Revised Validation Report

Delaware, SPS-1
Task Order 23, CLIN 2
March 18 to 21, 2008

List of Tables

List of Figures

1 Executive Summary

A visit was made to the Delaware 0100 on March 18 to 21, 2008 for the purposes of conducting a validation of the WIM system located on US 113 at milepost 25.04 north of the SR 579 intersection near Ellendale, DE.. The SPS-1 is located in the righthand, southbound lane of a four-lane divided facility. The posted speed limit at this location is 55 mph. The 85th percentile speed exceeds 60 mph. Only fifteen to twenty percent of the trucks observed in the classification review are traveling at or below the speed limit. 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 second validation visit to this location since new quartz piezo sensors were installed for this lane only. The site was installed on July 10 - 11, 2007 by IRD.

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 WIM and iSINC electronics. It is installed in portland cement concrete that has been ground 250 feet prior and 150 after the WIM scale area, totaling 400 feet in length.

The calibration and 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 78,880 lbs., the "golden" truck.
2) 5-axle tractor semi-trailer with a tractor having a 4 full leaf suspension and a trailer with a "Canadian" tandem (5 foot axle spacing) and an air suspension loaded to 66,300 lbs., the "partial" truck.

The validation speeds ranged from 39 to 55 miles per hour. The pavement temperatures ranged from 53 to 76 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 – 100100 – 21-Mar-2008

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	1.8 ± 5.9%	Pass
Tandem axles	±15 percent	-0.8 ± 7.2%	Pass
GVW	±10 percent	-0.5 ± 5.9%	Pass
Axle spacing	± 0.5 ft [150mm]	0.0 ± 0.0 ft	Pass

Prepared: bko *Checked:jrn*

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

significantly. A visual survey determined that there is no discernable bouncing or avoidance by trucks in the sensor area.

Based on profile data collected at this site on February 11, 2008 WIMIndex values have been computed. One of the values exceeded the Upper Threshold Limit, while twenty-one of the values were below the Lower Threshold with the remainder falling between the Lower and Upper Thresholds. The pavement roughness in the area between 25.8 m and 2.74 m in front of the scale may impact the operation of this scale.

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

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

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

Prepared: bko *Checked:jrn*

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 August 8, 2007. We do not have any information on when these parameters were changed, who made the changes or why they were made.

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

2 Corrective Actions Recommended

There are no recommendations for equipment repair or replacement. This site is scheduled for semi-annual maintenance.

The vehicle classification algorithm should be reviewed given the misclassifications seen in other than Class 5 vehicles.

Data collected since the last Validation visit which was completed on August 8th, 2007 should be reviewed. The system parameters were changed sometime after that visit and prior to this validation beginning on March 18th, 2008. We do not have any information on when these parameters were changed, who made the changes or why they were made.

3 Post Calibration Analysis

This final analysis is based on test runs conducted March 21, 2008 from noon to early evening at test site 100100 on US 113. This SPS-1 site is at milepost 25.0 on the southbound, righthand of a four-lane divided facility. No auto-calibration was used during test runs. The 2 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 78,880 lbs., the “golden” truck.
2. 5-axle tractor semi-trailer with a tractor having a 4 full leaf suspension and a trailer with a "Canadian" tandem and an air suspension loaded to 66,300 lbs., the “partial” truck.

A “Canadian” tandem refers to a tandem with an axle spacing of 5 feet. The initial and final validations used different pairs of trucks. The “golden” truck was the same for both.

Each truck made a total of 20 passes over the WIM scale at speeds ranging from approximately 39 to 55 miles per hour. The desired speed range was achieved during this validation. Pavement surface temperatures were recorded during the test runs ranging from about 53 to 76 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 site has met all criteria for research quality loading data. The failure to provide research quality classification data cannot be attributed to spacing measurement errors based on validation observations.

Table 3-1 Post-Validation Results – 100100 – 21-Mar-2008

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	1.8 ± 5.9%	Pass
Tandem axles	±15 percent	-0.8 ± 7.2%	Pass
GVW	±10 percent	-0.5 ± 5.9%	Pass
Axle spacing	± 0.5 ft [150mm]	0.0 ± 0.0 ft	Pass

Prepared: bko *Checked:jrn*

The test runs were conducted throughout the afternoon and into early evening producing a range of pavement temperatures sufficient to obtain three subsets. The runs were also conducted at various speeds to determine the effects of these variables on the performance of the WIM scale. To investigate these effects, the data set was split into three speed groups and three temperature groups. The distribution of runs by speed and temperature is illustrated in Figure 3-1. The figure indicates that the desired distribution of speed and temperature combinations was not achieved for this set of validation runs. The combinations lack a minimum of 30 degrees of temperature coverage and are somewhat sparse at the lower end of the observed range.

The three speed groups were divided as follows: Low speed – 39 to 47 mph, Medium speed – 48 to 51 mph and High speed – 52 + mph. The three temperature groups were created by splitting the runs between those at 53 to 60 degrees Fahrenheit for Low temperature, 61 to 67 degrees Fahrenheit for Medium temperature and 68 to 76 degrees Fahrenheit for High temperature.

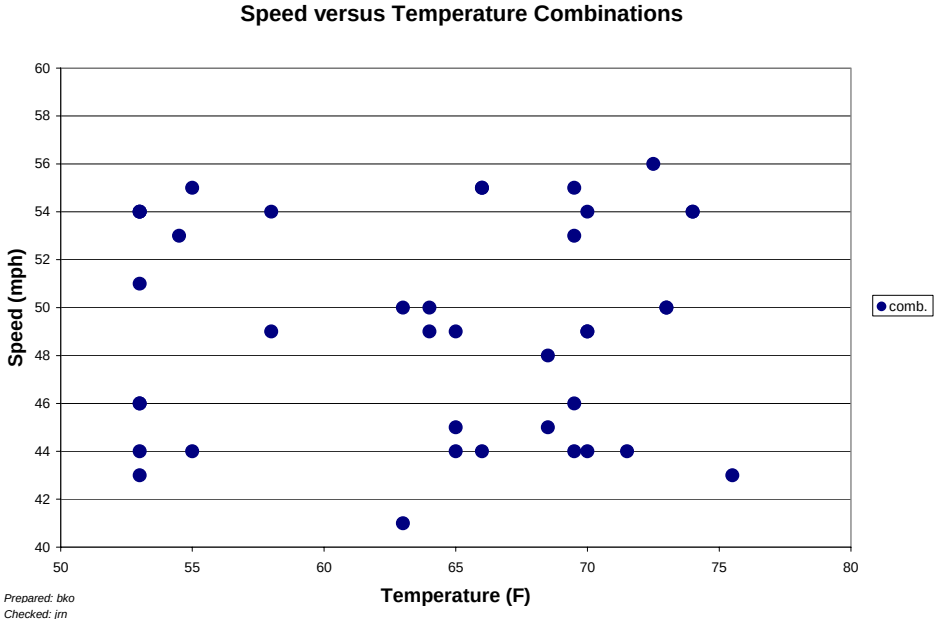

Figure 3-1 Post-Validation Speed-Temperature Distribution – 100100 – 21-Mar-2008

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. The estimate of GVW at the low end of the speed range is lower than that at the medium and high speeds. This is not considered critical given that essentially no trucks operate routinely in this speed range.

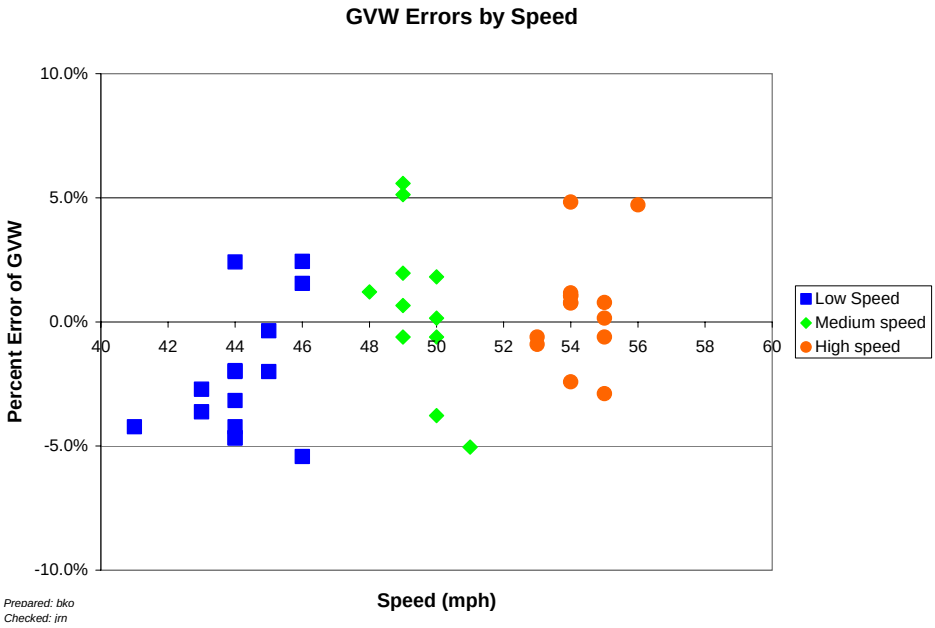

Figure 3-2 Post-validation GVW Percent Error vs. Speed – 100100 – 21-Mar-2008

Figure 3-3 shows the relationship between temperature and GVW percentage error. Graphically there is a slight increase in GVW error as temperatures increase.

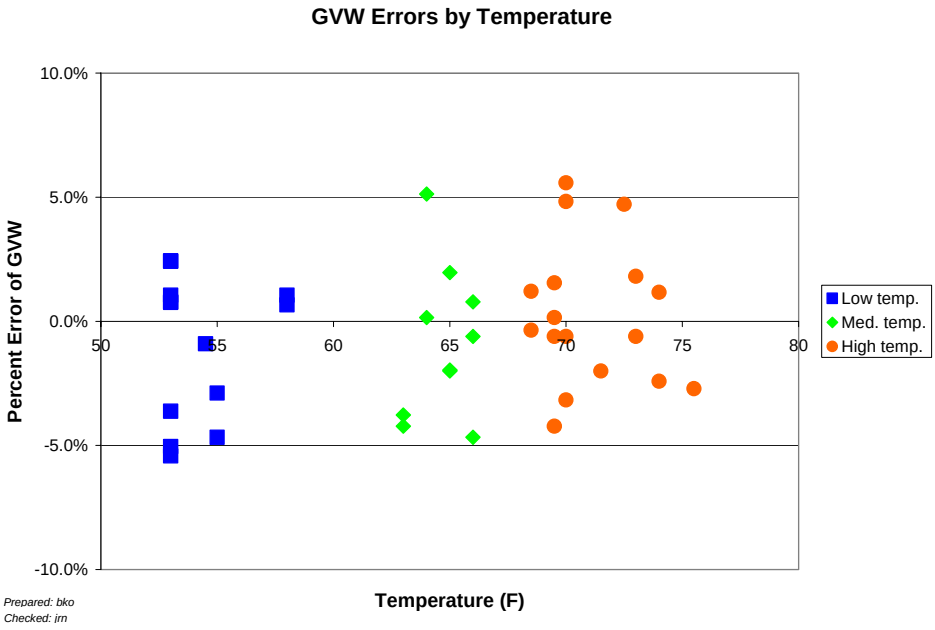

Figure 3-3 Post-Validation GVW Percent Error vs. Temperature – 100100 – 21-Mar-2008

Figure 3-4 shows the relationship between the drive tandem spacing errors in feet and speed. This graph is used as a potential indicator of classification errors due to failure to correctly identify spacings on a vehicle. Since the most common reference value is the drive tandem on a Class 9 vehicle, this is the spacing evaluated and plotted for validations. There is no apparent influence of speed on spacing error within the validation speed range.

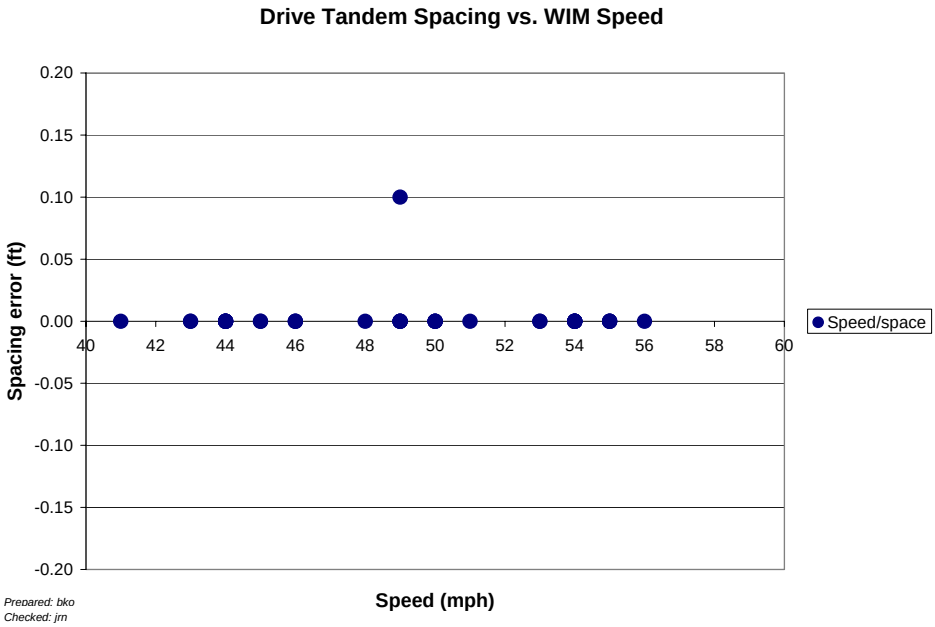

Figure 3-4 Post-Validation Spacing vs. Speed – 100100 – 21-Mar-2008

3.1 Temperature-based Analysis

The three temperature groups were created by splitting the runs between those at 53 to 60 degrees Fahrenheit for Low temperature, 61 to 67 degrees Fahrenheit for Medium temperature and 68 to 76 degrees Fahrenheit for High temperature.

Table 3-2 Post-Validation Results by Temperature Bin – 100100 – 21-Mar-2008

Element	95% Limit	Low Temperature 53 to 60 °F	Medium Temperature 61 to 67 °F	High Temperature 68 to 76 °F
Steering axles	±20 %	0.9 ± 6.6%	1.2 ± 9.0%	2.8 ± 3.5%
Tandem axles	±15 %	-1.3 ± 7.2%	-1.2 ± 7.8%	-0.2 ± 7.4%
GVW	±10 %	-1.0 ± 6.3%	-0.9 ± 6.9%	0.3 ± 6.1%
Axle spacing	± 0.5 ft	0.0 ± 0.0 ft	0.0 ± 0.0 ft	0.0 ± 0.1 ft

Prepared: bko *Checked:jrn*

In Table 3-2 there is a decreasing error in loading estimates for all elements with increasing temperature. The variability in the estimates is essentially the same throughout the observed range of temperatures.

Figure 3-5 is the distribution of GVW Errors versus Temperature by Truck graph. The influence of temperatures does not appear to be truck specific. Both test vehicles exhibit similar trends and variability.

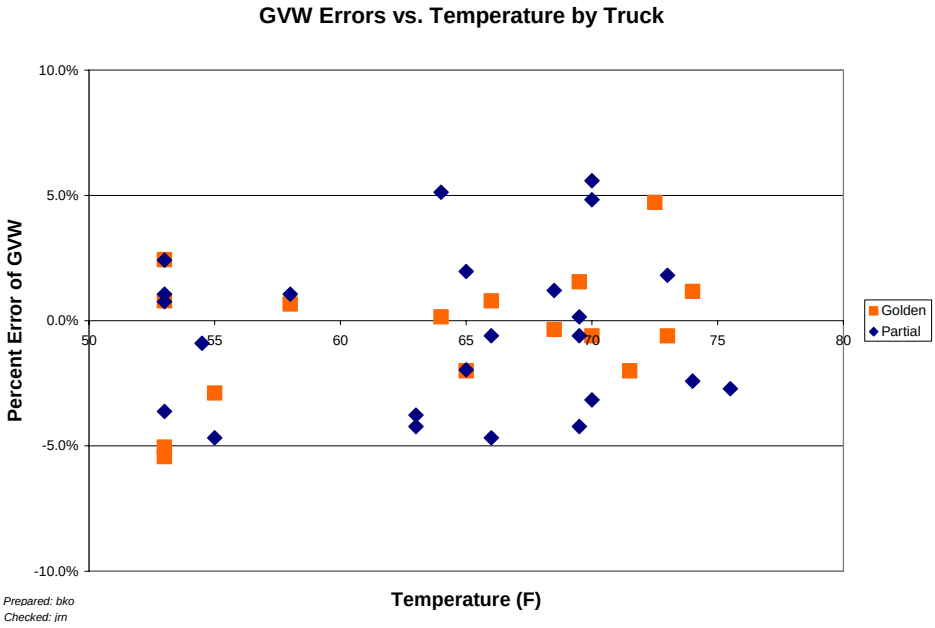

Figure 3-5 Post-Validation GVW Percent Error vs. Temperature by Truck – 100100 – 21-Mar-2008

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

associated only with Class 9 vehicles. There is a slight upward trend in steering axle errors with higher temperatures.

