~~	~~56/10.1~~	~~49/99~~		~~72.3~~	~~15.1~~	~~4.4~~	~~21.8~~	~~4.4~~	
41.5	55	2	11	13:27	4823	55	50/49	57/60	55/58	83/91	80/89		67.4	14.5	4.3	21.0	4.3	
45	62	1	13	13:55	4869	64	45/51	75/94	71/95	81/10.0	80/99		79.2	15.0	4.4	21.6	4.4	
45	62	2	13	13:55	4870	64	51/51	53/64	55/64	78/97	75/94		68.2	14.6	4.3	21.0	4.3	
38.5	59	1	14	14:09	4537	62	47/49	79/90	73/89	82/10.1	78/101		78.9	14.9	4.3	21.5	4.4	
38.5	64	2	14	14:10	4540	65	50/50	56/64	56/64	80/91	80/90		68.1	14.6	4.2	21.0	4.3	
40.5	63	1	15	14:23	4604	65	42/53	73/98	72/92	78/10.1	82/103		79.2	15.0	4.4	21.6	4.4	
40.5	62	2	15	14:24	4605	64	55/50	56/68	53/62	80/92	79/94		68.4	14.5	4.2	21.0	4.3	
43	62	1	16	14:37	4607	64	46/50	74/94	68/90	88/98	80/96		78.6	14.9	4.4	21.5	4.3	
43	62	2	16	14:37	4608	63	50/50	61/65	54/66	81/93	78/93		69.2	14.6	4.3	21.0	4.3	
43.5	62	1	17	14:51	4737	64	47/50	76/92	70/95	84/99	81/96		79.2	15.0	4.4	21.6	4.4	
43.5	60	2	17	14:51	4739	62	52/50	55/72	55/65	75/96	78/95		69.3	14.5	4.3	21.0	4.3	

Recorded by MARK Z

Checked by

Sheet 21	* STATE_CODE	51
LTPP Traffic Data	*SPS PROJECT_ID	0100
WIM System Test Truck Records 3 of 3	* DATE	12/02/2008

Rev. 08/31/2001

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
45	64	1	18	15:05	4827	64	46/51	73/94	68/90	85/10.0	81/10.0		78.8	15.0	4.4	21.6	4.4	
45	65	2	18	15:05	4829	65	50/49	58/66	53/66	79/96	77/92		68.6	14.6	4.3	21.0	4.3	
42.5	60	1	12	13:41	4392	60	44/52	73/90	73/94	89/103	89/10.2		80.1	15.0	4.4	21.6	4.3	
42.5	57	2	12	13:41	4393	57	53/50	58/62	54/61	81/94	81/93		68.8	14.5	4.2	21.0	4.3	
42	60	1	19	15:19	4910	60	46/52	77/93	74/93	86/10.1	85/10.1		80.9	15.0	4.4	21.6	4.3	
42	59	2	19	15:19	4912	61	51/52	54/66	52/65	80/95	76/93		68.7	14.6	4.3	21.0	4.3	
42.5	62	1	20	15:32	4984	64	47/50	75/93	71/92	83/98	78/10.0		78.7	15.0	4.3	21.6	4.4	
42.5	62	2	20	15:32	4987	62	49/50	54/68	57/62	84/90	79/92		68.5	14.5	4.3	21.0	4.3	
42	61	1	21	15:46	5046	64	44/52	71/94	72/95	90/10.1	90/98		78.6	15.0	4.4	21.6	4.3	
42	62	2	21	15:46	5047	63	51/49	58/66	55/61	79/93	78/91		68.0	14.5	4.3	21.0	4.3	

Recorded by MARK Z

Checked by

Sheet 21	* STATE_CODE	47
LTPP Traffic Data	*SPS PROJECT_ID	0600
WIM System Test Truck Records 1 of 1	* DATE	12/03/2008

