Validation Report

Michigan, SPS-1
Task Order 24, CLIN 2
June 24 and 25, 2008

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1 Executive Summary

A visit was made to the Michigan 0100 on June 24 and 25, 2008 for the purpose of conducting a validation of the WIM system located on US Route 27, approximately 2.6 miles north of M-21. The SPS-1 is located in the righthand, southbound lane of a four-lane divided facility. The posted speed limit at this location is 60 mph for trucks. The LTPP lane is one of 4 lanes instrumented at this site. The validation procedures were in accordance with LTPP's SPS WIM Data Collection Guide dated August 21, 2001.

This is the fourth validation visit to this location. This is the original site location. The site was installed in June 2005 by the agency.

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

The site is instrumented with quartz piezo sensors and DAW 190 electronics. It is installed in portland cement concrete.

The validation used the following trucks:

1) 5-axle tractor-trailer with a tractor having an air suspension and a trailer with a standard rear tandem and an air suspension loaded to 76,690 lbs., the "golden" truck.
2) 5-axle tractor semi-trailer with a tractor having an air suspension and a trailer with a split rear tandem and a 3 tapered steel leaf suspension loaded to 67,270 lbs., the "partial" truck. The tractor had a third axle that was lifted and therefore unused during this validation.

The validation speeds ranged from 49 to 71 miles per hour. Permission to run the test trucks at speeds above the legal limit was granted by the Michigan Motor Carrier Enforcement Group to the agency. The pavement temperatures ranged from 69 to 87 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 – 260100 – 25-Jun-2008

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	1.2 ± 8.5%	Pass
Single axles	±20 percent	-0.3 ± 8.7%	Pass
Tandem axles	±15 percent	-1.5 ± 5.4%	Pass
GVW	±10 percent	-1.1 ± 3.9%	Pass
Axle spacing	± 0.5 ft [150mm]	0.0 ± 0.0 ft	Pass

Prepared: djw *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.

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

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

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

Prepared: djw *Checked: bko*

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 October 2 to 3, 2007. The state agency representative on site stated that the factors were slightly changed as a result of a traffic weight data study performed after the trailing WIM sensor was replaced in May 2008.

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

2 Corrective Actions Recommended

There are no corrective measures recommended for this site at this time.

3 Post Calibration Analysis

This final analysis is based on test runs conducted June 25, 2008 during the morning and afternoon hours at test site 260100 on US Route 27. This SPS-1 site is on the southbound, righthand of a four-lane divided facility. No auto-calibration was used during the test runs. The two trucks used for the calibration and for the subsequent validation included:

1. 5-axle tractor-trailer with a tractor having an air suspension and trailer with a standard rear tandem and air suspension loaded to 76,690 lbs., the “golden” truck.
2. 5-axle tractor semi-trailer with a tractor having an air suspension and a trailer with a split rear tandem and a 3 tapered steel leaf suspension loaded to 67,270 lbs., the “partial” truck. The tractor had a third axle that was lifted and therefore unused during this validation.

Each truck made a total of 20 passes over the WIM scale at speeds ranging from approximately 49 to 71 miles per hour. The desired speed range was achieved during this validation. Pavement surface temperatures were recorded during the test runs ranging from about 69 to 87 degrees Fahrenheit. The desired 30 degree Fahrenheit temperature range was not achieved. The computed values of 95% confidence limits of each statistic for the total population are in Table 3-1.

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

Table 3-1 Post-Validation Results – 260100 – 25-Jun-2008

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	1.2 ± 8.5%	Pass
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GVW	±10 percent	-1.1 ± 3.9%	Pass
Axle spacing	± 0.5 ft [150mm]	0.0 ± 0.0 ft	Pass

Prepared: djw *Checked: bko*

The test runs were conducted primarily during the morning and afternoon hours under sunny weather conditions resulting in a wide 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 two temperature groups. The distribution of runs by speed and temperature is illustrated in Figure 3-1. The figure indicates that the desired distribution of speed and temperature combinations was not achieved for this set of validation runs.

The three speed groups were divided as follows: Low speed – 49 to 55 mph, Medium speed – 56 to 64 mph and High speed – 65 + mph. The two temperature groups were created by splitting the runs between those at 69 to 80 degrees Fahrenheit for Low temperature and 81 to 87 degrees Fahrenheit for High temperature.

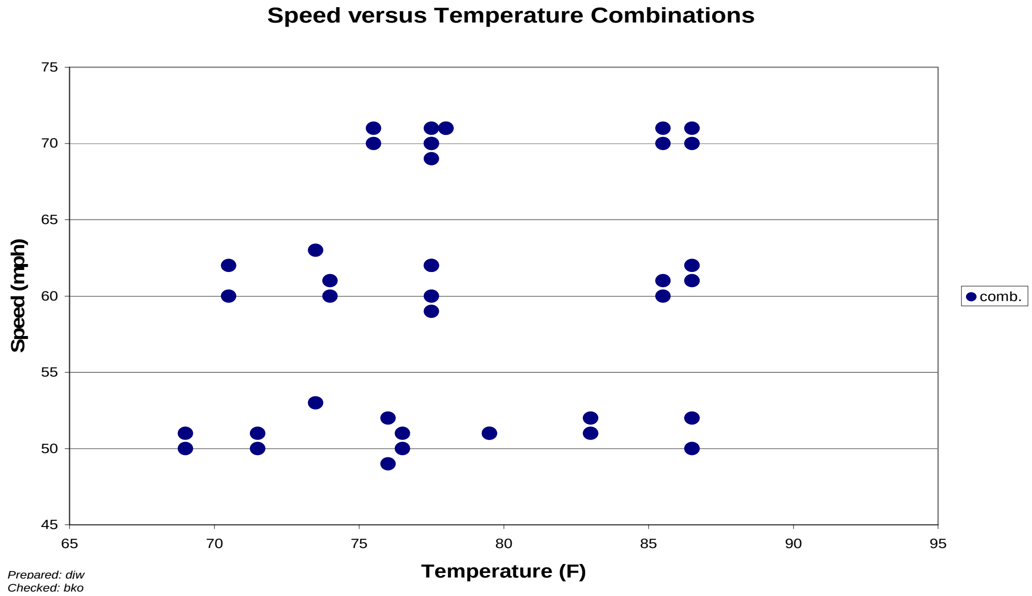

Figure 3-1 Post-Validation Speed-Temperature Distribution – 260100 – 25-Jun-2008

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 in the figure that the equipment slightly underestimates GVW at low and medium speeds. Variability appears to be higher at the lower speeds.

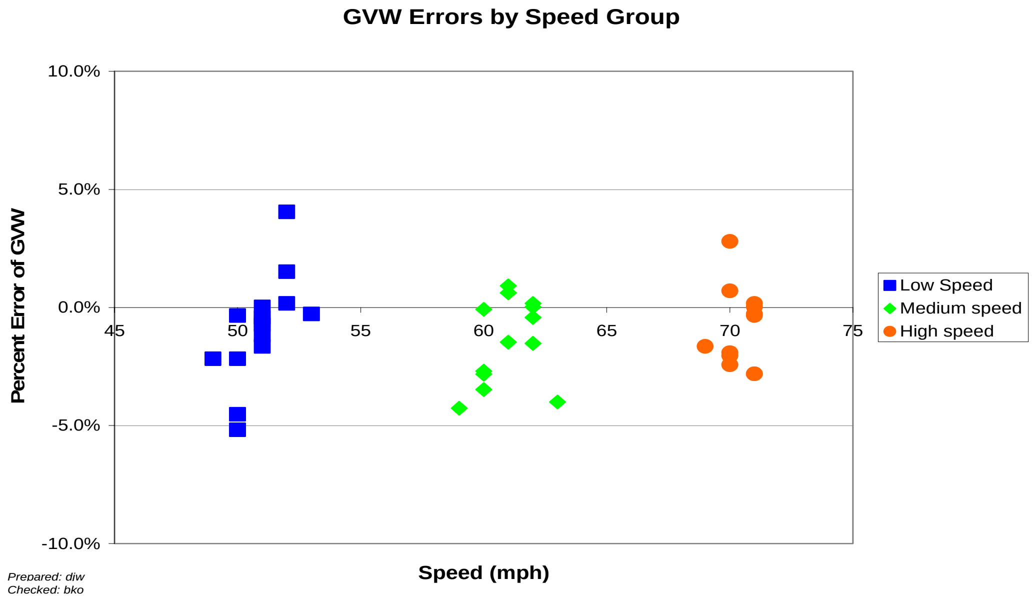

Figure 3-2 Post-validation GVW Percent Error vs. Speed – 260100 – 25-Jun-2008

Figure 3-3 shows the relationship between temperature and GVW percentage error. The system appears to underestimate GVW at the lower temperatures. This may be an effect of the smaller number of samples at the higher temperatures rather than an actual operating condition.

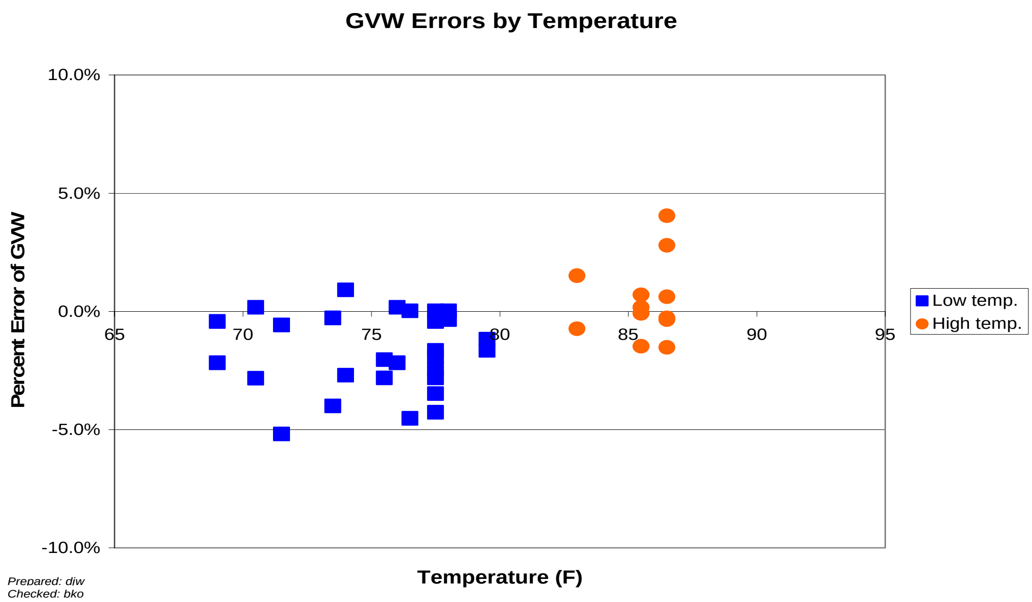

Figure 3-3 Post-Validation GVW Percent Error vs. Temperature – 260100 – 25-Jun-2008

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 influence of speed on spacing errors.

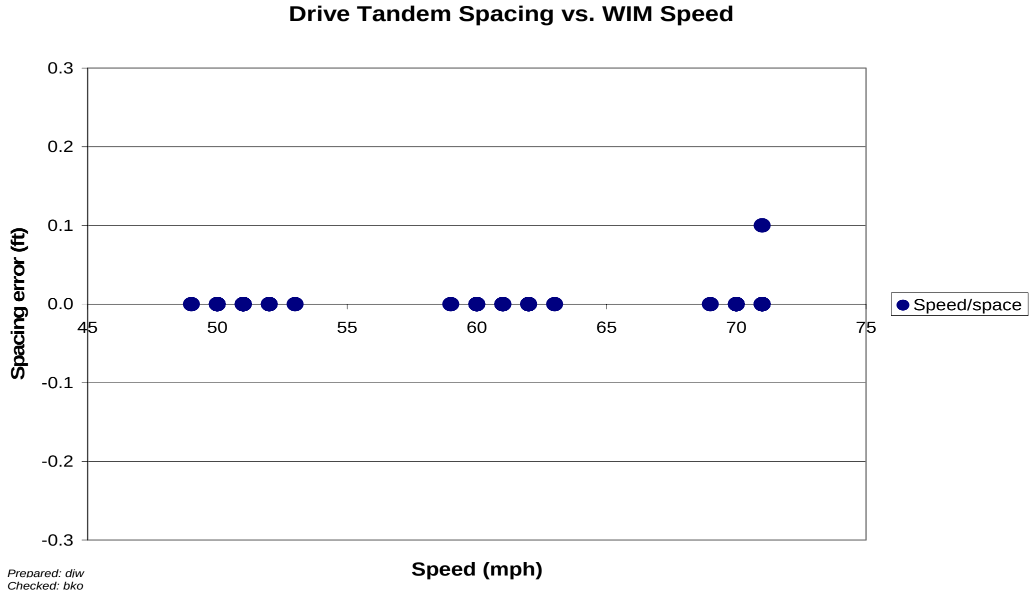

Figure 3-4 Post-Validation Spacing vs. Speed – 260100 – 25-Jun-2008

3.1 Temperature-based Analysis

The two temperature groups were created by splitting the runs between those at 69 to 80 degrees Fahrenheit for Low temperature and 81 to 87 degrees Fahrenheit for High temperature.

Table 3-2 Post-Validation Results by Temperature Bin – 260100 – 25-Jun-2008

Element	95% Limit	Low Temperature 69 to 80 °F	High Temperature81 to 87 °F
Steering axles	+20 %	0.7 ± 8.9%	2.5 ± 8.2%
Single axles	+20 %	-0.8 ± 8.6%	0.9 ± 9.2%
Tandem axles	+15 %	-2.2 ± 5.0%	0.3 ± 5.0%
GVW	+10 %	-1.7 ± 3.4%	0.5 ± 3.6%
Axle spacing	+ 0.5 ft	0.0 ± 0.0 ft	0.0 ± 0.1 ft

Prepared: djw Checked: bko

Table 3-2 demonstrates the tendency of the equipment to overestimate steering axle weights at the higher temperatures and underestimate GVW and tandem axle weights at the lower temperatures. Variability for each weight estimate appears to be consistent at all temperatures.

Figure 3-5 is the distribution of GVW Errors versus Temperature by Truck graph. From the graph, it can be seen that at the lower temperatures, the equipment tends to underestimate GVW for the Golden truck (squares). This tendency appears to cause an increase in the variability in error for the truck population as a whole at the lower temperatures.

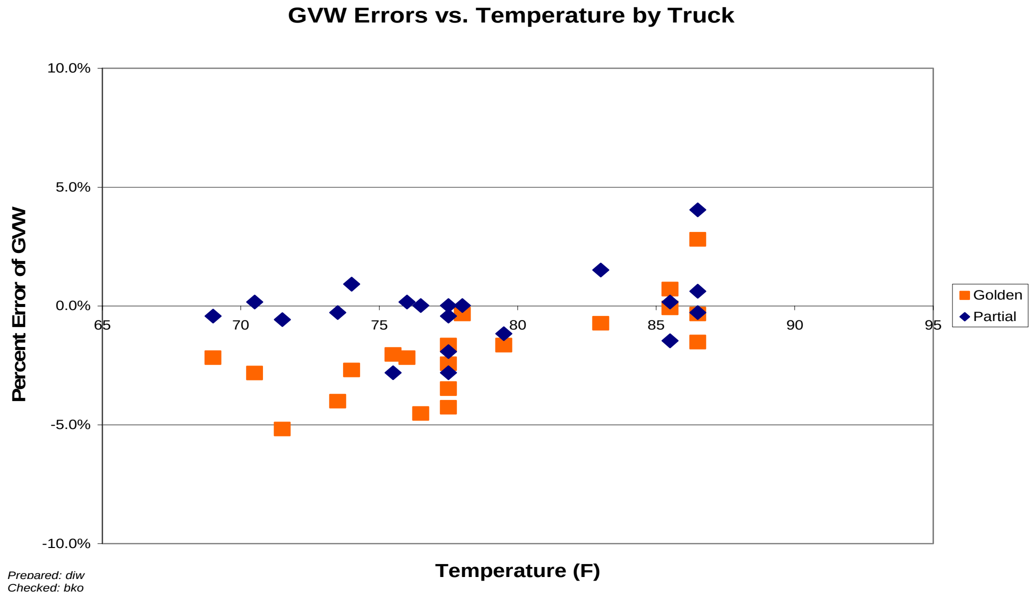

Figure 3-5 Post-Validation GVW Percent Error vs. Temperature by Truck – 260100 – 25-Jun-2008

Figure 3-6 shows the relationship between steering axle errors and temperature. This graph is included due to the frequent use of steering axle weights of Class 9 vehicles for auto-calibration. This site does not use auto-calibration. The steering axles in this graph are associated only with Class 9 vehicles. There is apparently no temperature trend associated with steering axle estimates.