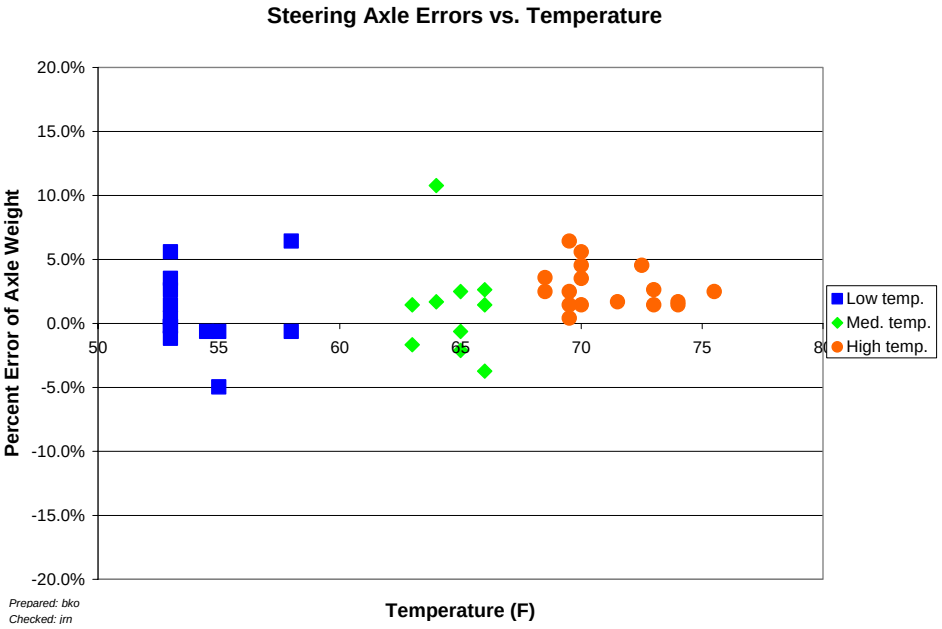

Figure 3-6 Post-Validation Steering Axle Error vs. Temperature by Group – 100100 – 21-Mar-2008

3.2 Speed-based Analysis

The three speed groups were divided using 39 to 47 mph for Low speed, 48 to 51 mph for Medium speed and 52+ mph for High speed.

Table 3-3 Post-Validation Results by Speed Bin – 100100 – 21-Mar-2008

Element	95% Limit	Low Speed 39 To 47 mph	Medium Speed 48 to 51 mph	High Speed 52+ mph
Steering axles	±20 %	1.9 ± 5.1%	3.3 ± 7.6%	0.5 ± 5.5%
Tandem axles	±15 %	-2.8 ± 7.0%	0.1 ± 8.1%	0.6 ± 5.4%
GVW	±10 %	-2.2 ± 5.6%	0.6 ± 7.2%	0.6 ± 4.7%
Axle spacing	± 0.5 ft	0 .0 ± 0.0 ft	0.0 ± 0.1 ft	0.0 ± 0.0 ft

Prepared: bko *Checked:jrn*

In Table 3-3 there is a decrease in errors for tandem axles as speeds increase. There is not a consistent trend for variability of those errors. There is no apparent effect of speed on axle spacing errors which might influence the classification results.

Figure 3-7 shows the trend in speed errors by truck. The test vehicles have a similar scatter of errors. The relatively wide scatter has been verified against data files directly downloaded from the WIM equipment.

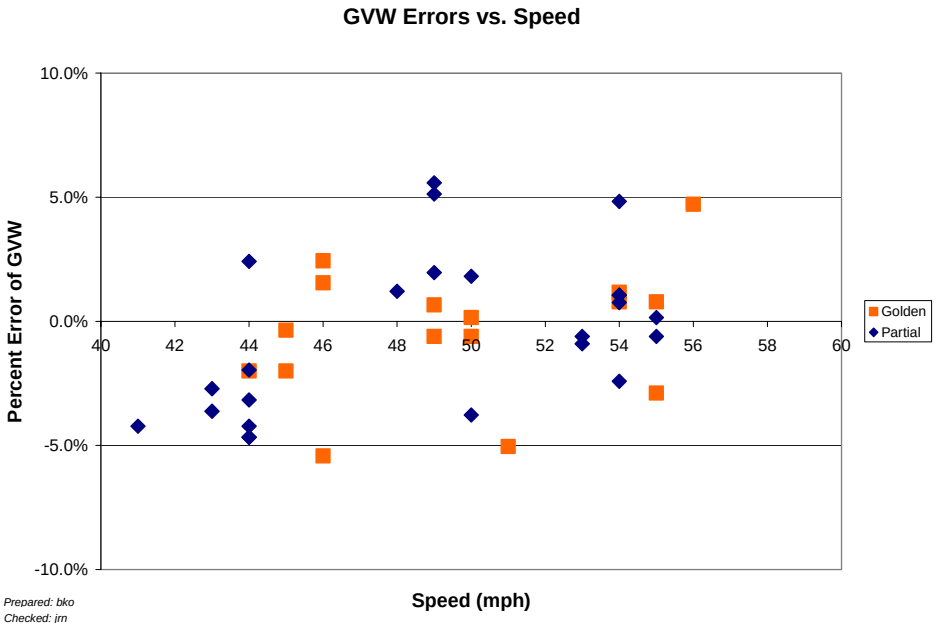

Figure 3-7 Post-Validation GVW Percent Error vs. Speed by Truck – 100100 – 21-Mar-2008

Figure 3-8 shows the relation between steering axle errors and speed. This graph is included due to the frequent use of steering axle weights of Class 9 vehicles for auto-calibration. This site does not use auto-calibration. The steering axles in this graph are associated only with Class 9 vehicles. There is a very slight downward trend in steering axle errors as speed increases.

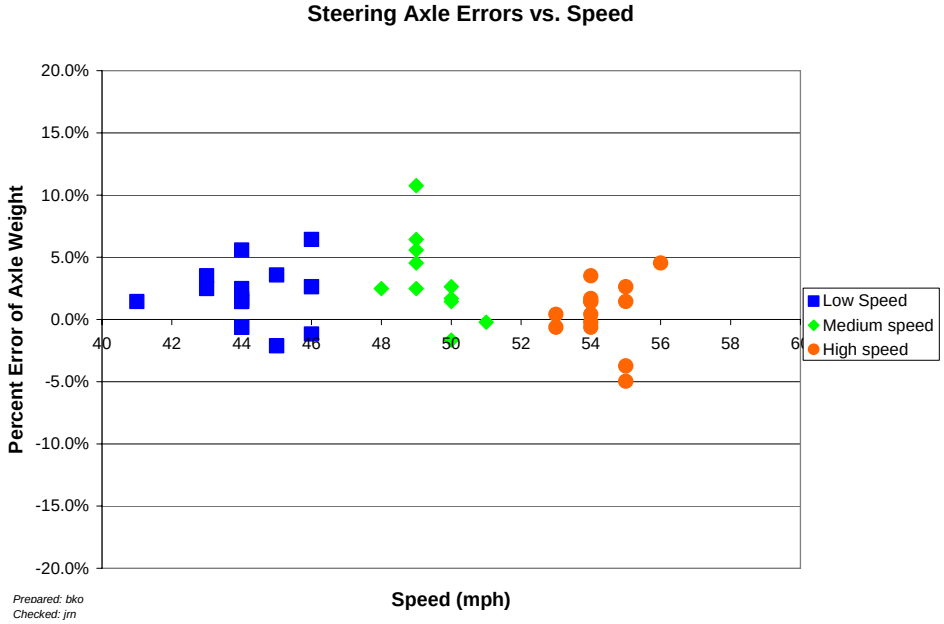

Figure 3-8 Post-Validation Steering Axle Percent Error vs. Speed by Group – 100100 – 21-Mar-2008

3.3 Classification Validation

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

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

The second check is the ability of the algorithm to correctly distinguish between truck classes with no more than 2% errors in such classifications. Table 3-4 has the classification error rates by class. The overall misclassification rate is 3.9 percent. The misclassification in the post validation sample is associated with Class 4s being recorded as Class 5s.

Table 3-4 Truck Misclassification Percentages for 100100 – 21-Mar-2008

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

Prepared: bko *Checked:jrn*

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. The value of misclassification for Class 4s is 100 but only represents two vehicles observed for that class.

Table 3-5 Truck Classification Mean Differences for 100100 – 21-Mar-2008

Class	Mean Difference	Class	Mean Difference	Class	Mean Difference
4	-100	5	6	6	0
7	0				
8	0	9	0	10	N/A
11	N/A	12	N/A	13	N/A

Prepared: bko *Checked:jrn*

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. In the case of Class 4s, both of the ones observed were misclassified. 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. The persistent failure to classify vehicles that are at the border of the length differentiation between Class 4 and Class 5 is not likely to be linked to the speed comparison producing out of tolerance results given effectively zero error for axle spacing.

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: bko *Checked:jrn*

4 Pavement Discussion

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

4.1 Profile Analysis

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

Profile data collected at the SPS WIM location by Stantec on February 11, 2008 were processed through the LTPP SPS WIM Index software, version 1.1. This WIM scale is installed on a rigid pavement.

A total of 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 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 bold while values below the lower index limits are italics.

Table 4-2 WIM Index Values – 100100 –11-Feb-2008

Profiler Passes			Pass 1	Pass 2	Pass 3	Pass 4	Pass 5	Ave.
Center	LWP	LRI (m/km)	0.888	1.116	0.981	1.060	1.015	1.012
		SRI (m/km)	0.736	0.551	0.752	0.593	0.625	0.651
		Peak LRI (m/km)	1.047	1.202	0.984	1.113	1.019	1.073
		Peak SRI (m/km)	0.786	*0.662*	0.799	0.752	0.898	0.779
	RWP	LRI (m/km)	0.752	0.894	0.643	0.769	0.718	0.755
		SRI (m/km)	*0.244*	*0.220*	*0.336*	0.525	0.605	*0.386*
		Peak LRI (m/km)	1.199	1.355	1.189	1.162	1.308	1.243
		Peak SRI (m/km)	*0.478*	*0.435*	*0.521*	0.791	*0.672*	*0.579*
Left Shift	LWP	LRI (m/km)	0.820	0.983	1.226			1.010
		SRI (m/km)	0.669	0.692	0.740			0.700
		Peak LRI (m/km)	1.060	1.175	1.242			1.159
		Peak SRI (m/km)	*0.747*	*0.692*	1.051			0.830
	RWP	LRI (m/km)	1.052	0.924	1.135			1.037
		SRI (m/km)	0.575	0.513	0.865			0.651
		Peak LRI (m/km)	1.282	1.278	1.512			1.357
		Peak SRI (m/km)	1.050	*0.670*	1.026			0.915
Right Shift	LWP	LRI (m/km)	0.779	0.732	0.768			0.760
		SRI (m/km)	0.549	*0.296*	*0.368*			*0.404*
		Peak LRI (m/km)	1.314	1.302	1.092			1.236
		Peak SRI (m/km)	*0.608*	*0.596*	*0.705*			*0.636*
	RWP	LRI (m/km)	0.922	0.855	0.707			0.828
		SRI (m/km)	*0.379*	*0.443*	*0.439*			*0.420*
		Peak LRI (m/km)	**2.277**	2.097	1.692			2.022
		Peak SRI (m/km)	*0.672*	*0.732*	0.883			0.762

Prepared: als *Checked: jrn*

From Table 4-2 it can be seen that one value is above the upper index limits while twenty-one of the values are below the lower index limits. Because the values below the lower limits are all either SRI or Peak SRI values, the pavement roughness close to the scale is less likely to impact the operation of the scale. The pavement roughness in the area between 25.8 m and 2.74 m in front of the scale may impact the operation of this scale.

The profile data evaluated was collected after the site installation and the first visit and before the current visit. There is no profile evaluation for conditions prior to that visit since the system was newly installed.

4.2 Distress Survey and Any Applicable Photos

During a visual survey of the pavement, another data collection installation was discovered approximately 100 feet prior to the site. A sensor at this location has been removed and the pavement has been patched. This patch, shown in Figure 4-1, does not appear to influence truck movement across the WIM scales.

Figure 4-1 10_0100_Removed_Sensor_03_18_2008.jpg

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 of any of the sensors for the equipment.

5 Equipment Discussion

The traffic monitoring equipment at this location includes quartz piezo WIM and iSINC. These sensors are installed in a portland cement concrete pavement in a ground section that is approximately 400 ft in length.

There was an unexplained modification in calibration factors since the validation on August 8, 2007. There were no changes in the hardware observed.

5.1 Pre-Evaluation Diagnostics

A complete electronic check of all systems components including in-road sensors, electrical power, and telephone service was performed. All sensors and system components were found to be within operating parameters.

5.2 Calibration Process

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

The factors that were in place after the last Validation visit on August 8, 2007 were:

	Sensor 1	Sensor 2
65 kph	3253	3388
72 kph	3253	3388
80 kph	3388	3529
88 kph	3421	3564
105 kph	3455	3599

It appears that the compensation factors had been changed at some time between the last Validation and this Validation. The controller weight compensation factors that were in place for the Pre-Validation were:

	Sensor 1	Sensor 2
65 kph	3172	3473
72 kph	3172	3473
80 kph	3303	3617
88 kph	3335	3653
105 kph	3369	3689

5.2.1 Calibration Iteration 1

Following the pre-validation runs it was determined that the factors for the 72 kph and 80 kph speed points needed to be increased slightly more than four percent. Table 5-1 indicates the results of the change after the calibration runs.

Table 5-1 Calibration Iteration 1 Results – 100100 – 21-Mar-2008 (11:35 AM)

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	1.2 ± 6.5%	Pass
Tandem axles	±15 percent	-1.4 ± 7.2%	Pass
GVW	±10 percent	-1.1 ± 5.7%	Pass
Axle spacing	± 0.5 ft	0.0 ± 0.0 ft	Pass

Prepared: bko *Checked:jrn*

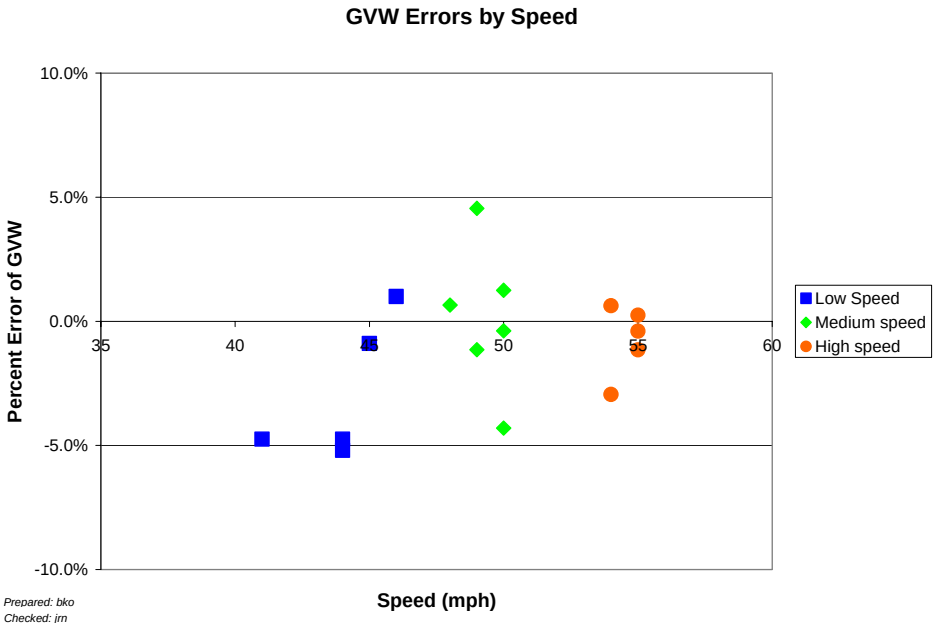

Figure 5-1 Calibration Iteration 1 GVW Percent Error vs. Speed Group – 100100 – 21-Mar-2008 (11:35 AM)

Based on the trends and scatter observed in Figure 5-1 and a review of the statistics it was determined that no further adjustments were required.

5.3 Summary of Traffic Sheet 16s

This site has validation information from previous visits as well as the current one in the tables below. Table 5-2 has the information 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 agency and only this contractor's validation visits.

Table 5-2 Classification Validation History – 100100 – 21-Mar-2008

Date	Method	Mean Difference				Percent Unclassified
		Class 9	Class 8	Class 5	Class 6	
19-Mar-2008	Manual	0	0	0	0	0.0%
18-Mar-2008	Manual	-2	0	4	-8	3.7%
8-Aug -2007	Manual	0	0	3		0.0%
7-Aug- 2007	Manual	0	0	16		0.0%
28-Oct- 2003	Manual	3	1			0.0%

Prepared: bko *Checked:jrn*

Table 5-3 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 agency and only this contractor's validation visits.

Table 5-3 Weight Validation History – 100100 – 21-Mar-2008

Date	Method	Mean Error and (SD)		
		GVW	Single Axles	Tandem Axles
21-Mar-2008	Test Trucks	-0.5 (2.9)	1.8 (2.9)	-0.8 (3.6)
20-Mar-2008	Test Trucks	-4.1 (5.6)	-3.4 (8.9)	-3.9 (4.7)
8-Aug_2007	Test Trucks	0.6 (3.1)	2.1 (3.5)	0.3 (4.0)
7-Aug-2007	Test Trucks	1.1 (2.9)	2.3 (3.3)	0.5 (5.0)

Prepared: bko *Checked:jrn*

The variability of the site does not appear to have changed in the short interval between validations. The calibration factors for the validation speed range have increased.

5.4 Projected Maintenance/Replacement Requirements

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

6 Pre-Validation Analysis

This pre-validation analysis is based on test runs conducted March 20 and 21, 2008 from early evening to late afternoon on the first day and during the morning of the second day at test site 100100 on US 113. This SPS-1 site is at milepost 25.0 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 78,830 lbs., the “golden” truck.
2. 5-axle tractor semi-trailer with a tractor having a 4 full leaf suspension and a trailer with a split rear tandem and an air suspension loaded to 73,320 lbs., the “split tandem” truck.

