Validation Report

Pennsylvania, SPS-6
Task Order 15, CLIN 2
November 4 to 5, 2008

List of Tables

List of Figures

1 Executive Summary

A visit was made to the Pennsylvania 0600 on November 4 to 5, 2008 for the purposes of conducting a validation of the WIM system located on I-80 at 0.2 miles east of Milesburg near exit 158. The SPS-6 is located in the righthand, westbound lane of a four-lane divided facility. The posted speed limit at this location is 65 mph. The LTPP lane is one of two lanes instrumented at this site. The validation procedures were in accordance with LTPP's SPS WIM Data Collection Guide dated August 21, 2001.

This site is a relocation of the site originally installed at milepost 151 near Snow Shoe, Pennsylvania. An assessment of that site determined that it would not be possible to validate the installation due to vehicles missing the right wheelpath sensor. This is the second validation visit to this location. The site was installed on April 30 to May 2, 2007 by International Road Dynamics Inc..

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

The site is instrumented with quartz piezo and iSINC electronics. It is installed in asphalt concrete, 400 feet long. There has been sensor repair since the last validation.

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 75,630 lbs., the "golden" truck.
2) 5-axle tractor semi-trailer with a tractor having a spring suspension and a trailer with a split rear tandem and an air suspension loaded to 65,390 lbs., the "partial" truck.

The validation speeds ranged from 51 to 64 miles per hour. The pavement temperatures ranged from 58 to 79 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 – 420600 – 05-Nov-2008

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	1.3 ± 7.7%	Pass
Single axles	±20 percent	-0.2 ± 14.8%	Pass
Tandem axles	±15 percent	-3.4 ± 4.8%	Pass
GVW	±10 percent	-1.7 ± 4.0%	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. The lower WIM index threshold was exceeded by 10 of the calculated values indicating that the pavement roughness should have limited impact on the ability to successfully validate the site.

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 May 30, 2007 for Sensor 2. It was remotely calibrated after sensor repairs.

This site needs three years of data to meet the goal of five years of research quality data assuming that a complete year of data is received for 2008.

2 Corrective Actions Recommended

At some unknown time, the cover of one section of the trailing sensor became loose and came off. The input channel for that particular section was remotely deactivated in the controller. It was recovered and IRD set it back in place with epoxy. It was then ground flush with the pavement. The sensor channel was activated and the sensor was remotely calibrated. The sensor was tested during the validation visit and it appeared to be working properly. As part of ongoing maintenance, data and sensors should be checked for any defects or problems resulting from this maintenance activity.

3 Post Calibration Analysis

This final analysis is based on test runs conducted November 05, 2008 from mid-morning through early afternoon at test site 420600 on I-80. This SPS-6 site is at milepost 158.2 on the westbound, righthand of a four-lane divided facility. No auto-calibration was used during test runs. The two trucks used for the calibration and for the subsequent validation included:

1. 5-axle tractor-trailer with a tractor having an air suspension and trailer with a standard rear tandem and air suspension loaded to 75,630 lbs., the "golden" truck.
2. 5-axle tractor semi-trailer with a tractor having a spring suspension and a trailer with a split rear tandem and an air suspension loaded to 65,390 lbs., the "partial" truck.

Each truck made a total of 20 passes over the WIM scale at speeds ranging from approximately 51 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 58 to 79 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.

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

Table 3-1 - Post-Validation Results – 420600 – 05-Nov-2008

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	1.3 ± 7.7%	Pass
Single axles	±20 percent	-0.2 ± 14.8%	Pass
Tandem axles	±15 percent	-3.4 ± 4.8%	Pass
GVW	±10 percent	-1.7 ± 4.0%	Pass
Axle spacing	± 0.5 ft [150mm]	0.0 ± 0.1 ft	Pass
		Prepared: ea	*Checked: bko*

The test runs were conducted primarily during the afternoon hours, resulting in a reasonable range of pavement temperatures. The runs were also conducted at various

speeds to determine the effects of these variables on the performance of the WIM scale. To investigate these effects, the data set was split into three speed groups and three temperature groups. The distribution of runs by speed and temperature is illustrated in Figure 3-1. The figure indicates that the desired distribution of speed and temperature combinations was 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 – 51 to 56 mph, Medium speed – 57 to 61 mph and High speed – 62 + mph. The three temperature groups were created by splitting the runs between those at 58 to 65 degrees Fahrenheit for Low temperature, 66 to 72 degrees Fahrenheit for Medium temperature and 73 to 79 degrees Fahrenheit for High temperature.

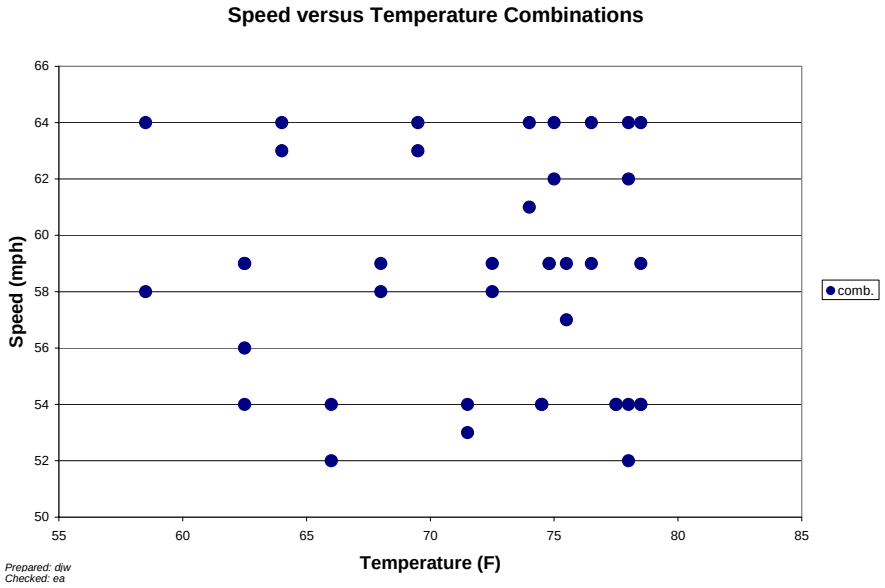


Figure 3-1 - Post-Validation Speed-Temperature Distribution – 420600 – 05-Nov-2008

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 somewhat underestimates GVW at all speeds. Variability in error is less at low and medium speeds as compared to high speeds.

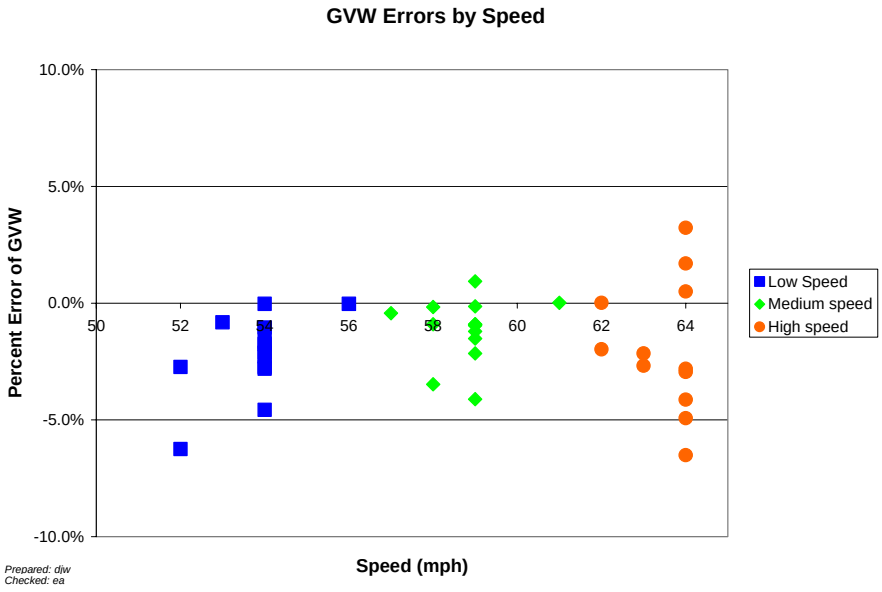


Figure 3-2 - Post-Validation GVW Percent Error vs. Speed – 420600 – 05-Nov-2008

Figure 3-3 shows the relationship between temperature and GVW percentage error. From Figure 3-3, it can be seen that the equipment underestimates GVW at all temperatures. The underestimation is greater at higher temperatures as compared to lower temperatures. Variability in error is consistent throughout the entire temperature range.

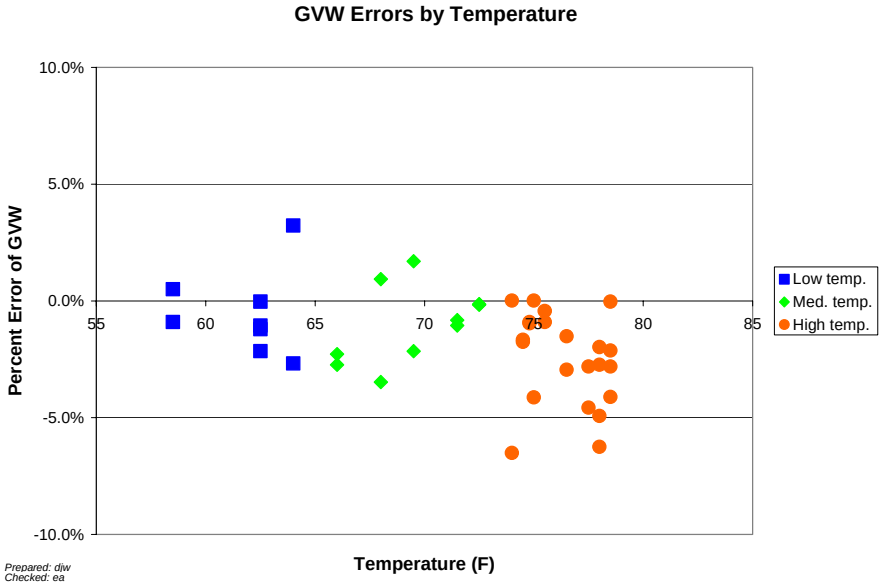


Figure 3-3 - Post-Validation GVW Percent Error vs. Temperature – 420600 – 05-Nov-2008

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.

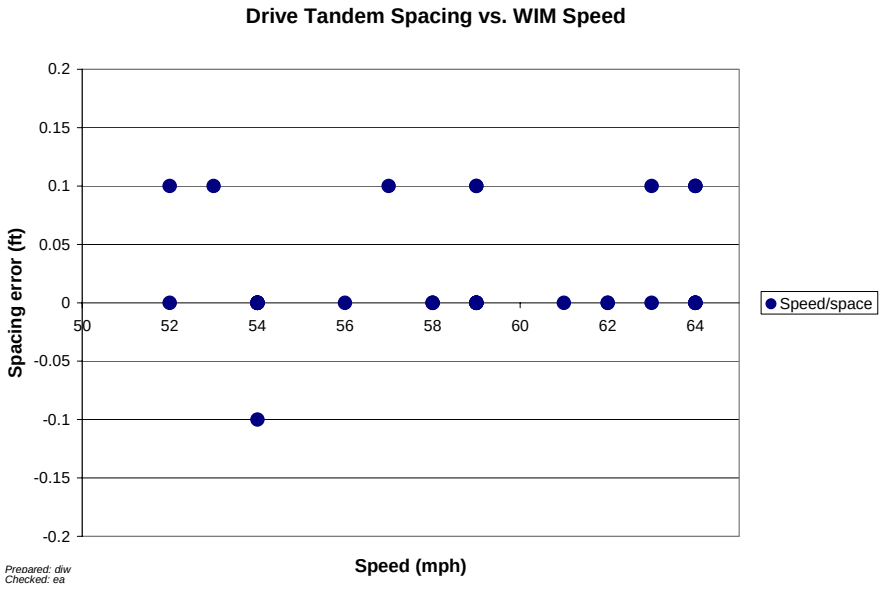


Figure 3-4 - Post-Validation Spacing vs. Speed – 420600 – 05-Nov-2008

3.1 Temperature-based Analysis

The three temperature groups were created by splitting the runs between those at 58 to 65 degrees Fahrenheit for Low temperature, 66 to 72 degrees Fahrenheit for Medium temperature and 73 to 79 degrees Fahrenheit for High temperature.

Table 3-2 - Post-Validation Results by Temperature Bin – 420600 – 05-Nov-2008

Element	95% Limit	Low Temperature 58 to 65 °F	Medium Temperature 66 to 72 °F	High Temperature 73 to 79 °F
Steering axles	±20 %	1.6 ± 9.5%	3.7 ± 4.5%	0.1 ± 8.1%
Single axles	±20 %	0.9 ± 17.1%	1.1 ± 15.6%	-1.2 ± 14.1%
Tandem axles	±15 %	-2.2 ± 7.7%	-3.5 ± 4.4%	-3.8 ± 4.5%
GVW	±10 %	-0.5 ± 4.3%	-1.0 ± 3.7%	-2.5 ± 4.0%
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 3-2 it can be seen the equipment underestimates GVW at all temperatures.

Figure 3-5 is the distribution of GVW Errors versus Temperature by Truck graph. From Figure 3-5 it can be seen that the GVW for both the golden truck (squares) and the partial truck (diamonds) were underestimated with a downward trend from lower to

greater temperatures. Variability in error is consistent throughout the entire speed range. The scatter for the golden truck is greater than that of the partial truck at the upper end of the temperature range.