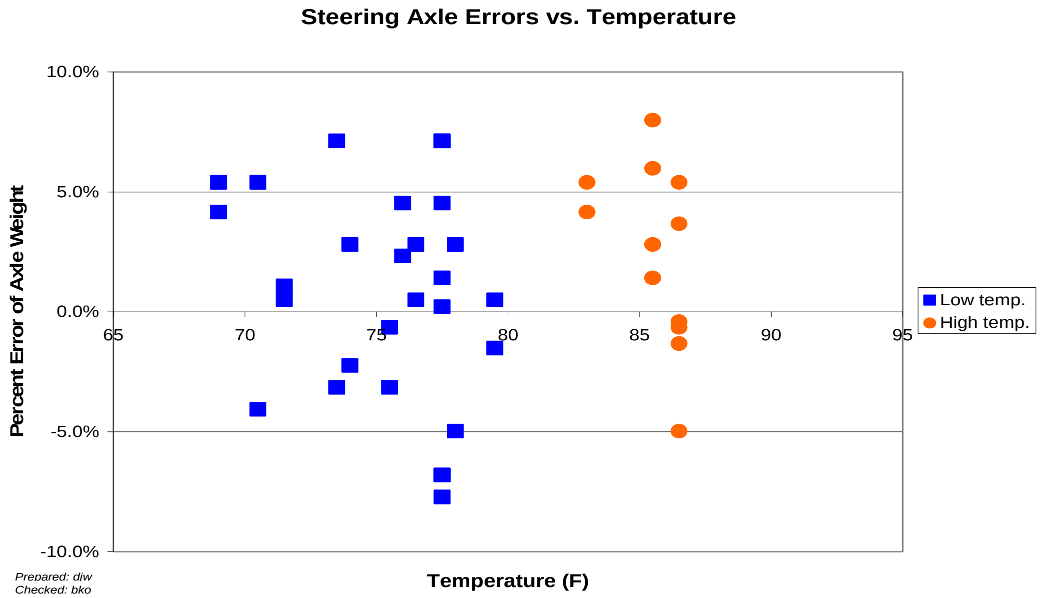

Figure 3-6 Post-Validation Steering Axle Error vs. Temperature by Group – 260100 – 25-Jun-2008

3.2 Speed-based Analysis

The three speed groups were divided using 49 to 55 mph for Low speed, 56 to 64 mph for Medium speed and 65+ mph for High speed.

Table 3-3 Post-Validation Results by Speed Bin – 260100 – 25-Jun-2008

Element	95% Limit	Low Speed 49 to 55 mph	Medium Speed 56 to 64 mph	High Speed 65+ mph
Steering axles	±20 %	2.7 ± 5.4%	1.5 ± 10.5%	-0.9 ± 10.2%
Single axles	±20 %	1.2 ± 6.7%	-0.1 ± 9.5%	-2.4 ± 9.8%
Tandem axles	±15 %	-2.0 ± 5.6%	-2.1 ± 5.5%	-0.1 ± 4.9%
GVW	±10 %	-0.9 ± 4.8%	-1.5 ± 4.0%	-0.9 ± 3.7%
Axle spacing	± 0.5 ft	0.0 ± 0.0 ft	0.0 ± 0.0 ft	0.0 ± 0.1 ft

Prepared: djw *Checked: bko*

From Table 3-3, it can bee seen that for steering and single axle weights, the equipment progresses from overestimation at the lower speeds to underestimation at the higher speeds. Variability in these weight estimations appears to be much greater at the medium and higher speeds when compared with the lower speeds. For GVW and tandem weights, weight estimates and variability remains reasonably consistent over the entire speed range.

From the graph in Figure 3-7, it appears that GVW for the Golden truck (squares) is underestimated at the low and medium speeds. GVW estimates for the Partial truck (diamonds) appear to be accurate throughout the entire speed range. Due to the underestimation of Golden truck GVW at the low and medium speeds, variability in error appears to be greater at these speeds.

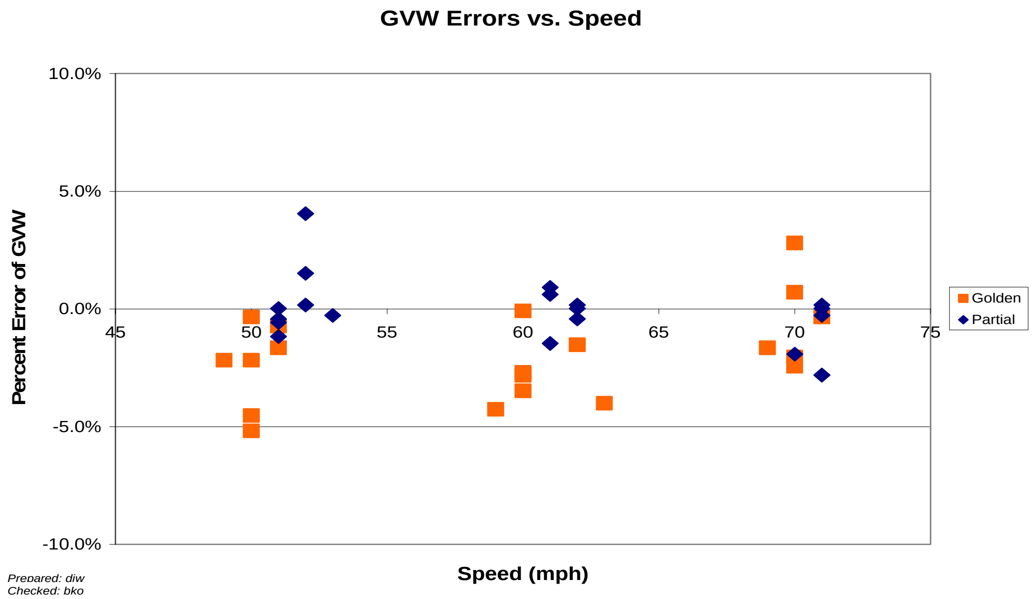

Figure 3-7 Post-Validation GVW Percent Error vs. Speed by Truck – 260100 – 25-Jun-2008

Figure 3-8 shows the relationship between steering axle errors and speed. This graph is included due to the frequent use of steering axle weights of Class 9 vehicles for auto-calibration. This site does not use auto-calibration. The steering axles in this graph are associated only with Class 9 vehicles. The figure shows an overestimation of steering axle weights at the lower speeds and an increased variability in error at the medium and high speeds.

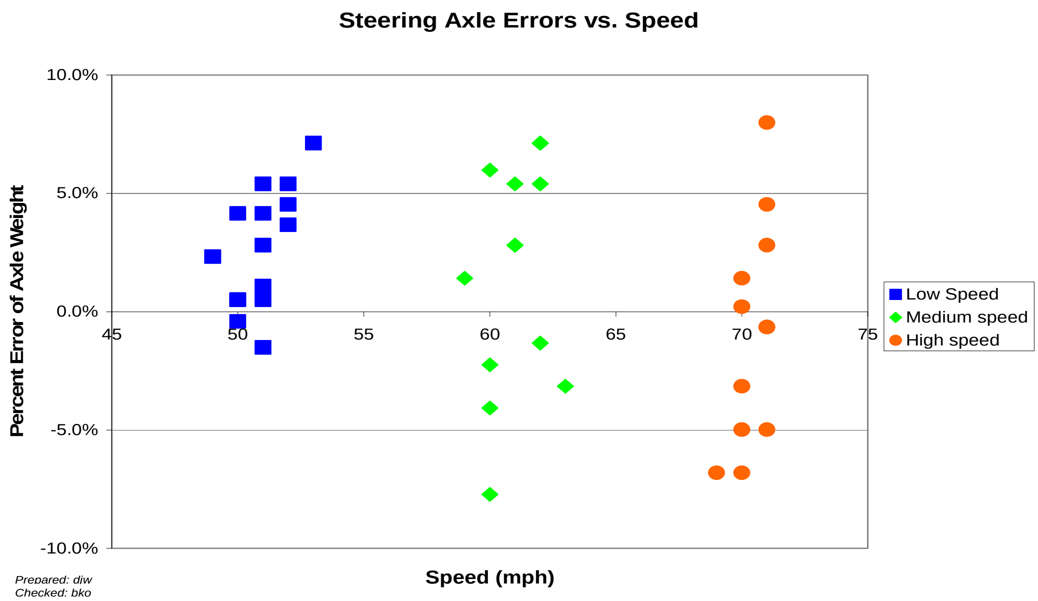

Figure 3-8 Post-Validation Steering Axle Percent Error vs. Speed by Group – 260100 – 25-Jun-2008

3.3 Classification Validation

The agency uses a variant of the FHWA 13-bin classification scheme. Classification 15 has been added to record the number of unclassified vehicles. The classification scheme is known to have difficulties in differentiating between some Class 10s and 13s and in identifying school buses.

The classification validation is intended to find gross errors in vehicle classification, not to validate the installed algorithm. A sample of 100 trucks was collected at the site. Video was taken at the site to provide ground truth for the evaluation. Based on the sample it was determined that there are zero percent unknown vehicles and 2.0 percent unclassified vehicles. The unclassified vehicles were one Class 9 truck and one Class 13 truck, both with irregular axle spacing configurations.

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 15.0 percent.

Table 3-4 Truck Misclassification Percentages for 260100 – 25-Jun-2008

Class	Percent Error	Class	Percent Error	Class	Percent Error
4	100	5	33	6	0
7	N/A				
8	33	9	4	10	0
11	N/A	12	N/A	13	N/A

Prepared: djw *Checked: bko*

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

Table 3-5 Truck Classification Mean Differences for 260100 – 25-Jun-2008

Class	Mean Difference	Class	Mean Difference	Class	Mean Difference
4	UNK	5	- 33	6	0
7	N/A				
8	67	9	- 4	10	0
11	N/A	12	N/A	13	N/A

Prepared: djw *Checked: bko*

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

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 heavy truck 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: djw Checked: bko

4 Pavement Discussion

The pavement condition did not 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 Consulting on April 22, 2008 were processed through the LTPP SPS WIM Index software, version 1.1. This WIM scale is installed on rigid 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 above the upper index limits are presented in italics and values below the lower index limits are presented in bold.

Table 4-2 WIM Index Values – 260100 –22-Apr-2008

Profiler Passes			Pass 1	Pass 2	Pass 3	Pass 4	Pass 5	Ave.
Center	LWP	LRI (m/km)	0.623	0.635	0.657	0.620	0.641	0.635
		SRI (m/km)	0.832	0.836	0.800	0.940	0.843	0.850
		Peak LRI (m/km)	0.729	0.769	0.759	0.700	0.739	0.739
		Peak SRI (m/km)	0.905	0.915	0.905	0.984	0.918	0.925
	RWP	LRI (m/km)	0.884	0.978	0.919	0.960	1.073	0.963
		SRI (m/km)	1.462	1.640	1.577	1.584	2.034	1.659
		Peak LRI (m/km)	0.970	1.043	0.993	1.030	1.144	1.036
		Peak SRI (m/km)	1.462	1.764	1.629	1.595	2.364	1.763
Left Shift	LWP	LRI (m/km)	0.619	0.619	0.655			0.631
		SRI (m/km)	0.800	0.800	1.073			0.891
		Peak LRI (m/km)	0.657	0.657	0.743			0.686
		Peak SRI (m/km)	0.834	0.834	1.090			0.919
	RWP	LRI (m/km)	0.885	0.885	1.143			0.971
		SRI (m/km)	1.289	1.289	2.037			1.538
		Peak LRI (m/km)	1.071	1.071	1.221			1.121
		Peak SRI (m/km)	1.426	1.426	2.314			1.722
Right Shift	LWP	LRI (m/km)	0.804	0.810	0.897			0.837
		SRI (m/km)	1.176	1.282	1.234			1.230
		Peak LRI (m/km)	1.029	0.975	1.012			1.005
		Peak SRI (m/km)	1.232	1.321	1.312			1.288
	RWP	LRI (m/km)	1.105	0.980	0.998			1.028
		SRI (m/km)	1.787	1.744	1.753			1.761
		Peak LRI (m/km)	1.188	1.091	1.084			1.121
		Peak SRI (m/km)	1.868	1.834	1.767			1.823

Prepared: als Checked: bko

From Table 4-2 it can be seen that all of indices computed from the profiles are between the upper and lower threshold values. Based on these results, the pavement smoothness may or may not contribute to the improper performance of the scale.

The results of the last available profile analysis are shown in Table 4-3. The data was collected with the same protocol and analyzed with the same software as the current profile information. At that time there was one location for which the index values were below the lower threshold value. In the interim the pavement appears to have gotten rougher at all locations as evaluated by this methodology.

Table 4-3 WIM Index Values - 260100 –02-Jun-2006

Profiler Passes			Pass 1	Pass 2	Pass 3	Pass 4	Pass 5	Ave.
Center	LWP	LRI (m/km)	0.544	0.562	0.600	0.582	0.565	0.571
		SRI (m/km)	0.630	*0.482*	0.635	0.648	0.594	0.598
		Peak LRI (m/km)	0.686	0.744	0.791	0.741	0.752	0.743
		Peak SRI (m/km)	*0.674*	*0.639*	*0.691*	*0.658*	*0.647*	*0.662*
	RWP	LRI (m/km)	0.809	0.741	0.771	0.805	0.820	0.789
		SRI (m/km)	1.123	0.973	1.226	1.286	1.316	1.185
		Peak LRI (m/km)	0.895	0.871	0.946	0.954	0.916	0.916
		Peak SRI (m/km)	1.180	1.112	1.311	1.367	1.363	1.267
Left Shift	LWP	LRI (m/km)	0.612	0.578	0.597			0.596
		SRI (m/km)	0.554	0.538	0.619			0.570
		Peak LRI (m/km)	0.672	0.640	0.727			0.680
		Peak SRI (m/km)	0.789	0.791	*0.689*			0.756
	RWP	LRI (m/km)	0.771	0.761	0.795			0.776
		SRI (m/km)	1.044	0.959	1.360			1.121
		Peak LRI (m/km)	1.182	1.196	0.957			1.112
		Peak SRI (m/km)	1.295	1.301	1.507			1.368
Right Shift	LWP	LRI (m/km)	0.672	0.682	0.612			0.655
		SRI (m/km)	0.839	0.824	0.617			0.760
		Peak LRI (m/km)	0.807	0.916	0.853			0.859
		Peak SRI (m/km)	0.911	0.951	*0.713*			0.858
	RWP	LRI (m/km)	0.854	0.903	0.779			0.845
		SRI (m/km)	1.217	1.305	1.266			1.263
		Peak LRI (m/km)	0.977	1.009	0.937			0.974
		Peak SRI (m/km)	1.313	1.379	1.285			1.326

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 DAW 190 electronics. The sensors are installed in a portland cement concrete pavement.

As a result of the last validation visit on October 3, 2007, it was reported that the trailing WIM sensor was damaged and needed to be replaced. The sensor was replaced in May 2008.

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 October 3, 2007. The state agency representative on site stated that the factors were slightly changed as a result of a traffic data weight study performed after the trailing WIM sensor was replaced.

For this equipment, there are 4 primary calibration factors. The overall sensitivity factor is increased to account for underestimation of all weights at all speeds and is decreased to compensate for overestimation of all weights at all speeds.

The three speed point factors are increased or decreased to compensate for underestimation or overestimation of weights at the lower, medium and high speed ranges.

No calibration iterations were required, but improving the statistics was desired so one iteration of the calibration process between the initial 40 runs and the final 40 runs was performed

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 - 260100 - 24-Jun-2008

Speed Bin	Left Sensor	Right Sensor
Speed Point 1	1010	1010
Speed Point 2	1051	1051
Speed Point 3	1071	1071

Prepared: djw *Checked: bko*

5.2.1 Calibration Iteration 1

The results of the pre-validation test runs indicated that the equipment was generally underestimating all weights at low speeds by approximately 5.0% and overestimating all weights at the high speeds by approximately 4.4%.

As a result, the primary factors were adjusted to compensate for these underestimations. The compensation factors were adjusted as shown in Table 5-2.

Table 5-2 Calibration 1 - Change in Parameters - 260100 - 25-Jun-2008

Speed Bins	New Right Sensor	Change	New Left Sensor	Change
Speed Point 1	1061	+5.0%	1061	+5.0%
Speed Point 2	1043	-0.6%	1043	-0.6%
Speed Point 3	1024	-4.4%	1024	-4.4%

Prepared: djw *Checked: bko*

The agency verified and input the new factors into the controller.

The results of the 12 calibration verification runs are shown in Table 5-3. No further calibrations were deemed necessary. A final 28 test runs were conducted to complete the post-validation series of 40 runs.