For the initial validation each truck made a total of 20 passes over the WIM scale at speeds ranging from approximately 35 to 55 miles per hour. The desired speed range was achieved during this validation. Pavement surface temperatures were recorded during the test runs ranging from about 31 to 75 degrees 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 6-1.
The statistics from the initial validation in Table 6-1 indicated that the site failed to provide research quality data for Single axles and GVW. The single axle failure was borderline. The actual variance for GVW exceeded the allowable error even before accounting for bias.

Table 6-1 Pre-Validation Results – 100100 – 21-Mar-2008

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	+20 percent	-1.0 ± 12.4%	Pass
Single axles	+20 percent	-3.4 ± 17.7%	Fail
Tandem axles	+15 percent	-3.9 ± 9.3%	Pass
GVW	+10 percent	-4.1 ± 11.3%	Fail
Axle spacing	+ 0.5 ft [150mm]	0.0 ± 0.0 ft	Pass

Prepared: bko *Checked:jrn*

The test runs were conducted from mid-morning to late afternoon of the first day and the morning of the second. This produced the desired range of pavement temperatures but not the coverage desired. 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 not achieved for this set of validation runs due to the gap in temperature coverage.

The three speed groups were divided into 35 to 47 mph for Low speed, 48 to 51 mph for Medium speed and 52+ mph for High speed. The two temperature groups were created by splitting the runs between those at 31 to 65 degrees Fahrenheit for Low temperature, to degrees Fahrenheit for Medium temperature and 66 to 75 degrees Fahrenheit for High temperature.

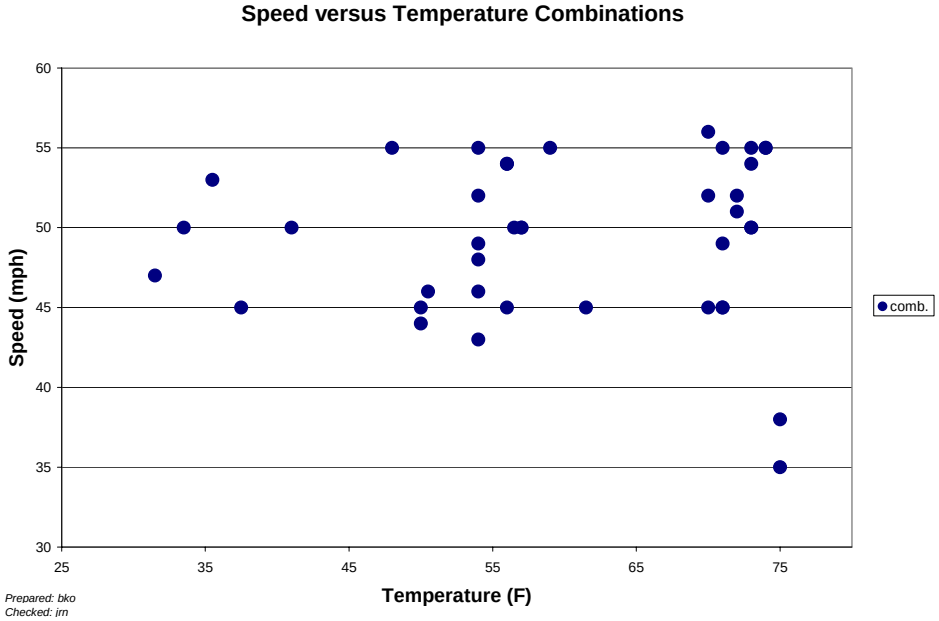

Figure 6-1 Pre-Validation Speed-Temperature Distribution – 100100 – 21-Mar-2008

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

Figure 6-2 shows the GVW Percent Error vs. Speed graph for the population as a whole. It indicates a tendency to underestimate GVW in the observed speed range. The outliers were confirmed using the files downloaded from the equipment. It is possible that this is a reflection of the very high LRI value when the trucks travel to the right of the center of the lane.

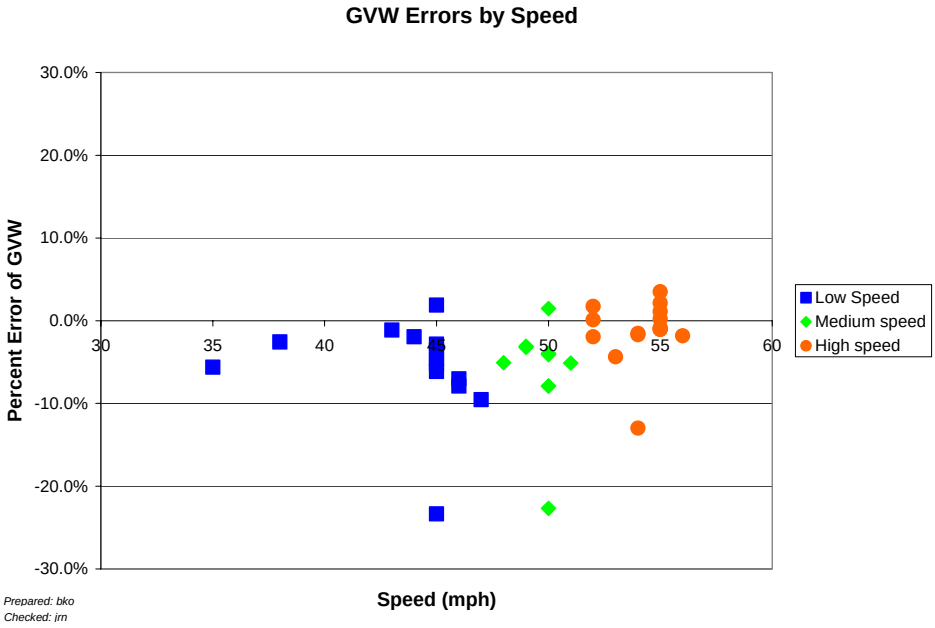

Figure 6-2 Pre-validation GVW Percent Error vs. Speed – 100100 – 21-Mar-2008

Figure 6-3 shows the relationship between temperature and GVW percentage error. There is no apparent trend in GVW errors with temperature.

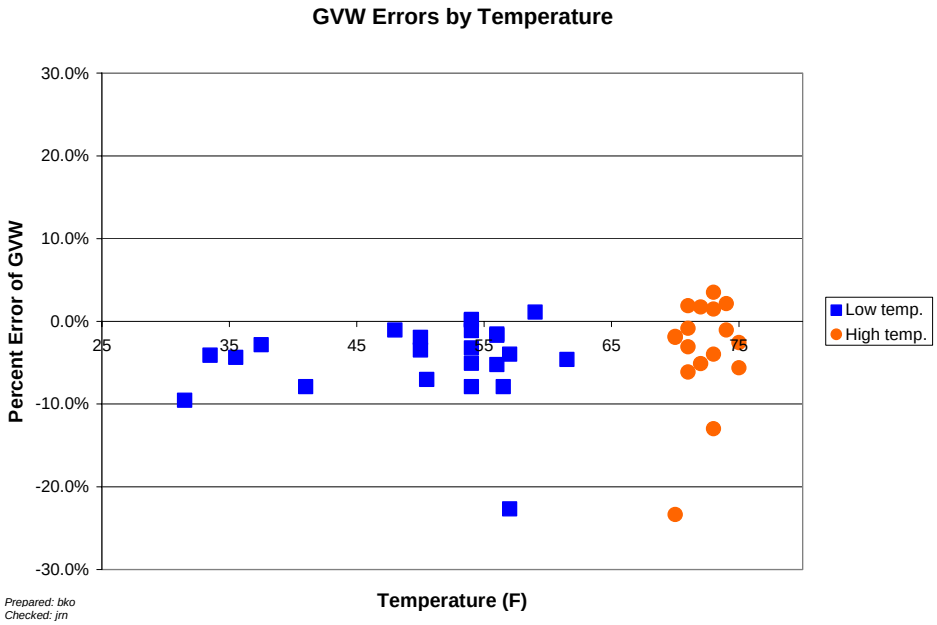

Figure 6-3 Pre-Validation GVW Percent Error vs. Temperature – 100100 – 21-Mar-2008

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

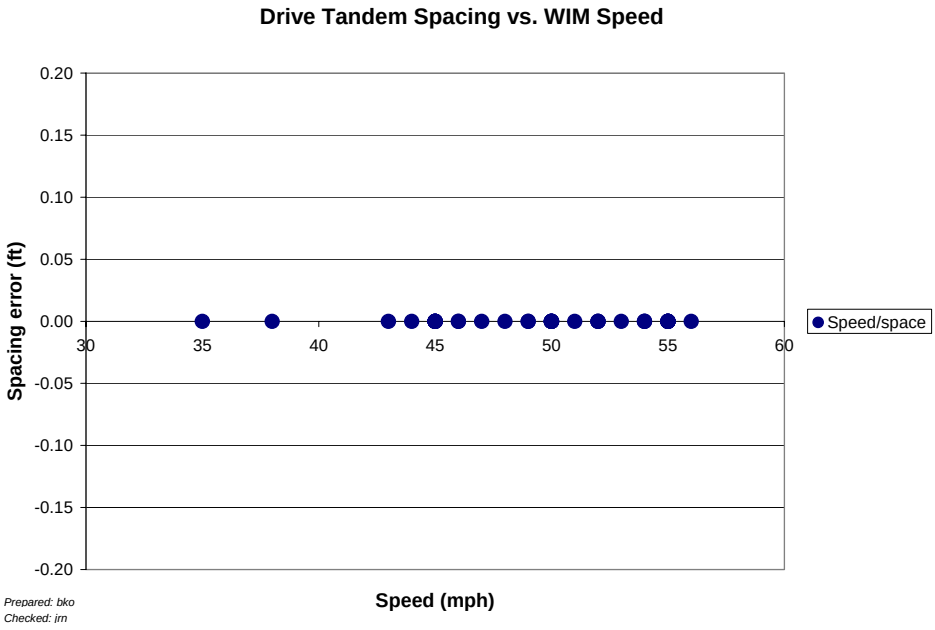

Figure 6-4 Pre-Validation Spacing vs. Speed - 100100 – 21-Mar-2008

6.1 Temperature-based Analysis

The two temperature groups were created by splitting the runs between those at 31 to 65 degrees Fahrenheit for Low temperature and 66 to 75 degrees Fahrenheit for High temperature. Too few truly low temperature points existed to justify three groups.

Table 6-2 Pre-Validation Results by Temperature Bin – 100100 – 21-Mar-2008

Element	95% Limit	Low Temperature 31 to 65 °F	High Temperature 66 to 75 °F
Steering axles	±20 %	-0.6 ± 7.9%	-1.5 ± 17.8%
Single axles	±20 %	-2.8 ± 16.1%	-4.0 ± 20.1%
Tandem axles	±15 %	-4.9 ± 8.2%	-2.5 ± 10.8%
GVW	±10 %	-4.6 ± 10.1%	-3.4 ± 13.8%
Axle spacing	± 0.5 ft	0.0 ± 0.0 ft	0.0 ± 0.0 ft

Prepared: bko *Checked:jrn*

There is no distinctly temperature related trend in Table 6-2 if the outliers are considered to be an outcome of a pavement and speed interaction.

Figure 6-5 shows the distribution of GVW Errors versus Temperature by Truck. A very slight upward trend appears graphically if the outliers were not considered.

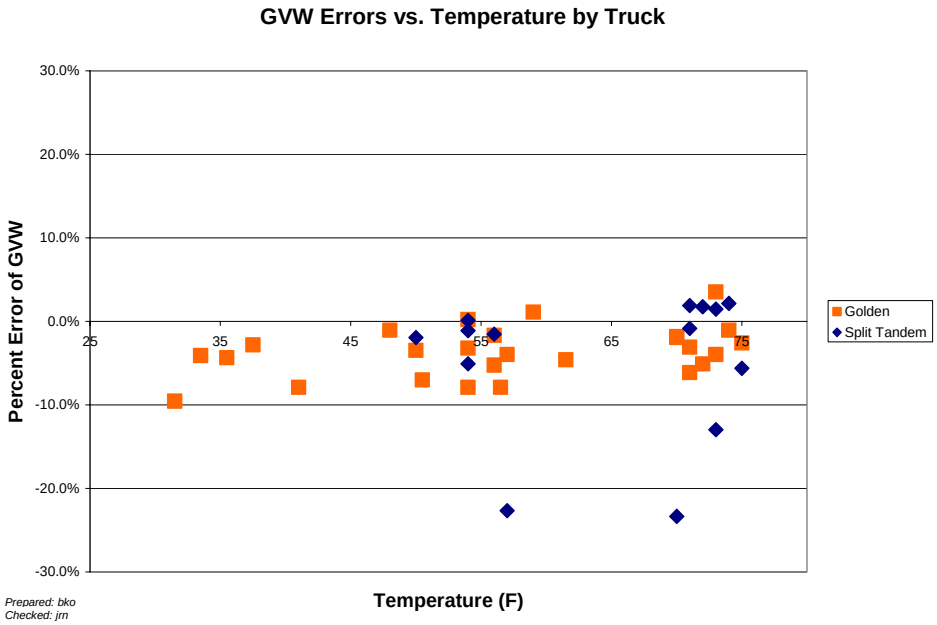

Figure 6-5 Pre-Validation GVW Percent Error vs. Temperature by Truck – 100100 – 21-Mar-2008

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 apparent trend in steering axle error with temperature. The appearance of increasing variability is considered to be a function of the number of data points graphed at various points of the range. The outliers are thought to be profile induced.

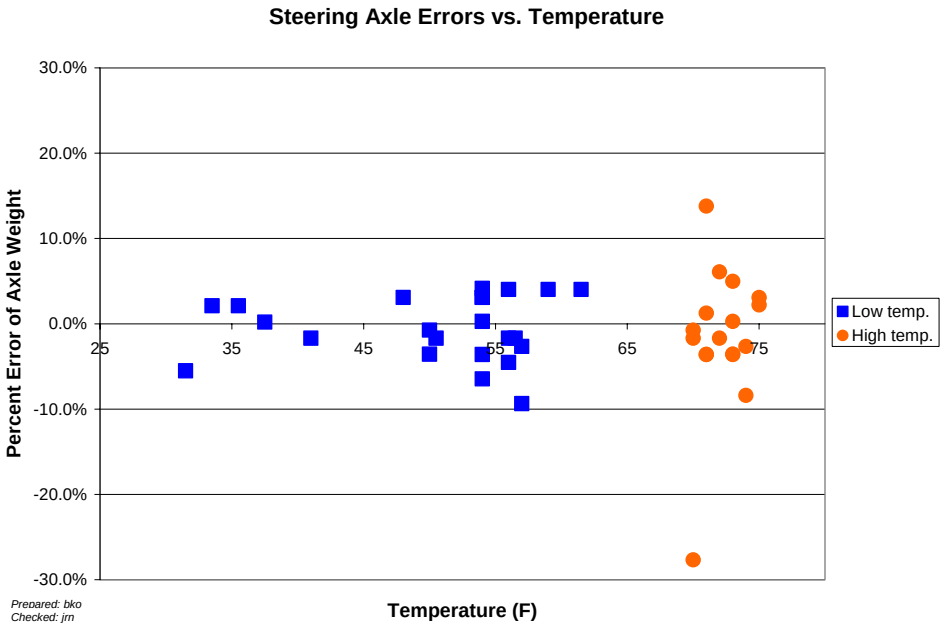

Figure 6-6 Pre-Validation Steering Axle Error vs. Temperature by Group – 100100 – 21-Mar-2008

Figure 6-7 shows the influence of temperature on the single axles where both the steering axles and the axles of the split tandem are considered. The increased visibility of the scatter at the high end of the range is a function of the number of included points noting that they all belong to the same truck.

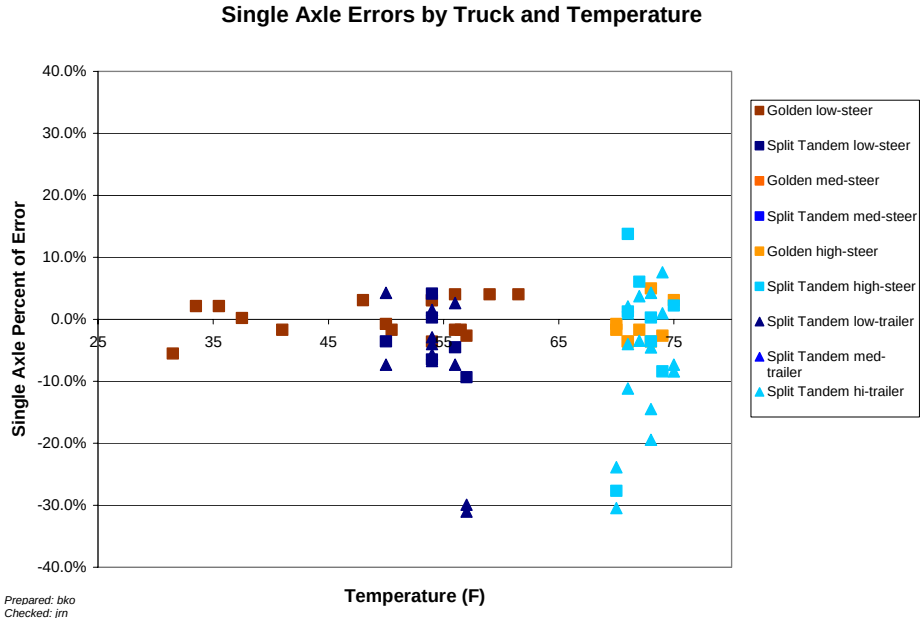

Figure 6-7 Pre-Validation Single Axle Errors by Truck and Temperature – 100100 – 21-Mar-2008

The tandem axle scatter in Figure 6-8 does not show the same tendency. The scatter is the similar throughout the temperature range.