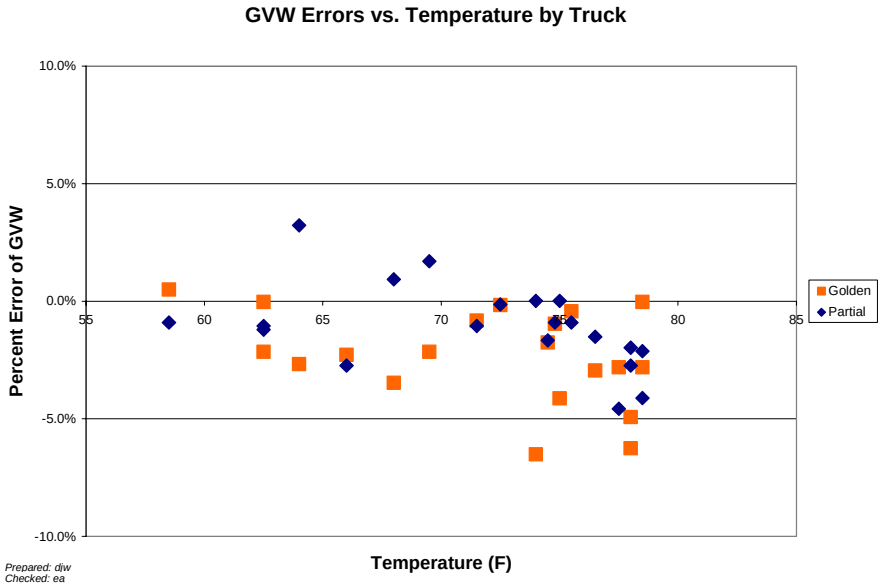


Figure 3-5 - Post-Validation GVW Percent Error vs. Temperature by Truck – 420600 – 05-Nov-2008

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

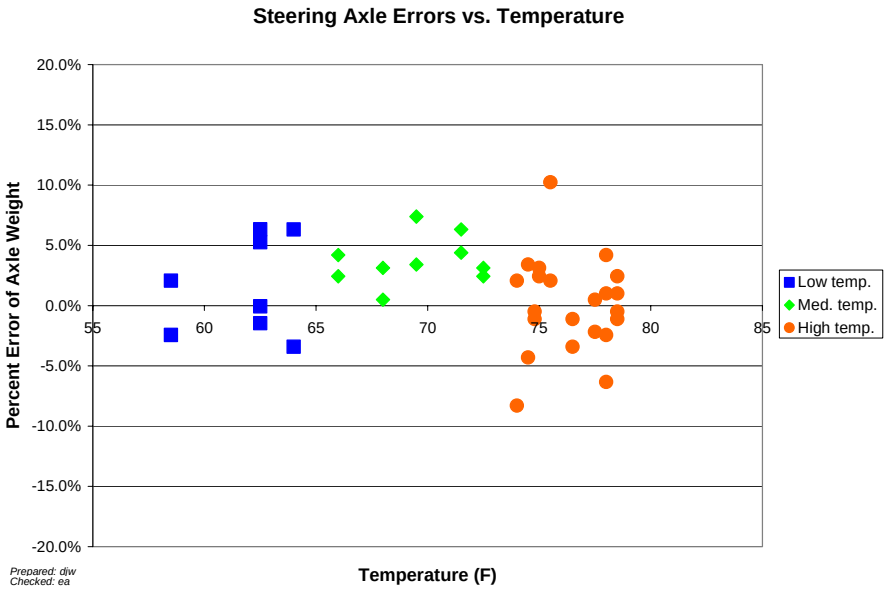


Figure 3-6 - Post-Validation Steering Axle Error vs. Temperature by Group – 420600 – 05-Nov-2008

Figure 3-7 shows the relationship between single axle errors and temperature. There is no apparent relationship between single axle errors and temperature. This graph is included because both vehicles had split tandem trailers. There is greater scatter for the single axles on the trailer for the golden truck than the partial truck. This may be a reflection of an inability to get individual axle weights on the split tandems at the available scale.

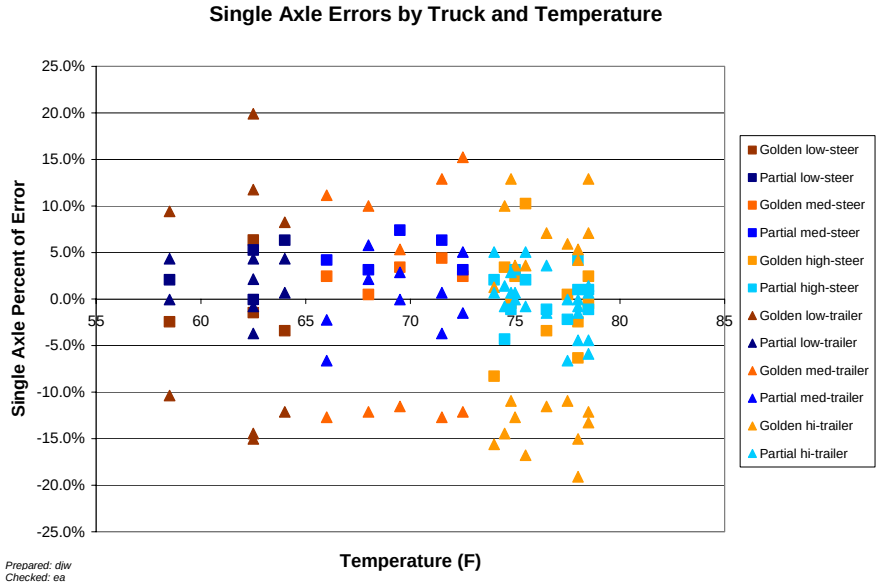


Figure 3-7 - Post-Validation Single Axle Errors by Truck and Temperature – 420600– 05-Nov-2008

3.2 Speed-based Analysis

The three speed groups were divided using 51 to 56 mph for Low speed, 57 to 61 mph for Medium speed and 62+ mph for High speed.

Table 3-3 - Post-Validation Results by Speed Bin – 420600 – 05-Nov-2008

Element	95% Limit	Low Speed 51 to 56 mph	Medium Speed 57 to 61 mph	High Speed 62+ mph
Steering axles	±20 %	1.4 ± 8.1%	2.0 ± 6.9%	0.3 ± 10.0%
Single axles	±20 %	-0.7 ± 16.6%	1.1 ± 13.7%	-1.3 ± 14.7%
Tandem axles	±15 %	-3.8 ± 3.0%	-3.8 ± 5.5%	-2.5 ± 6.6%
GVW	±10 %	-2.1 ± 3.7%	-1.1 ± 2.9%	-1.9 ± 6.2%
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft

Prepared: ea *Checked: bko*

Table 3-3 shows the overestimation of steering axle weights at all speeds. Single axles, tandem axle, and GVW show underestimates for most cases with the exception of single axles. These show an overestimation at medium speed. Variability in error is high at low and high speeds as compared to medium speed in most instances.

Figure 3-8 illustrates the tendency for the system to underestimate GVW errors for both trucks. The partially loaded trucks (diamonds), shows a slight overestimation at high speed and the golden trucks (squares), shows a greater amount of underestimation at high speed. The greater variability at high speed appears related to truck response more than site conditions.

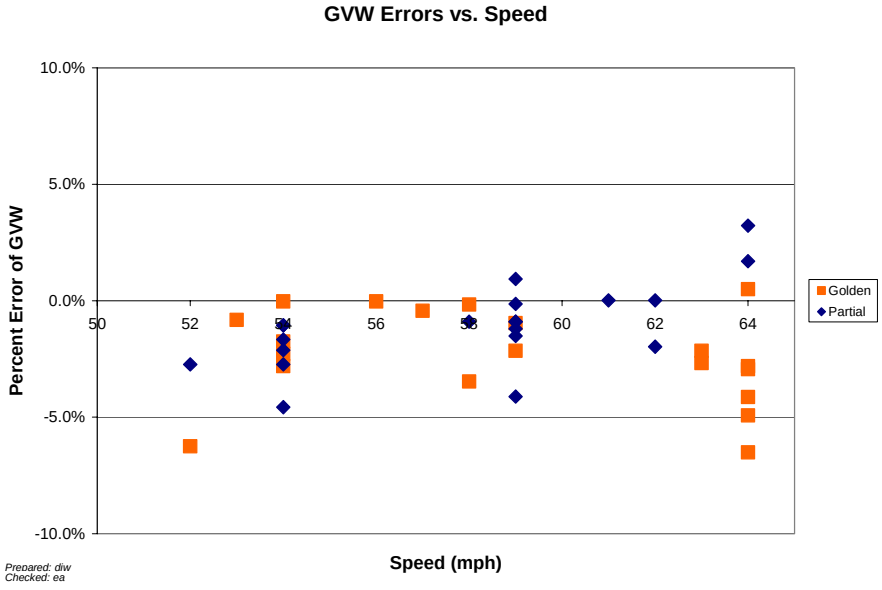


Figure 3-8 - Post-Validation GVW Percent Error vs. Speed by Truck – 420600 – 05-Nov-2008

Figure 3-9 shows the relationship between steering axle errors and speed. This graph is included due to the frequent use of steering axle weights of Class 9 vehicles for auto-calibration. This site does not use auto-calibration. The steering axles in this graph are associated only with Class 9 vehicles. Steering axle weights tend to be overestimated at all temperatures. Variability in graph is consistent throughout the entire graph.

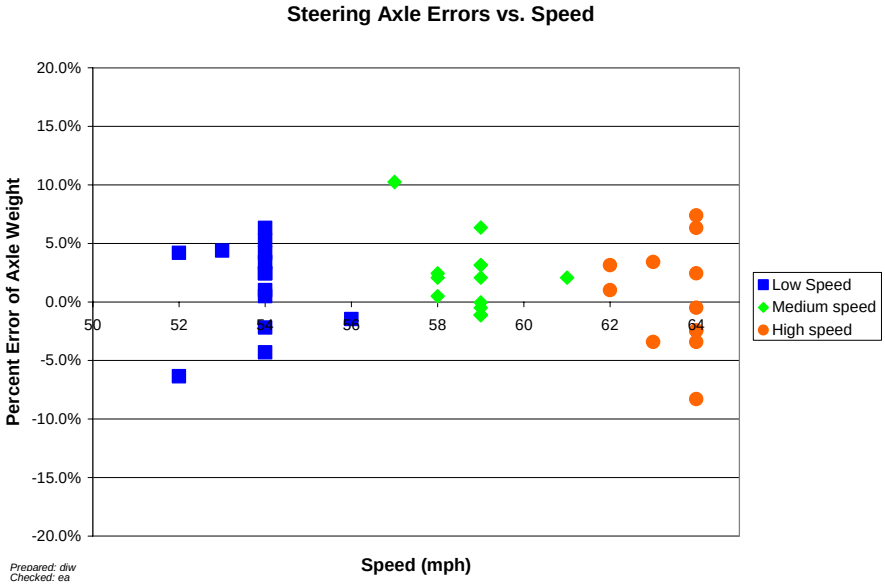


Figure 3-9 - Post-Validation Steering Axle Percent Error vs. Speed by Group – 420600 – 05-Nov-2008

Figure 3-10 is included because both trucks had split tandems on their trailers. There is greater scatter for the golden truck (yellow and gold (lighter) triangles) trailer singles than for the partial truck (blue (darker) triangles). This may be a reflection of the assumption on individual axle weights in the absence of a simple means to determine them at the available scale.

Figure 3-10 - Post-Validation Single Axle Errors by Truck and Speed – 420600 – 05-Nov-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 three hours (13 trucks) was collected at the site. Due to a downstream lane closure during the second day, trucks moved out of the LTPP lane prior to crossing the WIM system. This provided a much lower than typical truck sample for this location. Video was taken at the site to provide ground truth for the evaluation. Based on the sample it was determined that there are zero percent unknown vehicles and zero percent unclassified vehicles.

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

Table 3-4 - Truck Misclassification Percentages for 420600 – 05-Nov-2008

Class	Percent Error	Class	Percent Error	Class	Percent Error
4	N/A	5	0	6	N/A
7	N/A				
8	N/A	9	0	10	N/A
11	N/A	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 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 420600 – 05-Nov-2008

Class	Mean Difference	Class	Mean Difference	Class	Mean Difference
4	N/A	5	0	6	N/A
7	N/A				
8	N/A	9	0	10	N/A
11	N/A	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 by the observer. There is no way to tell how many vehicles of that type might actually exist. N/A means no vehicles of the class were recorded by either the equipment or the observer.

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

3.4 Evaluation by ASTM E-1318 Criteria

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

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

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

Prepared: 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 on October 21, 2008 were processed through the LTPP SPS WIM Index software, version 1.1. This WIM scale is installed on a flexible pavement.

A total of 11 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 5 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

Prepared: als Checked: jrn

Table 4-2 shows the computed index values for all 11 profiler passes for this WIM site. The average values over the passes in each path were also calculated when three or more passes were completed. These are shown in the right most column of the table. Values below the lower index limits are presented in italics and values above the upper index limits are presented in bold.

Table 4-2 - WIM Index Values – 420600 –21-Oct-2008

Profiler Passes			Pass 1	Pass 2	Pass 3	Pass 4	Pass 5	Ave.
Center	LWP	LRI (m/km)	*0.407*	*0.398*	*0.433*	*0.392*	*0.393*	*0.405*
		SRI (m/km)	*0.410*	*0.424*	*0.359*	*0.229*	*0.366*	*0.358*
		Peak LRI (m/km)	*0.499*	0.503	0.563	0.500	0.505	0.514
		Peak SRI (m/km)	*0.492*	*0.440*	*0.407*	*0.307*	*0.507*	*0.431*
	RWP	LRI (m/km)	*0.324*	*0.331*	*0.388*	*0.390*	*0.426*	*0.372*
		SRI (m/km)	*0.205*	*0.226*	*0.253*	*0.304*	*0.394*	*0.276*
		Peak LRI (m/km)	*0.468*	*0.461*	*0.453*	*0.475*	*0.475*	*0.466*
		Peak SRI (m/km)	*0.336*	*0.309*	*0.350*	*0.432*	*0.487*	*0.383*
Left Shift	LWP	LRI (m/km)	*0.393*	*0.434*	*0.380*			*0.402*
		SRI (m/km)	*0.366*	0.573	*0.391*			*0.443*
		Peak LRI (m/km)	0.505	*0.438*	0.503			*0.482*
		Peak SRI (m/km)	*0.507*	*0.699*	*0.463*			*0.556*
	RWP	LRI (m/km)	*0.426*	*0.376*	*0.391*			*0.398*
		SRI (m/km)	*0.394*	*0.323*	*0.332*			*0.350*
		Peak LRI (m/km)	*0.475*	*0.418*	*0.462*			*0.452*
		Peak SRI (m/km)	*0.487*	*0.415*	*0.459*			*0.454*
Right Shift	LWP	LRI (m/km)	*0.380*	*0.380*	*0.387*			*0.382*
		SRI (m/km)	*0.246*	*0.294*	*0.409*			*0.316*
		Peak LRI (m/km)	*0.433*	*0.460*	*0.442*			*0.445*
		Peak SRI (m/km)	*0.400*	*0.381*	*0.438*			*0.406*
	RWP	LRI (m/km)	*0.446*	*0.424*	*0.451*			*0.440*
		SRI (m/km)	*0.293*	*0.295*	*0.288*			*0.292*
		Peak LRI (m/km)	0.568	0.576	0.578			0.574
		Peak SRI (m/km)	*0.405*	*0.418*	*0.395*			*0.406*

Prepared: als Checked: jrn

From Table 4-2 it can be seen that all but 10 of indices computed from the profiles are below the lower threshold values. The indices which are above the lower threshold

values are still below the upper threshold values. This result indicates that the pavement roughness is expected to have limited impact on the ability to validate the site.

The profile data evaluated was collected after the site installation. As this is the only data collected since installation there is no information on the profile applying to the previous validation for comparison.

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 quartz piezo sensors and iSINC electronics. The sensors are installed in an asphalt concrete pavement about 400 ft in length.