Table 5-3 Calibration Iteration 1 Results – 260100 – 25-Jun-2008 (08:13 AM)

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	-0.3 ± 7.4%	Pass
Single axles	±20 percent	-1.0 ± 7.7%	Pass
Tandem axles	±15 percent	-2.8 ± 6.5%	Pass
GVW	±10 percent	-2.1 ± 4.5%	Pass
Axle spacing	± 0.5 ft	0.0 ± 0.0 ft	Pass

Prepared: djw *Checked: bko*

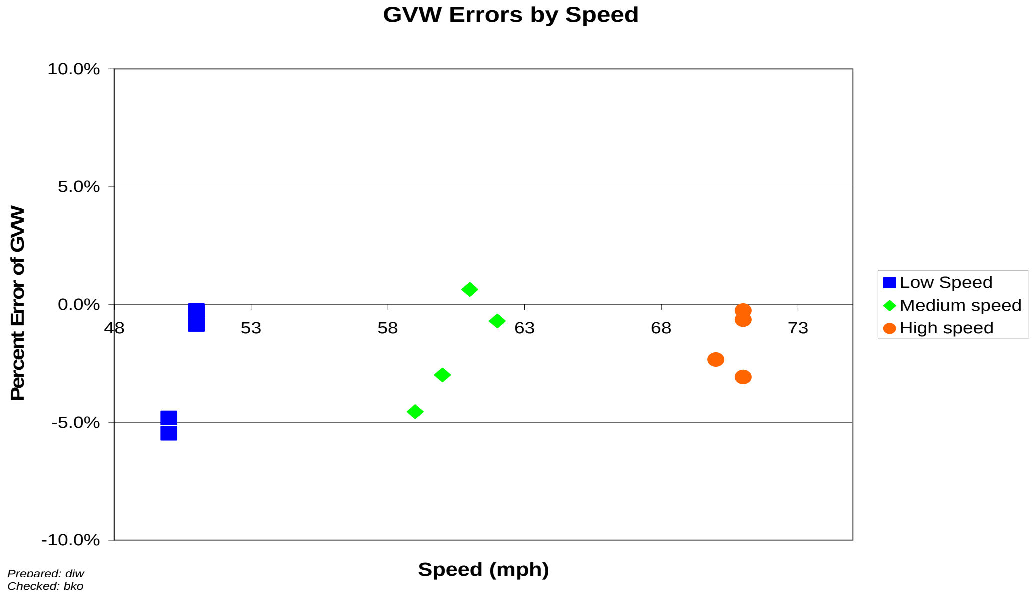

Figure 5-1 Calibration Iteration 1 GVW Percent Error vs. Speed Group – 260100 – 25-Jun-2008 (08:13 AM)

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 reflect only this contractor's validation visits.

Table 5-4 Classification Validation History – 260100 – 25-Jun-2008

Date	Method	Mean Difference				Percent Unclassified
		Class 9	Class 8	Other 1	Other 2	
06/25/2008	Manual	-4	67	-33 (Cl 5)	-8 (Cl 13)	2.0
06/24/2008	Manual	-2	0			1.0
10/03/2007	Manual	2	0			0.0
10/02/2007	Manual	0	0			0.0
07/11/2006	Manual	0	0	-6 (Cl 5)	0 (Cl 13)	0.0
12/07/2005	Manual	0	0			0.0

Prepared: djw *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 reflect only this contractor's validation visits.

Table 5-5 Weight Validation History – 260100 – 25-Jun-2008

Date	Method	Mean Error and (SD)		
		GVW	Single Axles	Tandem Axles
06/25/2008	Test Trucks	-1.1 (1.9)	-0.3 (4.4)	-1.5 (2.7)
06/24/2008	Test Trucks	-0.5 (4.3)	-0.9 (4.3)	-0.2 (5.3)
10/03/2007	Test Trucks	-0.5 (2.1)	5.5 (3.5)	-1.5 (3.1)
10/02/2007	Test Trucks	-10.8 (2.1)	-7.3 (3.1)	-11.4 (3.4)
07/11/2006	Test Trucks	-0.6 (1.7)	0.5 (4.7)	-1.2 (2.1)
12/08/2005	Test Trucks	-2.1 (3.4)	-4.2 (4.0)	-1.7 (4.3)

Prepared: djw Checked: bko

5.4 Projected Maintenance/Replacement Requirements

No corrective maintenance is required at this site at this time.

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 October 2 to 3, 2007. The state agency representative on site stated that the factors were slightly changed as a result of a traffic data weight study performed after the trailing WIM sensor was replaced.

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

Table 6-1 Calibration Factor Change – 260100 – since 03-Oct-2007

	Left Sensor		Right Sensor	
	24-Jun-2008	*03-Oct-2007*	*24-Jun-2008*	*03-Oct-2007*
Speed Point 1	1010	1000	1010	1000
Speed Point 2	1051	1050	1051	1050
Speed Point 3	1071	1071	1071	1071

Prepared: djw Checked: bko

This pre-validation analysis is based on test runs conducted June 24, 2008 during the morning and afternoon hours at test site 260100 on US Route 27. This SPS-1 site is on the southbound, righthand of a four-lane divided facility. No auto-calibration was used during test runs. The two trucks used for initial validation included:

1. 5-axle tractor semi-trailer combination with a tractor having an air suspension and trailer with standard rear tandem and an air suspension loaded to 76,240 lbs., the "golden" truck.
2. 5-axle tractor semi-trailer with a tractor having an air suspension and a trailer with a split rear tandem and a 3 tapered steel leaf suspension loaded to 66,170 lbs., the "partial" truck. The tractor had a third axle that was lifted and therefore unused during this validation.

For the initial validation each truck made a total of 20 passes over the WIM scale at speeds ranging from approximately 50 to 71 miles per hour. The desired speed range was achieved during this validation. Pavement surface temperatures were recorded during the test runs ranging from about 72 to 116degrees Fahrenheit. The desired 30 degree Fahrenheit temperature range was also achieved. The computed values of 95% confidence limits of each statistic for the total population are in Table 6-2.

Table 6-2 indicates that the conditions for research quality loading data were met.

Table 6-2 Pre-Validation Results – 260100 – 24-Jun-2008

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	0.5 ± 6.9%	Pass
Single axles	±20 percent	-0.9 ± 8.6%	Pass
Tandem axles	±15 percent	-0.2 ± 10.7%	Pass
GVW	±10 percent	-0.5 ± 8.8%	Pass
Axle spacing	± 0.5 ft [150mm]	0.0 ± 0.0 ft	Pass

Prepared: djw Checked: bko

The test runs were conducted primarily during the evening and early morning hours, resulting in a very narrow range of pavement temperatures. The runs were also conducted at various speeds to determine the effects of these variables on the performance of the WIM scale. To investigate these effects, the dataset was split into three speed groups and two temperature groups. The distribution of runs within these groupings is illustrated in Figure 6-1. The figure indicates that the desired distribution of speed and temperature combinations was achieved for this set of validation runs.

The three speed groups were divided into 50 to 55 mph for Low speed, 56 to 64 mph for Medium speed and 65+ mph for High speed. The two temperature groups were created by splitting the runs between those at 72 to 98 degrees Fahrenheit for Low temperature and 99 to 116 degrees Fahrenheit for High temperature. A break in the data collection period resulted in a gap in the temperature range that led to the decision to use two groups as shown in Figure 6-1.

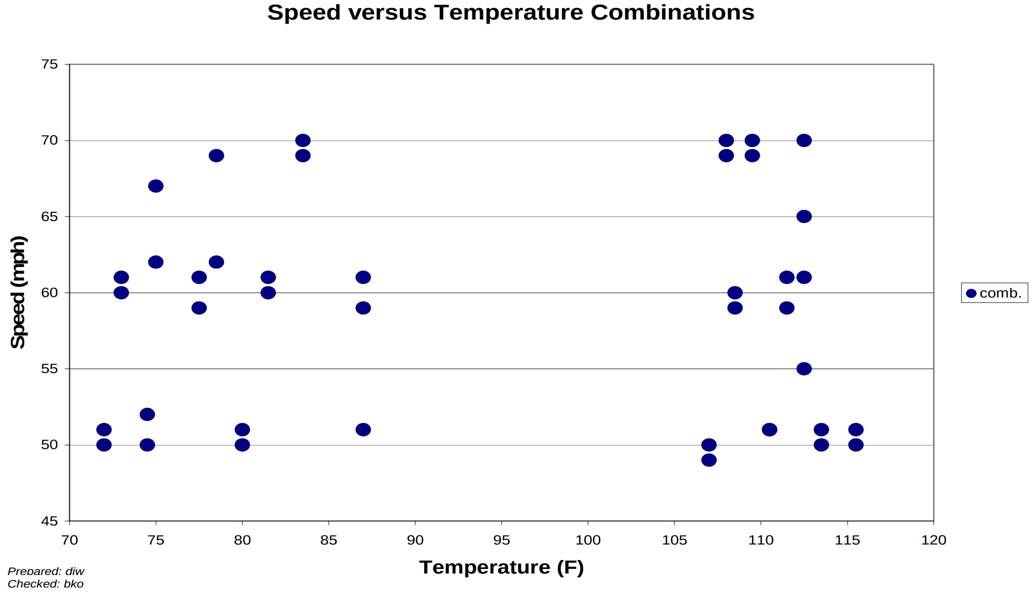

Figure 6-1 Pre-Validation Speed-Temperature Distribution – 260100 – 24-Jun-2008

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 can be seen in the figure; the equipment progresses from an underestimation of GVW at low speeds to an overestimation of GVW at the higher speeds. Variability appears to remain reasonably consistent over the entire speed range.

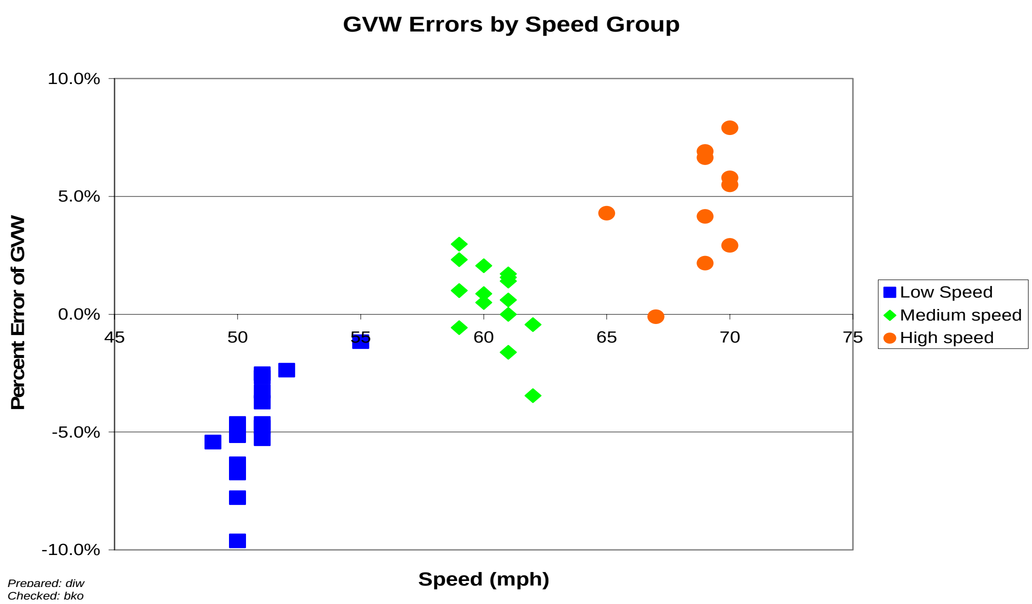

Figure 6-2 Pre-validation GVW Percent Error vs. Speed – 260100 – 24-Jun-2008

Figure 6-3 shows the relationship between temperature and GVW percentage error. GVW appears to be underestimated by the equipment at the lower temperatures. Variability appears to remain consistent throughout the entire temperature range.

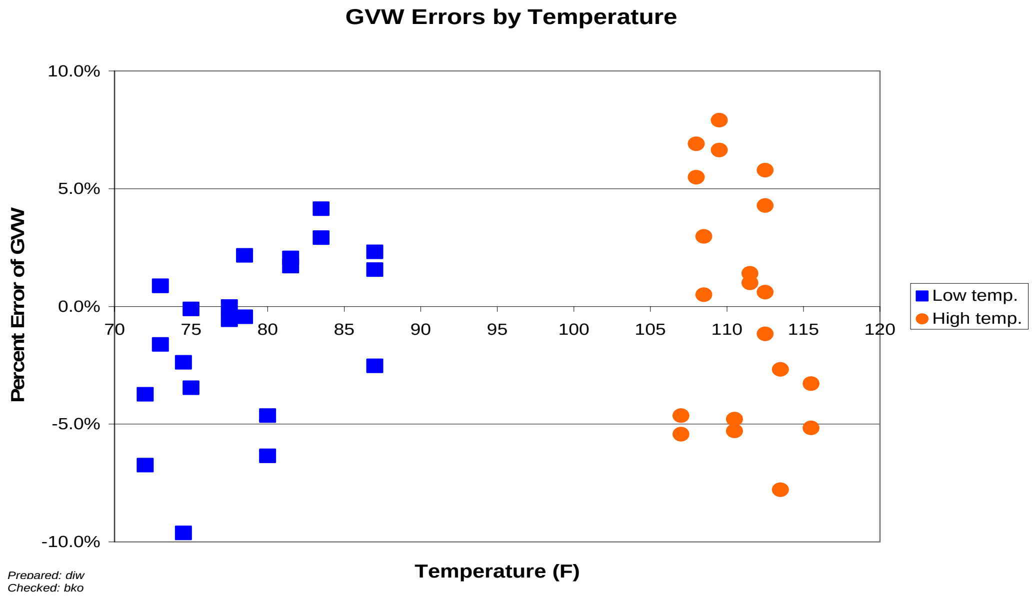

Figure 6-3 Pre-Validation GVW Percent Error vs. Temperature – 260100 – 24-Jun-2008

Figure 6-4 shows the relationship between the drive tandem spacing errors in feet and speeds. This graph is used as a potential indicator of classification errors due to failure to correctly identify spacings on a vehicle. Since the most common reference value is the drive tandem on a Class 9 vehicle, this is the spacing evaluated and plotted for validations. There is no apparent influence of speed on spacing error.

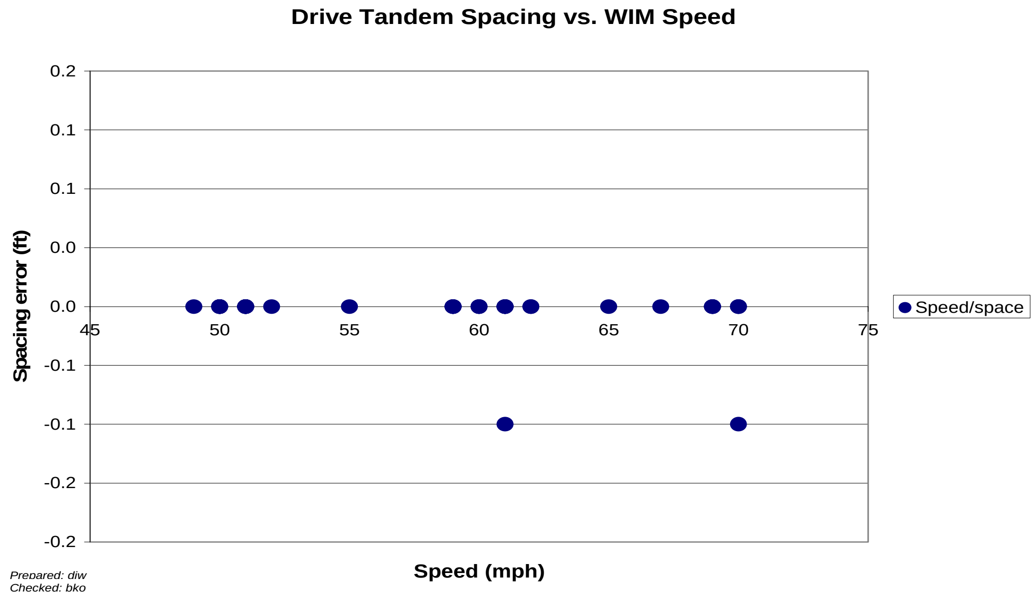

Figure 6-4 Pre-Validation Spacing vs. Speed - 260100 – 24-Jun-2008

6.1 Temperature-based Analysis

The two temperature groups were created by splitting the runs between those at 72 to 98 degrees Fahrenheit for Low temperature and 99 to 116 degrees Fahrenheit for High temperature.

Table 6-3 Pre-Validation Results by Temperature Bin – 260100 – 24-Jun-2008

Element	95% Limit	Low Temperature 72 to 98 °F	High Temperature 99 to 116 °F
Steering axles	±20 %	0.5 ± 6.0%	0.5 ± 8.3%
Single axles	±20 %	-0.9 ± 7.6%	-1.0 ± 9.8%
Tandem axles	±15 %	-1.2 ± 9.4%	0.9 ± 12.0%
GVW	±10 %	-1.2 ± 7.7%	0.2 ± 10.3%
Axle spacing	± 0.5 ft	0.0 ± 0 ft	0.0 ± 0.1 ft

Prepared: djw Checked: bko

From Table 6-3, it can be seen that the equipment generally estimates all weights with reasonable accuracy at all temperatures. Variability appears to greater at the higher temperatures when compared with lower temperatures.