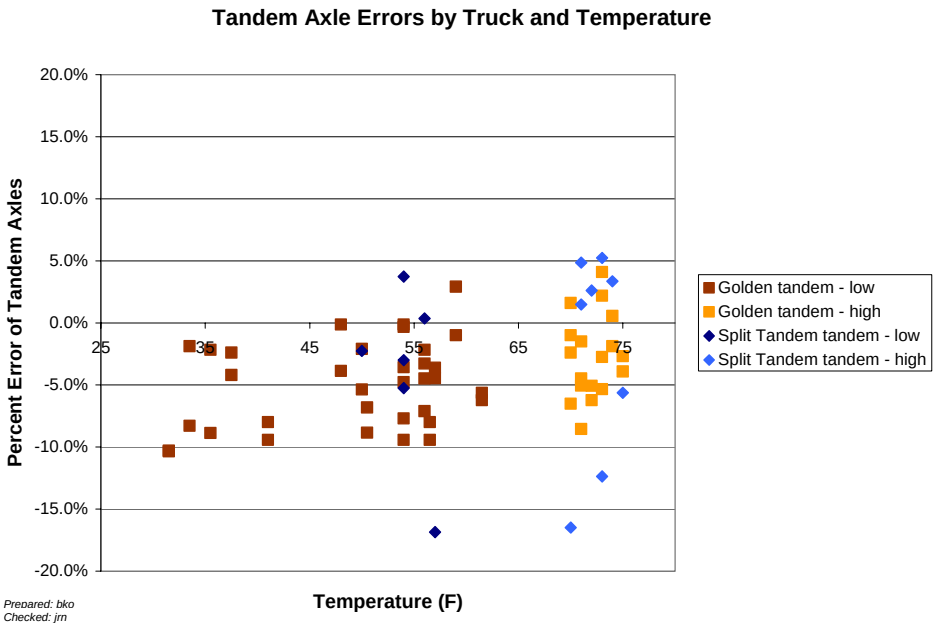

Figure 6-8 Pre-Validation Tandem Axle Errors by Truck and Temperature – 100100 – 21-Mar-2008

6.2 Speed-based Analysis

The speed groups were divided as follows: Low speed – 35 to 47 mph, Medium speed – 48 to 51 mph and High speed – 52+ mph.

Table 6-3 Pre-Validation Results by Speed Bin – 100100 – 21-Mar-2008

Element	95% Limit	Low Speed 35 To 47 mph	Medium Speed 48 to 51 mph	High Speed 52+ mph
Steering axles	±20 %	-1.5 ± 19.4%	-2.6 ± 7.7%	0.7 ± 8.4%
Single axles	±20 %	-4.1 ± 21.2%	-5.9 ± 20.9%	-1.3 ± 13.2%
Tandem axles	±15 %	-6.0 ± 7.8%	-5.5 ± 9.2%	-0.8 ± 8.6%
GVW	±10 %	-5.7 ± 12.7%	-6 .0± 13.6%	-1.2 ± 8.1%
Axle spacing	± 0.5 ft	0.0 ± 0.0 ft	0.0 ± 0.0 ft	0.0 ± 0.0 ft

Prepared: bko *Checked:jrn*

Table 6-3 has a general underestimation of loading for all elements in all speed groups.

Figure 6-9 show as underestimate of GVW trending towards unbiased estimates with increasing speed. Ignoring the outliers the variability is similar throughout the range.

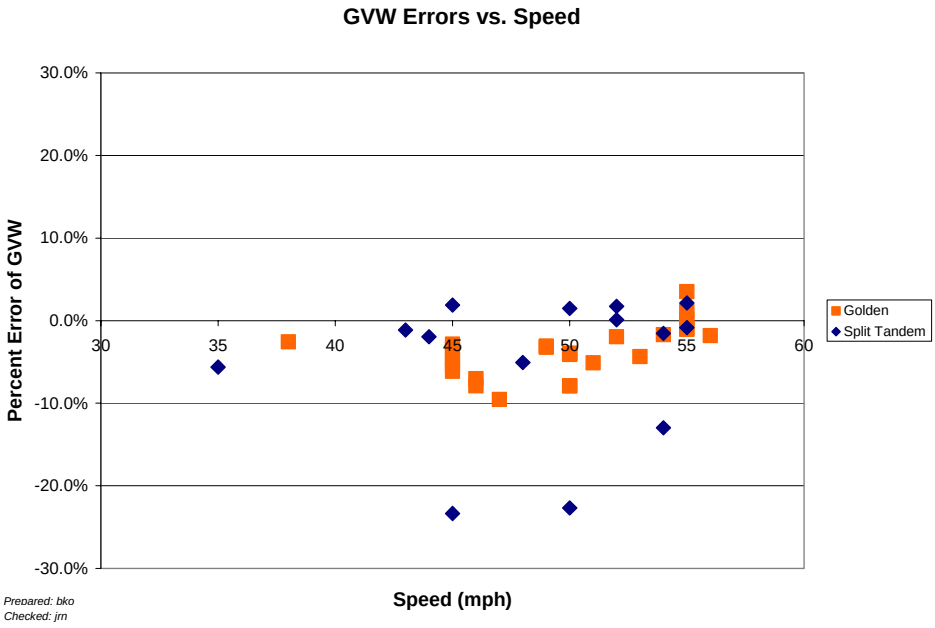

Figure 6-9 Pre-Validation GVW Percent Error vs. Speed Group - 100100 –21-Mar-2008

Figure 6-10 shows the relation between steering axle errors and speed. This graph is included due to the frequent use of steering axle weights of Class 9 vehicles for calibration. This site does not use auto-calibration. The steering axles in this graph are associated only with Class 9 vehicles. There appears to be a slight increase in scatter with increasing speed.

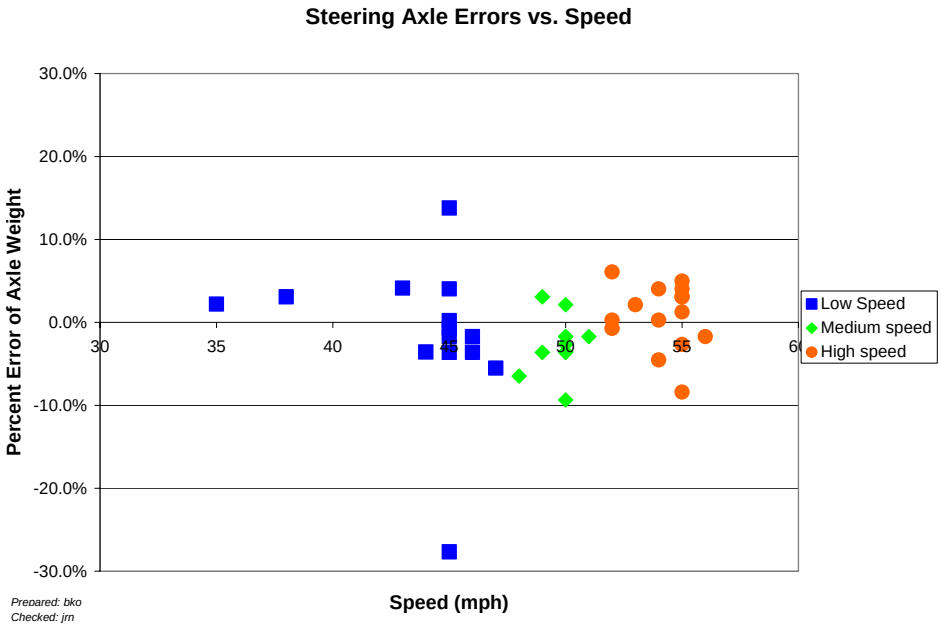

Figure 6-10 Pre-Validation Steering Axle Errors by Truck and Speed – 100100 – 21-Mar-2008

Figure 6-11 shows the influence of speed for all single axles in the test truck population. Even without the outlying values, a slight increase in scatter is observed with increasing speed.

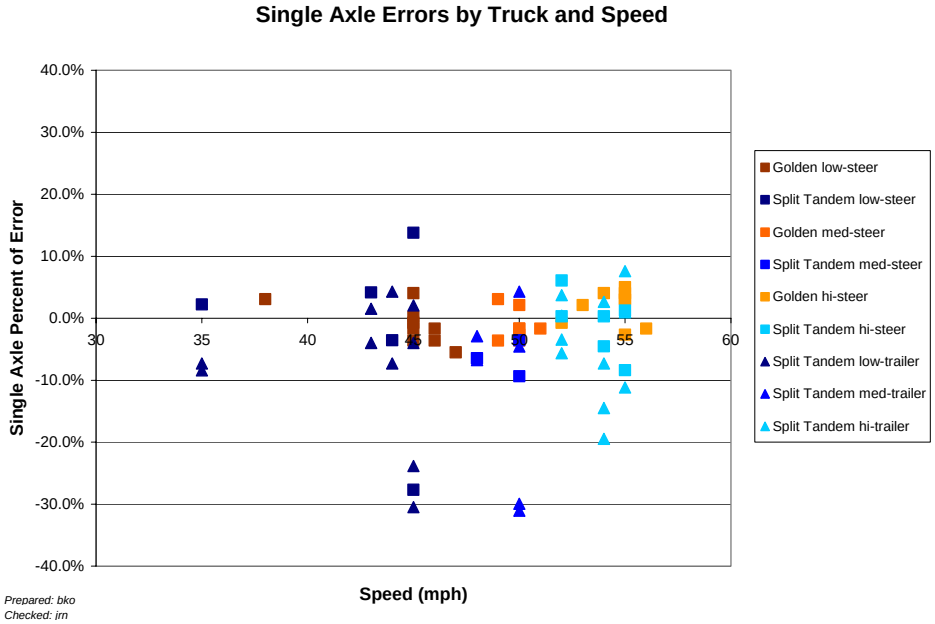

Figure 6-11 Pre-Validation Single Axle Errors by Truck and Speed – 100100 – 21-Mar-2008

When the tandem axle trends are compared to the two trucks as in Figure 6-12, two different patterns emerge. For the golden truck (squares), the scatter is similar across the speed range but the error goes from underestimation to overestimation. For the split tandem truck, no such trend appears, just a fairly wide scatter of estimates.

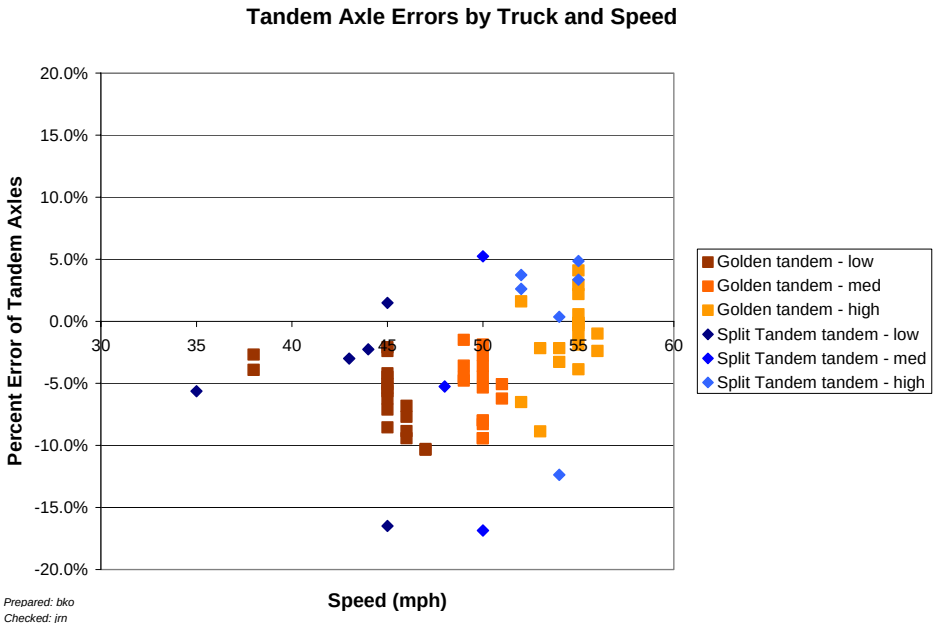

Figure 6-12 Pre-Validation Tandem Axle Errors by Truck and Speed – 100100 – 21-Mar-2008

6.3 Classification Validation

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

The classification validation is intended to find gross errors in vehicle classification, not to validate the installed algorithm. A sample of 100 trucks was collected at the site. The classification identification is to identify gross errors in classification, not validate the classification algorithm. Video was taken at the site to provide ground truth for the evaluation. Based on a 100 percent sample it was determined that there are 0 percent unknown vehicles and 4 percent unclassified vehicles. The unclassified vehicles included one Class 6, one Class 9 and two Class 10s. There were only one Class 4 and four Class 10s contributing to the large misclassification percentages for those classes.

The second check is the ability of the algorithm to correctly distinguish between truck classes with no more than 2% errors in such classifications. Table 6-4 has the classification error rates by class. The overall misclassification rate is 5.9 percent.

Table 6-4 Truck Misclassification Percentages for 100100 – 18-Mar-2008

Class	Percent Error	Class	Percent Error	Class	Percent Error
4	100	5	4	6	8
7	0				
8	0	9	2	10	50
11	N/A	12	N/A	13	N/A

Prepared: bko *Checked:jrn*

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

Table 6-5 Truck Classification Mean Differences for 100100 – 21-Mar-2008

Class	Mean Difference	Class	Mean Difference	Class	Mean Difference
4	-100	5	4	6	- 8
7	0				
8	0	9	- 2	10	- 50
11	N/A	12	N/A	13	N/A

Prepared: bko *Checked:jrn*

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. In this case the one Class 4 observed was not identified as such by the equipment. Numbers 1 or larger indicate at least how many more vehicles are assigned to the class than the actual "hundred observed". Classes marked Unknown are those identified by the equipment but no vehicles of the type were seen the observer. There is no way to tell how many vehicles of that type might actually exist. N/A means no vehicles of the class were recorded by either the equipment or the observer. The Class 4 misclassification was the result of one bus classified as a Class 5 vehicle. All other misclassifications were Class 6, 9 and 10 vehicles that were identified as Class 15 due to irregular axle spacings.

A limited investigation of the precision and bias of the speeds reported by the equipment was undertaken. The values were not within the expected tolerances. The classification errors occurred at speeds slightly above the speed range for the validation. There is no indication from the lack of spacing errors in the validation range that speed might have contributed to the misclassification in spite of the precision of the speed estimate failing to meet expectations for research quality data.

6.4 Evaluation by ASTM E-1318 Criteria

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

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

Characteristic	Limits for Allowable Error	Percent within Allowable Error	Pass/Fail
Single Axles	**± 20%**	**93%**	**Fail**
Axle Groups	± 15%	97%	Pass
GVW	**± 10%**	**93%**	**Fail**

Prepared: bko *Checked:jrn*

6.5 Prior Validations

The last validation for this site was done August 8, 2007. It was the first validation of the site. The site was producing research quality data. Figure 6-13 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 78,050 lbs. The "partial" truck which had air suspension on both tandems was loaded to 63,890lbs.

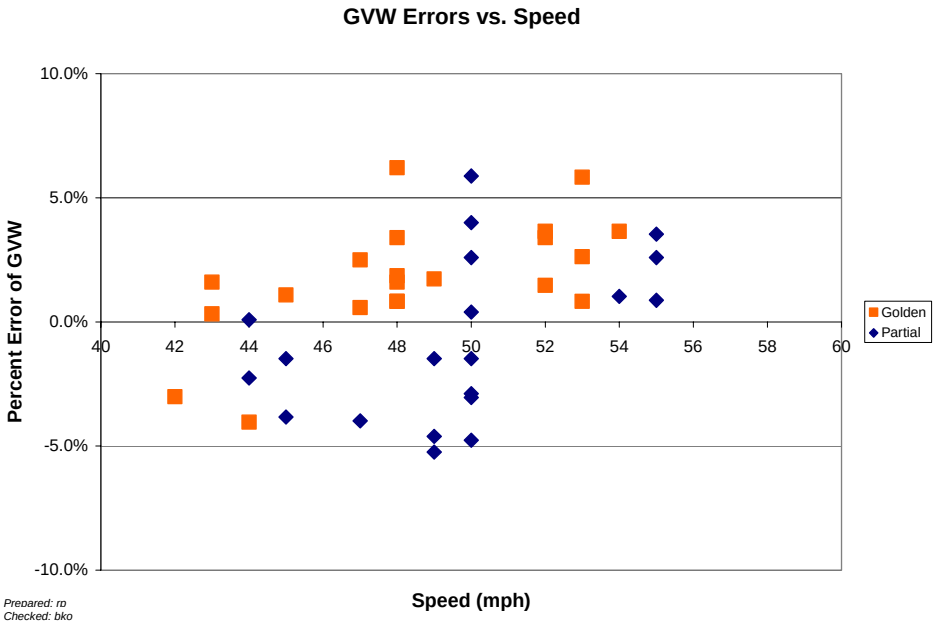

Figure 6-13 Last Validation GVW Percent Error vs. Speed – 100100 – 08-Aug-2007

Table 6-7 shows the overall results from the last validation. The equipment was producing essentially unbiased research quality data. The last validation had somewhat biased estimates of axle spacing.

Table 6-7 Last Validation Final Results – 100100 – 08-Aug-2007

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	2.1 ± 7.0%	Pass
Tandem axles	±15 percent	0.3 ± 8.0%	Pass
Gross vehicle weights	±10 percent	0.6 ± 6.2%	Pass
Axle spacing	± 0.5 ft [150 mm]	-0.2 ± 0.1 ft	Pass

Prepared: bko *Checked:jrn*

Table 6-8 has the results at the end of the last validation by temperature. Through this validation the equipment has been observed at temperature from 31 to 125 degrees Fahrenheit. The temperatures for the last validation were at the upper end of the expected range for this location. The current observations are at the lower end and middle of the expected range.