At some unknown time, the cover of one section of the trailing sensor became loose and came off. The input channel for that particular section was remotely deactivated in the controller. It was recovered and IRD set it back in place with epoxy. It was then ground flush with the pavement. The sensor channel was activated and the sensor was remotely calibrated. The sensor was tested during the validation visit and it appeared to be working properly.

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 May 30, 2007. The sensor repair undertaken in the interim resulted in remote calibration of Sensor 2.

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 - 420600 - 04-Nov-2008

Speed Bin	Left Sensor 1	Right Sensor 2	Left Sensor 3	Right Sensor 4
80 kph	3182	3784	3182	3372
88 kph	3150	3736	3150	3329
96 kph	3024	3587	3024	3196
104 kph	3024	3587	3024	3196
112 kph	3040	3606	3040	3213

Prepared: ea *Checked: bko*

5.2.1 Calibration Iteration 1

As a result of the Pre-Validation, where GVW error was underestimated by 3.6%, the compensation factors were adjusted as shown in Table 5-2.

Table 5-2 - Calibration Iteration 1 - Change in Parameters - 420600 - 05-Nov-2008

Speed Bin	Right Sensor 1	Left Sensor 2	Right Sensor 3	Left Sensor 4	Change
80 kph	3182	3784	3182	3372	N/A
88 kph	3164	3753	3164	3344	0.5%
96 kph	3128	3710	3128	3306	3.4%
104 kph	3116	3696	3116	3293	3.0%
112 kph	3040	3606	3040	3213	N/A

Prepared: ea *Checked: bko*

As shown in Table 5-3 and Figure 5-1, the calibration produced the expected results. The slight upward trend at the high end of the speed range was not considered worth adjusting since it contains points above the 85th percentile speed. No additional calibration iterations of the equipment were conducted.

Table 5-3 - Calibration Iteration 1 Results – 420600 – 05-Nov-2008 (10:08 AM)

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	1.2 ± 7.1%	Pass
Single axles	±20 percent	0.5 ± 16.1%	Pass
Tandem axles	±15 percent	-3.4 ± 6.9%	Pass
GVW	±10 percent	-1.2 ± 4.2%	Pass
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	Pass

Prepared: ea *Checked: bko*

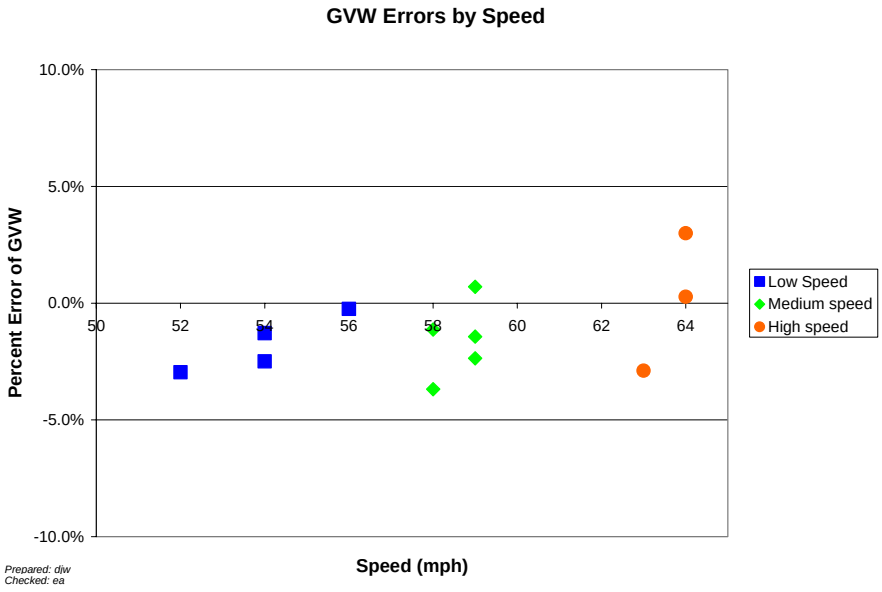


Figure 5-1 - Calibration Iteration 1 - GVW Percent Error vs. Speed Group – 420600 – 05-Nov-2008 (10:08 AM)

5.3 Summary of Traffic Sheet 16s

This site has validation information from previous visits as well as the current one in the tables below.

Table 5-4 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 are from this contractor's validation visits only.

Table 5-4 - Classification Validation History – 420600 – 05-Nov-2008

Date	Method	Mean Difference				Percent Unclassified
		Class 9	Class 8	Other 1	Other 2	
11/5/2008	Manual	0	0			0
11/4/2008	Manual	0	0			0
5/30/2007	Manual	0	0			0
5/29/2007	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. The Sheet 16s available are only for this contractor's two validation visits.

Table 5-5 - Weight Validation History – 420600 – 05-Nov-2008

Date	Method	Mean Error and (SD)		
		GVW	Single Axles	Tandem Axles
11/5/2008	Test Trucks	-1.7 (2.0)	-0.2 (7.5)	-3.4 (2.4)
11/4/2008	Test Trucks	-2.6 (1.9)	-2.1 (7.4)	-3.7 (2.4)
5/30/2007	Test Trucks	-0.1 (2.0)	-1.3 (5.7)	0.2 (3.4)
5/29/2007	Test Trucks	-2.3 (2.6)	-2.7 (4.5)	-2.6 (3.7)

Prepared: ea *Checked: bko*

5.4 Projected Maintenance/Replacement Requirements

This site is scheduled for semi-annual maintenance under the installation contract. During the maintenance sensors should be checked for any defects or consequences of the repair which might affect data collection or quality.

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 May 30, 2007. The site has had equipment maintenance work and factor adjustments made remotely between our last Validation visit and this one according to conversations with the installation contractor.

The factors in place at the end of our last Validation visit and those found prior to validation are shown below for the Right sensors. There was no change for the left sensors.

Table 6-1 - Calibration Factor Change – 420600 – Since 30-May-2007

	Right Sensor 2		Right Sensors 4	
	04-Nov-2008	30-May-2007	04-Nov-2008	30-May-2007
80 kph	3784	3372	3372	3372
88 kph	3736	3329	3329	3329
96 kph	3587	3196	3196	3196
104 kph	3587	3196	3196	3196
112 kph	3606	3231	3231	3231

Prepared: ea *Checked: bko*

This pre-validation analysis is based on test runs conducted November 4, 2008 in the late morning and afternoon at test site 420600 on I-80. This SPS-6 site is at milepost 158.2 on the westbound, righthand of a four-lane divided facility. No auto-calibration was used during test runs. The two trucks used for initial validation included:

1. 5-axle tractor semi-trailer combination with a tractor having an air suspension and trailer with standard rear tandem and an air suspension loaded to 75,940 lbs., the “golden” truck.
2. 5-axle tractor semi-trailer with a tractor having a spring suspension and a trailer with a split rear tandem and an air suspension loaded to 65,660 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 53 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 55 to 64degrees 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. .

Table 6-2 - Pre-Validation Results – 420600 – 04-Nov-2008

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	-4.9 ± 6.8%	Pass
Single axles	±20 percent	-2.1 ± 14.6%	Pass
Tandem axles	±15 percent	-3.7 ± 4.8%	Pass
GVW	±10 percent	-2.6 ± 3.9%	Pass
Axle spacing	± 0.5 ft [150mm]	0.0 ± 0.1 ft	Pass

Prepared: ea *Checked: bko*

The test runs were conducted from late morning to mid-afternoon hours under cloudy skies, resulting in a narrow range of pavement temperatures. The runs were also conducted at various speeds to determine the effects of these variables on the performance of the WIM scale. To investigate these effects, the dataset was split into three speed groups and 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 53 to 56 mph for Low speed, 57 to 61 mph for Medium speed and 62+ mph for High speed. The one temperature group was created with the runs between those at 55 to 64 degrees Fahrenheit called Medium temperature.

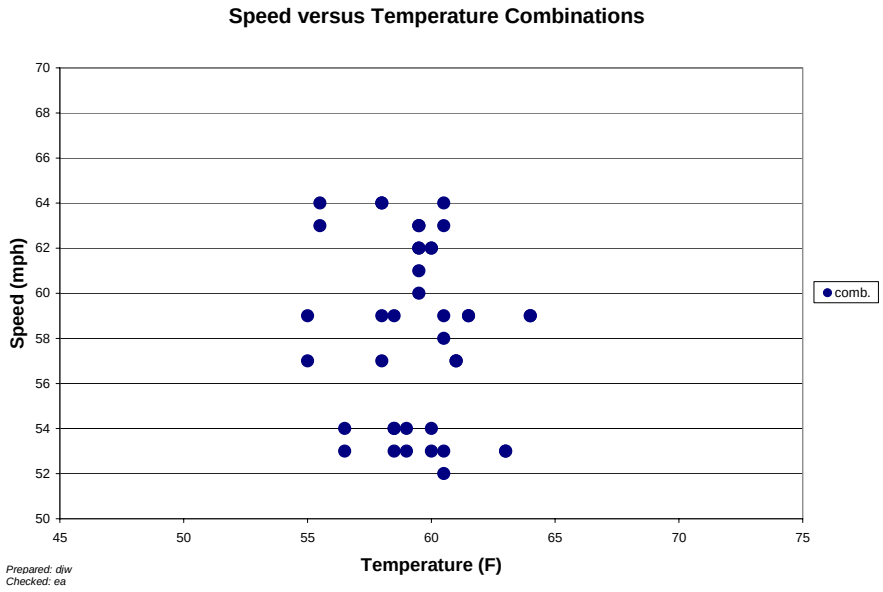


Figure 6-1 - Pre-Validation Speed-Temperature Distribution – 420600 – 04-Nov-2008

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. As it can be seen in Figure 6-2 the system overestimates the GVW with a downward trend from low to high speed. Variability in error is consistent throughout the entire range.

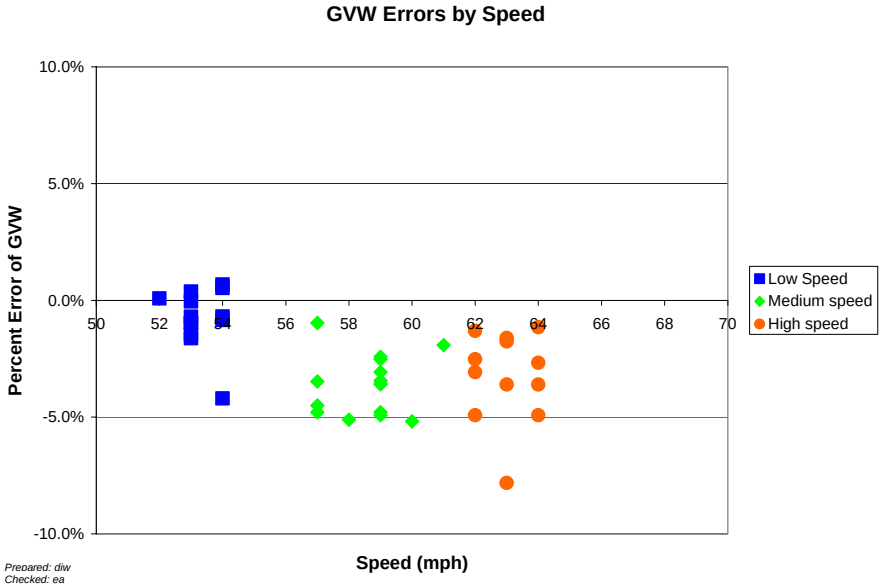


Figure 6-2 - Pre-Validation GVW Percent Error vs. Speed – 420600 – 04-Nov-2008

Figure 6-3 shows the relationship between temperature and GVW percentage error. Figure 6-3 shows that GVW is underestimated in this temperature range.

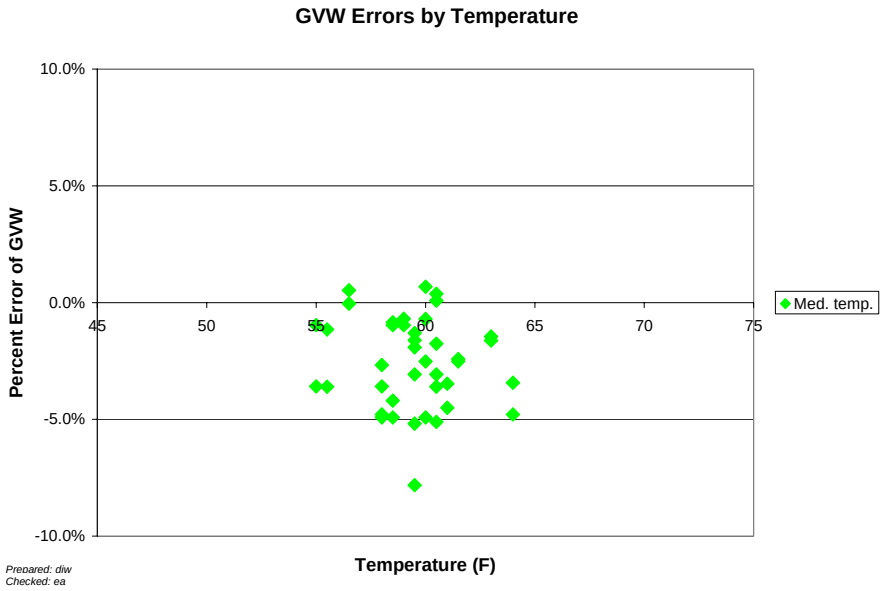


Figure 6-3 - Pre-Validation GVW Percent Error vs. Temperature – 420600 – 04-Nov-2008

Figure 6-4 shows the relationship between the drive tandem spacing errors in feet and speed. 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.

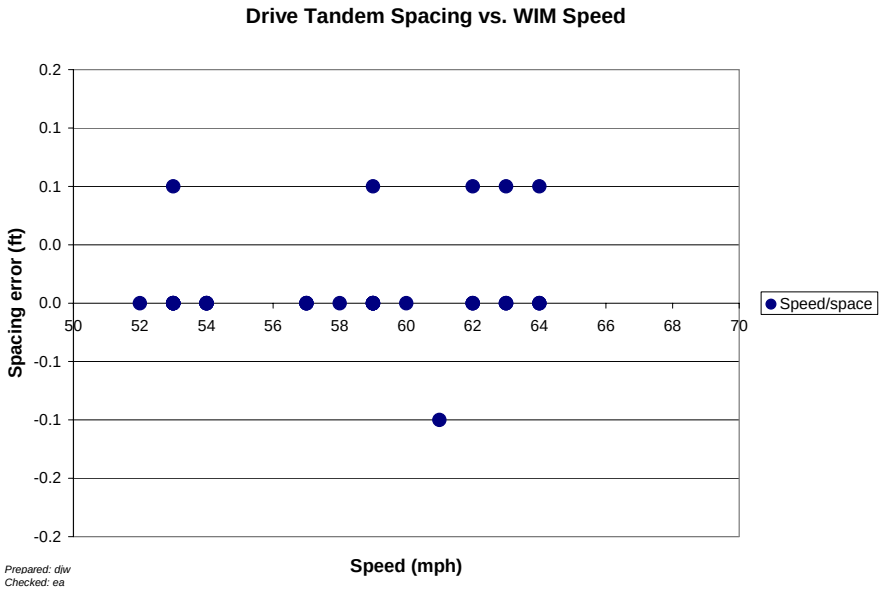


Figure 6-4 - Pre-Validation Spacing vs. Speed - 420600 – 04-Nov-2008

6.1 Temperature-based Analysis

The one temperature group was created with the runs between 55 to 64 degrees Fahrenheit as Medium temperature.