Figure 6-5 shows the distribution of GVW Errors versus Temperature by Truck. At all temperatures, the patterns for the two trucks are similar. Variability in error for the each truck independently as well as for the truck population as a whole appears greater at the higher temperatures.

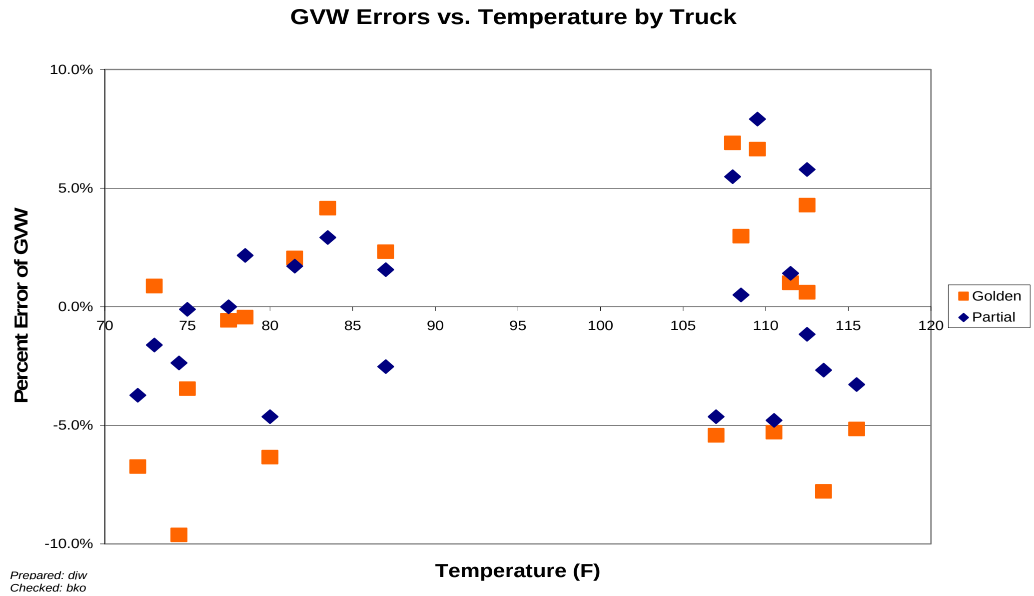

Figure 6-5 Pre-Validation GVW Percent Error vs. Temperature by Truck – 260100 – 24-Jun-2008

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. There is no obvious visual trend in steering axle errors with respect to temperature.

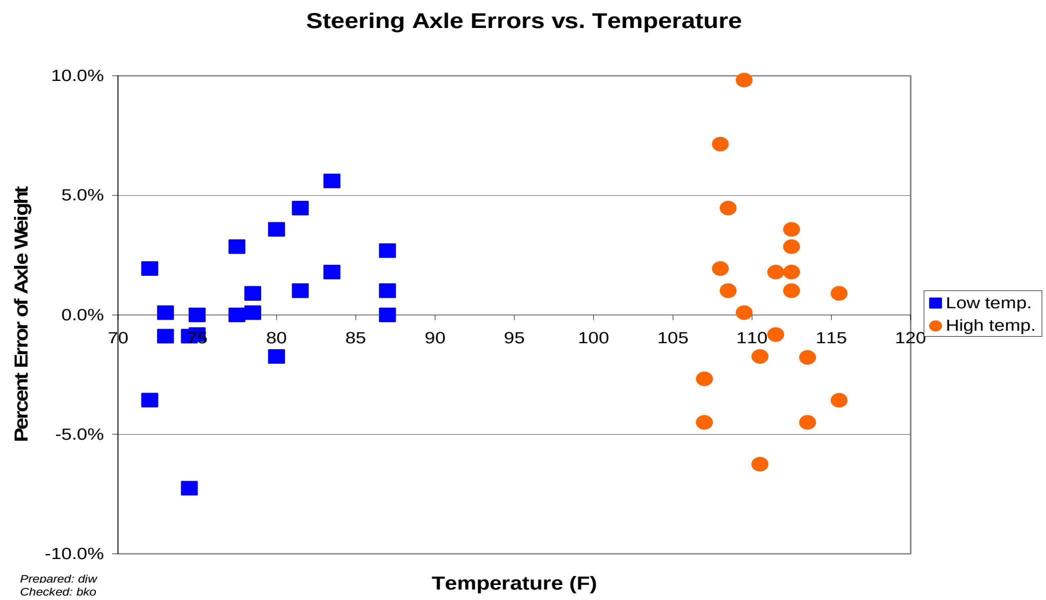

Figure 6-6 Pre-Validation Steering Axle Error vs. Temperature by Group – 260100 – 24-Jun-2008

6.2 Speed-based Analysis

The speed groups were divided as follows: Low speed – 50 to 55 mph, Medium speed – 56 to 64 mph and High speed – 65+ mph.

Table 6-4 Pre-Validation Results by Speed Bin – 260100 – 24-Jun-2008

Element	95% Limit	Low Speed 50 to 55 mph	Medium Speed 56 to 64 mph	High Speed 65+ mph
Steering axles	±20 %	-1.9 ± 6.5%	1.4 ± 4.0%	3.2 ± 7.5%
Single axles	±20 %	-4.0 ± 7.5%	0.4 ± 5.9%	2.3 ± 7.1%
Tandem axles	±15 %	-5.0 ± 6.9%	0.8 ± 5.7%	6.2 ± 7.1%
GVW	±10 %	-4.8 ± 4.6%	0.6 ± 3.7%	4.6 ± 5.5%
Axle spacing	± 0.5 ft	0.0 ± 0.0 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft

Prepared: djw *Checked: bko*

Table 6-4 shows the tendency for the equipment to underestimate all weights at the lower speeds and overestimate all weights at the higher speeds. Variability appears to be greater for all weight estimates at the low and high speeds when compared with medium speeds.

As shown in Figure 6-7, the patterns of the two trucks appear similar at the medium and high speeds, with generally the same overestimation at the high speeds. At the lower speeds, GVW for the Golden truck (squares) is underestimated by a greater amount than GVW for the Partial truck (diamonds). For this reason, variability for the truck population as a whole is greater at the lower speeds.

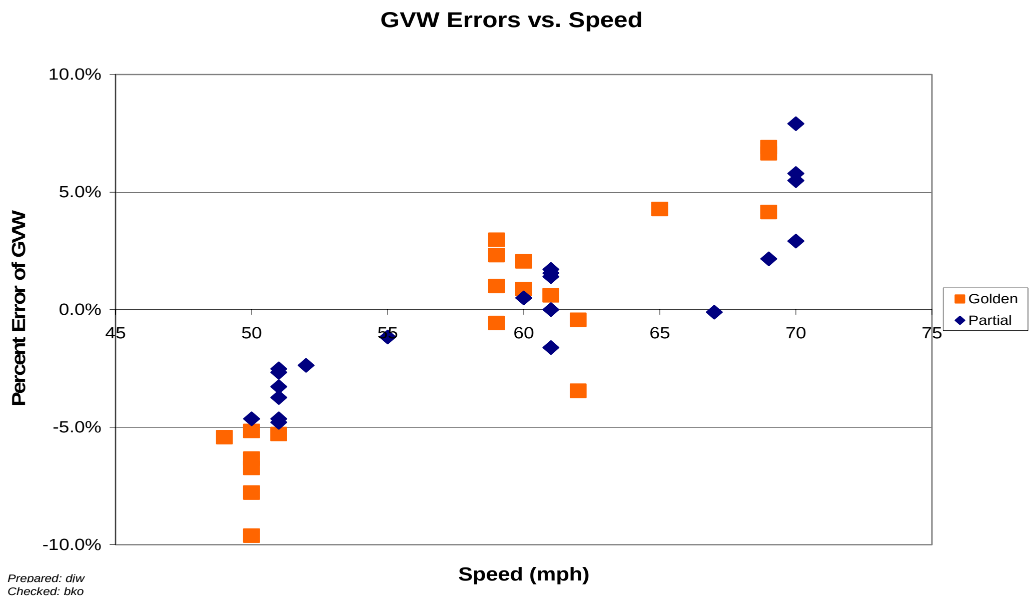

Figure 6-7 Pre-Validation GVW Percent Error vs. Speed Group - 260100 –24-Jun-2008

Figure 6-8 shows the relationship between steering axle errors and speed. This graph is included due to the frequent use of steering axle weights of Class 9 vehicles for calibration. This site does not use auto-calibration. The steering axles in this graph are associated only with Class 9 vehicles. The figure illustrates the tendency for the equipment to transition from an underestimation of steering axle weights at the low speeds to an overestimation at the higher speeds. Variability in error is much less at the medium speed when compared with low and high speeds.

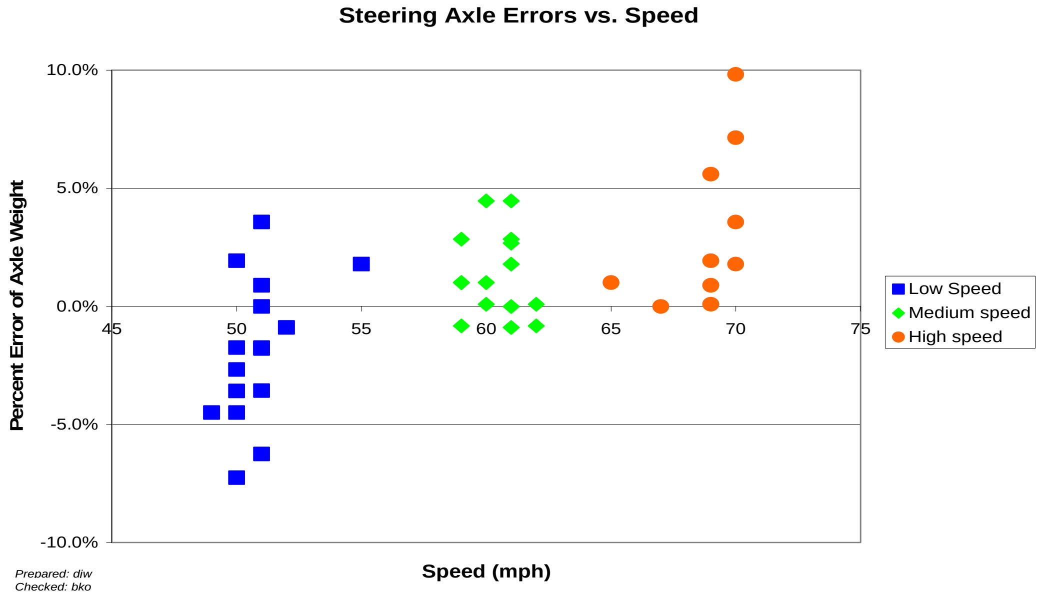

Figure 6-8 Pre-Validation Steering Axle Percent Error vs. Speed Group - 260100 – 24-Jun-2008

6.3 Classification Validation

The agency uses a variant of the FHWA 13-bin classification scheme. Classification 15 has been added to record the number of unclassified vehicles. The classification scheme is known to have difficulties in differentiating between some Class 10s and 13s and in identifying school buses.

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 one percent unclassified vehicles. The unclassified vehicle was a Class 9 truck with an irregular axle spacing configuration.

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 6.0 percent.

Table 6-5 Truck Misclassification Percentages for 260100 – 24-Jun-2008

Class	Percent Error	Class	Percent Error	Class	Percent Error
4	100	5	10	6	0
7	N/A				
8	0	9	2	10	5
11	N/A	12	N/A	13	N/A

Prepared: djw Checked: bko

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

Table 6-6 Truck Classification Mean Differences for 260100 – 24-Jun-2008

Class	Mean Difference	Class	Mean Difference	Class	Mean Difference
4	UNK	5	- 10	6	0
7	N/A				
8	0	9	- 2	10	- 5
11	N/A	12	N/A	13	N/A

Prepared: djw Checked: bko

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

A limited investigation of the precision and bias of the speeds reported by the equipment was undertaken. The values were not within the expected tolerances. Since the heavy truck 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: djw *Checked: bko*

6.5 Prior Validations

The last validation for this site was done October 3, 2007. It was the third validation of the site. The site was producing research quality data. Figure 6-9 shows the GVW Percent Error vs. Speed for the post validation runs. The site was validated with two trucks. The "Golden" truck was loaded to 75,700 lbs. The "partial" truck which had air suspension on both tandems was loaded to 65,390 lbs.

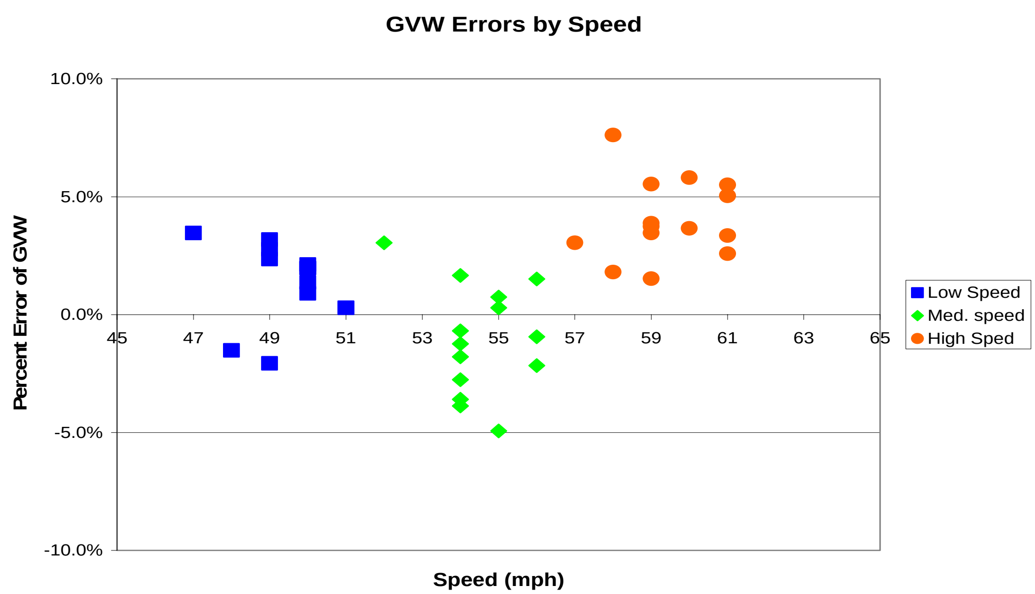

Figure 6-9 Last Validation GVW Percent Error vs. Speed – 260100 – 03-Oct-2007

Table 6-8 shows the overall results from the last validation. At then end the site was slightly underestimating tandem and gross vehicle weights.

Table 6-8 Last Validation Final Results – 260100 – 03-Oct-2007

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	5.5 ± 7.0%	Pass
Tandem axles	±15 percent	-1.5 ± 6.1%	Pass
Gross vehicle weights	±10 percent	-0.5 ± 4.3%	Pass
Axle spacing	± 0.5 ft [150 mm]	0.0 ± 0.1 ft	Pass

Prepared: djw *Checked: bko*

Table 6-9 has the results at the end of the last validation by temperature. Mostly cloudy weather conditions resulted in a limited range of pavement temperatures. Through this validation the equipment has been observed at temperatures from 1 to 116 degrees Fahrenheit.

Table 6-9 Last Validation Results by Temperature Bin – 260100 – 03-Oct-2007

Element	95% Limit	Low Temperature 62 to 73 °F	High Temperature 74 to 86 °F
Steering axles	±20 %	5.2 ± 8.7%	5.8 ± 5.0%
Tandem axles	±15 %	-2.1 ± 5.2%	-0.7 ± 7.0%
GVW	±10 %	-1.1 ± 4.0%	0.2 ± 4.7%
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	0.0 ± 0.0 ft

Prepared: djw Checked: bko

Table 6-10 has the results of the prior post validation by speed groups. GVW was estimated with reasonable accuracy. Tandem axles were underestimated at all speeds while steering axle weights were overestimated at all speeds.