Table 6-8 Last Validation Results by Temperature Bin – 100100 – 08-Aug-2007

Element	95% Limit	Low Temperature 80 to 105 °F	High Temperature 106 to 125 °F
Steering axles	±20 %	0.9 ± 7.9%	3.2 ± 5.9%
Tandem axles	±15 %	-0.1 ± 8.3%	0.6 ± 7.9%
GVW	±10 %	0.1 ± 6.5%	1.0 ± 6.3%
Axle spacing	± 0.5 ft	-0.2 ± 0.1 ft	-0.2 ± 0.1 ft

Prepared: bko *Checked:jrn*

Table 6-9 has the results of the prior post validation by speed groups. Essentially the same speed bins were used for the current validation.

Table 6-9 Last Validation Results by Speed Bin – 100100 – 08-Aug-2007

Element	95% Limit	Low Speed 40 to 46 mph	Medium Speed 47 to 50 mph	High Speed 51+ mph
Steering axles	±20 %	-0.2 ± 5.7%	2.3 ± 7.2%	3.6 ± 7.7%
Tandem axles	±15 %	-1.6 ± 8.3%	-0.1 ± 8.7%	2.4 ± 4.7%
GVW	±10 %	-1.3 ± 4.9%	0.2 ± 7.1%	2.7 ± 3.4%
Axle spacing	± 0.5 ft	-0.1 ± 0.1 ft	-0.1 ± 0.1 ft	-0.2 ± 0.1 ft

Prepared: bko *Checked:jrn*

7 Data Availability and Quality

As of March 21, 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.

Table 7-1 Amount of Traffic Data Available 100100 – 21-Mar-2008

Year	Classification Days	Months	Coverage	Weight Days	Months	Coverage
2007	77	3	Full week	77	3	Full week

Prepared: bko *Checked:jrn*

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

Class 9s and Class 5 constitute more than 10 percent of the truck population. Based on the data collected from the end of the last calibration iteration the following are the expected values for these populations. The precise values to be used in data review will need to be determined by the 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 – 100100 – 21-Mar-2008

Characteristic	Class 9	Class 5
Percentage Overweights	0.6%	0%
Percentage Underweights	0.2%	0.6%
Unloaded Peak	32, 000 lbs.	
Loaded Peak	76,000 lbs.	
Peak		4,000 lbs

Prepared: bko *Checked:jrn*

The expected percentage of unclassified vehicles is 0.7 percent. This is based on the percentage of unclassified vehicles in the post-validation data download.

The graphical screening comparison figures are found in Figure 7-1 through Figure 7-4. These are based on data collected immediately after the validation and may not be wholly representative of the population at the site. They should however provide a sense of the statistics expected when SPS comparison data is computed for the Post-Validation Sheet 16.

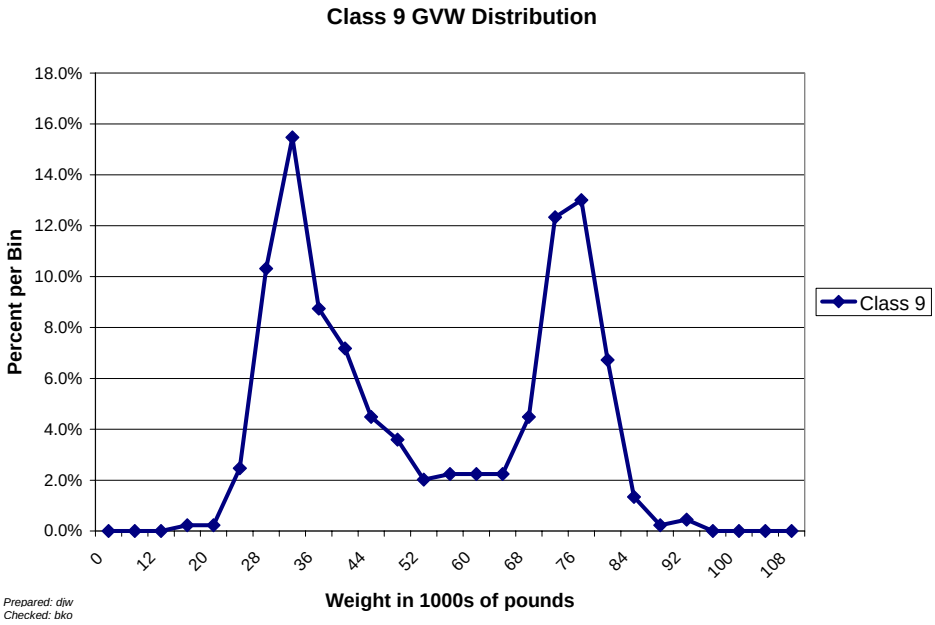

Figure 7-1 Expected GVW Distribution Class 9 – 100100 – 21-Mar-2008

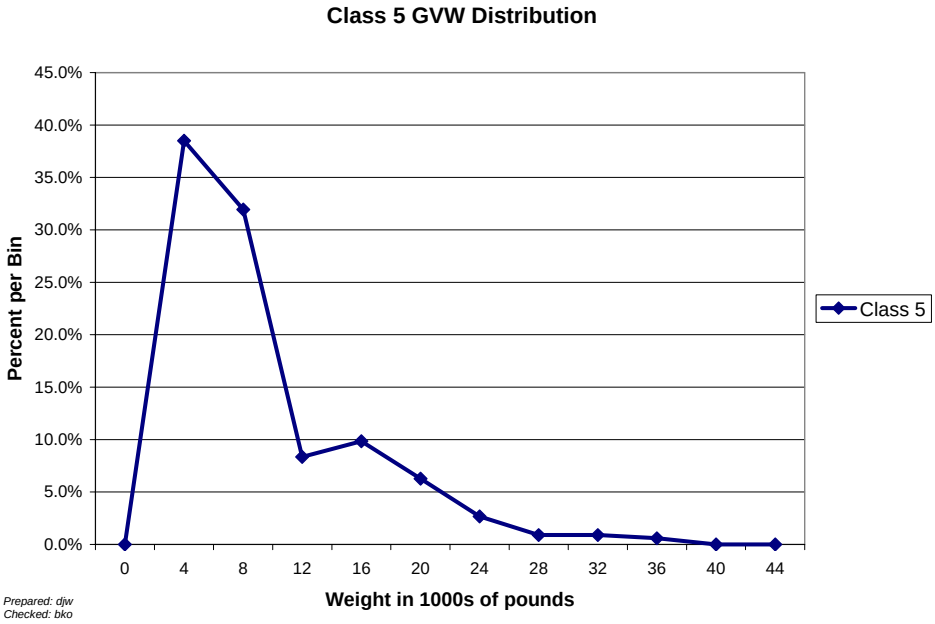

Figure 7-2 Expected GVW Distribution Class 5 – 100100 – 21-Mar-2008

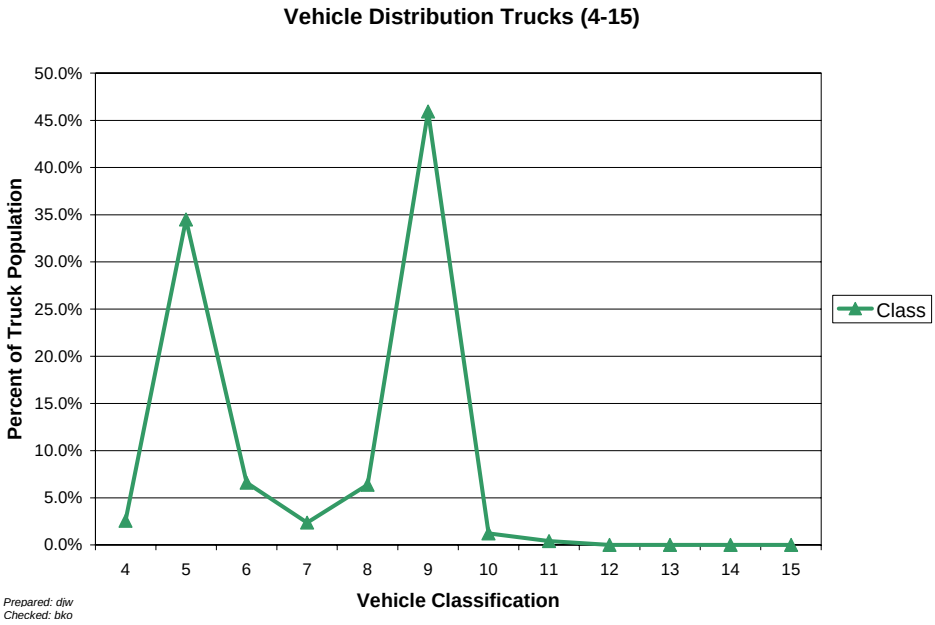

Figure 7-3 Expected Vehicle Distribution – 100100 – 21-Mar-2008

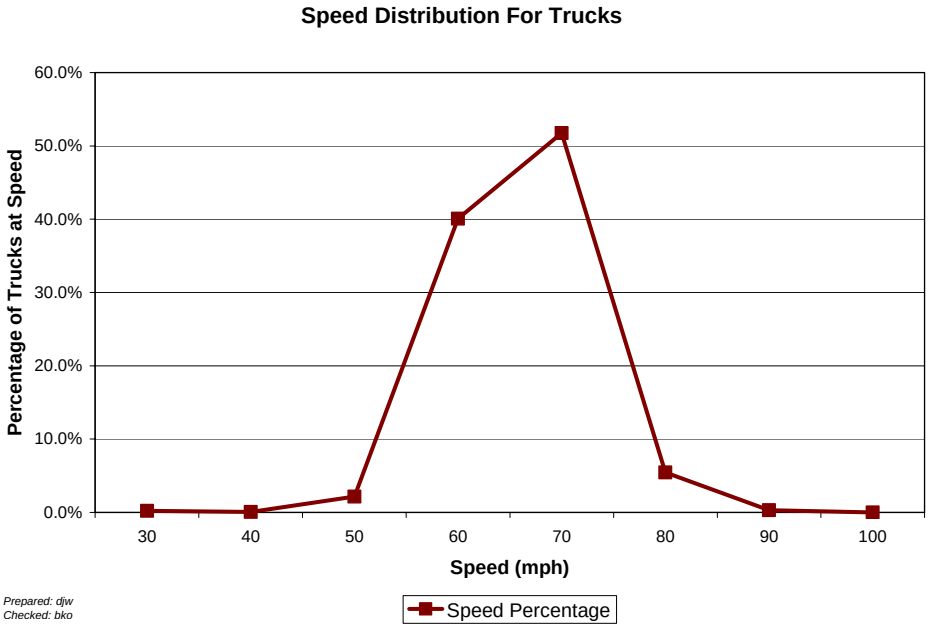

Figure 7-4 Expected Speed Distribution – 100100 – 21-Mar-2008

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 (day 1) - loaded 3S2 with a split tandem on the trailer (2 pages)

Sheet 19 – Truck 3 (day 2) – 3S2 partially loaded (2 pages)

Sheet 20 – Classification verification – pre-validation (2 pages)
Sheet 20 – Classification verification – post-validation (2 pages)

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

Calibration Iteration 1 Worksheets – (1 pages)

Test Truck Photographs (9 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 on the following page. It includes a current Sheet 17 with all applicable maps and photographs. The Agency and FHWA contact information has been updated since the original distribution of the Pre-Visit Handout Guide.

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 VALIDATION

STATE: Delaware

SHRP ID: 0100

Figures

1. General Information

SITE ID: *100100*

LOCATION: *US 113 SB (Mile Post: 25.04) (North of SR 579, Ellendale)*

VISIT DATE: *March 18, 2008*

VISIT TYPE: *Validation*

2. Contact Information

POINTS OF CONTACT:

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

Highway Agency: *Wayne Kling, 302-760-2400, wayne.kling@state.de.us*

Joe Cantalupo, 302-760-2121, joseph.cantalupo@state.de.us

Tyrone Crittenden, 302-760-2162, tyrone.crittenden@state.de.us

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

FHWA Division Office Liaison*: Tashia J. Clemons, 302-734-5324, Tashia.clemons@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: *March 18 to 21, 2008*

TRUCK ROUTE CHECK: *See Route Map*

4. Site Location/ Directions

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

DIRECTIONS TO THE SITE: *Near Intersection of US 113 and SR 579*

MEETING LOCATION: *On site at 9:00 AM, March 18, 2008*

WIM SITE LOCATION: *On US 113 Southbound just North of SR 579*

WIM SITE LOCATION MAP: *See Figure 4.1*

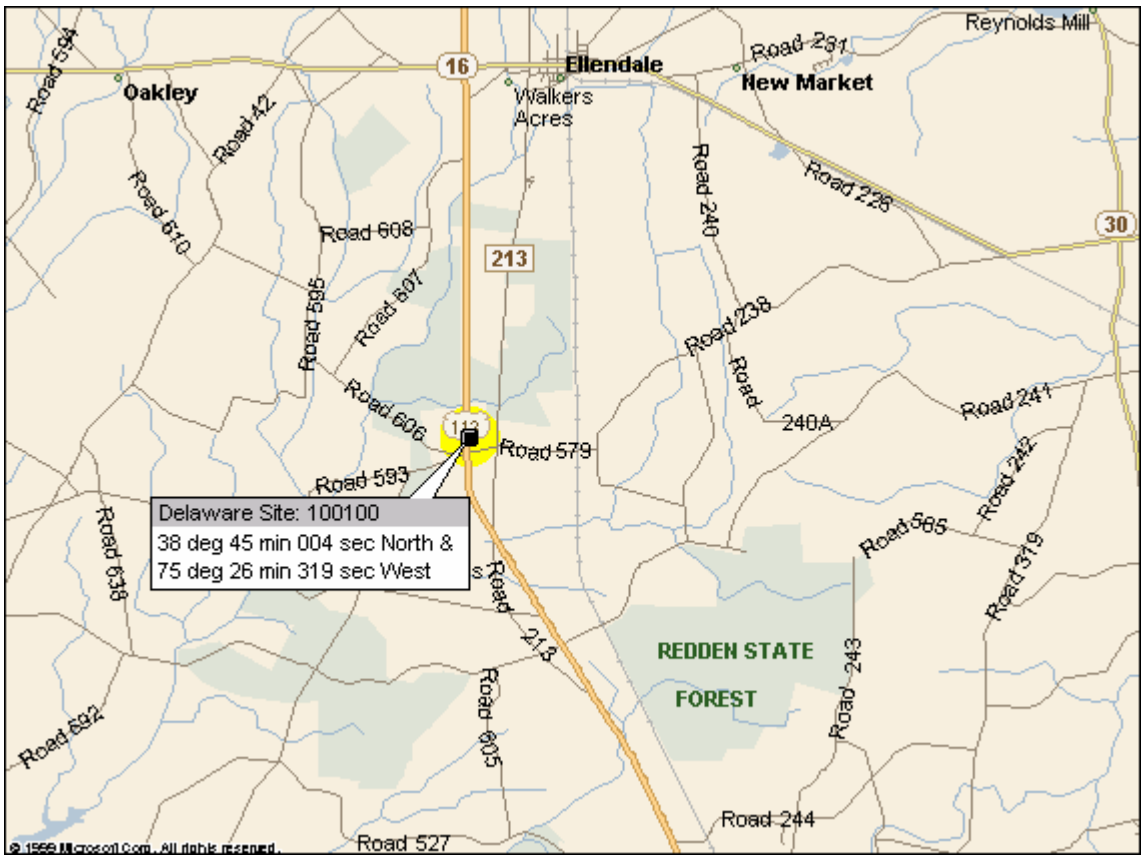

Figure 4-1 Section 100100 near Ellendale, Delaware

5. Truck Route Information

ROUTE RESTRICTIONS: *None*

SCALE LOCATION: *Royster-Clark, Inc., 250 N. Rehoboth Blvd., Milford, DE*

TRUCK ROUTE:

- 0.660 miles to Southbound turn around (38^0 45’ 258’’ North and 75^0 26’ 175’’ West)
- 1.376 miles slow turn around to go Northbound or
- 1.813 miles high speed turn around past WIM to go Northbound (38^0 46’ 799’’ North and 75^0 26’ 311’’ West)

6. Sheet 17 – Delaware (100100)

1.* ROUTE ___US 113____ MILEPOST __25.04__ LTPP DIRECTION - N S E W

2.* WIM SITE DESCRIPTION - Grade ___< 1_____ % Sag vertical Y / N
Nearest SPS section upstream of the site __0__1__0__4__
Distance from sensor to nearest upstream SPS Section ___1_2__6____ ft

3.* LANE CONFIGURATION
Lanes in LTPP direction __2__ Lane width _1_ _2_ ft

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

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

Shoulder width _1___2__ ft

4.* PAVEMENT TYPE _____Portland Concrete Cement_____

5.* PAVEMENT SURFACE CONDITION – Distress Survey
Date _3/18/2008____ Filename: __10_0100_Upstream_03_18_2008.jpg _____
Date _3/18/2008____ Filename: __10_0100_Downstream_03_18_2008.jpg _____
Date _____ Filename: _____

6. * SENSOR SEQUENCE _____

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 _50_____ ft

Distance from system ___5_6 ft

TYPE _____

CABINET ACCESS controlled by LTPP / STATE / JOINT?

Contact - name and phone number ___Tom Hrupsa 302-222-5931____

Alternate - name and phone number _____Mike Sommers 302-659-2024_____

11. * POWER

Distance to cabinet from drop __6_1_5__ ft Overhead / under ground / solar / AC in cabinet?

Service provider _____Del Electric Co-op___Phone number _____

12. * TELEPHONE

Distance to cabinet from drop ___ ___ ___ ft Overhead / under ground / cell?

Service provider _Verizon(302-856-5666)_ Phone Number _____

13.* SYSTEM (software & version no.)- ___ADR 3000_____

Computer connection – RS232 / Parallel port / USB / Other _____

14. * TEST TRUCK TURNAROUND time __15_____ minutes

DISTANCE __~11.5 __ mi.