Table 6-3 - Pre-Validation Results by Temperature Bin – 420600 – 04-Nov-2008

Element	95% Limit	Medium Temperature 55 to 64 °F
Steering axles	±20 %	-4.9 ± 6.8%
Single axles	±20 %	-2.1 ± 14.6%
Tandem axles	±15 %	-3.7 ± 4.8%
GVW	±10 %	-2.6 ± 3.9%
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft

Prepared: ea *Checked: bko*

Table 6-3 indicates 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.
As shown by the graph, the equipment mostly underestimates the GVW for both trucks.
Both the square and the diamond truck show similar variability.

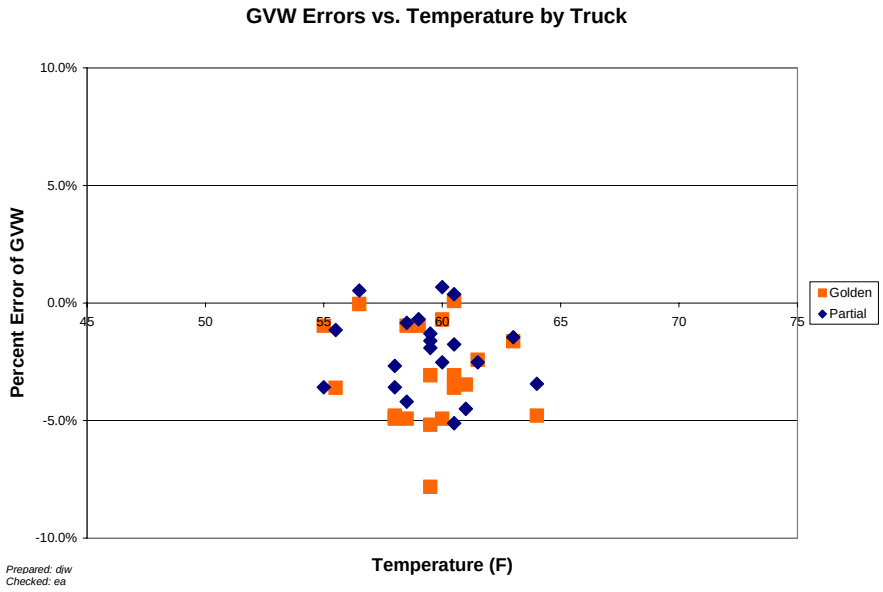


Figure 6-5 - Pre-Validation GVW Percent Error vs. Temperature by Truck – 420600 – 04-Nov-2008

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. At medium temperature, the steering axle weights are underestimated. Variability is consistent throughout the graph.

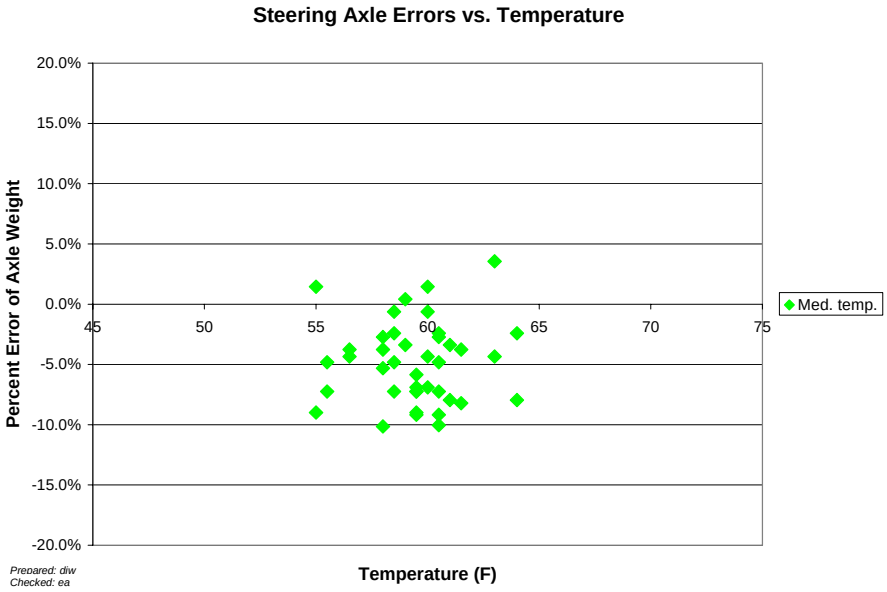


Figure 6-6 - Pre-Validation Steering Axle Error vs. Temperature by Group – 420600 – 04-Nov-2008

Figure 6-7 shows the relationship between single axle errors by truck and temperature. There is no apparent influence of single axle weights on temperature.

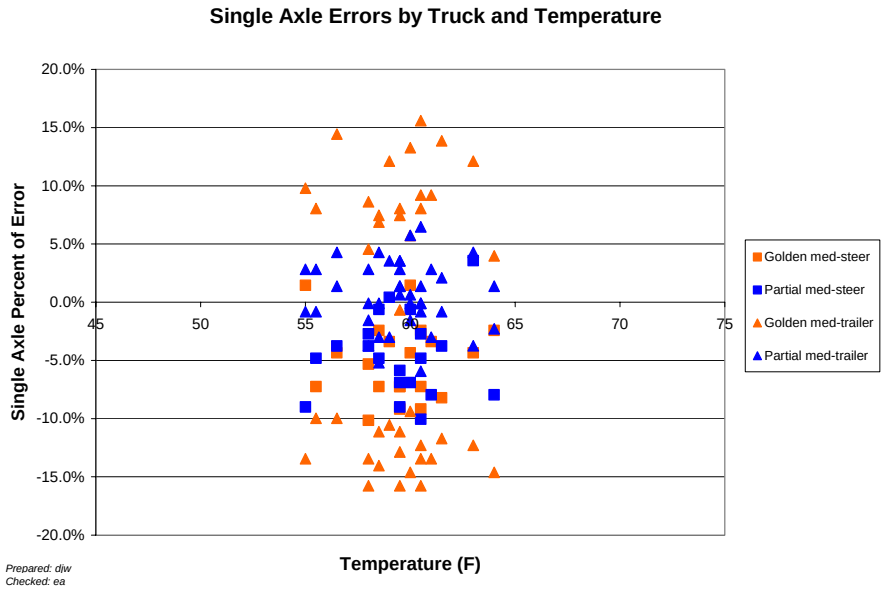


Figure 6-7 - Pre-Validation Single Axle Errors by Truck and Temperature - 420600 - 04-Nov-2008

6.2 Speed-based Analysis

The speed groups were divided as follows: Low speed – 53 to 56 mph, Medium speed – 57 to 61 mph and High speed – 62+ mph.

Table 6-4 - Pre-Validation Results by Speed Bin – 420600 – 04-Nov-2008

Element	95% Limit	Low Speed 53 to 56 mph	Medium Speed 57 to 61 mph	High Speed 62+ mph
Steering axles	±20 %	-2.5 ± 6.4%	-6.0 ± 6.9%	-6.0 ± 6.3%
Single axles	±20 %	-0.2 ± 15%	-2.8 ± 15.3%	-3.1 ± 13.8%
Tandem axles	±15 %	-2.0 ± 4.7%	-5.2 ± 4.1%	-3.7 ± 4.1%
GVW	±10 %	-0.8 ± 2.8%	-3.6 ± 2.7%	-3.2 ± 4.2%
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft

Prepared: ea *Checked: bko*

Table 6-4 shows that the equipment underestimates weights at all speeds. Variability in error is consistent throughout the entire speed range.

Figure 6-8 shows the tendency of the equipment to underestimate the golden truck (squares) and partial truck (diamonds) with a downward trend from low to high speed.

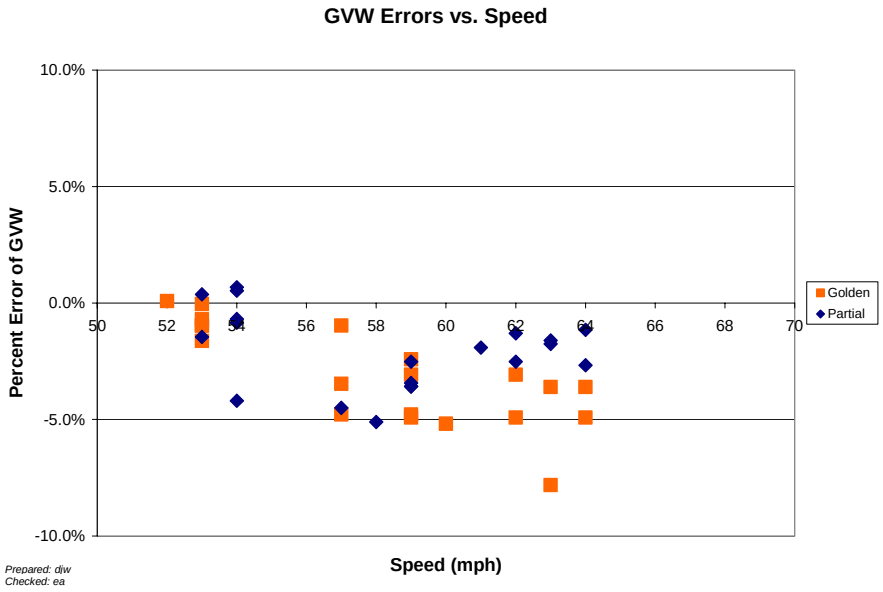


Figure 6-8 - Pre-Validation GVW Percent Error vs. Speed Group - 420600 –04-Nov-2008

Figure 6-9 shows the relation between steering axle errors and speed. This graph is included due to the frequent use of steering axle weights of Class 9 vehicles for calibration. This site does not use auto-calibration. The steering axles in this graph are associated only with Class 9 vehicles. The graph shows the tendency of the equipment to increasing underestimate steering axle weights from lower to higher speeds. Variability in error is consistent throughout the entire speed range.

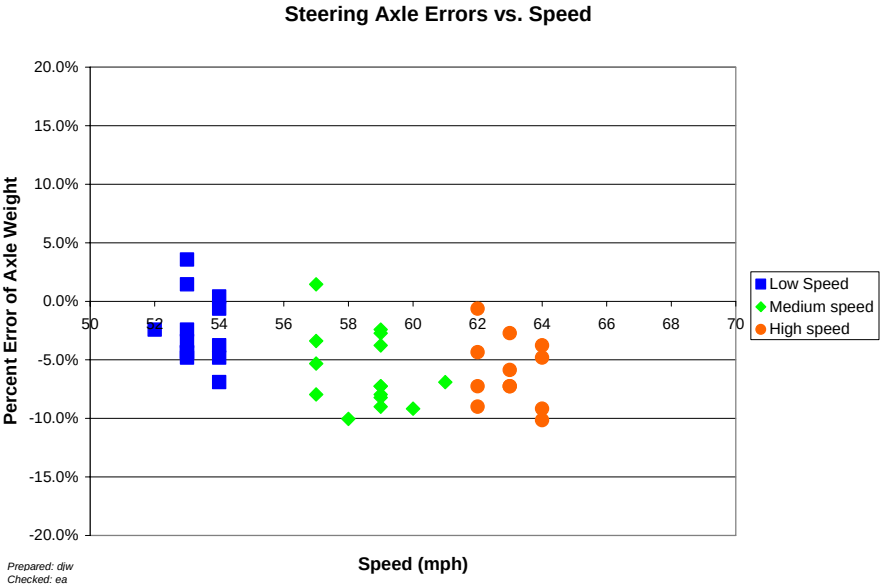


Figure 6-9 - Pre-Validation Steering Axle Percent Error vs. Speed Group - 420600 – 04-Nov-2008

Figure 6-10 shows the relationship between single axle errors by truck and speed. The graph shows a downward trend from low to high speeds. Variability in error is consistent throughout the entire graph. The wider variability for the golden truck's single axles (gold and orange/light triangles) may be a reflection of the assumption on distribution of weight between the two axles on the split tandem.

Figure 6-10 - Pre-Validation Axle Group Errors by Truck and Speed – 420600 – 04-Nov-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 420600 – 04-Nov-2008

Class	Percent Error	Class	Percent Error	Class	Percent Error
4	N/A	5	0	6	0
7	0				
8	N/A	9	0	10	0
11	0	12	0	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 6-6 - Truck Classification Mean Differences for 420600 – 04-Nov-2008

Class	Mean Difference	Class	Mean Difference	Class	Mean Difference
4	N/A	5	0	6	0
7	0				
8	N/A	9	0	10	0
11	0	12	0	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 the observer. There is no way to tell how many vehicles of that type might actually exist. N/A means no vehicles of the class were recorded by either the equipment or the observer.

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

6.4 Evaluation by ASTM E-1318 Criteria

The ASTM E-1318 criteria for a successful validation of Type I sites is 95% of the observed errors within the limits for allowable errors for each of the relevant statistics. If this site had been evaluated using ASTM E-1318-02 it would have met the conditions for

a Type I site exclusive of wheel loads. LTPP does not validate WIM performance with respect to wheel loads.

Table 6-7 - 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 May 30, 2007. It was the first validation of the site. The site was producing research quality data. Figure 6-11 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 77,240 lbs. The "partial" truck which had air suspension on both tandems was loaded to 62,460 lbs.