Table 6-10 Last Validation Results by Speed Bin – 260100 – 03-Oct-2007

Element	95% Limit	Low Speed 49 to 55 mph	Medium Speed 56 to 62 mph	High Speed 63+ mph
Steering axles	±20 %	2.2 ± 5.8%	7.4 ± 5.2%	7.1 ± 5.8%
Tandem axles	±15 %	-2.4 ± 7.3%	-1.3 ± 5.7%	-0.6 ± 5.3%
GVW	±10 %	-1.7 ± 5.5%	-0.1 ± 3.6%	0.4 ± 3.4%
Axle spacing	± 0.5 ft	0.0 ± 0.0 ft	0.0 ± 0.0 ft	0.0 ± 0.1 ft

Prepared: djw *Checked: bko*

7 Data Availability and Quality

As of June 24, 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, between 1996 and 2006 all years but 1996, 1998 and 1999 for classification and 1996,1999 and 2002 for weight have a sufficient quantity of data to be considered complete years of data. **With the 2006 and 2007 validation information available for these years it can be seen that at least three additional years of research quality data are needed to meet the goal of a minimum of 5 years of research weight data. Since the site was installed in June 2005, analysis of data from prior years for consideration as research quality data will require validation information for that installation.**

Table 7-1 Amount of Traffic Data Available 260100 – 24-Jun-2008

Year	Classification Days	Months	Coverage	Weight Days	Months	Coverage
1996	176	7	Full week	191	7	Full week
1997	339	12	Full week	322	11	Full week
1998	1	1	Weekday(s)	356	12	Full week
1999	127	6	Full week	136	6	Full week
2000	309	11	Full week	309	12	Full week
2001	345	12	Full week	341	12	Full week
2002	345	12	Full week	353	12	Full week
2003	300	10	Full week	298	10	Full week
2004	280	11	Full week	323	11	Full week
2005	333	12	Full week	340	12	Full week
2006	316	12	Full week	357	12	Full week
2007	135	5	Full week	144	5	Full week

Prepared: djw *Checked: bko*

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

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

Table 7-2 is generated with a column for every vehicle class 4 or higher that represents 10 percent or more of the truck (class 4-20) population. In creating Table 7-2 the following definitions are used:

- Class 9 overweights are defined as the percentage of vehicles greater than 88,000 pounds
- Class 9 underweights are defined as the percentage of vehicles less than 20,000 pounds.
- Class 9 unloaded peak is the bin less than 44,000 pounds with the greatest percentage of trucks.
- Class 9 loaded peak is the bin 60,000 pounds or larger with the greatest percentage of trucks.
- For all other trucks the typical axle configuration is used to determine the maximum allowable weight based on 18,000 pounds for single axles and 34,000 pounds for tandem axles. A ten percent cushion above that maximum is used to set the overweight threshold.
- For all other trucks in the absence of site specific information the computation of under weights assumes the power unit weighs 10,000 pounds and each axle on a trailer 5,000 pounds. Ninety percent of the total for the unloaded configuration is the value below which a truck is considered under weight.
- For all trucks other than class 9s that have a bi-modal distribution the unloaded peak is defined to be in a bin less than or equal to half of the allowable maximum weight.
- For all trucks other than class 9s that have a bi-modal distribution the loaded peak is defined to be in a bin greater than or equal to half of the allowable maximum weight.

There may be more than one bin identified for the unloaded or loaded peak due to the small sample size collected after validation. Where only one peak exists, the peak rather than a loaded or unloaded peak is identified. This may happen with single unit trucks. It is not expected to occur with combination vehicles.

Table 7-2 GVW Characteristics of Major sub-groups of Trucks – 260100 – 25-Jun-2008

Characteristic	Class 5	Class 9	Class 10
Percentage Overweights	0.0%	0.2%	0.7%
Percentage Underweights	0.7%	0.0%	0.0%
Unloaded Peak		32,000 lbs	38,000 lbs
Loaded Peak		76,000 lbs	108,000 lbs
Peak	12,000 lbs		

Prepared: djw
Checked: bko

The expected percentage of unclassified vehicles is 2.1%. This is based on the percentage of unclassified vehicles in the post-validation data download.

The graphical screening comparison figures are found in Figure 7-2 through Figure 7-5. These are based on data collected immediately after the validation and may not be wholly representative of the population at the site. They should however provide a sense of the statistics expected when SPS comparison data is computed for the post-validation period.

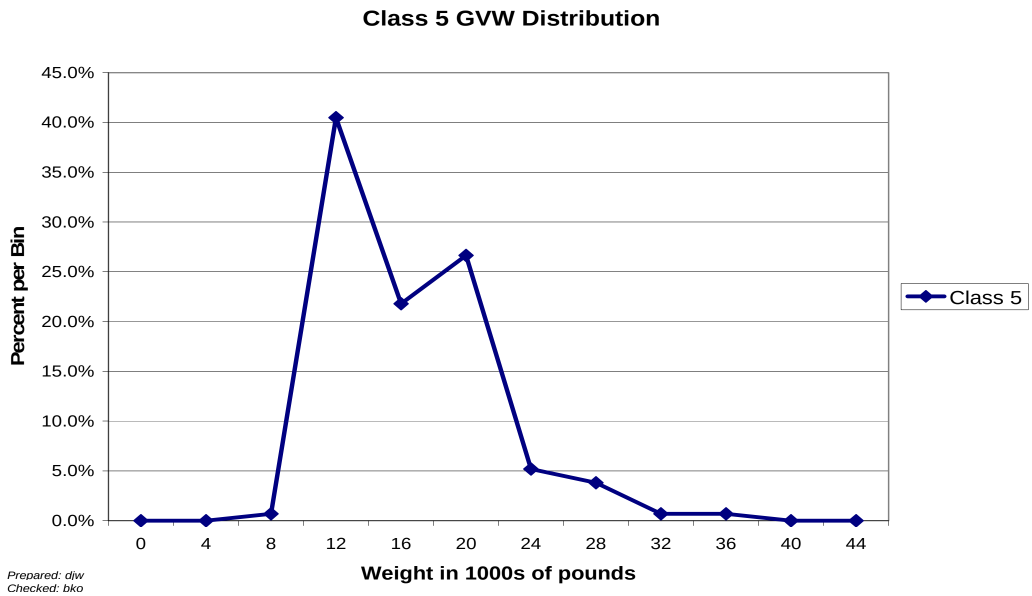

Figure 7-1 Expected GVW Distribution Class 5 – 260100 – 25-Jun-2008

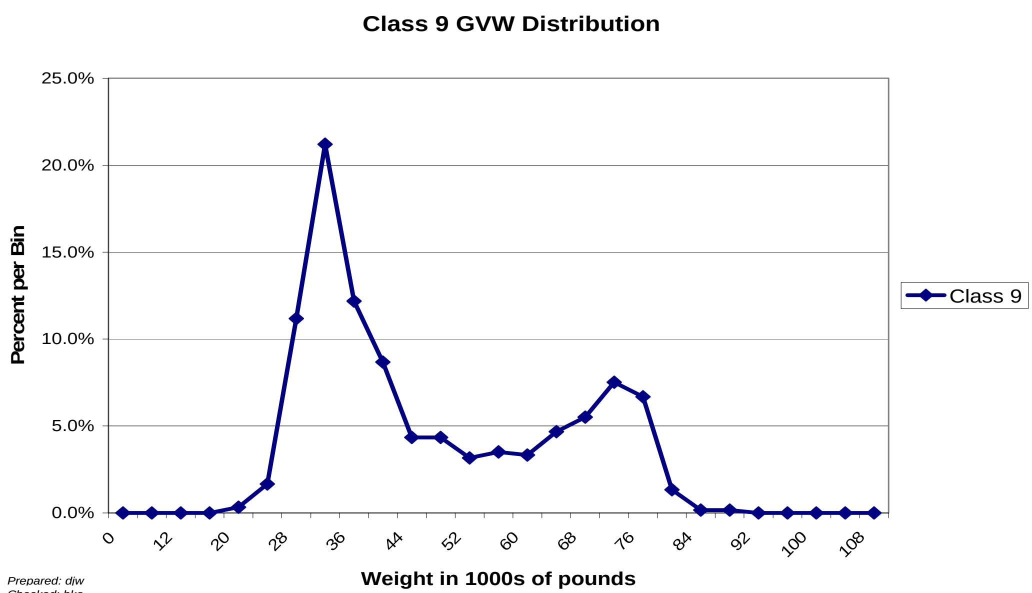

Figure 7-2 Expected GVW Distribution Class 9 – 260100 – 25-Jun-2008

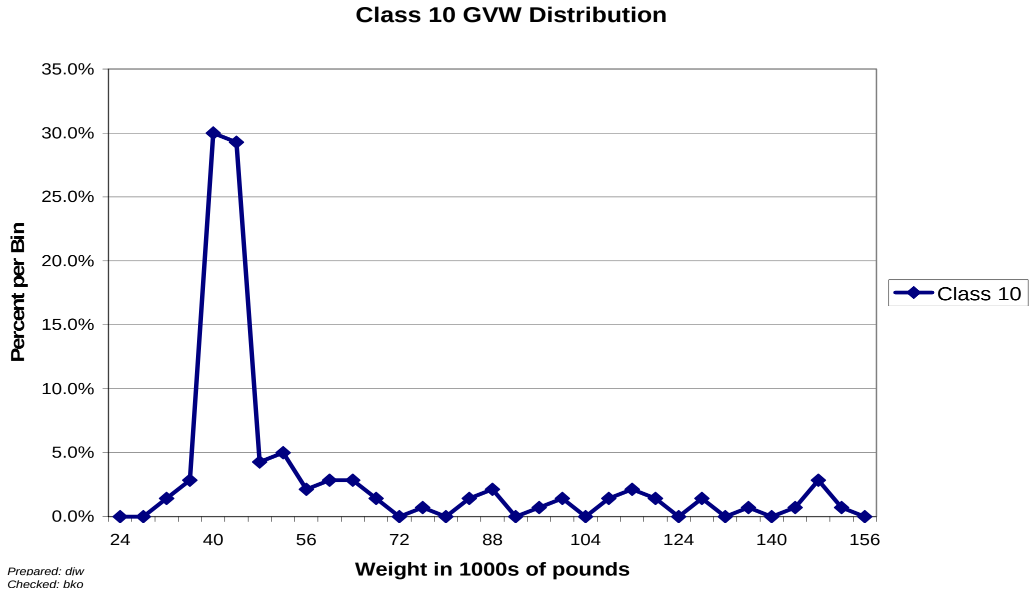

Figure 7-3 Expected GVW Distribution Class 10 – 260100 – 25-Jun-2008

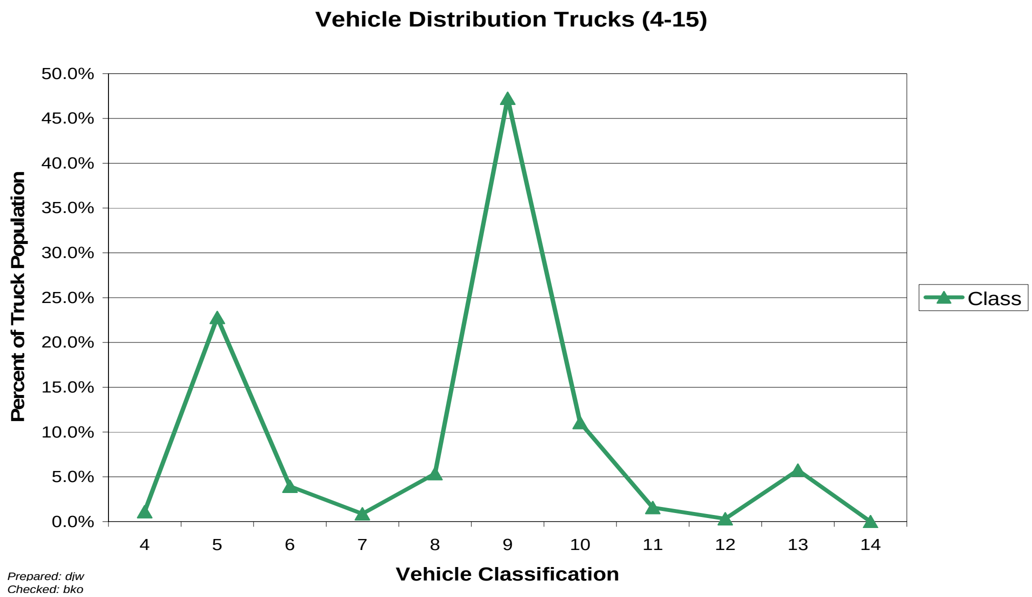

Figure 7-4 Expected Vehicle Distribution – 260100 – 25-Jun-2008

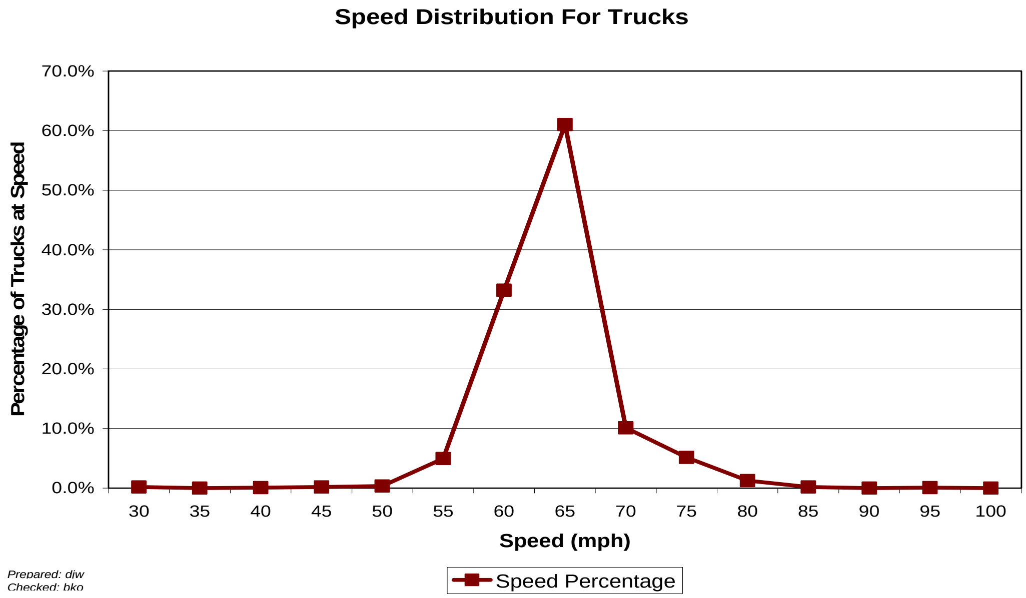

Figure 7-5 Expected Speed Distribution – 260100 – 25-Jun-2008

8 Data Sheets

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

Sheet 19 – Truck 1 – 3S2 loaded air suspension (3 pages)
Sheet 19 – Truck 2 – 3S2 partially loaded air suspension, split tandem (3 pages)

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

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

Calibration Iteration 1 Worksheet – (1 page)

Test Truck Photographs (6 pages)

LTPP Mod 3 Classification Scheme (1 page)

Final System Parameters (1 page)

9 Updated Handout Guide and Sheet 17

A copy of the handout has been included following 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.

POST-VISIT HANDOUT GUIDE FOR SPS WIM FIELD VALIDATION

STATE: Michigan

SHRP ID: 0100

Figures

Photo

1. General Information

SITE ID: *260100*

LOCATION: *US Route 27 South, approximately 2.36 miles north of M-21.*

VISIT DATE: *June 24th, 2008*

VISIT TYPE: *Validation*

2. Contact Information

POINTS OF CONTACT:

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

Highway Agency: *Tom Hynes, 517-322-5711, hynest@michigan.gov*

James Kramer, 517-322-1716, kramerj2@michigan.gov

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

FHWA Division Office Liaison: *Ryan Rizzo, 517-702-1842, ryan.rizzo@fhwa.dot.gov*

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

3. Agenda

BRIEFING DATE: *No briefing requested for this visit*

ON SITE PERIOD: June 24th *and 25th, 2008.*

TRUCK ROUTE CHECK: *Completed. See Figure 5-2.*

4. Site Location/ Directions

NEAREST AIRPORT: *Capital City Airport, Lansing, MI*

DIRECTIONS TO THE SITE: *Located on US Route 27, approximately 2.36 miles north of M-21.*

MEETING LOCATION: *June 24th, 2008, on site beginning at 9:00 a.m.*

WIM SITE LOCATION: *US 27 South (Latitude: 43.0239^0 and Longitude: -84.5435^0)*

WIM SITE LOCATION MAP:

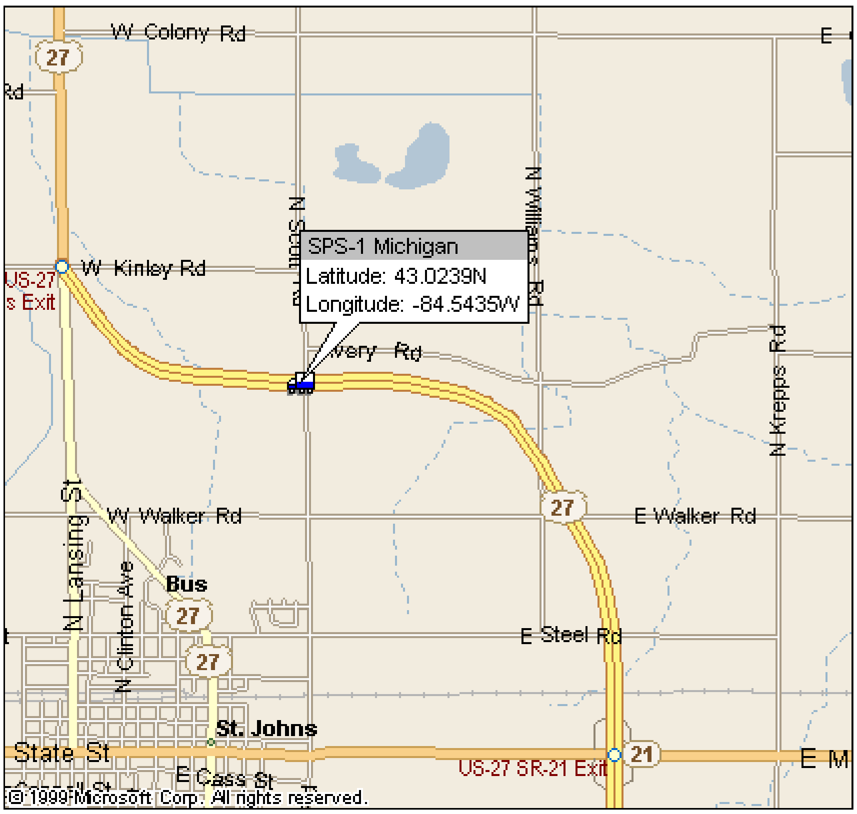

Figure 4-1 - Site Location for SPS-1 in Michigan

5. Truck Route Information

ROUTE RESTRICTIONS: *None.*

SCALE LOCATION: *See Figure 5-1.*

Don's Windmill Truck Stop, I-96 Exit 98A & I-69 Exit 70, Dimondale, MI, Phone – (517)646-6752, Open 24hrs, $8.00 per weigh.