15. PHOTOS FILENAME

Power source 10_0100_Power_Source_03_18_2008.jpg

Phone source 10_0100_Telephone_Source_03_18_2008.jpg

Cabinet exterior 10_0100_Cabinet_Exterior_03_18_2008.jpg

Cabinet interior 10_0100_Cabinet_Interior_Front_03_18_2008.jpg

10_0100_Cabinet_Interior_Rear_03_18_2008.jpg

Old Cabinet 10_0100_Old_Cabinet_03_18_2008.jpg

Weight sensors 10_0100_Leading_WIM_Sensor_03_18_2008.jpg

10_0100_Trailing_WIM_Sensor_03_18_2008.jpg

Classification sensors _None_____

Other sensors 10_0100_Leading_Loop_03_18_2008.jpg

10_0100_Trailing_Loop_03_18_2008.jpg

Description _Loops_____

Downstream direction at sensors on LTPP lane

__10_0100_Downstream_03_18_2008.jpg _____ _

Upstream direction at sensors on LTPP lane

__10_0100_Upstream_03_18_2008.jpg _____

COMMENTS ____78'6" End of 104 to Concrete_____

COMPLETED BY ____Dean Wolf_____

PHONE _301-210-5105_____ DATE COMPLETED _3/ /2008___

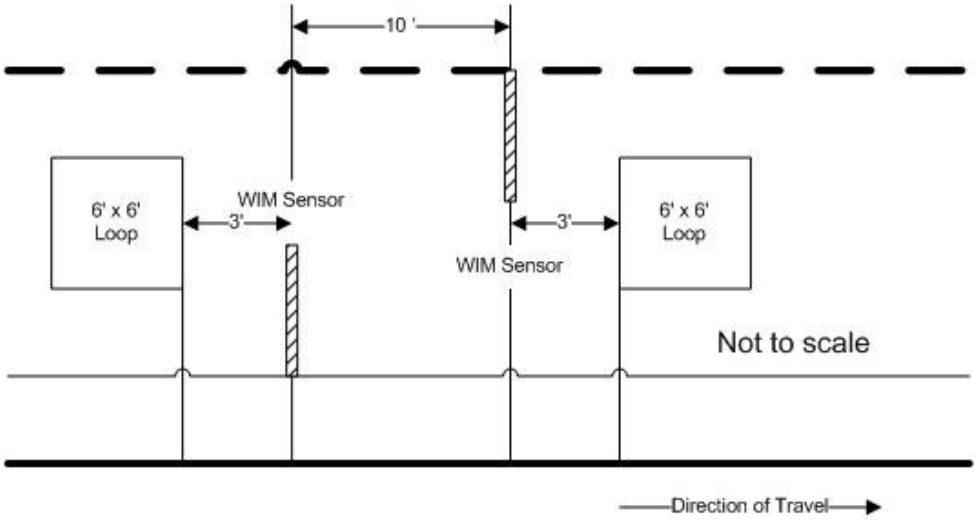

Figure 6-1 Equipment Layout 100100

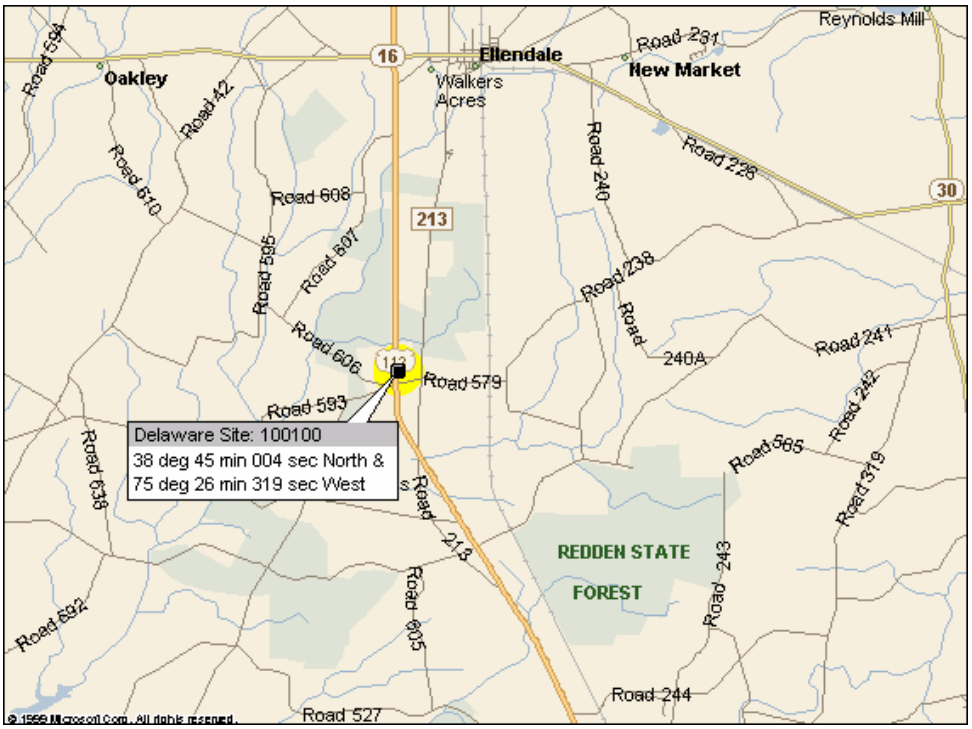

Figure 6-2 Section 100100 near Ellendale, Delaware

Photo 6-1 10_0100_Upstream_03_18_2008.jpg

Photo 6-2 10_0100_Downstream_03_18_2008.jpg

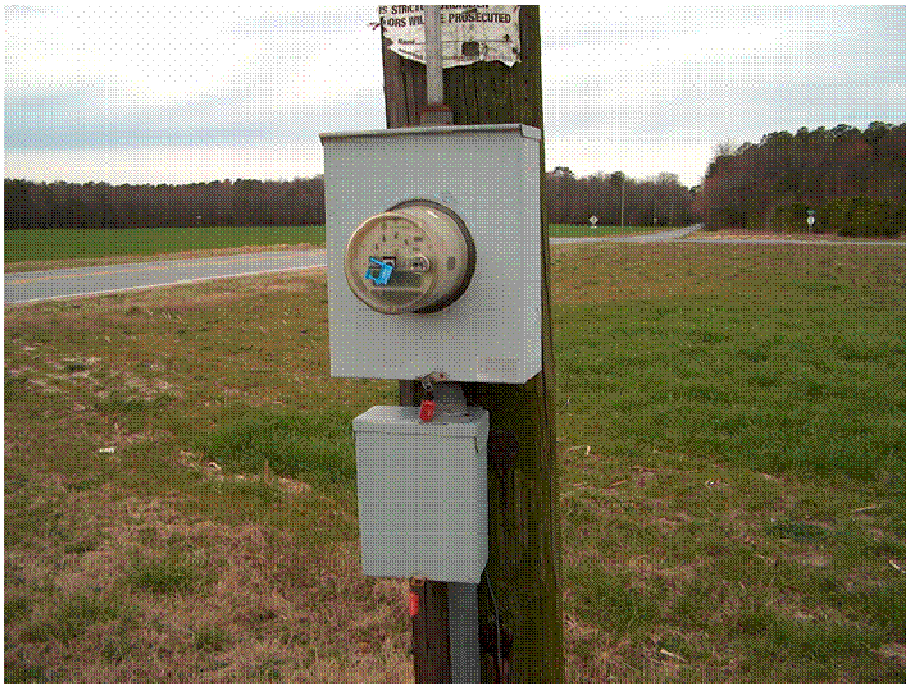

Photo 6-3 10_0100_Power_Meter_03_18_2008.jpg

Photo 6-4 10_0100_Telephone_Box_03_18_2008.jpg

Photo 6-5 10_0100_Cabinet_Exterior_03_18_2008.jpg

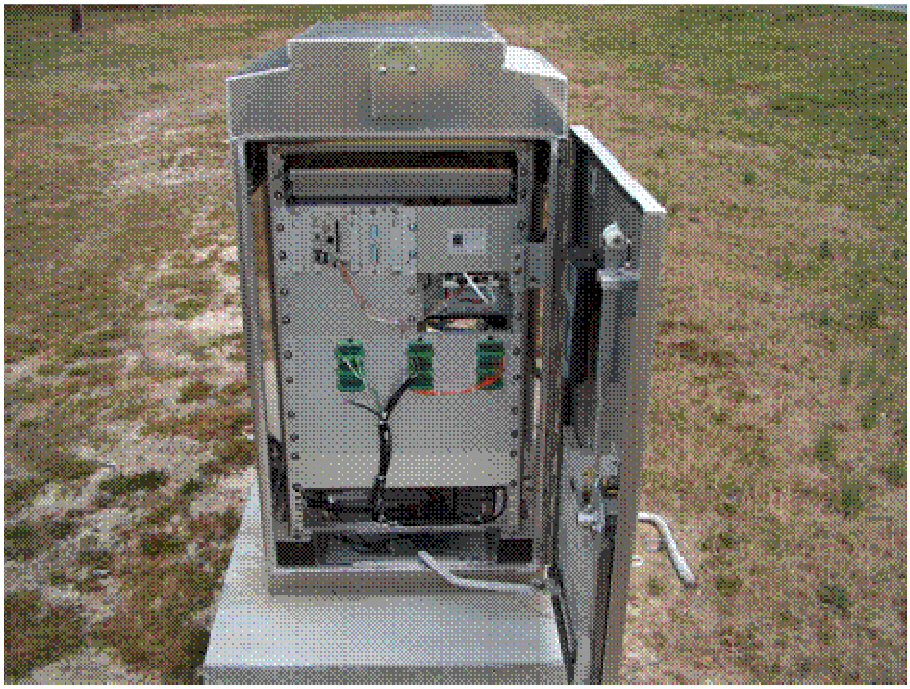

Photo 6-6 10_0100_Cabinet_Interior_Front_03_18_2008.jpg

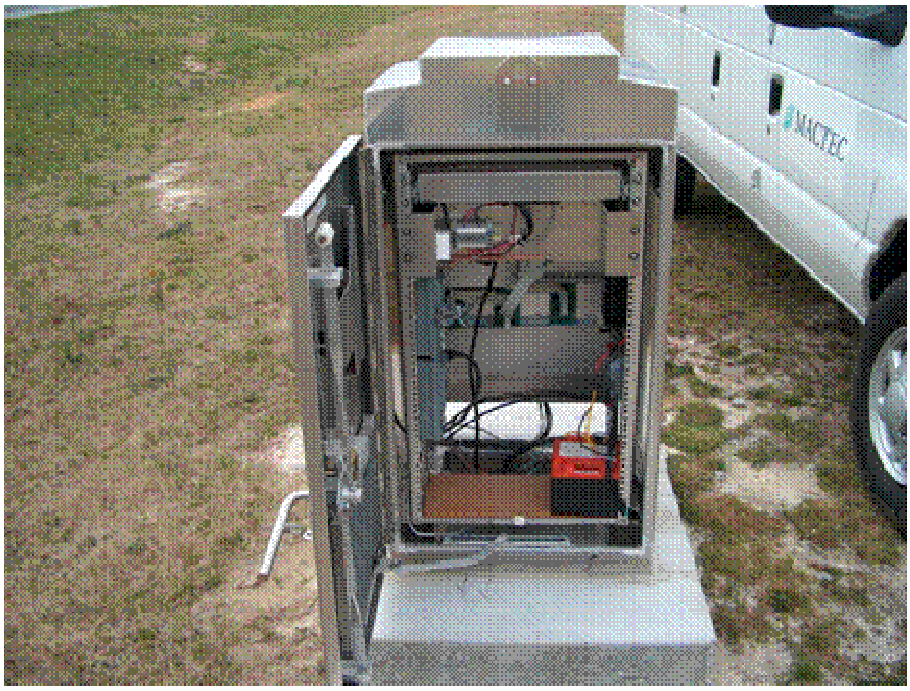

Photo 6-7 10_0100_Cabinet_Interior_Rear_03_18_2008.jpg

Photo 6-8 10_0100_Leading _WIM_Sensor_03_18_2008.jpg

Photo 6-9 10_0100_ Trailing WIM_Sensor_03_18_2008.jpg

Photo 6-10 10_0100_Leading_Loop_Sensor_03_18_2008.jpg

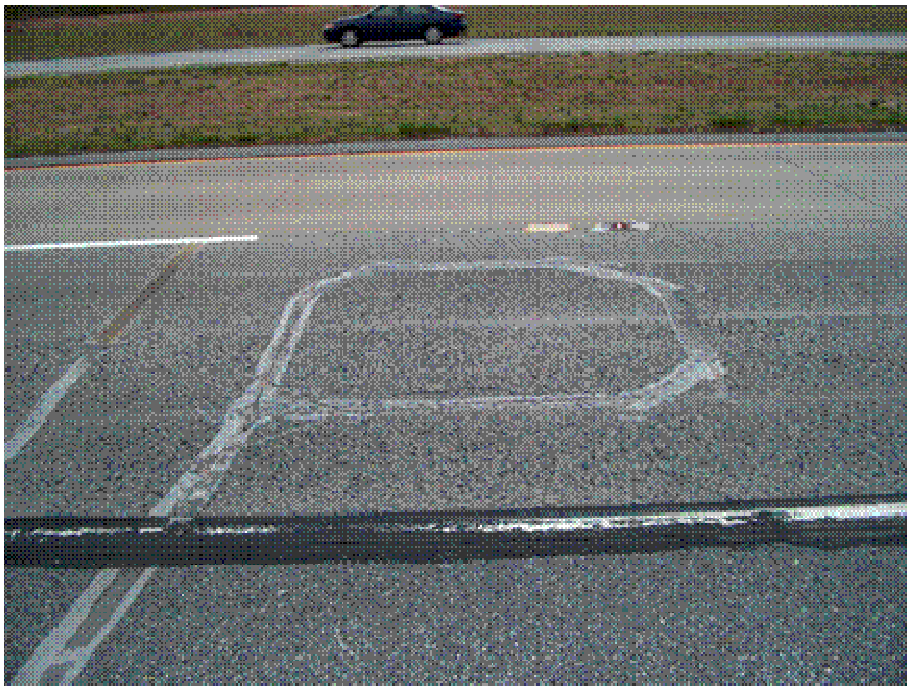

Photo 6-11 10_0100_ Trailing_Loop_Sensor_03_18_2008.jpg

Photo 6-12 10_0100_Old_Cabinet_03_18_2008.jpg

SHEET 18	STATE CODE [10]
LTPP MONITORED TRAFFIC DATA	SPS PROJECT ID [0100]
WIM SITE COORDINATION	DATE: (mm/dd/yyyy) 3/18/2007

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 – _____

e. Test Vehicles
   i. Trucks –
      1st – Air suspension 3S2 ☐ State ☒ LTPP
      2nd – 3S2 different weight/suspension ☐ State ☒ LTPP
      3rd – _____ ☐ State ☐ LTPP
      4th – _____ ☐ State ☐ LTPP
   ii. Loads – ☐ State ☒ LTPP
   iii. Drivers – ☐ State ☒ LTPP

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

   _____

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

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

i. Traffic Control Required – ☐ Yes ☒ No

j. Enforcement Coordination Required – ☐ Yes ☒ No

5. SITE SPECIFIC CONDITIONS –
   a. Funds and accountability – _____
   b. Reports – _____
   c. Other – _____
   d. Special Conditions – _____

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

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

      Agency: IRD

b. Maintenance (equipment) –

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

Agency: IRD

c. Data Processing and Pre-Visit Data –

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

Agency: IRD

d. Construction schedule and verification –

Name: _____ Phone:_____

Agency: _____

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

Name: _____ Phone:_____

Agency: _____

f. Traffic Control –

Name: _____ Phone:_____

Agency: _____

g. Enforcement Coordination –

Name: _____ Phone:_____

Agency: _____

h. Nearest Static Scale

Name: Royster-Clark, Inc. Location:Milford, DE

Phone: 302-422-3570

SHEET 16 **LTPP MONITORED TRAFFIC DATA** **SITE CALIBRATION SUMMARY**	*STATE ASSIGNED ID [__ __ __ __] *STATE CODE [10] *SHRP SECTION ID [0100]

SITE CALIBRATION INFORMATION

1. * DATE OF CALIBRATION (MONTH/DAY/YEAR) [3/20/2008]

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

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

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

5. EQUIPMENT MANUFACTURER ___IRD/ PAT Traffic_____

WIM SYSTEM CALIBRATION SPECIFICS**

6.**CALIBRATION TECHNIQUE USED:

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

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

__ 20__ PASSES PER TRUCK

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

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

7. SUMMARY CALIBRATION RESULTS (EXPRESSED AS A PERCENT)

MEAN DIFFERENCE BETWEEN ---

DYNAMIC AND STATIC GVW	___-4.1	STANDARD DEVIATION ___5.6
DYNAMIC AND STATIC SINGLE AXLES	___-3.4	STANDARD DEVIATION ___8.9
DYNAMIC AND STATIC DOUBLE AXLES	___-3.9	STANDARD DEVIATION ___4.7

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

9. DEFINE THE SPEED RANGES USED (MPH) _____ _45_ __50__ __55_ _____ __ __ _____ _____
_____ _____ _____ _____ _____ _____ _____ _____ _____ _____

10. CALIBRATION FACTOR (AT EXPECTED FREE FLOW SPEED) ___3369 / 3689___

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

CLASSIFIER TEST SPECIFICS***

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

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

14. MEAN DIFFERENCE IN VOLUMES BY VEHICLES CLASSIFICATION:

*** FHWA CLASS 9 ____ 0	FHWA CLASS ____	____ ____ _____
*** FHWA CLASS 8 ____ 0	FHWA CLASS ____	____ ____ _____
	FHWA CLASS ____	____ ____ _____
	FHWA CLASS ____	____ ____ _____

*** PERCENT "UNCLASSIFIED" VEHICLES: ____ 4.0

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 [10] *SHRP SECTION ID [0100]

SITE CALIBRATION INFORMATION

1. * DATE OF CALIBRATION (MONTH/DAY/YEAR) [3/21/2008]

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

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

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

5. EQUIPMENT MANUFACTURER ___IRD/ PAT Traffic_____

WIM SYSTEM CALIBRATION SPECIFICS**

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

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

   __ 20__ PASSES PER TRUCK

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

TRUCK	TYPE	SUSPENSION
1	___9____	___1_____
2	___9____	___1_____
3	_____	_____

7. SUMMARY CALIBRATION RESULTS (EXPRESSED AS A PERCENT)
   MEAN DIFFERENCE BETWEEN ---
   DYNAMIC AND STATIC GVW ___-0.5 STANDARD DEVIATION ___2.9
   DYNAMIC AND STATIC SINGLE AXLES ___1.8 STANDARD DEVIATION ___2.9
   DYNAMIC AND STATIC DOUBLE AXLES ___-0.8 STANDARD DEVIATION ___3.6

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

9. DEFINE THE SPEED RANGES USED (MPH) _____ _45_ __50__ __55_ _____ __ __ _____ _____
   _____ _____ _____ _____ _____ _____ _____ _____ _____ _____

10. CALIBRATION FACTOR (AT EXPECTED FREE FLOW SPEED) ___3369 / 3689___

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

CLASSIFIER TEST SPECIFICS***

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

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

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

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

APPENDIX A

Sheet 19	* STATE_CODE	10
LTPP Traffic Data	* SPS PROJECT ID	0100
*CALIBRATION TEST TRUCK # 1	* DATE	03/20/08

Rev. 08/31/01

PART I.