Rev. 08/31/2001

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
50.5	55	2	1	13:45	9088	56	53/50	52/62	54/58	76/89	76/91		66.0	14.6	4.3	21.0	4.3	
50.5	55	1	1	13:45	9089	57	51/48	77/87	73/85	88/93	83/93		77.8	14.9	4.4	21.6	4.4	
49.5	57	2	2	14:00	9146	58	53/49	55/62	54/55	81/87	78/86		65.8	14.5	4.3	21.0	4.3	
49.5	56	1	2	14:00	9147	59	48/49	76/~~87~~	73/86	82/~~84~~	82/~~88~~		77.8	15.0	4.4	21.6	4.4	
50.5	62	2	3	14:15	9243	62	51/48	~~54~~/59	56/60	80/91	76/87		66.3	14.5	4.3	20.9	4.3	
50.5	~~60~~ 62	1	3	14:15	9245	62	46/47	73/88	67/90	82/98	80/97		76.7	15.0	4.4	21.6	4.4	
40	56	2	4	14:29	9309	57	50/49	55/62	52/60	74/90	75/92		66.1	14.6	4.3	21.0	4.3	
40	56	1	4	14:29	9314	56	47/48	75/88	75/86	84/95	84/93		77.5	15.0	4.4	21.6	4.4	
43.5	58	2	5	14:42	9402	60	51/49	55/61	54/60	80/90	77/88		66.7	14.6	4.2	21.0	4.4	
43.5	57	1	5	14:43	9403	60	47/46	73/89	77/84	87/93	83/94		77.3	15.0	4.4	21.6	4.4	
WRONG TRUCKS	62	2	6	14:57	9468	63	47/49	72/89	69/89	80/95	79/96		76.5					
	63	1	6	14:58	9475	65												
40.5	62	2	6	14:57	9468	63	50/48	53/63	52/61	80/89	73/90		66.0	14.6	4.2	21.0	4.3	
40.5	63	1	6	14:58	9475	65	47/49	72/89	69/89	80/95	79/96		76.5	15.0	4.4	21.6	4.4	

Recorded by MARK E

Checked by

Sheet 21	* STATE_CODE	51
LTPP Traffic Data	*SPS PROJECT_ID	0100
WIM System Test Truck Records 1 of 2	* DATE	12/04/2008

Rev. 08/31/2001

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
35	52	1	7	7:58	12405	54	49/48	74/85	69/84	83/90	62/90		75.5	15.0	4.4	21.6	4.4	
35	53	2	7	7:58	12406	54	51/54	52/62	51/64	74/92	72/90		66.2	14.6	4.3	21.0	4.3	
35.5	58	1	8	8:13	12485	59	51/49	75/85	68/85	81/93	79/92		75.9	15.0	4.4	21.6	4.4	
35.5	56	2	8	8:13	12489	57	46/54	51/64	51/64	77/92	75/92		66.6	14.6	4.3	21.0	4.3	
29.5	61	1	9	8:26	12555	63	45/51	72/87	67/87	81/92	80/95		75.7	15.0	4.3	21.6	4.4	
29.5	58	2	9	8:27	12558	60	48/52	50/63	50/63	75/87	73/88		65.0	14.6	4.3	21.0	4.3	
29.5	53	1	10	8:40	12619	54	53/49	75/82	79/82	81/92	78/80		75.0	15.0	4.4	21.6	4.4	
29.5	53	2	10	8:40	12621	55	51/53	52/64	51/61	79/95	77/91		67.4	14.6	4.3	21.0	4.4	
38	59	1	15	8:54	12681	60	50/49	73/85	65/86	79/93	78/93		75.0	15.0	4.4	21.6	4.4	
38	57	2	15	8:54	12682	59	51/52	51/60	50/62	75/93	72/93		65.8	14.5	4.2	21.0	4.3	
38.5	63	1	12	9:07	12747	65	45/50	70/89	66/89	80/96	76/95		75.7	15.0	4.4	21.7	4.4	
38.5	59	2	12	9:08	12748	62	49/52	51/67	50/64	72/90	69/92		65.6	14.6	4.3	21.1	4.3	
45.5	53	2	13	9:21	12811	55	51/53	53/65	53/63	79/93	76/91		67.6	14.6	4.2	21.0	4.3	

Recorded by MARK 3 Checked by

Sheet 21	* STATE_CODE	51
LTPP Traffic Data	*SPS PROJECT_ID	0100
WIM System Test Truck Records 2 of 2	* DATE	12/04/2008