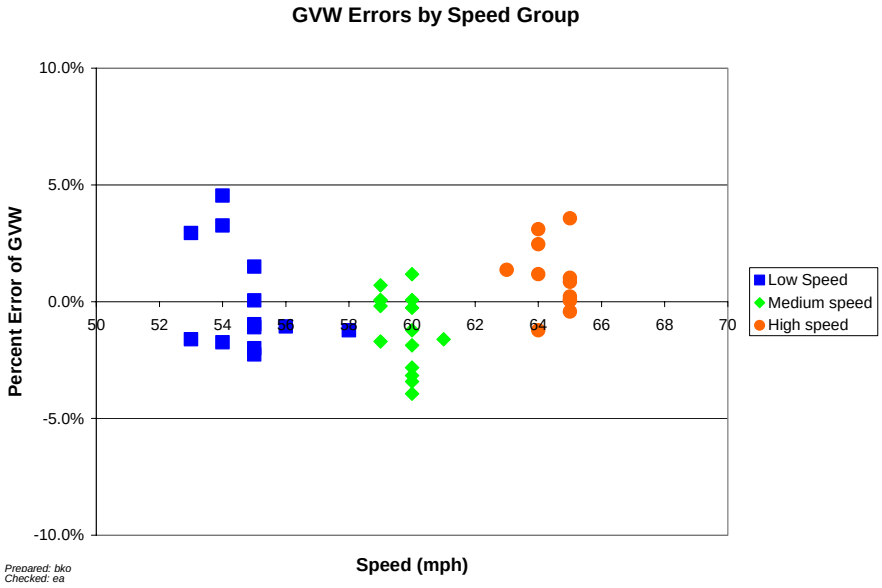


Figure 6-11 - Last Validation GVW Percent Error vs. Speed – 420600 – 30-May-2007

Table 6-8 shows the overall results from the last validation. Compared to the pre-validation results in Table 6-2, Table 6-8 shows that both the GVW and tandem axle errors were essentially unbiased with about the same variability.

Table 6-8 - Last Validation Final Results – 420600 – 30-May-2007

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	-4.4 ± 5.6%	Pass
Single axles	±20 percent	-1.3 ± 11.3%	Pass
Tandem axles	±15 percent	0.2 ± 6.8%	Pass
Gross vehicle weights	±10 percent	-0.1 ± 4.0%	Pass
Axle spacing	± 0.5 ft [150 mm]	0.0 ± 0.1 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 and the previous validation had a downward trend with increasing temperature comments on changes due to temperature are not appropriate. Through this validation the equipment has been observed at temperature from 55 to 120 degrees Fahrenheit.

Table 6-9 - Last Validation Results by Temperature Bin – 420600 – 30-May-2007

Element	95% Limit	Low Temperature 76 to 88 °F	Medium Temperature 89 to 101 °F	High Temperature 102 to 117 °F
Steering axles	±20 %	-2.8 ± 6.4%	-3.9 ± 5.7%	-6.2 ± 3.6%
Single axles	±20 %	-0.7 ± 10.3%	-0.9 ± 11.0%	-2.2 ± 13.3%
Tandem axles	±15 %	1.1 ± 6.9%	0.7 ± 7.4%	-0.8 ± 6.7%
GVW	±10 %	0.5 ± 3.8%	0.2 ± 4.2%	-0.9 ± 4.5%
Axle spacing	± 0.5 ft	0.0 ± 0.2 ft	0.0 ± 0.1 ft	0.0 ± 0.2 ft

Prepared: ea *Checked: bko*

Table 6-10 has the results of the prior post validation by speed groups. A similar pattern of underestimation and trends with speed appear in both tables. The results for steering and single axles are very similar for both validation sets. The drift to under estimation is concentrated in the estimation of tandem axle loads and GVW.

Table 6-10 - Last Validation Results by Speed Bin – 420600 – 30-May-2007

Element	95% Limit	Low Speed 53 to 58 mph	Medium Speed 59 to 62 mph	High Speed 63+ mph
Steering axles	±20 %	-2.0 ± 5.9%	-5.0 ± 4.1%	-6.3 ± 3.9%
Single axles	±20 %	-0.2 ± 7.2%	-2.0 ± 8.3%	-1.7 ± 17.1%
Tandem axles	±15 %	0.1 ± 7.4%	-1.2 ± 6.2%	2.4 ± 5.4%
GVW	±10 %	0.0 ± 4.9%	-1.2 ± 3.4%	1.0 ± 3.2%
Axle spacing	± 0.5 ft	-0.1 ± 0.1 ft	0.0 ± 0.2 ft	0.0 ± 0.2 ft

Prepared: ea *Checked: bko*

7 Data Availability and Quality

As of November 4, 2008 this site does not have at least 5 years of research quality data. Research quality data is defined to be at least 210 days in a year of data of known calibration meeting LTPP's precision requirements.

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

The amount and coverage for the site is shown in Table 7-1. The value for months is a measure of the seasonal variation in the data. The indicator of coverage indicates whether day of week variation has been accounted for on an annual basis. As can be seen from the table only 2000 and 2005 have a sufficient quantity to be considered complete years of data and that year 2005 has a sufficient quantity to be considered complete years of weight data. **In the absence of previously gathered validation information describing research quality data 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**

Table 7-1 - Amount of Traffic Data Available 420600 – 04-Nov-2008

Year	Classification Days	Months	Coverage	Weight Days	Months	Coverage
2007	202	8	Full Week	205	8	Full Week
2008	187	7	Full Week	187	7	Full Week

Prepared: ea *Checked: bko*

The validation information for this SPS-6 project prior to the installation of this site does not support designation of one or more years of data as research quality. Data from the previous location is represented by information from 2006 and earlier and is not included. The validation information available for those years does not qualify the data to meet LTPP's definition of research quality.

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 9 vehicles are the only trucks constituting 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. .

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 – 420600 – 05-Nov-2008

Characteristic	Class 9
Percentage Overweights	0.1%
Percentage Underweights	0.2%
Unloaded Peak	32,000 lbs
Loaded Peak	72,000 lbs

Prepared: ea *Checked: bko*

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

The graphical screening comparison figures are found in Figure 7-1 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.

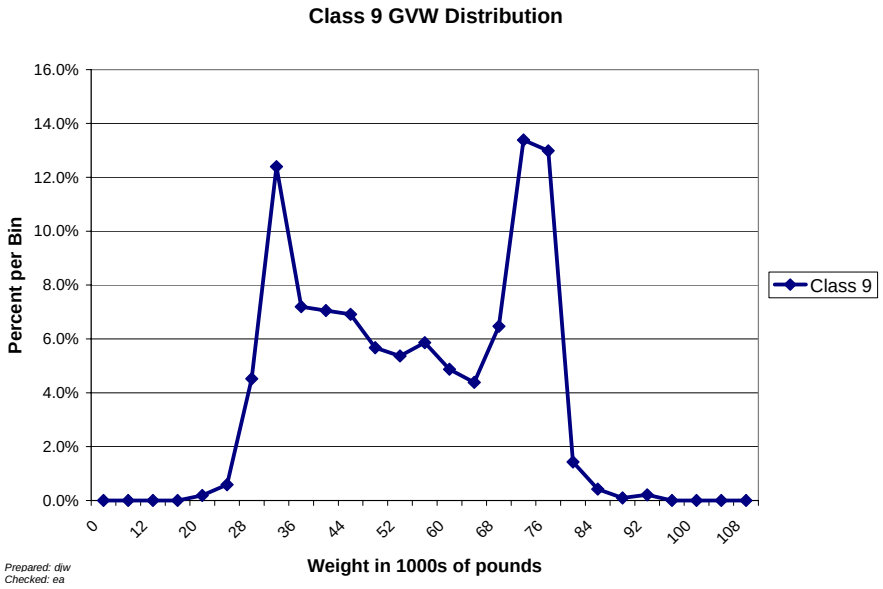


Figure 7-1 - Expected GVW Distribution Class 9 – 420600 – 05-Nov-2008

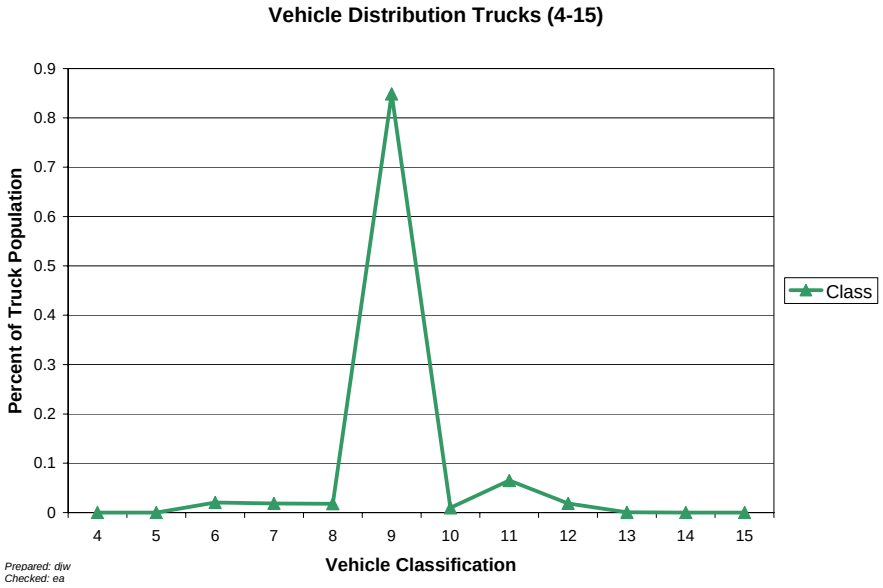


Figure 7-2 - Expected Vehicle Distribution – 420600 – 05-Nov-2008

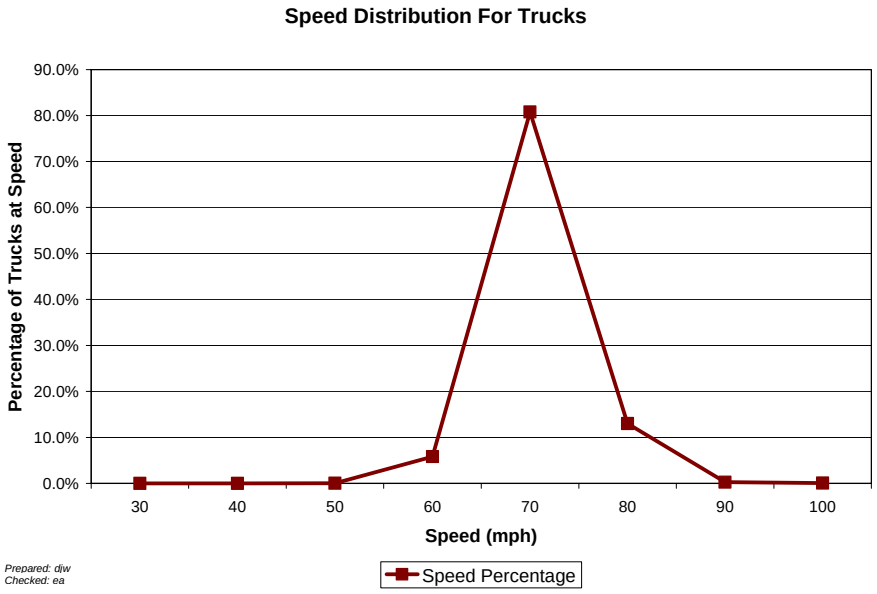


Figure 7-3 - Expected Speed Distribution – 420600 – 05-Nov-2008

8 Data Sheets

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

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

Sheet 20 – Classification verification – Pre-Validation (2 pages)
Sheet 20 – Classification verification – Post-Validation (1 page)

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 (7 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 page 34. 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 and prior to Appendix A.

POST-VISIT HANDOUT GUIDE FOR SPS WIM VALIDATION

STATE: Pennsylvania

SHRP ID: 0600

Figures

Photos

1. General Information

SITE ID: *420600*

LOCATION: *I-80 West, milepost 158.2, near Milesburg, PA*

VISIT DATE: *November 4, 2008*

VISIT TYPE: *Validation*

2. Contact Information

POINTS OF CONTACT:

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

Highway Agency: *Todd Rottet, 717-787-4574, trottet@state.pa.us*

Dan Dawood, 717-787-4246, dawood@dot.state.pa.us

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

FHWA Division Office Liaison: *Zahur Siddiqui, 717-221-3410, zahur.siddiqui@fhwa.dot.gov*

LTPP SPS WIM WEB PAGE: *http://www.tfhrc.gov/pavement/ltpp/spstraffic/index.htm*

3. Agenda

BRIEFING DATE: *Not requested for this visit.*

ON-SITE PERIOD: *Beginning November 4, 2008 at 10:00 am.*

TRUCK ROUTE CHECK: *Completed.*

4. Site Location/ Directions

NEAREST AIRPORT: *Pittsburgh International Airport, Pittsburgh, PA*

DIRECTIONS TO THE SITE: *Approximately .5 miles east of I-80, Exit 158.*

MEETING LOCATION: *On site beginning at 10:00 am.*

WIM SITE LOCATION: *I -80, milepost 158.2, Latitude: 40.9555° N, Longitude: -77.7593° W, near Milesburg, PA*

WIM SITE LOCATION MAP: *See Figure 4.1*

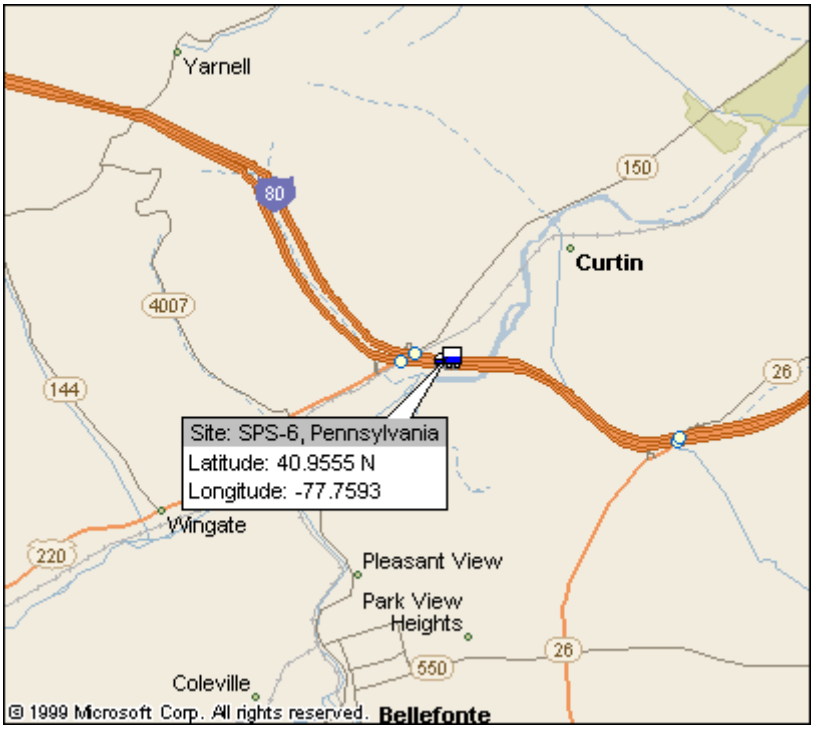


Figure 4-1 – Section 420600 near Milesburg, Pennsylvania

5. Truck Route Information

ROUTE RESTRICTIONS: *None*

SCALE LOCATION: *TA Milesburg, I 80, exit 158 in Milesburg, PA (approximately .5 west of the site). Open 24 hours. Cost is $9.00 per weigh.*