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

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

GEOMETRY

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

9. a) * Make: FREIGHTLINER b) * Model: CLASSIC XL

10.* Trailer Load Distribution Description:

CRANE COUNTERWEIGHT LOADED MID-TRAILER

CONCRETE BLOCK LOADED ALONG TRAILER

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

b). Trailer Tare Weight (units): _____

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

A to B 19.4 B to C 4.2 C to D 37.4

D to E 4.1 E to F _____

Wheelbase (measured A to last) _____ Computed _____

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

(+ is to the rear)

SUSPENSION

Axle	14. Tire Size	15.* Suspension Description (leaf, air, no. of leaves, taper or flat leaf, etc.)
A	11R24.5	2 FULL LEAF
B	11R24.5	AIR
C	11R24.5	AIR
D	11R22.5	AIR
E	11R22.5	AIR
F		

Sheet 19	* STATE_CODE	10
LTPP Traffic Data	* SPS PROJECT ID	0100
*CALIBRATION TEST TRUCK # 1	* DATE	03-20-08

Rev. 08/31/01

PART II Day 1

7.1b *b) Average Pre-Test Loaded weight 78925
*c) Post Test Loaded Weight 78140
*d) Difference Post Test – Pre-test -785

Table 2. Raw Axle and GVW measurements

Axles – by axle group	Meas.	Pre-test	Post-test	Other
A (1)	I	10500	10170	
B + C (1)	II	33940	33600	
D + E (1)	III	34480	34310	
A (2)	IV	10500	10300	
B + C (2)	V	33950	33600	
D + E (2)	VI	34480	34300	
A (3)	VII			
B + C (3)	VIII			
D + E (3)	IX			

Table 4. Axle and GVW computations - pre-test axle groups

Axle A		Axle B –C		Axle D-E		GVW	
I	10500	II	33940	III	34480	I+II+III	78920
VI	10500	V	33950	VI	34480	IV+V+VI	78930
VII		VIII		IX		VII+VIII+IX	
Avg.	10500		33945		34480		78925

Table 5a. Axle and GVW computations - post test axle groups

Axle A		Axle B - C		Axle D-E		GVW	
I	10170	II	33600	III	34310	I+II+III	78080
VI	10300	V	33600	VI	34300	IV+V+VI	78200
VII		VIII		IX		VII+VIII+IX	
Avg.	10235		33600		34305		78140

Table 5b. Axle and GVW computations - Other axle groups

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

Measured By DSW Verified By MD Weight date 3/20/08

PART II Day 2

Sheet 19	* STATE_CODE	10
LTPP Traffic Data	* SPS PROJECT ID	0100
*CALIBRATION TEST TRUCK # 1	* DATE	3-21-08

Rev. 08/31/01

Day 2

7.1b *b) Average Pre-Test Loaded weight ~~79310~~ 79305
*c) Post Test Loaded Weight ~~78960~~ 78455
*d) Difference Post Test – Pre-test -850 ~~-850~~ OK

Table 2.2 Raw Axle and GVW measurements

Axles – by axle group	Meas.	Pre-test	Post-test	Other
A (1)	I	10610	10380	
B + C (1)	II	34150	33740	
D + E (1)	III	34520	34370	
A (2)	IV	10740	10360	
B + C (2)	V	34080	33690	
D + E (2)	VI	34510	34370	
A (3)	VII			
B + C (3)	VIII			
D + E (3)	IX			

Table 4.2 Axle and GVW computations - pre-test axle groups

Axle A		Axle B –C		Axle D-E		GVW	
I	10610	II	34150	III	34520	I+II+III	79280
VI	10740	V	34080	VI	34510	IV+V+VI	79330
VII		VIII		IX		VII+VIII+IX	
Avg.	10675		34115		34515		79305

Table 5.2a Axle and GVW computations - post test axle groups

Axle A		Axle B - C		Axle D-E		GVW	
I	10380	II	33740	III	34370	I+II+III	78490
VI	10360	V	33690	VI	34370	IV+V+VI	78420
VII		VIII		IX		VII+VIII+IX	
Avg.	10370		33715		34370		78455

Table 5.2b Axle and GVW computations - Other axle groups

Axle A		Axle B - C		Axle D-E		GVW	
I	*	II		III		I+II+III	
VI		V		VI		IV+V+VI	
VII		VIII		IX		VII+VIII+IX	
Avg.							

Measured By RJW Verified By BKD Weight date 3-21-08

PART II Day 3

Sheet 19	* STATE_CODE	10
LTPP Traffic Data	* SPS PROJECT ID	0100
*CALIBRATION TEST TRUCK # 2	* DATE	03/20/08

Rev. 08/31/01

PART I.

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

AXLES - units - lbs / 100s lbs / kg

GEOMETRY

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

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

10.* Trailer Load Distribution Description:

CRANE COUNTERWEIGHTS LOADED MID-TRAILER

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

b). Trailer Tare Weight (units): _____

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

A to B 19.4 B to C 4.3 C to D 31.7

D to E 10.1 E to F _____

Wheelbase (measured A to last) _____ Computed _____

13. *Kingpin Offset From Axle B (units) + 1.7 (_____)

(+ is to the rear)

SUSPENSION

Axle	14. Tire Size	15.* Suspension Description (leaf, air, no. of leaves, taper or flat leaf, etc.)
A	11R24.5	4 FULL LEAF
B	11R24.5	AIR
C	11R24.5	AIR
D	11R22.5	AIR
E	11R22.5	AIR
F		

Sheet 19	* STATE_CODE	10
LTPP Traffic Data	* SPS PROJECT ID	0100
*CALIBRATION TEST TRUCK # 2	* DATE	03-20-08

Rev. 08/31/01

PART II Day 1

7.1b

*b) Average Pre-Test Loaded weight 73630 ~~73540~~

*c) Post Test Loaded Weight 73015

*d) Difference Post Test – Pre-test -615

Table 2. Raw Axle and GVW measurements

Axles – by axle group	Meas.	Pre-test	Post-test	Other
A (1)	I	10430	10310	
B + C (1)	II	26800	26530	
D + E (1)	III	36360	36140	
A (2)	IV	10430	10310	
B + C (2)	V	26880	26600	
D + E (2)	VI	36360	36140	
A (3)	VII			
B + C (3)	VIII			
D + E (3)	IX			

Table 4. Axle and GVW computations - pre-test axle groups

Axle A		Axle B –C		Axle D-E		GVW	
I	10430	II	26800	III	36360	I+II+III	73590
VI	10430	V	26880	VI	36360	IV+V+VI	73670
VII		VIII		IX		VII+VIII+IX	
Avg.	10430		26840		36360		46
							73630

Table 5a. Axle and GVW computations - post test axle groups

Axle A		Axle B - C		Axle D-E		GVW	
I	10310	II	26530	III	36140	I+II+III	72980
VI	10310	V	26600	VI	36140	IV+V+VI	73050
VII		VIII		IX		VII+VIII+IX	
Avg.	10310		26565		36140		73015

Table 5b. Axle and GVW computations - Other axle groups

Axle A		Axle B - C		Axle D-E		GVW	
I	40	II		III		I+II+III	
VI		V		VI		IV+V+VI	
VII		VIII		IX		VII+VIII+IX	
Avg.							

Measured By DW Verified By [signature] Weight date 3-20-08

PART II Day 2

Sheet 19	* STATE_CODE	10
LTPP Traffic Data	* SPS PROJECT ID	0100
*CALIBRATION TEST TRUCK # 3	* DATE	03-26-08

Rev. 08/31/01

PART I.

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

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

GEOMETRY

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

9. a) * Make: FREIGHTLINER b) * Model: Classic XL

10.* Trailer Load Distribution Description:

CRANE COUNTERWEIGHTS LOADED MID-TRAILER

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

b). Trailer Tare Weight (units): _____

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

A to B 19.5 B to C 4.2 C to D 33.9

D to E 5.0 E to F _____

Wheelbase (measured A to last) _____ Computed _____

13. *Kingpin Offset From Axle B (units) 12.0 (_____)
(+ is to the rear)

SUSPENSION

Axle	14. Tire Size	15.* Suspension Description (leaf, air, no. of leaves, taper or flat leaf, etc.)
A	75R22.5	2 FW LEAF
B	75R22.5	AIR
C	75R22.5	AIR
D	75R24.5	AIR
E	75R24.5	AIR
F		

Sheet 19	* STATE_CODE	10
LTPP Traffic Data	* SPS PROJECT ID	0100
*CALIBRATION TEST TRUCK # 3	* DATE	03/26/08

Rev. 08/31/01

DAM 2

7.1b
*b) Average Pre-Test Loaded weight ~~66,670~~ 66665
*c) Post Test Loaded Weight ~~66,800~~ 65935
*d) Difference Post Test – Pre-test ~~+130~~ -730

Table 2.2 Raw Axle and GVW measurements

Axles – by axle group	Meas.	Pre-test	Post-test	Other
A (1)	I	9830	9610	
B + C (1)	II	29580	29070	
D + E (1)	III	27250	27290	
A (2)	IV	9650	9550	
B + C (2)	V	29530	28940	
D + E (2)	VI	27490	27410	
A (3)	VII			
B + C (3)	VIII			
D + E (3)	IX			

Table 4.2 Axle and GVW computations - pre-test axle groups

Axle A		Axle B –C		Axle D-E		GVW	
I	9830	II	29580	III	27250	I+II+III	66660
VI	9650	V	29530	VI	27490	IV+V+VI	66670
VII		VIII		IX		VII+VIII+IX	
Avg.							66665

Table 5.2a Axle and GVW computations - post test axle groups

Axle A		Axle B - C		Axle D-E		GVW	
I	9610	II	29070	III	27290	I+II+III	65970
VI	9550	V	28940	VI	27410	IV+V+VI	65900
VII		VIII		IX		VII+VIII+IX	
Avg.	9580		29005		27350		65935

Table 5.2b Axle and GVW computations - Other axle groups

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

Measured By DAM Verified By [signature] Weight date 3-21-08

PART II Day 3

Sheet 20	* STATE_CODE	1 0
LTPP Traffic Data	*SPS PROJECT_ID	0 1 0 0
Speed and Classification Checks * 1 of* 2	* DATE	3 / 18 / 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
64	9	44	64	9	60	9	175	61	9
60	9	60	59	9	64	9	176	64	9
59	9	67	58	9	57	7	185	58	7
63	9	75	63	9	59	9	190	60	9
62	8	87	62	8	67	9	195	65	9
56	10	88	57	10	64	6	202	64	6
61	6	89	57	6	55	6	203	57	6
63	7	90	57	7	54	9	205	54	9
64	9	91	63	9	59	8	206	60	8
58	5	101	58	5	60	15	230	60	10
62	9	108	58	9	59	9	231	59	9
54	6	116	54	6	60	15	232	60	10
64	6	117	54	6	60	9	239	62	9
62	5	127	62	5	53	9	248	54	9
50	5	129	53	5	62	9	255	62	9
65	8	130	62	8	59	5	266	59	5
63	9	131	62	9	62	9	268	65	9
56	10	133	56	10	57	6	274	57	6
49	8	134	49	8	60	9	276	60	9
61	9	138	63	9	61	7	280	61	7
59	5	147	62	5	57	7	282	60	7
63	5	153	61	5	60	5	293	60	5
55	5	156	59	5	55	5	294	56	5
61	5	165	61	5	62	9	307	62	9
62	9	166	61	9	65	5	311	65	5

14.2
18.8
13.6
4.0

Recorded by MARK Direction 5 Lane 1 Time from 1004AM to 1050AM

Sheet 20	* STATE_CODE	1 0
LTPP Traffic Data	*SPS PROJECT_ID	0 1 0 0
Speed and Classification Checks * 2 of* 2	* DATE	3 / 18 / 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
64	9	317	64	9	52	9	427	55	9
62	9	318	62	9	53	5	433	53	6
64	9	324	64	9	62	5	436	65	5
62	9	326	62	9	64	5	437	64	5
62	5	329	64	5	57	9	440	58	9
64	9	331	64	9	56	15	441	58	6
64	6	332	64	6	59	9	444	59	9
68	6	336	68	6	58	6	454	58	6
57	5	340	57	5	63	9	463	63	9
59	9	357	62	9	66	9	472	66	9
46	6	359	48	6	58	9	477	58	9
55	15	365	56	9	57	9	502	57	9
57	8	368	59	8	57	9	505	55	9
67	9	370	67	9	54	9	506	55	9
59	5	371	60	5	59	5	516	59	5
52	9	374	53	9	64	5	535	62	5
62	8	381	62	8	68	9	542	67	9
60	8	382	60	8	52	5	545	51	5
60	8	383	59	8	50	5	546	53	5
63	9	387	63	9	55	5	554	55	5
60	5	398	60	5	59	9	563	59	9
62	9	402	63	9	58	8	588	59	8
60	5	405	62	5	57	8	589	55	8
53	5	406	53	5	57	9	591	59	9
57	5	412	56	4	58	9	592	59	9

Recorded by MARK Direction S Lane 1 Time from 10:50 AM to 11:46 AM

Sheet 20	* STATE_CODE 1 0
LTPP Traffic Data	*SPS PROJECT_ID 0 1 0 0
Speed and Classification Checks * 1 of* 2	* DATE 3 / 21 / 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
54	5	18617	54	5	60	9	18972	60	9
52	5	18619	52	5	61	9	18976	61	9
54	5	18621	53	5	63	6	19010	63	6
64	9	18661	62	9	61	5	19012	60	5
59	5	18669	58	5	63	9	19018	63	9
63	5	18682	63	5	60	9	19020	59	9
57	9	18685	57	9	56	6	19079	56	6
60	5	18702	60	5	54	6	19088	54	6
49	5	18707	49	5	66	6	19089	65	6
65	5	18728	62	4	55	5	19104	55	5
65	9	18767	65	9	64	9	19144	64	9
67	9	18785	67	9	61	9	19147	59	9
62	9	18801	61	9	57	5	19149	55	5
57	5	18810	58	5	65	9	19159	64	9
58	5	18843	59	9	60	9	19161	60	9
57	9	18844	56	9	64	9	19162	63	9
55	9	18857	56	9	60	8	19164	60	8
63	9	18867	63	9	58	5	19171	59	5
57	6	18881	57	6	59	5	19182	59	5
71	5	18884	71	5	61	9	19213	61	9
62	9	18885	62	9	67	9	19214	67	9
63	9	18890	63	9	61	9	19215	60	9
62	9	18918	62	9	55	6	19218	54	6
60	5	18944	60	5	57	6	19234	55	6
64	9	18960	64	9	64	5	19252	64	5

Recorded by MARK Z Direction S Lane 1 Time from 12:14 PM to 1:58 PM

Sheet 20	* STATE_CODE 1 0
LTPP Traffic Data	*SPS PROJECT_ID 0 1 0 0
Speed and Classification Checks * 2 of* 2	* DATE 3 / 21 / 98

Rev. 08/31/2001

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
64	9	19256	63	9	63	5	19494	64	5
60	8	19258	58	8	72	9	19495	70	9
60	5	19260	60	5	63	9	19519	62	9
65	9	19262	64	9	60	9	19548	60	9
60	9	19286	60	9	55	9	19549	54	9
55	5	19292	56	5	54	9	19552	54	9
60	5	19306	60	5	64	6	19556	64	6
59	5	19310	59	5	59	5	19564	60	5
67	9	19314	66	9	50	7	19579	50	7
65	5	19326	65	5	55	6	19586	53	6
59	5	19330	59	5	67	9	19594	66	9
70	5	19344	67	5	61	9	19596	59	9
59	5	19349	58	5	55	6	19619	53	6
70	5	19355	60	5	65	9	19662	65	9
61	5	19382	60	5	63	6	19669	61	6
50	5	19383	48	5	57	5	19679	59	5
48	6	19385	47	6	67	9	19682	67	9
61	9	19392	61	9	63	5	19716	63	5
61	9	19393	61	9	62	5	19717	62	4
72	5	19418	72	5	57	6	19727	55	6
57	5	19431	56	5	55	9	19729	54	9
58	9	19437	58	9	62	6	19753	60	6
56	5	19441	57	5	54	5	19793	54	5
54	6	19488	54	6	62	9	19799	61	9
62	9	19490	61	9	60	5	19801	59	5