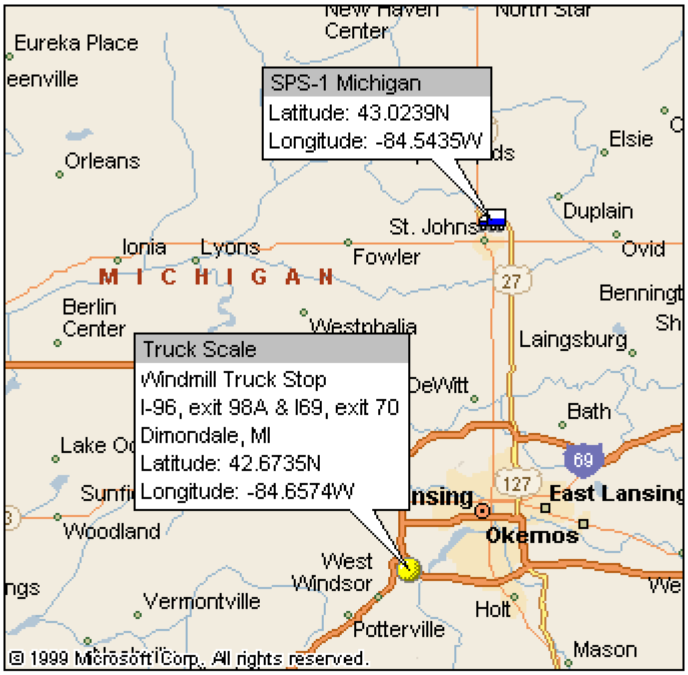

Figure 5-1 - Truck Scale Location for Michigan SPS-1

TRUCK ROUTE: *See Figure 5-2.*

Northbound to US-27 Business Exit (W. Kinsley Drive) – 1.0 miles.

Southbound to M-21 Exit – 2.36 miles.

Total distance = 6.72 miles
Total time = 10 minutes

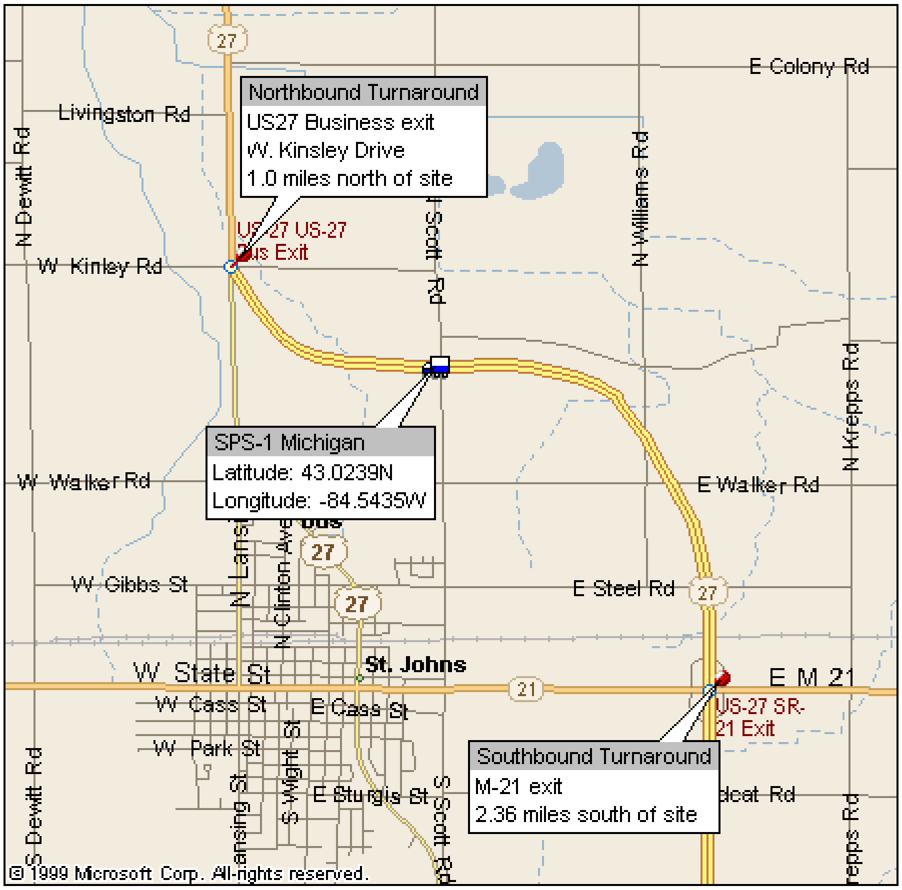

Figure 5-2 - Truck Route for SPS-1 in Michigan

6. Sheet 17 – Michigan (260100)

1.* ROUTE ___US 27_______MILEPOST _unk_ LTPP DIRECTION - N S E W

2.* WIM SITE DESCRIPTION - Grade __<1____ % Sag vertical Y / N
Nearest SPS section upstream of the site __unknown (signs/markings not visible)
Distance from sensor to nearest upstream SPS Section __3.05 miles___

3.* LANE CONFIGURATION
Lanes in LTPP direction __2__ Lane width _1_2__ ft

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

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

Shoulder width __1_1___ ft

4.* PAVEMENT TYPE ____Portland Concrete Cement___

5.* PAVEMENT SURFACE CONDITION – Distress Survey
Date _06/24/08__________ Photo Filename _____26_0100_Upstream_06_24_08.jpg___
Date _06/24/08 __________Photo Filename ___26_0100_Downstream_06_24_08.jpg __
Date _______________________Distress Photo Filename _________________

6. * SENSOR SEQUENCE
______quartz piezo – loop – quartz piezo______________________________

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 _5_1__ ft
Distance from system __4_7_ __ ft
TYPE _____M_____________________

CABINET ACCESS controlled by LTPP / STATE / JOINT ?
Contact - name and phone number ____Jim Kramer 517-322-1736___
Alternate - name and phone number ____Tom Foltz 517-712-1948____

11. * POWER
Distance to cabinet from drop ___1_6_5 ___ ft Overhead / underground / solar / AC in cabinet?
Service provider _____________________ Phone number _______________

12. * TELEPHONE
Distance to cabinet from drop ___1_6_5___ ft Overhead / under ground / cell?
Service provider __Verizon____________ Phone Number _______________

13.* SYSTEM (software & version no.)- ____DAW-190_________________________
Computer connection – RS232 / Parallel port / USB / Other ________________

15. PHOTOS FILENAME

Power source	__26_0100_Power_Service_Box_06_24_08.jpg _______________
	__26_0100_Cell_Service_Mast_06_24_08.jpg________________
Phone source	__26_0100_Telephone_Service_Box_06_24_08.jpg ___________
Cabinet exterior	__26_0100_Cabinet_Exterior_06_24_08.jpg _______________
Cabinet interior	__26_0100_Cabinet_Interior_06_24_08.jpg _________________
Weight sensors	__26_0100_Leading_WIM_Sensor_06_24_08.jpg ____________
	__26_0100_Trailing_WIM_Sensor_06_24_08.jpg ____________
Other sensors	__26_0100_Loop_Sensor_06_24_08.jpg ___________________
	__26_0100_Old_Loop_and_Sensor_06_24_08.jpg____________

Description ___Loops____

Downstream direction at sensors on LTPP lane
______26_0100_Downstream_06_24_08.jpg __________________

Upstream direction at sensors on LTPP lane
______26_0100_Upstream_06_24_08.jpg ______________________

COMMENTS ____
_______________GPS Coordinates: Latitude: 43.029^0 and Longitude: -84.5435^0 ________

_____Amenities in St. John's – gas, food, Wal-Mart – located south 2 miles off of M-21 exit, right approximately 2 miles. ____

_____Hotels in Dewitt, approximately 17 miles from site. __________________________

COMPLETED BY __Dean J. Wolf________________________________

PHONE _301-210-5105______ DATE COMPLETED _ 0_6 _ /_24_ / 2_0 0_8_ _ _

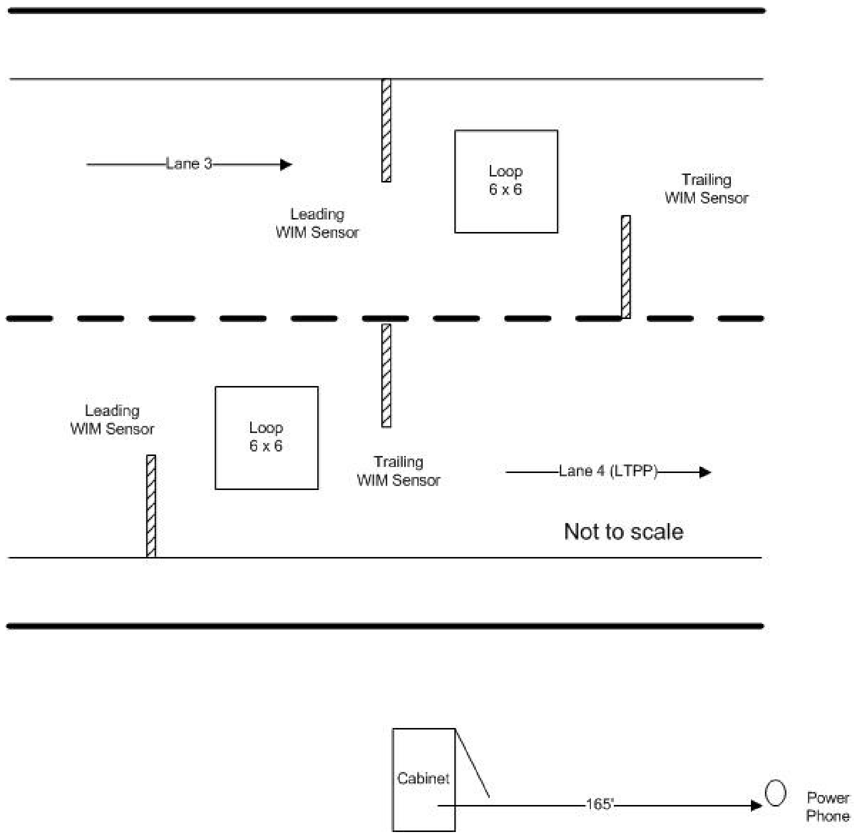

Figure 6-1 - Sketch of equipment layout

Figure 6-2 - Site Map 260100

Photo 1 - 26_0100_Upstream_06_24_08.jpg

Photo 2 - 26_0100_Downstream_06_24_08.jpg

Photo 3 - 26_0100_Cell_Service_Mast_06_24_08.jpg

Photo 4 - 26_0100_Power_Service_Box_06_24_08.jpg

Photo 5 - 26_0100_Telephone_Service_Box_06_24_08.jpg

Photo 6 - 26_0100_Cabinet_Exterior_06_24_08.jpg

Photo 7 - 26_0100_Cabinet_Interior_06_24_08.jpg

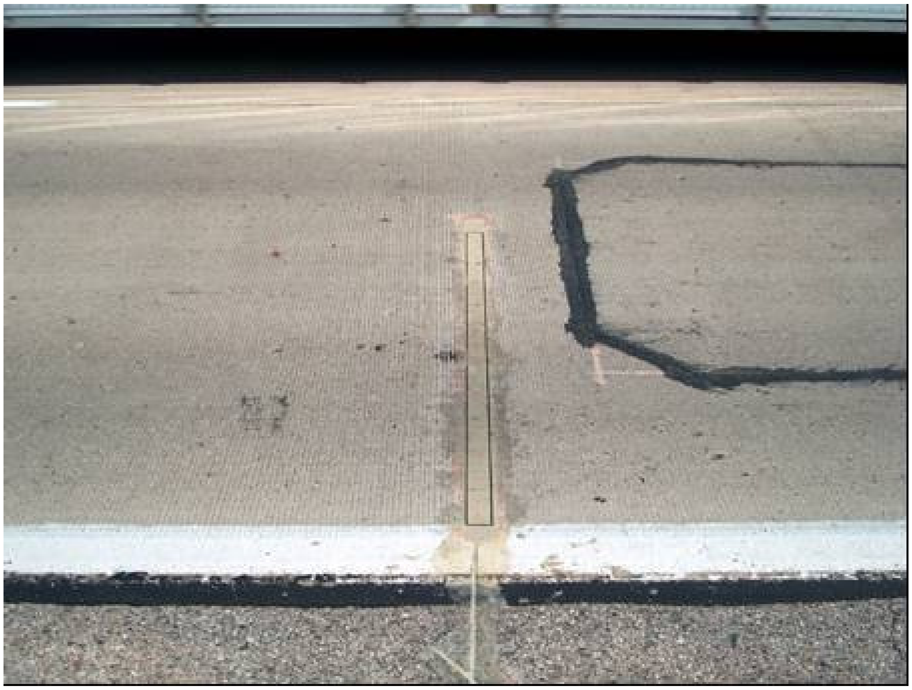

Photo 8 - 26_0100_Leading_WIM_Sensor_06_24_08.jpg

Photo 9 - 26_0100_Trailing_WIM_Sensor_06_24_08.jpg

Photo 10 - 26_0100_Loop_Sensor_06_24_08.jpg

Photo 11 - 26_0100_Old_Loop_and_Sensor_06_24_08.jpg

SHEET 18	STATE CODE [26_]
LTPP MONITORED TRAFFIC DATA	SPS PROJECT ID [0100]
WIM SITE COORDINATION	DATE: (mm/dd/yyyy) «06/24/2008»

Rev. 05/15/07

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

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

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

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

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

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

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

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

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

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

g. Communication –

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

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

3. PAVEMENT –

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

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

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

4. ON SITE ACTIVITIES –

a. WIM Validation Check - advance notice required 2 ☐ days ☒ weeks

b. Notice for straightedge and grinding check - __2_ ☐ days ☒ weeks

i. On site lead –
- ☒ State
- ☐ LTPP

ii. Accept grinding –
- ☒ State
- ☐ LTPP

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

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

SHEET 18	STATE CODE [26]
LTPP MONITORED TRAFFIC DATA	SPS PROJECT ID [0100]
WIM SITE COORDINATION	DATE: (mm/dd/yyyy) 06/24/08

Rev. 05/15/07

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: Jim Kramer Phone:(517)-322-1736

      Agency: Michigan DOT

b. Maintenance (equipment) –

Name: Jim Kramer Phone:(517) -322-1736

Agency: Michigan DOT

c. Data Processing and Pre-Visit Data –

Name: Jim Kramer Phone:(517) -322-1736

Agency: Michigan DOT

d. Construction schedule and verification –

Name: _____ Phone:_____

Agency: _____

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

Name: Brian Hitchcock Phone:(517)521-2124

Agency: MBH Trucking LLC

f. Traffic Control –

Name: _____ Phone:_____

Agency: _____

g. Enforcement Coordination –

Name: _____ Phone:_____

Agency: _____

h. Nearest Static Scale

Name: Don's Windmill Location:I-96 Exit 98A, I-69 Exit 70

Truck Stop

Phone: 517-646-6752

SHEET 16 LTPP MONITORED TRAFFIC DATA SITE CALIBRATION SUMMARY	*STATE ASSIGNED ID [__ __ __ __] *STATE CODE [_2_6_] *SHRP SECTION ID [_0_1_0_0_]