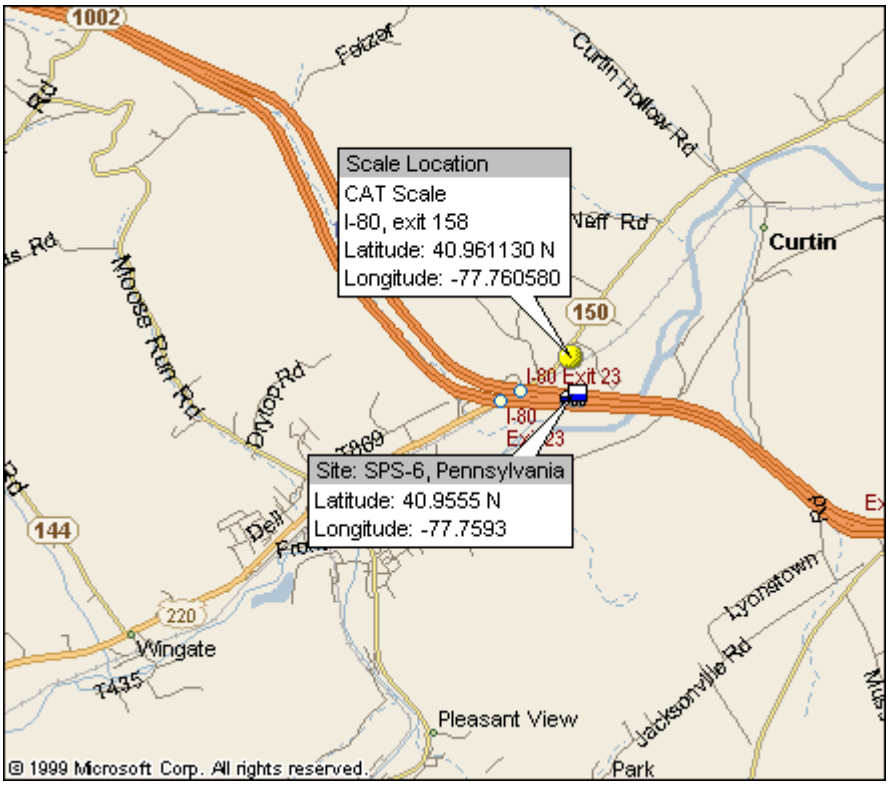


Figure 5-1 – Scale Location for 420600 in Pennsylvania

TRUCK ROUTE:

- *.5 miles West to exit 158, west on SR150 for .4 miles, right onto I-80*
- *2.5 miles East to exit 161, east on SR26 for .6 miles, right turn onto I-80*

6 total miles – 12 minutes

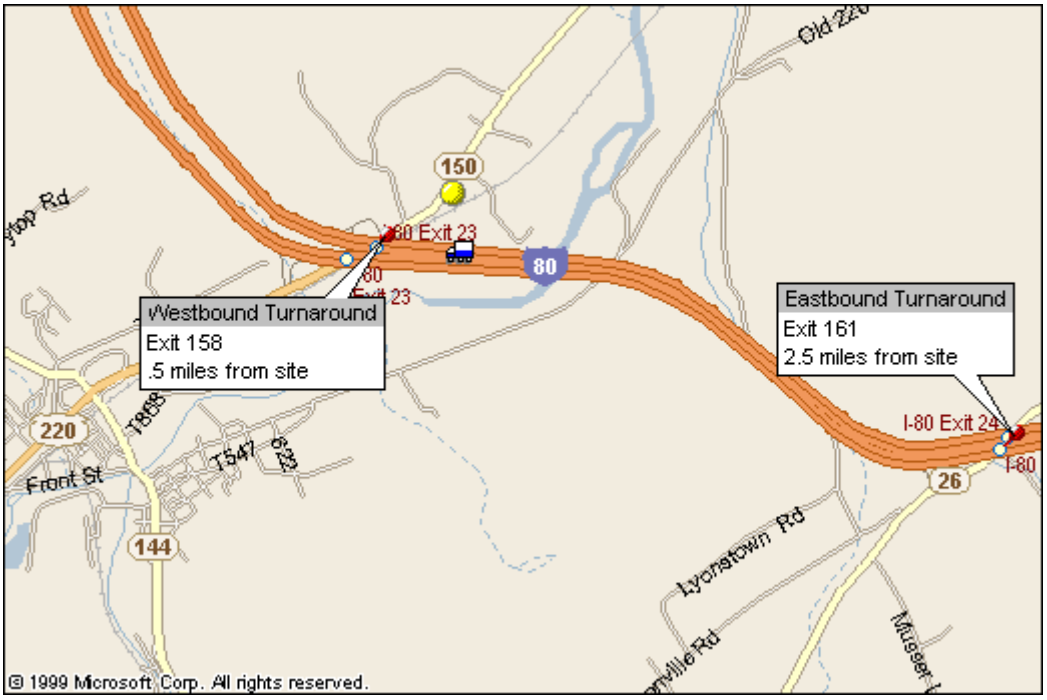


Figure 5-2 – Test Truck Route for 420600 in Pennsylvania

6. Sheet 17 – Pennsylvania (420600)

1.* ROUTE _____I-80__ MILEPOST __158.2__ LTPP DIRECTION - N S E W

2.* WIM SITE DESCRIPTION - Grade __< 1%__ % Sag vertical Y / N
Nearest SPS section upstream of the site __unknown___
Distance from sensor to nearest downstream SPS Section ___ ___ ___ ___ 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_2_ ft

4.* PAVEMENT TYPE ___asphalt_____

5.* PAVEMENT SURFACE CONDITION – Distress Survey
Date __11/04/08__Photo___42_0600_Upstream_11_04_08.jpg___
Date __11/04/08__Photo___42_0600_DownStream_11_04_08.jpg__
Date _____Photo_____

6. * SENSOR SEQUENCE _____loop – quartz piezo – quartz piezo loop_____

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

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

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

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

10. * CABINET LOCATION

Same side of road as LTPP lane Y / N Median Y/ N Behind barrier Y/N
Distance from edge of traveled lane 91 ft
Distance from system 108 ft
TYPE 3R

CABINET ACCESS controlled by LTPP / STATE / JOINT ?
Contact - name and phone number Todd Rottet (717) 787-5983
Alternate - name and phone number Roy Czinku (306) 653-6627

11. * POWER

Distance to cabinet from drop 3 ft Overhead / underground / solar / AC in cabinet?
Service provider _____Phone number _____

12. * TELEPHONE

Distance to cabinet from drop 0 ft Overhead / under ground / cell?
Service provider _____ Phone Number _____

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

14. * TEST TRUCK TURNAROUND time 12 minutes DISTANCE 4.5 mi.

15. PHOTOS

	FILENAME
Power source	42_0600_Solar_Panels_11_04_08.jpg
Phone source	42_0600_Cell_Modem_11_04_08.jpg
Cabinet exterior	42_0600_Cabinet_Exterior_11_04_08.jpg
Cabinet interior	42_0600_Cabinet_Interior_Back_11_04_08.jpg
	42_0600_Cabinet_Interior_Front_11_04_08.jpg
Weight sensors	42_0600_Leading_WIM_Sensor_11_04_08.jpg
	42_0600_Trailing_WIM_Sensor_11_04_08.jpg
	42_0600_Repaired_WIM_Sensor_1_11_04_08.jpg
	42_0600_Repaired_WIM_Sensor_2_11_04_08.jpg
Classification sensors	None
Other sensors	42_0600_Leading_Loop_11_04_08.jpg
	42_0600_Trailing_Loop_11_04_08.jpg
Description	Loops

Downstream direction at sensors on LTPP lane 42_0600_DownStream_11_04_08.jpg
Upstream direction at sensors on LTPP lane 42_0600_Upstream_11_04_08.jpg

COMMENTS

__ Mile post is 158 + 1013’

___ GPS 40.9555 N -77.7593 W

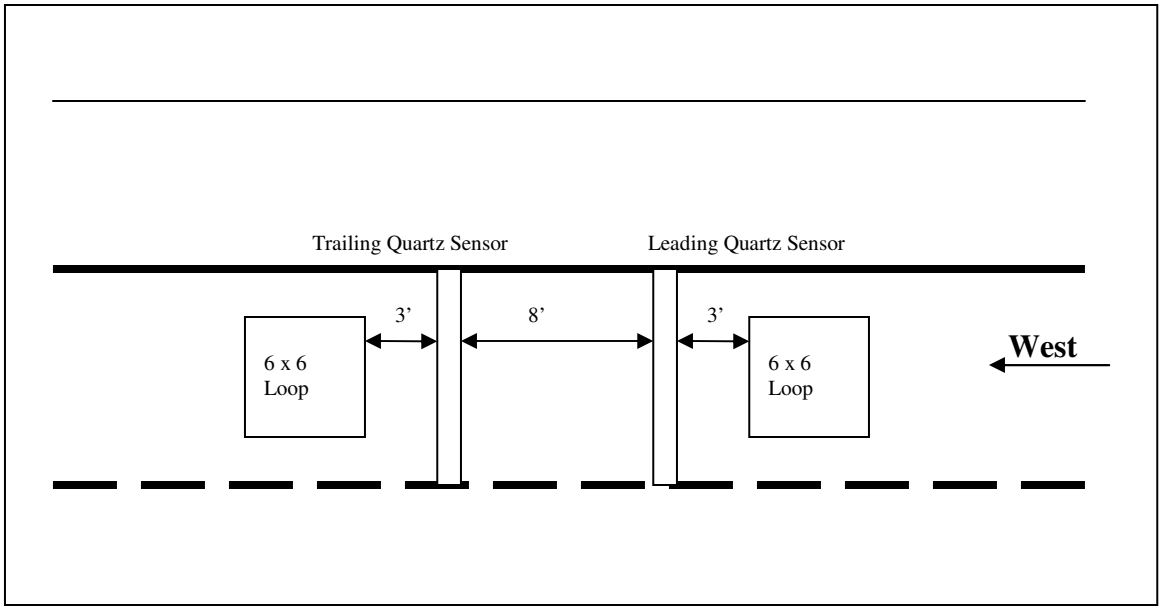
Truck route west 2600 ft (turn around, exit 158), east (exit 161) 9130 ft

Old site 36260’ from new site to the west

COMPLETED BY ___Dean J. Wolf.

PHONE __301-210-5105_____ DATE COMPLETED _11 _ /_5 _ _ / _2_ 0_0_8_

Figure 6-1 Sketch of Equipment Layout - 420600



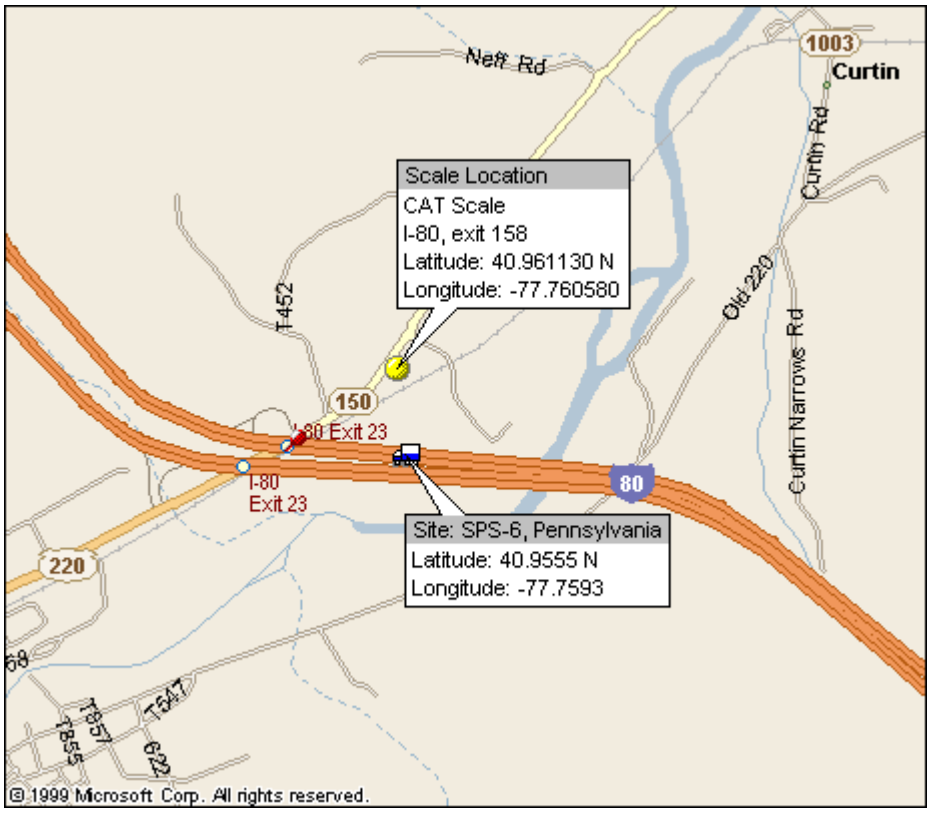


Figure 6-2 – Site Map of 420600 in Pennsylvania

Photo 1- 42_0600_Upstream_11_04_08.jpg

Photo 2 - 42_0600_Downstream_11_04_08.jpg

Photo 3 - 42_0600_Solar_Panels_11_04_08.jpg

Photo 4 - 42_0600_Cell_Modem_11_04_08.jpg

Photo 5 - 42_0600_Cabinet_Exterior_11_04_08.jpg

Photo 6 - 42_0600_Cabinet_Interior_Back_11_04_08.jpg

Photo 7 - 42_0600_Cabinet_Interior_Front_11_04_08.jpg

Photo 8 - 42_0600_Leading_Loop_11_04_08.jpg

Photo 9 - 42_0600_Trailing_Loop_11_04_08.jpg

Photo 10 - 42_0600_Leading_WIM_Sensor_11_04_08.jpg

Photo 11 - 42_0600_Trailing_WIM_Sensor_11_04_08.jpg

Photo 12 - 42_0600_Repaired_WIM_Sensor_1_11_04_08.jpg

Photo 13 - 42_0600_Repaired_WIM_Sensor_2_11_04_08.jpg

SHEET 18	STATE CODE [42]
LTPP MONITORED TRAFFIC DATA	SPS PROJECT ID [0600]
WIM SITE COORDINATION	DATE: (mm/dd/yyyy) 11/4/2008

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: _____ Phone:_____

Agency: _____

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

Name: J. Shroeder Trucking Phone:(814) 827 1875

Agency: _____

f. Traffic Control –

Name: _____ Phone:_____

Agency: _____

g. Enforcement Coordination –

Name: _____ Phone:_____

Agency: _____

h. Nearest Static Scale

Name: TA Milesburg Location:I-80 Exit 158

Phone: (814) 355 7561

SHEET 16 **LTPP MONITORED TRAFFIC DATA** **SITE CALIBRATION SUMMARY**	*STATE ASSIGNED ID [__ __ __ __] *STATE CODE [42] *SHRP SECTION ID [0600]