Rev. 08/31/2001

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
53.5	53	1	13	12:02	607	55	48/47	75/84	71/84	85/92	80/91		75.6	15.0	4.4	21.5	4.4	
53.5	53	2	14	12:07	609	54	52/53	54/64	52/61	80/91	79/91		67.6	14.5	4.2	21.0	4.3	
52.5	57	1	14	12:15	661	60	52/49	76/84	71/84	88/92	82/90		76.4	15.0	4.4	21.6	4.4	
52.5	58	2	15	12:16	666	59	51/52	51/69	51/64	78/93	72/95		67.7	14.6	4.3	21.1	4.3	
51	64	1	15	12:28	713	65	50/47	76/90	72/90	82/93	81/93		77.5	15.0	4.4	21.6	4.4	
51	61	2	16	12:29	716	62	49/53	51/68	53/64	76/89	75/89		66.3	14.6	4.3	21.0	4.3	
53.5	54	1	16	12:41	764	54	53/49	74/86	68/84	85/89	84/92		76.5	15.0	4.4	21.6	4.4	
53.5	54	2	17	12:43	768	54	52/52	54/66	53/59	81/91	78/90		67.6	14.6	4.3	21.0	4.3	
53.5	59	1	17	12:55	810	60	49/49	76/85	72/84	85/92	81/90		76.2	15.0	4.4	21.6	4.4	
53.5	58	2	18	12:56	818	59	50/54	51/63	51/62	74/94	76/92		66.6	14.6	4.3	21.1	4.3	
50	64	1	18	13:08	871	66	44/52	73/93	65/95	76/98	77/97		77.2	15.0	4.4	21.7	4.4	
50	62	2	19	13:09	873	64	48/54	50/67	48/67	70/94	69/94		66.0	14.6	4.3	21.1	4.4	
49.5	55	1	19	13:21	939	54	52/48	78/82	69/85	82/92	81/93		76.3	14.9	4.4	21.6	4.3	
49.5	54	2	20	13:22	942	55	51/49	54/65	56/60	82/80	81/89		67.6	14.6	4.3	21.0	4.3	
50.5	60	1	20	13:34	1001	60	50/48	75/87	73/85	85/91	81/92		76.8	15.0	4.3	21.5	4.4	
50.5	62	2	21	13:35	1008	59	53/52	55/60	52/60	81/89	76/90		66.9	14.6	4.3	21.1	4.3	

Recorded by MARK Z

Checked by

Calibration Worksheet

Site: 510100

Calibration Iteration 1 Date 12/3/08

Beginning factors:

Speed Point (mph)	Name	Value
Overall		1 * 2
Front Axle	dynamic compensation	~~3565~~ 100
1 – (45)	72 kph	3565
2 – (65)	88 kph	3565
3 – (75)	104 kph	3565
4 – (85)	121 kph	3565
5 – (95)	137 kph	3565

Errors:

	Speed Point 1	Speed Point 2 (55)	Speed Point 3 (60)	Speed Point 4 (65)	Speed Point 5
F/A		+2.3	+1.0	-0.9	
Tandem		+5.3	+5.3	+4.6	
GVW		+4.7	+4.4	+3.5	

Adjustments:

	Raise	Lower	Percentage
Overall	☐	☐	
Front Axle	☑	☐	3.0 %
Speed Point 1	☐	☑	-4.0 %
Speed Point 2	☐	☑	-4.0 %
Speed Point 3	☐	☑	-4.0 %
Speed Point 4	☐	☑	-4.0 %
Speed Point 5	☐	☑	-4.0 %

End factors:

Speed Point (mph)	Name	Value
Overall		
Front Axle	dynamic compensation	103
1 – (45)	72 kph	3422
2 – (65)	88 kph	3422
3 – (75)	104 kph	3422
4 – (85)	121 kph	3422
5 – (95)	137 kph	3422

TEST VEHICLE PHOTOGRAPHS FOR SPS WIM VALIDATION

December 2, 2008

STATE: VIRGINIA

SHRP ID: 510100

Photo 1 - Truck_1_Tractor_ 51_0100_12_2_09.JPG

Photo 2 - Truck_1_Trailer_Load_1_51_0100_12_2_08.JPG

Photo 3 - Truck_1_Suspension_1_51_0100_12_2_08.JPG

Photo 4 - Truck_1_Suspension_2_51_0100_12_2_08.JPG

Photo 5 - Truck_1_Suspension_3_51_0100_12_2_08.JPG

Photo 6 - Truck_2_Tractor_51_0100_12_2_08.JPG

Photo 7 - Truck_2_Trailer_51_0100_12_2_08.JPG

Photo 8 - Truck_2_Suspension_1_51_0100_12_2_08.JPG

Photo 9 - Truck_2_Suspension_2_51_0100_12_2_08.JPG

Photo 10 - Truck_2_Suspension_3_51_0100_12_2_08.JPG

ETG LTPP CLASS SCHEME, MOD 3

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

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

System Operating Parameters

Virginia SPS-1 (Lane 1)

Validation Visit – 4 December 2008

Calibration factor for sensors #1 & 2:

	December 4, 2008	December 2, 2008	July 25, 2007
Dynamic compensation	103	100	
72 kph	3422	3565	3700
88 kph	3422	3565	3700
105 kph	3422	3565	3700
121 kph	3422	3565	3700
137 kph	3422	3565	3700