SITE CALIBRATION INFORMATION

1. * DATE OF CALIBRATION (MONTH/DAY/YEAR) [_0_ 6__ / _2_4 __ / _2 0_0_8 __ __]

2. * TYPE OF EQUIPMENT CALIBRATED __ WIM __ CLASSIFIER __X_ BOTH

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

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

5. EQUIPMENT MANUFACTURER ________IRD/ PAT____________________

WIM SYSTEM CALIBRATION SPECIFICS**

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

__ __ __ NUMBER OF TRUCKS COMPARED __ _2_ __ NUMBER OF TEST TRUCKS USED

__ 2_0_ PASSES PER TRUCK

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

TRUCK	TYPE	SUSPENSION
1	___9_____	_____1_______________
2	___9_____	_____2_______________
3	________	___________________

7. SUMMARY CALIBRATION RESULTS (EXPRESSED AS A PERCENT)
MEAN DIFFERENCE BETWEEN ---
DYNAMIC AND STATIC GVW ___ _-0.5__ ___ . __ STANDARD DEVIATION __ __4 . _3_
DYNAMIC AND STATIC SINGLE AXLES ___ _-0.9__ ___ . __ STANDARD DEVIATION __ _ 4. _ 3_
DYNAMIC AND STATIC DOUBLE AXLES ___ _-0.2__ ___ . __ STANDARD DEVIATION __ _ 5_ . 3__

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

9. DEFINE THE SPEED RANGES USED (MPH) __50____ __60____ __70____ _______ ______ ______ ______
______ ______ ______ ______ ______ ______ ______ ______ ______ ______

10. CALIBRATION FACTOR (AT EXPECTED FREE FLOW SPEED) ___ _1071__ ___ . ___ ___

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

CLASSIFIER TEST SPECIFICS***

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

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

14. MEAN DIFFERENCE IN VOLUMES BY VEHICLES CLASSIFICATION:
*** FHWA CLASS 9 ____ _-2___ ____ FHWA CLASS ____ ____ _____-5___ ____
*** FHWA CLASS 8 ____ __0__ ____ FHWA CLASS ____ ____ _____7___ ____
FHWA CLASS ____ ____ ____ ____ ____
FHWA CLASS ____ ____ ____ ____ ____
*** PERCENT "UNCLASSIFIED" VEHICLES: ____ _1.0___ . ____

PERSON LEADING CALIBRATION EFFORT: _____Dean J. Wolf, MACTEC________________________________ CONTACT INFORMATION: _____301.210.5105____ rev. November 9, 1999

SHEET 16 LTPP MONITORED TRAFFIC DATA SITE CALIBRATION SUMMARY	*STATE ASSIGNED ID [__ __ __ __] *STATE CODE [_2_6_] *SHRP SECTION ID [_0_1_0_0_]

SITE CALIBRATION INFORMATION

1. * DATE OF CALIBRATION (MONTH/DAY/YEAR) [_0_ 6__ / _2_5 __ / _2 0_0_8 __ __]

2. * TYPE OF EQUIPMENT CALIBRATED __ WIM __ CLASSIFIER __X_ BOTH

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

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

5. EQUIPMENT MANUFACTURER ________IRD/ PAT________________________________

WIM SYSTEM CALIBRATION SPECIFICS**

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

__ __ __ NUMBER OF TRUCKS COMPARED __ _2_ __ NUMBER OF TEST TRUCKS USED

__ 2_0_ PASSES PER TRUCK

	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 ___ _-1.1__ ___ . __ STANDARD DEVIATION __ __1 . _9_
DYNAMIC AND STATIC SINGLE AXLES ___ _-0.3__ ___ . __ STANDARD DEVIATION __ _ 4. _ 4_
DYNAMIC AND STATIC DOUBLE AXLES ___ _-1.5__ ___ . __ STANDARD DEVIATION __ _ 2_ . 7__

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

9. DEFINE THE SPEED RANGES USED (MPH) __50____ __60____ __70____ _______ ______ ______ ______
______ ______ ______ ______ ______ ______ ______ ______ ______ ______

10. CALIBRATION FACTOR (AT EXPECTED FREE FLOW SPEED) ___ _1024__ ___ . ___ ___

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 ____ _-4___ ____ FHWA CLASS ____ ____ _____-33___ ____
*** FHWA CLASS 8 ____ __67__ ____ FHWA CLASS ____ ____ _____8____ ____
FHWA CLASS ____ ____ ____ ____ ____
FHWA CLASS ____ ____ ____ ____ ____
*** PERCENT "UNCLASSIFIED" VEHICLES: ____ _2.0___ . ____

PERSON LEADING CALIBRATION EFFORT: _____Dean J. Wolf, MACTEC__________________   CONTACT INFORMATION: _____301.210.5105__________________ rev.   November 9, 1999

APPENDIX A

Sheet 19	* STATE_CODE _2_6_
LTPP Traffic Data	* SPS PROJECT ID _0_1_0_0_
*CALIBRATION TEST TRUCK #_1_	* DATE 6/24/08

Rev. 08/31/01

TRUCK 30
TRAILER 705

PART I.

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

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:
PALLETIZED BAGS OF FERTILIZER

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 17.4 B to C 4.3 C to D 33.4

D to E 4.1 E to F ______

Wheelbase (measured A to last) ______ Computed 59.2

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	75R 24.5	~~AIR~~ 2 FULL LEAF
B	75R 24.5	AIR
C	77R 24.5	AIR
D	75R 22.5	AIR
E	75R 22.5	AIR
F		

Sheet 19	* STATE_CODE _2_6_
LTPP Traffic Data	* SPS PROJECT ID _0_1_0_0_
*CALIBRATION TEST TRUCK #_1_	* DATE 6/24/08

Rev. 08/31/01

PART II

Day 1

*b) Average Pre-Test Loaded weight 76480

*c) Post Test Loaded Weight 75990

*d) Difference Post Test – Pre-test -490

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10940	15820	15820	16930	16930		76440
2	11060	15750	15750	16980	16980		76520
3							
Average	11000	15785	15785	16955	16955		76480

Table 6. Raw data – Axle scales –

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10880	15610	15610	16960	16960		76020
2	10680	15700	15700	16940	16940		75960
3							
Average	10780	15655	15655	16950	16950		75990

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10880	15610	15610	16960	16960		76020
2	10680	15700	15700	16940	16940		75960
3							
Average	10780	15655	15655	16950	16950		75990

Measured By djw Verified By MZ Weight date 6/24/08

Sheet 19	* STATE_CODE _2_6_
LTPP Traffic Data	* SPS PROJECT ID _0_1_0_0_
*CALIBRATION TEST TRUCK #_1_	* DATE 6/25/08

Rev. 08/31/01

Day 2

7.2 *b) Average Pre-Test Loaded weight 76690
*c) Post Test Loaded Weight 76230
*d) Difference Post Test – Pre-test -460

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	11160	15800	15800	16980	16980		76720
2	11020	15850	15850	16970	16970		76660
3							
Average	11090	15825	15825	16975	16975		76690

Table 6.2. Raw data – Axle scales –

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

Table 7.2 Raw data – Axle scales – post-test

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10800	15760	15760	16960	16960		76240
2	10800	15760	15760	16950	16950		76220
3							
Average	10800	15760	15760	16955	16955		76230

Measured By Ayw Verified By MZ Weight date 6/25/08

Sheet 19	* STATE_CODE _2_6_
LTPP Traffic Data	* SPS PROJECT ID _0_1_0_0_
*CALIBRATION TEST TRUCK #_2_	* DATE 6/24/08

Rev. 08/31/01

TRUCK 41
TRAILER 31.T

PART I.

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

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:

PALLETIZED BAGS OF FERTILIZER

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 19.0   B to C 4.3   C to D 29.6

D to E 9.0   E to F ______

Wheelbase (measured A to last) ______   Computed ______

13. *Kingpin Offset From Axle B (units) 1.3 (__________)__
(+ is to the rear)

SUSPENSION

Axle	14. Tire Size	15.* Suspension Description (leaf, air, no. of leaves, taper or flat leaf, etc.)
A	75R 24.5	2 FULL LEAF
B	75R 24.5	AIR
C	75R 24.5	AIR
D	11R 22.5	3 TAPERED LEAF
E	11R 22.5	3 TAPERED LEAF
F		

Sheet 19	* STATE_CODE _2_6_
LTPP Traffic Data	* SPS PROJECT ID _0_1_0_0_
*CALIBRATION TEST TRUCK # 2	* DATE

Rev. 08/31/01

Day ~~3~~ 1

7..3 *b) Average Pre-Test Loaded weight 66390
*c) Post Test Loaded Weight 65950
*d) Difference Post Test – Pre-test -440

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	11320	13880	13880	13660	13660		66400
2	11260	14020	14020	13540	13540		66380
3							
Average	11290	13950	13950	13600	13600		66390

Table 6.3. Raw data – Axle scales –

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

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	11100	14180	14180	13240	13240		65940
2	11120	14180	14180	13240	13240		65960
3							
Average	11110	14180	14180	13240	13240		65950

Measured By Mw Verified By MZ Weight date 6/25/03

Sheet 19	* STATE_CODE _2_6_
LTPP Traffic Data	* SPS PROJECT ID _0_1_0_0_
*CALIBRATION TEST TRUCK #_2_	* DATE 6/25/08

Rev. 08/31/01

Day 2

7.2 *b) Average Pre-Test Loaded weight 67270
*c) Post Test Loaded Weight 66900
*d) Difference Post Test – Pre-test -370

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	11640	14510	14510	13310	13310		67280
2	11680	14520	14520	13270	13270		67260
3							
Average	11660	14515	14515	13290	13290		67270

Table 6.2. Raw data – Axle scales –

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

Table 7.2 Raw data – Axle scales – post-test

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	11500	14360	14360	13340	13340		66900
2	11480	14390	14390	13320	13320		66900
3							
Average	11490	14375	14375	13330	13330		66900

Measured By djw Verified By MZ Weight date 6/25/08

Sheet 20	* STATE_CODE _2_6_
LTPP Traffic Data	*SPS PROJECT_ID _0_1_0_0_
Speed and Classification Checks * 1 of* 2	* DATE 6/24/08

Rev. 08/31/2001

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
56	10	6101	57	10	54	8	6812	52	8
63	5	6108	66	5	53	8	6814	53	8
59	9	6118	58	9	59	9	6821	58	9
56	9	6119	56	9	51	13	6825	51	13
58	9	6216	58	9	62	13	6836	62	13
61	9	6251	61	9	55	5	6853	53	5
59	9	6252	59	9	57	10	6862	58	10
64	10	6274	64	10	68	9	6891	64	9
59	9	6286	59	9	61	9	6902	60	9
61	10	6355	61	10	60	8	6904	60	8
* 56	4	6379	55	5	59	10	6945	59	10
64	9	6393	64	9	63	5	6955	66	5
59	6	6434	60	6	59	9	6985	59	9
57	13	6435	58	13	57	6	7011	58	6
62	9	6473	64	9	60	13	7019	60	13
60	5	6480	56	5	62	13	7035	62	10 *
68	10	6486	67	10	53	13	7051	54	13
58	9	6492	58	9	59	6	7082	62	6
58	13	6540	59	13	62	9	7087	63	9
60	9	6545	58	9	67	5	7093	70	5
54	9	6579	52	9	54	10	7127	54	10
57	9	6711	58	9	54	9	7162	55	9
62	9	6730	61	9	55	10	7175	54	10
55	9	6740	55	9	62	9	7217	66	9
63	5	6742	60	5	59	10	7231	59	10

Recorded by MARK Z Direction S Lane 4 Time from 10:54AM to 11:58AM

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Sheet 20	* STATE_CODE _2_6_
LTPP Traffic Data	*SPS PROJECT_ID _0_1_0_0_
Speed and Classification Checks * 2 of* 2	* DATE 6/24/08

Rev. 08/31/2001

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
62	9	7239	62	9	55	9	7714	52	9
62	9	7247	62	9	56	6	7722	56	6
56	8	7267	56	8	63	13	7763	63	13
61	9	7296	61	9	63	10	7776	63	10
60	10	7302	62	10	60	9	7782	60	9
59	9	7347	59	9	55	10	7783	57	10
57	10	7348	57	10	62	10	7802	61	10
59	9	7373	59	9	61	9	7851	62	9
55	9	7459	53	9	62	13	7860	62	13
67	15	7460	67	9	63	9	7880	64	9
58	5	7492	57	5	60	8	7888	60	8
62	9	7495	62	9	60	9	7917	59	9
63	6	7514	63	6	60	9	7935	60	9
57	13	7520	56	13	59	9	7956	58	9
55	9	7534	55	9	38	10	7959	41	10
60	9	7549	61	9	58	10	7974	55	10
58	13	7644	59	13	57	13	7980	56	13
57	9	7651	55	9	62	6	7994	60	6
57	9	7652	56	9	61	13	8009	61	13
58	9	7659	58	9	58	10	8040	55	10
59	9	7663	59	9	56	13	8042	56	13
63	10	7677	61	10	62	5	8073	62	5
62	9	7686	62	9	54	13	8079	54	13
59	9	7690	59	9	63	5	8113	61	5
60	8	7697	61	8	49	9	8117	48	9

Recorded by MARK Z Direction 5 Lane 4 Time from 11:58 AM to 12:47 PM

Sheet 20	* STATE_CODE _2_6__
LTPP Traffic Data	*SPS PROJECT_ID _0_1_0_0_
Speed and Classification Checks * 1 of* 2	* DATE 6 / 25 / 08

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	5746	64	9	60		6206	61	13
57	9	5753	55	9	64	8	6227	64	5
61	9	5776	61	9	58	[illegible]	6236	56	13
56	6	5816	55	6	58		6257	56	13
58	9	5821	60	9	62	9	6258	58	9
64	5	5839	64	5	62	9	6301	62	9
61	10	5843	61	10	60	10	6326	60	10
66	9	5849	66	9	56	10	6344	54	10
59	5	5916	59	5	60	10	6353	58	10
64	9	5922	61	9	63	9	6380	62	9
59	9	5930	60	9	60	9	6404	58	9
66	9	5961	59	9	60	4	6406	59	5
66	9	5987	60	9	63	10	6417	62	10
63	5	5998	63	5	64	9	6418	61	9
61	9	6017	65	9	65	9	6428	65	9
67	9	6031	64	9	58	9	6436	58	9
63		6036	63	13	55	4	6448	55	5
65	9	6085	64	9	62	9	6449	61	9
61	9	6102	64	9	66		6458	66	9
61	10	6116	60	10	66	5	6461	66	5
59	6	6118	58	6	58	9	6471	58	9
64	9	6126	62	9	63	10	6483	62	10
64	8	6137	63	8	61		6489	62	13
59		6154	58	10	62	9	6499	63	9
61		6184	61	13	69	5	6530	68	5

Recorded by MARK Z Direction S Lane 4 Time from 1035AM to 11:15AM

Sheet 20	* STATE_CODE _2_6_
LTPP Traffic Data	*SPS PROJECT_ID _0_1_0_0_
Speed and Classification Checks * 2 of* 2	* DATE 6/25/08

Rev. 08/31/2001

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
61	9	6545	61	9	54	9	7162	53	9
60	10	6546	60	10	56	4	7177	52	5
62	4	6547	62	5	58	5	7185	59	5
61	9	6556	63	9	62		7206	60	13
61	5	6558	61	5	61	6	7340	61	6
62	9	6568	62	9	65	13	7361	64	13
60	9	6581	59	9	54	8	7384	52	8
64	9	6592	62	9	58	5	7403	58	5
62	13	6594	62	13	54	10	7409	54	10
63	9	6602	62	9	55	9	7413	53	9
56	9	6609	55	9	55	8	7420	54	9
61	9	6620	60	9	68	9	7422	68	9
60	6	6631	59	6	58	9	7460	58	9
57	9	6641	58	9	61	9	7507	60	9
57	10	6650	57	10	61	9	7519	61	9
63	8	6687	63	8	60		7606	58	9
55	13	6692	54	13	60	9	7610	60	9
62	5	6723	61	5	54		7622	54	13
55	6	6758	55	6	55	10	7643	54	10
56	10	6780	55	10	59	9	7678	59	9
59	5	6783	58	5	58	9	7679	59	9
63	9	6794	64	9	59	9	7673	59	9
60	9	6814	61	9	62	9	7685	61	9
58	9	7119	55	9	58		7736	58	13
58	9	7141	60	9	59	9	7739	58	9

Recorded by MARK Z Direction S Lane 4 Time from 11:15 AM to 12:16 PM

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Sheet 21	* STATE_CODE _2_6_
LTPP Traffic Data	*SPS PROJECT_ID _0_1_0_0_
WIM System Test Truck Records 1 of 3	* DATE 6/24/08