SITE CALIBRATION INFORMATION

1. * DATE OF CALIBRATION (MONTH/DAY/YEAR) [11/4/2008]

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 ____ BENDING PLATES
   ____ CHANNELIZED ROUND PIEZO ____ LOAD CELLS _X__ QUARTZ PIEZO
   ____ CHANNELIZED FLAT PIEZO _X__ INDUCTANCE LOOPS ____ CAPACITANCE PADS
   ____ OTHER (SPECIFY) _____

5. EQUIPMENT MANUFACTURER ___IRD/ Kistler_____

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_____	___2_____
3 - OTHER (DESCRIBE)	3	_____	_____

7. SUMMARY CALIBRATION RESULTS (EXPRESSED AS A PERCENT)
   MEAN DIFFERENCE BETWEEN ---
   DYNAMIC AND STATIC GVW ___-2.6 STANDARD DEVIATION ___1.9
   DYNAMIC AND STATIC SINGLE AXLES ___-2.1 STANDARD DEVIATION ___7.4
   DYNAMIC AND STATIC DOUBLE AXLES ___-3.7 STANDARD DEVIATION ___2.4

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) ___3024 / 3587 / 3024 / 3196___

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

CLASSIFIER TEST SPECIFICS***

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

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

14. MEAN DIFFERENCE IN VOLUMES BY VEHICLES CLASSIFICATION:
   *** FHWA CLASS 9 ____ 0 FHWA CLASS ____ ____ ____ _____
   *** FHWA CLASS 8 ____ 0 FHWA CLASS ____ ____ ____ _____
   FHWA CLASS ____ ____ ____ _____
   FHWA CLASS ____ ____ ____ _____
   *** PERCENT "UNCLASSIFIED" VEHICLES: ____ 0.0

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

SHEET 16 **LTPP MONITORED TRAFFIC DATA** **SITE CALIBRATION SUMMARY**	*STATE ASSIGNED ID [__ __ __ __] *STATE CODE [42] *SHRP SECTION ID [0600]

SITE CALIBRATION INFORMATION

1. * DATE OF CALIBRATION (MONTH/DAY/YEAR) [11/5/2008]

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

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

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

5. EQUIPMENT MANUFACTURER ___IRD/ Kistler_____

WIM SYSTEM CALIBRATION SPECIFICS**

6.**CALIBRATION TECHNIQUE USED:

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

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

__ 20__ PASSES PER TRUCK

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

TRUCK	TYPE	SUSPENSION
1	___9_____	___1_____
2	___9_____	___2_____
3	_____	_____

7. SUMMARY CALIBRATION RESULTS (EXPRESSED AS A PERCENT)

MEAN DIFFERENCE BETWEEN ---

DYNAMIC AND STATIC GVW	___-1.7	STANDARD DEVIATION ___2.0
DYNAMIC AND STATIC SINGLE AXLES	___-0.2	STANDARD DEVIATION ___7.5
DYNAMIC AND STATIC DOUBLE AXLES	___-3.4	STANDARD DEVIATION ___2.4

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) ___3116 / 3696 / 3116 / 3293___

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 _X__ TIME ___ NUMBER OF TRUCKS

14. MEAN DIFFERENCE IN VOLUMES BY VEHICLES CLASSIFICATION:
*** FHWA CLASS 9 ____ 0
*** FHWA CLASS 8 ____ 0
FHWA CLASS ____ ____ ____ _____
FHWA CLASS ____ ____ ____ _____
FHWA CLASS ____ ____ ____ _____
FHWA CLASS ____ ____ ____ _____
*** PERCENT "UNCLASSIFIED" VEHICLES: ____ 0.0

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

APPENDIX A

Sheet 19	* STATE_CODE	42
LTPP Traffic Data	* SPS PROJECT ID	0600
*CALIBRATION TEST TRUCK # 1	* DATE	11/4/08

Rev. 08/31/01

PART I.

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

AXLES - units - lbs / 100s lbs / kg

GEOMETRY

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

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

10.* Trailer Load Distribution Description:

railroad ties over front and back of 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 16.5 B to C 4.3 C to D 27.1

D to E 10.1 E to F _____

Wheelbase (measured A to last) _____ Computed 58

13. *Kingpin Offset From Axle B (units) +2.0 (_____)

(+ is to the rear)

SUSPENSION

Axle	14. Tire Size	15.* Suspension Description (leaf, air, no. of leaves, taper or flat leaf, etc.)
A	11R24.5	2 Full leaf.
B	11R24.5	air
C	11R24.5	air
D	11R24.5	air
E	11R24.5	air
F		

Sheet 19	* STATE_CODE	42
LTPP Traffic Data	* SPS PROJECT ID	0600
*CALIBRATION TEST TRUCK # 1	* DATE	11/4/08

Rev. 08/31/01

PART II

Day 1

*b) Average Pre-Test Loaded weight 76080
*c) Post Test Loaded Weight 75790
*d) Difference Post Test – Pre-test -290

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10420	15570	15570	17260	17260		76080 ✓
2	10380	15610	15610	17240	17240		76080 ✓
3							
Average							76080

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	10290	15570	15570	17180	17180		75780 ✓
2	10320	15560	15560	17180	17180		75800 ✓
3							
Average	10300	15565	15565	17180	17180		75790

Measured By _____ Verified By EA Weight date 11/4/08

Sheet 19	* STATE_CODE	42
LTPP Traffic Data	* SPS PROJECT ID	0600
*CALIBRATION TEST TRUCK # 1	* DATE	11/5/08

Rev. 08/31/01

Day 2

7.2 *b) Average Pre-Test Loaded weight 75790

*c) Post Test Loaded Weight 75460

*d) Difference Post Test – Pre-test -330

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10280	15570	15570	17180	17180		75780
2	10320	15560	15560	17180	17180		75800
3							
Average	10300	15565	15565	17180	17180		75790

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	10240	15430	15430	15H 17180	17180		75460 ✓
2	10160	15460	15460	17190	17190		75460 ✓
3							
Average	10200	15445	15445	17185	17185		75460

Measured By AJW Verified By SA Weight date 11/5/08

Sheet 19	* STATE_CODE	42
LTPP Traffic Data	* SPS PROJECT ID	0600
*CALIBRATION TEST TRUCK #_2_	* DATE	11 | 4 | 09

Rev. 08/31/01

PART I.

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

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

GEOMETRY

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

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

10.* Trailer Load Distribution Description:

railroad ties loaded evenly along 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 15.5 B to C 4.2 C to D 30.7

D to E 10.1 E to F _____

Wheelbase (measured A to last) _____ Computed 60.5

13. *Kingpin Offset From Axle B (units) +2.0 (_____)

(+ is to the rear)

SUSPENSION

Axle	14. Tire Size	15.* Suspension Description (leaf, air, no. of leaves, taper or flat leaf, etc.)
A	11 R24.5	3 full leaf
B	11 R24.5	Spring
C	11 R24.5	Spring
D	11 R24.5	air
E	11 R24.5	air
F		

Sheet 19	* STATE_CODE	42
LTPP Traffic Data	* SPS PROJECT ID	0600
*CALIBRATION TEST TRUCK # 2	* DATE	11/4/08

Rev. 08/31/01

PART II

Day 1

*b) Average Pre-Test Loaded weight 65770

*c) Post Test Loaded Weight 65540

*d) Difference Post Test – Pre-test -230

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	9620	14360	14360	13710	13710		65760 ✓
2	9640	14360	14360	13710	13710		65780 ✓
3							
Average	9630	14360	14360	13710	13710		65770

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	9500	14300	14300	13720	13720		65540 ✓
2	9480	14320	14320	13710	13710		65540 ✓
3							
Average	9490	14310	14310	13715	13715		65540

Measured By dj Verified By SP Weight date 11/4/08

Sheet 19	* STATE_CODE	42
LTPP Traffic Data	* SPS PROJECT ID	0600
*CALIBRATION TEST TRUCK #_2_	* DATE	11/5/08

Rev. 08/31/01

Day 2

7.2 *b) Average Pre-Test Loaded weight 65540

*c) Post Test Loaded Weight 65240

*d) Difference Post Test – Pre-test -300

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	9500	14300	14300	13720	13720		65540
2	9480	14320	14320	13710	13710		65540
3							
Average	9490	14310	14310	13715	13715		65540

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	9320	14260	14260	13700	13700		65240 ✓
2	9320	14260	14260	13700	13700		65240 ✓
3							
Average	9320	14260	14260	13700	13700		65240

Measured By DJW Verified By CEA Weight date 11/5/08

Sheet 20	* STATE_CODE 42
LTPP Traffic Data	*SPS PROJECT_ID 0600
Speed and Classification Checks * 1 of* 2	* DATE 11/04/2008

Rev. 08/31/2001

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
67	9	618	68	9	69	9	924	70	9
65	9	629	64	9	73	7	938	71	7
64	9	640	63	9	65	10	940	64	10
68	12	654	73	12	71	11	1060	70	11
65	9	656	63	9	64	13	1066	65	13
65	9	758	64	9	69	9	1079	70	9
67	9	772	66	9	72	9	1086	70	9
68	9	777	68	9	66	9	1089	65	9
64	9	787	66	9	64	9	1121	63	9
68	5	792	67	9	65	9	1123	63	9
68	9	804	69	9	67	9	1133	67	9
64	9	825	65	9	67	9	1136	65	9
62	9	838	68	9	60	5	1170	63	5
67	9	844	69	9	59	9	1171	55	9
62	9	849	63	9	60	6	1174	60	6
66	9	862	63	9	67	9	1195	67	9
63	9	866	63	9	70	9	1207	70	9
69	9	867	69	9	67	9	1321	65	9
65	12	871	65	12	60	9	1322	59	9
65	9	872	64	9	64	9	1331	66	9
68	9	874	66	9	68	7	1348	64	7
64	9	881	65	9	64	9	1372	64	9
64	9	890	65	9	71	9	1382	70	9
70	10	895	70	10	70	9	1386	68	9
68	9	904	67	9	54	5	1390	55	5

Recorded by MARK Z Direction W Lane 1 Time from 11:24 to 12:00

Sheet 20	* STATE_CODE	_42_
LTPP Traffic Data	*SPS PROJECT_ID	_0600_
Speed and Classification Checks * 2 of* 2	* DATE	11/04/2008

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	9	1579	64	9	67	9	1897	64	9
63	9	1587	63	9	60	9	1906	59	9
66	7	1597	64	7	67	9	1909	64	9
62	9	1599	63	9	64	9	1936	61	9
63	9	1604	63	9	64	9	1940	62	9
65	9	1606	62	9	62	11	1956	61	11
67	11	1607	66	11	60	9	1959	62	9
64	11	1610	64	11	70	9	1962	69	9
74	5	1623	72	5	72	7	1965	72	7
60	9	1778	59	9	71	9	1970	69	9
62	7	1779	60	7	67	9	1976	69	9
64	9	1782	64	9	65	9	1977	64	9
66	9	1796	64	9	65	9	1979	63	9
65	9	1801	64	9	64	9	1992	62	9
63	9	1802	60	9	67	9	2000	67	9
67	9	1817	63	9	73	9	2072	75	9
67	11	1819	66	11	64	9	2074	64	9
65	9	1829	69	9	68	9	2075	67	9
65	6	1832	64	6	68	11	2078	66	11
64	7	1833	62	7	68	9	2081	67	9
72	9	1849	71	9	68	9	2089	67	9
64	9	1852	67	9	65	9	2097	64	9
74	9	1861	72	9	67	5	2101	66	5
71	6	1876	68	6	64	11	2104	64	11
67	6	1888	66	6	68	6	2117	68	6

Recorded by MARK Z Direction W Lane 1 Time from 12:10 to 12:36

Sheet 20	* STATE_CODE 42
LTPP Traffic Data	*SPS PROJECT_ID 0600
Speed and Classification Checks * 1 of* 1	* DATE 11/05/2008

Rev. 08/31/2001

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
65	9	2280	65	9					
57	9	2412	57	9					
69	9	2546	69	9					
60	9	2690	60	9					
59	9	2964	58	9					
66	9	3146	65	9					
69	9	3737	69	9					
65	9	4164	65	9					
67	5	4573	67	5					
66	9	4584	65	9					
66	9	4595	65	9					
60	9	4658	61	9					
61	9	4662	60	9					

Recorded by MARK Z Direction W Lane 1 Time from 1120 AM to 2:20 PM

Sheet 21	* STATE_CODE	42
LTPP Traffic Data	*SPS PROJECT_ID	0600
WIM System Test Truck Records 1 of 3	* DATE	1/10/2008

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
55	57	1	1	1045	37	57	56/40	65/92	76/77	81/108	65/84		75.2	16.5	4.3	27	10	
55	59	2	1	1045	39	59	42/45	65/71	63/68	66/75	67/69		63.3	15.5	4.2	30.7	10.1	
55.5	62	1	2	1057	230	63	40/47	63/82	79/71	81/105	68/87		73.2	16.5	4.4	27.2	10.1	
55.5	63	2	2	1057	231	64	43/48	66/72	68/75	64/72	68/73		64.9	15.6	4.2	30.8	10	
56.5	53	1	3	1109	440	53	52/47	62/91	61/74	66/111	69/86		75.9	16.6	4.4	27.1	10.1	
56.5	53	2	3	1109	442	54	44/48	66/75	72/75	68/75	68/71		66.0	15.5	4.2	30.8	10.1	
58	57	1	4	1120	666	57	51/47	62/80	71/71	80/105	69/81		72.3	16.4	4.3	26.9	10	
58	59	2	4	1120	668	59	45/48	65/70	66/67	66/75	64/61		63.3	15.5	4.2	30.7	10.1	
59.5	63	1	5	1133	953	63	50/46	54/89	71/74	76/95	65/88		70.0	16.5	4.3	27.0	10	
59.5	63	2	5	1133	956	62	41/46	66/75	68/73	69/77	69/71		64.8	15.5	4.2	30.6	10	
58.5	53	1	6	1145	1211	53	52/49	62/98	80/74	64/101	69/84		75.2	16.4	4.3	27.1	10.1	
58.5	54	2	6	1145	1212	54	47/44	64/69	69/69	67/70	66/64		62.9	15.6	4.2	30.9	10.1	
60.5	59	1	7	1157	1433	59	49/47	58/88	74/71	78/110	65/84		73.6	16.4	4.3	27.1	10.1	
60.5	58	2	7	1157	1435	58	42/44	63/73	62/72	66/75	62/67		62.3	15.5	4.2	30.8	10.1	
60	61	1	8	1207	1627	62	52/47	65/63	79/80	84/100	67/80		72.2	16.6	4.4	27.2	10	
60	60	2	8	1207	1628	62	47/48	65/74	65/70	66/71	63/72		64.0	15.7	4.2	31.0	10.1	

Recorded by MARK Z

Checked by

Sheet 21	* STATE_CODE	42
LTPP Traffic Data	*SPS PROJECT_ID	0600
WIM System Test Truck Records 2 of 3	* DATE	11/04/2008

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
60	53	1	9	1219	1889	53	54/51	62/63	82/70	85/110	68/88		75.4	16.5	4.3	27.2	10.1	
60	54	2	9	1219	1890	54	43/46	69/74	72/74	69/76	61/71		66.1	15.5	4.2	30.9	10.1	
61	57	1	10	1233	2198	57	51/49	63/63	68/72	81/107	64/85		73.3	16.5	4.3	27.0	10.1	
61	57	2	10	1234	2200	57	42/46	60/72	63/69	67/74	63/70		62.7	15.4	4.2	30.6	10.0	
59.5	63	1	11	1244	2432	62	50/46	69/91	77/75	84/105	65/85		73.6	16.5	4.3	27.3	10.1	
59.5	61	2	11	1244	2434	61	42/47	65/72	65/73	65/73	68/74		68.9	15.4	4.1	30.6	10.1	
63	54	1	12	~~1244~~ 1357	3812	53	51/48	59/97	76/71	83/110	65/66		74.7	16.4	4.3	28.0	10.1	
63	54	2	12	1357	3813	53	48/51	63/71	68/71	67/76	64/68		64.7	15.7	4.2	30.0	10.2	
64	59	1	13	1404 ~~1349~~	4087	59	51/50	60/89	74/71	75/104	63/84		72.3	16.5	4.4	27	10.0	
64	59	2	13	1404	4088	59	42/46	65/73	64/70	64/75	64/70		63.4	15.5	4.2	~~30.8~~ 30.6	10.1	
60.5	64	1	14	~~1415~~ 1415	4321	64	47/47	56/69	76/77	77/109	68/81		73.2	16.6	4.4	27.2	10.1	
60.5	63	2	14	1415	4322	63	46/47	64/72	67/73	63/74	67/70		64.5	15.6	4.2	30.9	10.1	
60.5	53	1	15	1427	4591	52	53/48	63/97	75/~~78~~	84/115	65/86		~~76.0~~	16.5	4.3	27.0	10.1	
60.5	53	2	15	1427	4593	53	42/49	66/~~72~~	70/77	66/80	65/71		65.9	15.5	4.2	30.6	10.1	
61.5	59	1	16	14:41	4962	59	49/46	61/90	78/69	83/113	67/65		74.1	16.5	4.3	27.0	10.0	
61.5	58	2	16	14:41	4965	59	46/46	63/76	64/70	66/74	65/71		64.0	15.5	4.2	30.7	10.1	

Recorded by MARK Z

Checked by

Sheet 21	* STATE_CODE	42
LTPP Traffic Data	*SPS PROJECT_ID	0600
WIM System Test Truck Records 3 of 3	* DATE	11/04/2008

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
59.5	60	1	17	14:44	5277	60	49/45	59/64	74/70	82/103	71/82		72.0	16.5	4.3	27.1	10.1	
59.5	62	2	17	14:44	5278	63	44/46	62/72	68/70	65/74	69/73		64.6	15.5	4.2	30.7	10.1	
59	53	1	18	15:08	5681	53	51/49	67/89	78/70	80/113	66/88		75.2	16.5	4.3	27.2	10.1	
59	54	2	18	15:08	5683	54	46/50	65/73	71/72	66/76	61/72		65.2	15.6	4.2	31.0	10.1	
58.5	59	1	19	15:19	5935	59	49/47	68/91	71/72	80/10.4	61/80		72.2	16.4	4.3	27.0	10.0	
58.5	54	2	19	15:19	5938	54	48/47	63/74	68/73	68/75	64/69		65.1	15.6	4.2	30.9	10.1	
58	64	1	20	15:33	6290	64	48/45	62/93	74/71	78/10.2	65/84		72.2	16.5	4.3	27.2	10.1	
58	64	2	20	15:33	6291	64	45/47	68/70	69/70	63/72	67/76		63.9	15.7	4.2	30.9	10.1	

Recorded by MARK Z

Checked by

Sheet 21	* STATE_CODE	42
LTPP Traffic Data	*SPS PROJECT_ID	0600
WIM System Test Truck Records 1 of 1	* DATE	11/05/2008

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
62.5	54	1	1	10:08	399	56	51/50	61/91	79/72	87/11.9	62/84	8	75.6	16.6	4.3	27.2	10.0	
62.5	53	2	1	10:08	400	54	48/51	66/70	68/72	64/76	64/68		64.7	15.6	4.2	30.8	10.1	
58.5	62	1	2	10:19	616	64	52/48	64/10.2	81/72	82/10.6	69/85		76.0	16.5	4.3	27.0	10.1	
58.5	58	2	2	10:19	617	58	47/49	65/72	65/70	67/76	67/70		64.8	15.5	4.2	30.8	10.0	
62.5	58	1	3	10:31	802	59	58/51	65/87	72/76	80/10.3	57/80		74.0	16.7	4.4	27.1	10.1	
62.5	58	2	3	10:31	804	59	44/50	64/74	64/71	67/76	63/73		64.6	15.5	4.2	30.7	10.0	
64	64	1	4	10:42	1023	63	51/48	61/88	77/75	79/10.7	66/85		73.6	16.5	4.3	26.9	10.0	
64	63	2	4	10:42	1024	64	48/52	72/75	70/77	64/74	70/73		67.5	15.6	4.2	30.9	10.1	
66	54	1	5	10:52	1216	54	56/49	58/90	72/72	85/10.6	68/82		73.9	16.5	4.3	27.1	10.1	
66	53	2	5	10:52	1220	52	47/51	64/71	67/78	63/71	60/68		63.5	15.5	4.2	30.6	10.0	
68	57	1	6	11:04	1481	58	52/51	59/89	68/71	82/10.7	66/85		73.0	16.5	4.3	26.9	10.0	
68	55	2	6	11:04	1482	59	46/51	67/75	68/68	66/79	67/73		66.0	15.6	4.2	30.8	10.1	

Recorded by MARK E

Checked by

Sheet 21	* STATE_CODE	42
LTPP Traffic Data	*SPS PROJECT_ID	0600
WIM System Test Truck Records 1 of 2	* DATE	11/05/2008

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
69.5	64	1	7	11:16	1712	63	56/50	64/88	78/71	77/10.4	68/84		74.0	16.6	4.4	27.2	10.0	
69.5	64	2	7	11:16	1713	64	47/54	66/76	68/75	66/71	68/73		66.5	15.7	4.2	31.0	10.0	
71.5	53	1	8	11:29	1986	53	57/50	65/91	73/70	85/10.9	67/82		75.0	16.6	4.4	27.1	10.1	
71.5	52	2	8	11:29	1988	54	48/52	63/73	69/73	63/75	64/68		64.7	15.6	4.2	30.9	10.1	
72.5	58	1	9	11:42	2228	58	54/51	62/88	78/74	86/112	66/85		75.5	16.5	4.3	27.1	10.1	
72.5	59	2	9	11:42	2229	59	46/51	66/78	63/70	67/77	63/72		65.3	15.5	4.2	30.7	10.0	
74.5	52	1	10	12:06	2742	54	56/50	63/94	75/69	86/103	66/81		74.3	16.6	4.3	27.1	10.1	
74.5	51	2	10	12:06	2743	54	41/49	64/72	67/73	64/75	65/71		64.3	15.4	4.1	30.8	10.1	
74.5	59	1	11	12:17	2955	59	54/48	64/89	79/70	86/108	68/85		74.9	16.6	4.4	27.2	10.1	
74.5	58	2	11	12:17	2957	59	44/49	66/74	65/71	66/75	65/73		64.8	15.5	4.2	30.7	10.1	
77.5	54	1	12	12:27	3170	54	52/51	59/98	66/75	79/103	65/88		73.5	16.5	4.3	27.1	10.1	
77.5	54	2	12	12:27	3171	54	47/45	62/70	67/69	64/71	63/65		62.4	15.6	4.2	30.7	10.1	
75.5	58	1	13	12:39	3379	57	61/52	71/10.1	78/70	89/94	65/78		75.3	16.6	4.4	27.2	10.1	
75.5	57	2	13	12:39	3381	59	48/48	65/72	65/69	68/76	65/71		64.8	15.6	4.2	30.9	10.1	
75	62	1	14	12:49	3583	64	56/49	60/92	69/70	83/95	69/81		72.5	16.6	4.4	27.2	10.1	
75	61	2	14	12:49	3584	62	48/49	65/75	67/75	65/73	66/71		65.4	15.6	4.2	31.0	10.1	

Recorded by MARK Z

Checked by

Sheet 21	* STATE_CODE	42
LTPP Traffic Data	*SPS PROJECT_ID	0600
WIM System Test Truck Records 2 of 2	* DATE	11/05/2008

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
78	52	1	15	13:00	3814	52	52/44	62/86	81/65	82/99	62/77		70.9	16.5	4.4	27.2	10.1	
78	54	2	15	13:00	3815	54	49/49	62/73	66/71	65/71	64/67		63.6	15.6	4.2	31.0	10.1	
78.5	64	1	16	13:10	4012	64	55/47	63/85	83/68	84/100	68/81		73.5	16.6	4.3	27.3	10.1	
78.5	60	2	16	13:10	4016	59	48/45	61/72	62/70	66/72	62/69		62.7	15.5	4.2	30.8	10.1	
78	63	1	17	13:22	4267	64	52/48	57/89	74/73	74/105	61/85		71.9	16.6	4.4	27.2	10.0	
78	61	2	17	13:22	4268	62	47/48	65/72	66/70	64/71	67/70		64.1	15.6	4.2	30.9	10.0	
78.5	53	1	18	13:32	4525	54	55/50	65/93	79/70	85/109	70/81		75.6	16.6	4.3	27.1	10.0	
78.5	53	2	18	13:32	4527	54	47/48	66/72	66/72	64/75	62/67		64.0	15.7	4.2	30.9	10.1	
76.5	64	1	19	13:43	4757	64	53/46	60/91	81/68	85/99	68/84		73.4	16.6	4.3	27.2	10.1	
76.5	59	2	19	13:43	4758	59	46/47	63/72	67/72	66/76	63/72		64.4	15.6	4.2	30.9	10.1	
74	64	1	20	13:54	5028	64	50/44	65/81	83/66	85/89	67/78		70.7	16.6	4.4	27.4	10.1	
74	62	2	20	13:54	5030	61	45/51	64/73	65/74	65/73	67/77		65.4	15.5	4.2	30.8	10.0	

Recorded by MARK B

Checked by

Calibration Worksheet

Site: 420600

Calibration Iteration 1 Date 11/5/09

Beginning factors: 1/3 2/4

Speed Point (mph)	Name	Value	
~~Overall~~ distance		1/3 ~~2/4~~ 243	
Front Axle	dynamic compensation	~~243~~ 109	
1 – (80) 50	80 kph	3182 / 3182	3784 / 3372
2 – (88) 55	88 kph	3150 / 3150	3736 / 3329
3 – (96) 60	96 kph	3024 / 3024	3587 / 3196
4 – (104) 65	104 kph	3024 / 3024	3587 / 3196
5 – (112) 70	112 kph	3040 / 3040	3606 / 3213

Errors: 55 60 65

	Speed Point 1	Speed Point 2	Speed Point 3	Speed Point 4	Speed Point 5
F/A		-2.5	-6.0	-6.0	
Tandem		-2.0	-5.2	-3.7	
GVW		-0.8	-3.6	-3.2	

Adjustments:

	Raise	Lower	Percentage
~~Overall~~ distance	☒	☐	3.0
Front Axle	☐	☐	
Speed Point 1	☐	☐	
Speed Point 2	☒	☐	.5
Speed Point 3	☒	☐	3.4
Speed Point 4	☒	☐	3.0
Speed Point 5	☐	☐	

End factors: 1/3 2/4

Speed Point (mph)	Name	Value	
~~Overall~~ distance		243	
Front Axle	dynamic compensation	103	
1 – (80) 50	80 kph	3182 / 3182	3784 / 3372
2 – (88) 55	88 kph	3164 / 3164	3753 / 3344
3 – (96) 60	96 kph	3128 / 3128	3710 / 3306
4 – (104) 65	104 kph	3116 / 3116	3696 / 3293
5 – (112) 70	112 kph	3040 / 3040	3606 / 3213

TEST VEHICLE PHOTOGRAPHS FOR SPS WIM VALIDATION

November 04, 2008

STATE: Pennsylvania

SHRP ID: 420600

Photo 1 - Truck_1_Suspension_ 1_42_0600_11_04_08.JPG

Photo 2 - Truck_1_Suspension_2_42_0600_11_04_08.JPG

Photo 3 - Truck_1_Suspension_3_42_0600_11_04_08.JPG

Photo 4 - Truck_1_Suspension_4_42_0600_11_04_08.JPG

Photo 5 - Truck_1_Tractor_42_0600_11_04_08.JPG

Photo 6 - Truck_1_Trailer_42_0600_11_04_08.JPG

Photo 7 - Truck_2_Suspension_1_42_0600_11_04_08.JPG

Photo 8 - Truck_2_Suspension_2_42_0600_11_04_08.JPG

Photo 9 - Truck_2_Suspension_3_42_0600_11_04_08.JPG

Photo 10 - Truck_2_Suspension_4_42_0600_11_04_08.JPG

Photo 11 - Truck_2_Tractor_42_0600_11_04_08.JPG

Photo 12 - Truck_2_Trailer_42_0600_11_04_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

Pennsylvania SPS-6 (Lane 4)

Validation Visit – November 5, 2008

Sensors 1/3 (Left)

	November 5, 2008	November 4, 2008	May 30, 2007
Distance	243	243	
Front Axle	103	100	
Speed Point (mph)			
80 kph (50)	3182	3182	3182
88 kph (55)	3164	3150	3150
96 kph (60)	3128	3024	3024
104 kph (65)	3116	3024	3024
112 kph (70)	3040	3040	3040

Sensors 2/4(Left)

	November 5, 2008	November 4, 2008	May 30, 2007
Speed Point (mph)			
80 kph (50)	3784 / 3372	3784 / 3372	3372 / 3372
88 kph (55)	3753 / 3344	3736 / 3329	3329 / 3329
96 kph (60)	3710 / 3306	3587 / 3196	3196 / 3196
104 kph (65)	3696 / 3293	3587 / 3196	3196 / 3196
112 kph (70)	3606 / 3213	3606 / 3213	3213 / 3213