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
72	50	2	1	8:37	3764	51	10.8	13.3	13.8	13.4	12.6		63.7	19.0	4.3	29.6	9.0	
72	50	1	1	8:37	3771	50	11.1	14.2	14.3	15.7	15.9		71.1	17.4	4.3	33.5	4.0	
73	61	2	2	8:47	3932	61	11.1	13.6	14.1	13.5	12.8		65.1	19.1	4.3	29.6	9.0	
73	60	1	2	8:49	3968	60	10.9	16.4	15.4	17.2	17.1		76.9	17.5	4.3	33.7	4.1	
75	68	2	3	8:58	4108	67	11.2	14.3	14.2	13.3	13.2		66.1	19.1	4.3	29.6	9.0	
75	62	1	3	9:00	4142	62	10.8	15.3	15.1	16.1	16.3		73.6	17.4	4.3	33.5	4.1	
74.5	51	2	4	9:08	4277	52	11.1	13.9	14.2	13.0	12.4		64.6	19.0	4.3	29.5	9.0	
74.5	50	1	4	9:11	4325	50	10.1	15.1	13.7	14.5	15.6		68.9	17.3	4.3	33.5	4.0	
~~77.5~~	~~61~~	~~2~~	~~5~~	~~9:18~~	~~4430~~	~~61~~	~~10.6~~	~~11.5~~	~~11.7~~	~~9.8~~	~~9.2~~		~~52.8~~	~~19.1~~	~~4.3~~	~~39.7~~	~~9.0~~	
77.5	59	1	5	9:21	4499	59	11.2	15.7	15.7	16.7	16.6		75.8	17.4	4.3	33.6	4.1	
78.5	69	2	5	9:28	4624	69	11.3	14.3	15.1	13.8	13.0		67.6	19.0	4.3	29.5	9.0	
78.5	62	1	6	9:33	4699	62	10.9	15.4	15.8	17.3	16.5		75.9	17.4	4.3	33.6	4.1	
80	52	2	6	9:39	4798	51	11.6	13.4	13.8	12.6	11.9		63.1	19.0	4.3	29.5	9.0	
80	50	1	7	9:43	4862	50	10.7	14.3	14.4	15.9	16.2		71.4	17.4	4.3	33.5	4.1	
81.5	61	2	7	9:51	4998	61	11.7	14.2	14.6	13.9	12.8		67.3	19.1	4.3	29.6	9.0	
81.5	61	1	8	9:54	5045	60	11.0	15.4	15.4	18.3	17.7		77.8	17.4	4.3	33.5	4.1	

OFF SCALE

Recorded by MARK Z Checked by [signature]

1061
1043
1024

Sheet 21	* STATE_CODE 2 6
LTPP Traffic Data	*SPS PROJECT_ID 0 1 0 0
WIM System Test Truck Records 2 of 3	* DATE 6/24/08

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
83.5	70	2	8	10:02	5167	70	11.4	14.3	15.1	13.6	13.6		68.1	19.0	4.3	29.5	9.0	
83.5	69	1	9	10:05	5213	69	11.5	16.5	15.9	18.5	17.0		79.4	17.4	4.3	33.5	4.1	
87	51	2	~~10~~ 9	10:15	5375	51	11.2	13.5	14.1	13.2	12.6		64.5	19.0	4.3	29.5	9.0	
87	59	1	10	10:26	5571	59	11.0	15.9	15.5	17.9	17.7		78.0	17.4	4.3	33.5	4.1	
87	61	2	~~5~~ 10	10:25	5550	61	~~[illegible]~~ 11.5	14.2	14.6	14.0	13.0		67.2	19.0	4.3	29.5	9.0	
107	50	~~1~~ 2	11	13:13	8534	50	10.9	13.6	13.7	12.8	12.0		63.4	19.0	4.3	29.6	9.0	
107	51	~~2~~ 1	11	13:14	8552	49	10.4	14.8	15.0	16.1	15.8		72.1	17.4	4.3	33.5	4.1	
108.5	60	2	12	13:23	8717	60	11.7	14.0	14.3	13.4	13.0		66.5	19.0	4.3	29.6	9.0	
108.5	59	1	12	13:24	8725	59	11.0	16.0	15.4	18.0	18.1		78.5	17.4	4.3	33.5	4.0	
109.5	68	2	13	13:34	8931	70	12.3	14.6	16.2	14.7	13.6		71.4	19.1	4.2	39.7	9.0	
109.5	68	1	13	13:36	8981	69	10.9	16.5	17.0	18.1	18.8		81.3	17.4	4.3	33.6	4.0	
110.5	51	2	14	13:44	9144	51	10.5	13.9	13.7	12.4	12.5		63.0	19.0	4.3	29.6	9.0	
110.5	50	1	14	13:46	9179	51	10.7	15.1	14.7	16.1	15.7		72.2	17.4	4.3	33.5	4.1	
111.5	61	2	15	13:54	~~9366~~ 9318	61	11.4	14.2	15.1	13.6	12.8		67.1	19.0	4.2	29.5	9.0	
111.5	60	1	15	13:57	9375	59	~~[illegible]~~ 10.8	~~[illegible]~~ 16.6	~~17.0~~ 15.2	17.0	17.3		77.0	17.4	4.3	33.5	4.1	
112.5	70	2	16	14:05	9544	70	11.6	15.0	15.7	14.0	13.7		70.0	19.1	4.3	29.6	9.0	

Recorded by MARK Z   Checked by [signature]

Sheet 21	* STATE_CODE 2 6
LTPP Traffic Data	*SPS PROJECT_ID 0 1 0 0
WIM System Test Truck Records 3 of 3	* DATE 6 / 24 / 00

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
112.5	65	1	16	14:07	9587	65	11.0	16.5	15.9	18.6	17.5		79.5	17.3	4.3	33.4	4.1	
113.5	50	2	17	14:17	9819	51	11.0	13.9	14.1	13.0	12.3		64.4	19.1	4.3	29.6	9.0	
113.5	50	1	17	14:17	9823	50	10.4	14.6	14.8	15.7	14.8		70.3	17.4	4.3	33.5	4.1	
112.5	55	2	18	14:28	10007	55	11.4	13.9	14.3	13.4	12.3		65.4	19.1	4.3	29.6	9.0	
112.5	60	1	18	14:28	10015	61	11.2	16.0	15.3	17.2	17.1		76.7	17.4	4.3	33.4	4.1	
108	71	2	19	14:39	10262	70	12.0	15.1	15.8	13.9	13.1		69.8	19.0	4.3	29.5	9.0	
108	69	1	19	14:39	10269	69	11.1	15.3	17.0	19.4	18.7		81.5	17.4	4.3	33.5	4.1	
115.5	52	2	20	14:49	10469	51	11.3	13.9	13.8	12.9	12.2		64.0	19.0	4.3	29.5	9.0	
115.5	51	1	20	14:50	10476	50	10.5	14.1	14.8	16.3	16.6		72.3	17.4	4.3	33.5	4.0	

Recorded by MARK Z

Checked by [signature]

6420070022_SPSWIM_TO_24_26_2.103_0100_Pre-Validation_Sheet_21.doc

Sheet 21	* STATE_CODE 2 6
LTPP Traffic Data	*SPS PROJECT_ID 0 1 0 0
WIM System Test Truck Records 1 of 1	* DATE 6/25/08

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
71.5	51	2	1	8:13	3370	51	11.7	14.5	14.4	13.4	12.8		66.7	19.0	4.3	29.5	9.0	
71.5	50	1	1	8:13	3329	50	11.0	14.7	14.6	16.4	15.9		72.5	17.4	4.3	33.6	4.1	
74	61	2	2	8:23	3530	61	11.9	14.4	14.5	14.0	12.8		67.7	19.1	4.3	29.9	9.0	
74	61	1	2	8:24	3551	60	10.7	14.7	14.5	17.1	17.4		74.4	17.4	4.3	33.5	4.0	
75.5	71	2	3	8:35	3741	71	11.5	13.7	14.6	13.0	12.3		65.2	19.1	4.3	29.6	9.0	
75.5	70	1	3	8:35	3746	70	10.6	15.1	15.4	17.3	16.5		74.9	17.4	4.3	33.6	4.1	
76.5	50	2	4	8:45	3899	51	11.9	14.1	14.7	13.5	13.0		67.1	19.0	4.3	29.6	9.0	
76.5	49	1	4	8:46	3913	50	11.0	15.4	15.1	15.5	16.0		73.0	17.4	4.3	33.6	4.1	
77.5	62	2	5	8:56	4056	62	12.4	14.2	14.2	13.7	12.3		66.8	19.0	4.3	29.5	9.0	
77.5	59	1	5	8:57	4072	59	11.1	15.3	14.9	15.8	16.0		73.2	17.4	4.3	33.6	4.1	
78	71	2	6	9:07	4234	71	11.9	14.2	14.9	13.5	12.6		67.1	19.1	4.3	29.7	9.1	
78	70	1	6	9:08	4245	71	10.4	15.7	15.6	17.7	16.8		76.2	17.4	4.3	33.5	4.1	

Recorded by MARK Z Checked by ____________

6420070022_SPSWIM_TO_24_26_2.103_0100_Cal 1 Sheet_21.doc

Sheet 21	* STATE_CODE 2 6
LTPP Traffic Data	*SPS PROJECT_ID 0 1 0 0
WIM System Test Truck Records 1 of 2	* DATE 6/25/08

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
79.5	50	2	7	9:17	4404	51	11.4	13.9	14.6	13.7	12.7		66.3	19.1	4.3	29.7	9.0	
79.5	50	1	7	9:18	4431	51	11.0	15.6	15.2	16.9	16.5		75.2	12.4	4.3	33.6	4.1	
86.5	62	1	8	10:30	5651	62	10.8	16.5	15.6	16.1	16.4		75.3	17.4	4.3	33.5	4.0	
86.5	61	2	8	10:30	5661	61	12.2	14.6	14.8	13.4	12.7		67.5	19.0	4.3	29.5	8.9	
86.5	71	1	9	10:42	5857	70	10.4	16.3	16.1	18.4	17.3		78.6	17.4	4.3	33.6	4.1	
86.5	71	2	9	10:42	5874	71	11.5	14.0	14.5	13.9	13.0		66.9	19.1	4.4	29.6	9.0	
86.5	49	1	10	10:52	6047	50	10.9	16.1	15.7	17.1	16.4		76.2	17.5	4.3	33.6	4.1	
86.5	52	2	10	10:53	6064	52	12.0	14.9	15.4	14.1	13.4		69.8	19.1	4.3	29.7	9.0	
85.5	60	1	11	11:02	6261	60	11.6	15.8	15.3	16.6	17.2		76.4	17.4	4.3	33.6	4.0	
85.5	61	2	11	11:03	6276	61	11.9	14.2	14.3	13.3	12.4		66.1	19.1	4.3	29.6	9.0	
85.5	70	1	12	11:14	6508	70	11.1	15.7	16.3	17.2	16.8		77.0	17.4	4.3	33.7	4.1	
85.5	70	2	12	11:15	6524	70	12.5	14.2	14.8	13.5	12.2		67.2	19.1	4.3	29.7	9.0	
83	51	1	13	11:25	6704	51	11.4	15.8	15.3	16.9	16.4		75.9	17.4	4.3	33.6	4.1	
83	52	2	13	11:26	6735	52	12.2	14.4	14.7	14.1	12.8		68.1	19.1	4.3	29.6	9.0	
73.5	60	1	14	11:53	7268	63	10.6	15.5	14.7	16.5	16.0		73.4	17.4	4.3	33.6	4.1	
73.5	51	2	14	11:55	7304	53	12.4	13.9	14.6	13.2	12.7		66.9	19.1	4.3	29.6	9.0	

Recorded by MARK Z Checked by ____________

Sheet 21	* STATE_CODE	2 6
LTPP Traffic Data	*SPS PROJECT_ID	0 1 0 0
WIM System Test Truck Records 2 of 2	* DATE	6 / 25 / 08

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	49	1	15	12:04	7516	50	11.4	14.8	15.1	17.0	16.5		74.8	17.5	4.3	33.6	4.1	
69	51	2	15	12:05	7542	51	12.2	14.1	13.8	13.7	13.0		66.8	19.0	4.3	29.6	9.0	
70.5	59	1	16	12:15	7728	60	10.5	15.7	14.8	16.6	16.7		74.3	17.4	4.3	33.6	4.0	
70.5	62	2	16	12:15	7742	62	12.2	14.4	14.6	13.2	12.9		67.2	19.1	4.3	29.6	9.0	
77.5	68	1	17	13:10	8768	69	10.2	15.4	15.9	17.6	16.2		75.2	17.4	4.3	33.7	4.1	
77.5	68	2	17	13:11	8778	70	11.6	14.1	15.0	12.9	12.2		65.8	19.0	4.3	29.5	9.0	
76	49	1	18	13:20	8963	49	11.2	15.2	15.2	16.5	16.6		74.8	17.4	4.3	33.5	4.1	
76	52	2	18	13:21	8988	52	12.1	14.1	14.6	13.2	13.2		67.2	19.1	4.3	29.6	9.0	
77.5	60	1	19	13:31	9185	60	10.1	15.8	14.5	16.7	16.7		73.8	17.3	4.3	33.5	4.1	
77.5	62	2	19	13:32	9205	62	12.4	14.3	14.4	13.2	12.8		67.1	19.0	4.3	29.6	9.0	
77.5	68	1	20	13:44	9427	70	10.2	14.6	15.3	17.1	17.5		74.6	17.4	4.3	33.6	4.0	
77.5	71	2	20	13:44	9437	71	12.1	14.0	14.6	12.0	12.5		65.2	19.1	4.3	29.6	9.0	

Recorded by MARK Z

Checked by ____________

Calibration Worksheet

Site: 260100

Calibration Iteration 1 Date 6/25/08

Beginning factors:

Speed Point (mph)	Name	Left Sensor 1 / 3	Right Sensor 2 / 4
Overall			
Front Axle			
Distance			
1 – (50)	SP1	1010	1010
2 – (60)	SP2	1050	1050
3 – (70)	SP3	1071	1071
4 – ( )			
5 – ( )			

Errors:

	Speed Point 1 (50)	Speed Point 2 (60)	Speed Point 3 (70)	Speed Point 4 ( )	Speed Point 5 ( )
F/A	-4.0	+0.4	+2.2		
Tandem	-5.0	+0.8	+6.2		
GVW	-4.8	+0.6	+4.6		

Adjustments:

	Raise	Lower	Percentage
Overall	☐	☐	
Front Axle	☐	☐	
Speed Point 1	☒	☐	+5.0
Speed Point 2	☐	☒	-0.6
Speed Point 3	☐	☒	-4.4
Speed Point 4	☐	☐	
Speed Point 5	☐	☐	

End factors:

Speed Point (mph)	Name	Left Sensor 1 / 3	Right Sensor 2 / 4
Overall			
Front Axle			
Distance			
1 – (50)	SP1	1061	1061
2 – (60)	SP2	1043	1043
3 – (70)	SP3	1024	1024
4 – ( )			
5 – ( )			

TEST VEHICLE PHOTOGRAPHS FOR SPS WIM VALIDATION

June 24, 2008

STATE: Michigan

SHRP ID: 260100

Photo 1 26_0100_Truck_1_Tractor_06_24_08.jpg

Photo 2 26_0100_Truck_1_Trailer_06_24_08.jpg

Photo 3 26_0100__Truck_1_Suspension_1_06_24_08.jpg

Photo 4 26_0100_Truck_1_Suspension_2_06_24_08.jpg

Photo 5 26_0100_Truck_1_Suspension_3_06_24_08.jpg

Photo 6 26_0100_Truck_2_Tractor_06_24_08.jpg

Photo 7 26_0100_Truck_2_Trailer_06_24_08.jpg

26_Photo 8 0100_Truck_2_Suspension_1_06_24_08.jpg

Photo 9 26_0100_Truck_2_Suspension_2_06_24_08.jpg

Photo 10 26_0100_Truck_2_Suspension_3_06_24_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

Michigan SPS-1 (Lane 4)

Calibration Factors for Sensor #1

Validation Visit Factor	June 25, 2008	June 24, 2008	October 2, 2007
Overall	820	820	900
Front Axle	1039	1039	1039
Bin 1 (50 mph)	1061	1010	1000
Bin 2 (60 mph)	1043	1050	1050
Bin 3 (70 mph)	1024	1071	1071
Piezo 1	960	960	960
Piezo 2	1040	1040	1040

Calibration Factors for Sensor #2

Validation Visit Factor	June 25, 2008	June 24, 2008	October 2, 2007
Overall	820	820	900
Front Axle	1039	1039	1039
Bin 1 (50 mph)	1061	1010	1000
Bin 2 (60 mph)	1043	1050	1050
Bin 3 (70 mph)	1024	1071	1071
Piezo 1	960	960	960
Piezo 2	1040	1040	1040

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