Recorded by Mark Z Direction S Lane 1 Time from 1:58 to 3:21

Sheet 21	* STATE_CODE	1 0
LTPP Traffic Data	*SPS PROJECT_ID	0 1 0 0
WIM System Test Truck Records 1 of 3	* DATE	3 / 20 / 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
50	45	1	1	9:23	11387	45	48/56	86/88	85/80	81/80	93/76		76.1	19.5	4.2	37.3	4.2	
50	44	2	1	9:22	11390	44	44/56	69/70	57/74	68/12.1	72/96		71.9	19.4	4.3	31.7	10.0	
54	50	1	2	9:46	11547	49	60/48	83/82	82/80	86/86	83/73		76.3	19.5	4.2	37.3	4.2	
54	50	2	2	9:47	11554	48	53/44	63/71	61/58	76/10	86/83		69.6	19.5	4.3	31.8	10.1	
54	55	1	3	10:09	11667	55	51/57	87/82	86/83	89/87	92/76		79.0	19.6	4.2	37.4	4.2	
54	52	2	3	10:10	11669	52	38/66	59/79	63/76	65/11.7	75/96		73.4	19.3	4.3	31.6	10.0	
54	46	1	4	10:30	11775	46	46/55	80/79	77/77	80/74	74/84		72.6	19.5	4.2	37.3	4.2	
54	44	2	4	10:31	11783	43	50/58	60/74	59/66	71/11.3	74/10.0		72.5	19.4	4.3	31.5	10.0	
57	50	1	5	10:55	11921	50	57/45	84/77	85/78	83/87	78/84		75.7	19.3	4.2	37.3	4.2	
57	51	2	5	10:57	11934	50	47/49	31/82	30/79	49/87	48/77		56.7	19.5	4.3	31.7	10.0	
56	54	1	6	11:15	12038	54	52/57	83/80	84/81	87/84	87/79		77.5	19.5	4.2	37.4	4.2	
54	53	2	6	11:19	12064	54	49/50	62/74	61/71	70/11.6	77/91		72.2	19.3	4.3	31.5	10.0	
56	45	1	7	11:36	12159	45	48/55	80/79	78/78	82/84	85/78		74.7	19.5	4.2	37.4	4.2	
72	52	2	7	13:14	12755	52	49/62	66/73	66/69	78/11.8	76/99		74.6	19.6	4.3	31.8	10.1	
72	50	1	8	13:13	12751	51	48/55	77/82	79/80	80/88	74/85		74.8	19.5	4.2	37.5	4.2	
74	55	1	9	13:38	12923	55	47/55	78/82	80/91	77/85	75/91		78.0	19.6	4.2	37.6	4.2	

KEEP ON SAME

Recorded by MARK E

Checked by JMW

Sheet 21	* STATE_CODE	1 0
LTPP Traffic Data	*SPS PROJECT_ID	0 1 0 0
WIM System Test Truck Records 2 of 3	* DATE	3 / 20 / 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
74	54	2	8	13:39	12922	55	46/49	63/90	62/71	72/12.3	7.9/10.4		74.9	19.4	4.3	31.6	10.0	
75	38	1	10	14:00	13051	38	51/57	86/81	84/79	84/81	87/79		76.8	19.5	4.2	37.2	4.1	
75	35	2	9	14:00	13052	35	46/60	54/76	56/66	56/11.2	64/10.0		69.2	19.5	4.3	31.7	10.0	
73	50	1	11	14:19	13182	50	47/54	79/84	76/82	88/85	78/84		75.7	19.5	4.2	37.5	4.2	
73	50	2	10	14:20	13184	50	42/58	63/80	66/72	73/11.6	89/93		74.4	19.5	4.3	31.8	10.0	
73	55	1	12	14:41	13323	55	55/55	90/86	93/84	89/87	91/85		81.6	19.5	4.2	37.3	4.2	
73	53	2	10	14:43	13334	54	51/53	59/59	57/59	72/78	64/62		63.8	19.5	4.3	31.7	10.0	
71	46	1	13	15:05	13478	45	48/53	77/86	78/81	74/90	72/79		74.0	19.6	4.2	37.6	4.2	
71	45	2	12	15:06	13489	45	54/64	63/72	63/73	71/11.4	77/97		74.7	19.5	4.3	31.6	10.0	
71	49	1	14	15:27	13637	49	44/57	77/91	77/89	79/89	77/84		76.4	19.5	4.2	37.3	4.2	
71	55	2	13	15:32	13667	55	47/58	65/78	62/75	76/85	91/92		72.7	19.4	4.3	31.7	10.0	
70	52	1	15	15:58	13834	52	40/55	81/79	81/76	91/90	80/82		77.3	19.5	4.2	37.3	4.2	
70	45	2	14	16:06	13908	45	46/29	54/58	51/60	74/64	78/48		56.2	19.3	4.3	31.6	10.0	
70	56	1	16	16:22	14020	56	50/53	8.2/8.5	8.3/8.1	8.8/8.9	8.2/8.2		77.4	19.5	4.2	37.5	4.2	
31.5	46	1	17	7:41	17134	47	47/52	74/80	75/75	76/80	72/81		71.3	19.6	4.2	37.6	4.2	
33.5	50	1	18	8:03	17245	50	59/48	80/78	80/73	82/89	82/85		75.6	19.5	4.2	37.3	4.2	

Recorded by MARK Z

Checked by

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

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
35.5	53	1	19	8:35	17402	53	55/57	74/78	78/77	83/84	88/82		75.4	19.6	4.2	37.5	4.1	
37.5	45	1	20	8:58	17553	45	54/51	85/83	86/77	86/86	81/77		76.6	19.6	4.2	37.3	4.2	
41	50	1	21	9:28	17647	50	47/56	77/79	78/78	78/81	79/74		72.6	19.5	4.2	37.4	4.2	
48	54	1	22	9:51	17765	55	52/56	82/82	83/79	87/84	88/85		78.0	19.5	4.2	37.5	4.1	
50.5	45	1	23	10:14	17889	46	50/53	75/84	76/81	71/88	69/86		73.3	19.5	4.2	37.5	4.2	
56.5	49	1	24	10:40	17647	50	4.7/56	7.7/8.0	7.8/78	7.8/8.1	7.9/7.4		72.6	19.5	4.2	37.5	4.2	
59	55	1	25	11:10	18209	55	45/64	82/82	84/91	81/94	78/88		79.7	19.4	4.2	37.3	4.2	
61.5	45	1	26	11:34	18355	45	49/60	79/81	81/79	82/79	80/82		75.2	19.6	4.2	37.5	4.2	

BRO from Spreadsheet very hard copy

BRO per Captureit

Recorded by MARK Z

Checked by BRO

PRE-VALIDATION

Sheet 21	* STATE_CODE	10
LTPP Traffic Data	*SPS PROJECT_ID	0100
WIM System Test Truck Records 1 of 1	* DATE	3/21/08

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
63	50	~~2~~	~~1~~	11:35	18358	50	43/52	69/76	61/83	64/51	64/76		63.8	19.5	4.2	33.9	5.0	
63	39	2	2	11:51	18463	41	45/53	66/71	61/76	57/68	64/75		63.5	19.5	4.2	34.0	5.0	
64	50	1	1	12:00	18515	50	47/60	83/84	86/80	93/88	88/81		79.0	19.5	4.2	37.3	4.2	
64	48	2	3	12:05	18542	49	50/57	74/72	68/82	81/73	69/72		69.7	19.5	4.2	33.9	5.0	
66	55	2	4	12:19	18628	55	48/50	67/79	60/89	65/74	57/75		65.9	19.7	4.2	34.2	5.0	
~~66~~	44	2	5	12:34	18732	44	44/54	65/70	60/81	64/61	64/69		63.2	19.5	4.2	34.0	5.0	
66	54	1	2	12:35	18738	55	49/59	84/86	88/85	88/86	89/82		79.5	19.5	4.2	37.5	4.2	
68.5	49	2	6	12:48	18827	48	44/55	69/78	63/88	65/67	63/79		67.1	19.5	4.2	34.0	5.0	
68.5	45	1	3	12:54	18848	45	49/60	86/86	88/85	86/88	86/78		78.6	19.5	4.2	37.5	4.2	
69.5	54	2	7	13:02	18898	55	47/51	67/72	65/83	71/70	68/71		66.4	19.5	4.2	33.9	5.0	
69.5	44	2	8	13:17	18987	44	47/52	66/70	64/80	61/65	65/66		~~63.5~~	19.5	4.2	34.0	5.0	
69.5	46	1	4	13:17	18988	46	54/58	88/88	91/88	91/75	82/85		80.1	19.6	4.2	37.5	4.2	
73	49	2	9	13:30	19064	50	43/55	69/81	64/95	48/77	58/84		67.5	19.5	4.2	34.1	5.0	
73	50	1	5	13:~~58~~	19244	49	50/58	79/91	79/82	85/94	77/87		~~78.4~~	~~19.5~~	~~4.2~~	~~37.5~~	4.2	verified
74	53	1	6	14:30	19461	54	50/57	87/86	89/83	93/87	90/76		79.8	19.6	4.2	37.6	4.2	
~~74~~	52	2	10	14:35	19498	54	44/54	68/74	62/82	79/70	55/68		64.7	19.6	4.2	34.0	5.0	

Recorded by MARK Z Checked by

Sheet 21	* STATE_CODE	1_0_
LTPP Traffic Data	*SPS PROJECT_ID	0_1_0_0
WIM System Test Truck Records 1 of 2	* DATE	3/21/08

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
75.5	42	2	11	14:50	19595	43	43/56	65/71	62/82	57/68	72/69		64.5	19.6	4.2	34.0	5.0	
71.5	44	1	7	14:57	19648	44	49/58	81/84	83/80	82/93	79/85		77.3	19.6	4.2	37.5	4.2	
70	48	2	12	15:04	19694	49	43/59	69/87	66/94	65/78	59/80		70.0	19.6	4.3	34.2	5.0	
70	53	2	13	15:18	19789	54	49/51	79/77	71/84	69/73	63/78		69.5	19.6	4.2	34.0	5.0	
70	48	1	8	15:21	19803	49	51/59	80/90	82/86	81/93	75/85		78.4	19.7	4.2	32.8	4.2	
70	44	2	14	15:32	19882	44	45/53	66/72	61/83	58/69	65/71		64.2	19.6	4.2	34.1	5.0	
72.5	56	1	9	15:43	19949	56	57/53	92/92	92/84	89/90	91/86		82.6	19.6	4.2	37.6	4.2	
69.5	54	2	15	15:45	19957	53	44/53	69/76	66/83	70/70	57/71		65.9	19.5	4.2	33.9	5.0	
65	46	1	10	16:53	20406	45	48/55	86/97	77/77	74/92	74/93		77.3	19.5	4.2	37.3	4.2	
65	44	2	16	16:54	20407	44	42/54	63/72	60/81	64/75	70/67		65.0	19.6	4.2	34.1	5.0	
65	48	2	17	17:09	20496	49	47/52	69/78	64/85	67/74	65/75		67.6	19.5	4.2	34.0	5.0	
58	49	1	11	17:19	20571	49	53/59	83/86	85/82	88/86	90/80		79.4	19.6	4.2	37.5	4.2	
58	54	2	18	17:25	20603	54	43/53	68/79	61/80	63/76	58/78		67.0	19.5	4.2	34.0	5.0	
55	44	2	19	17:40	20696	44	44/52	64/72	60/80	53/65	71/71		63.2	19.5	4.2	34.1	5.0	
55	54	1	12	17:43	20716	55	46/54	78/88	77/89	89/92	76/91		76.6	19.5	4.2	37.3	4.1	
53	54	2	20	17:54	20777	54	45/53	70/72	63/81	72/71	66/73		66.8	19.6	4.2	34.0	5.0	

Recorded by MARK Z

Used cal 1 for first runs MZ

Checked by MS

Sheet 21	* STATE_CODE	10
LTPP Traffic Data	*SPS PROJECT_ID	0100
WIM System Test Truck Records 2 of 2	* DATE	3/21/08

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
53	46	1	13	18:06	20854	46	52/56	91/87	92/86	91/87	89/79		80.8	19.5	4.2	37.3	4.2	
53	44	2	21	18:09	20865	44	54/48	74/75	67/84	67/74	60/77		67.9	19.5	4.2	33.9	5.0	
53	45	1	14	18:25	20974	46	49/55	80/84	82/80	83/89	80/65		74.6	19.5	4.2	37.3	4.2	
54.5	54	2	22	18:29	20995	53	45/51	67/73	62/81	69/71	68/70		65.7	19.5	4.2	34.0	5.0	
53	51	1	15	18:44	21069	51	52/53	77/86	79/80	85/90	79/69		74.9	19.5	4.2	37.3	4.8	
53	43	2	23	18:44	21071	43	42/58	65/68	59/78	68/67	66/66		63.9	19.5	4.2	33.9	5.0	
53	53	2	24	18:59	21152	54	47/50	74/73	69/82	65/74	67/70		67.0	19.6	4.2	34.1	5.0	
53	54	1	16	19:03	21167	54	57/48	88/85	89/81	87/88	90/83		79.5	19.5	4.2	37.3	4.2	

Recorded by MARK Z

Checked by

Calibration Worksheet Site: 100100

Calibration Iteration 1 Date 3/19/08

Beginning factors: 1 / 2

Speed Point (mph)	Name	Value
Overall		
Front Axle		
1 – (40)	65 kph	3172 / 3473
2 – (45)	72 kph	3172 / 3473
3 – (50)	80 kph	3303 / 3617
4 – (55)	88 kph	3335 / 3653
5 – (60) kph	96 kph	3369 / 3689

Errors:

	40 Speed Point 1	45 Speed Point 2	50 Speed Point 3	55 Speed Point 4	60 Speed Point 5
F/A	–	0	-1.0	0	–
Tandem		-6.0	-5.0	0	
GVW	–	-4.0	-4.0	0	–

Adjustments:

	Raise	Lower	Percentage
Overall	☐	☐	
Front Axle	☐	☐	
Speed Point 1	☐	☐	
Speed Point 2	☒	☐	4.2
Speed Point 3	☒	☐	4.2
Speed Point 4	☐	☐	
Speed Point 5	☐	☐	

End factors: 1 / 2

Speed Point (mph)	Name	Value
Overall		
Front Axle		
1 – (40)	65 kph	3172 / 3473
2 – (45)	72 kph	~~3172 / 3473~~ 3304 / 3618
3 – (50)	80 kph	~~3289 / 3617~~ 3441 / 3768
4 – (55)	88 kph	3335 / 3653
5 – (60)	96 kph	3369 / 3689

TEST VEHICLE PHOTOGRAPHS FOR SPS WIM VALIDATION

Visit Date

STATE: Delaware

SHRP ID: 0100

Photo 1 10_0100_Truck_1_Tractor_03_20_2008.jpg

Photo 2 10_0100_Truck_1_Trailer_03_20_2008.jpg

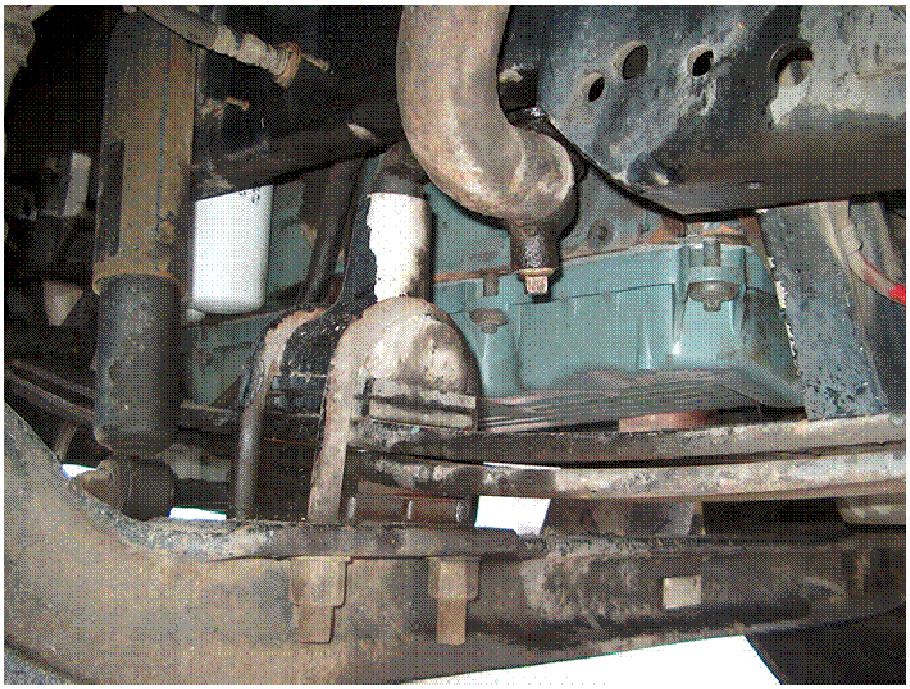

Photo 3 10_0100_Truck_1_Suspension_1_03_20_2008.jpg

Photo 4 10_0100_Truck_1_Suspension_2_03_20_2008 .jpg

Photo 5 10_0100_Truck_1_Suspension_2_03_20_2008 .jpg

Photo 6 10_0100_Truck_2_day_1_Tractor_03_20_2008.jpg

Photo 7 10_0100_Truck_2_day_1_Trailer_03_20_2008.jpg

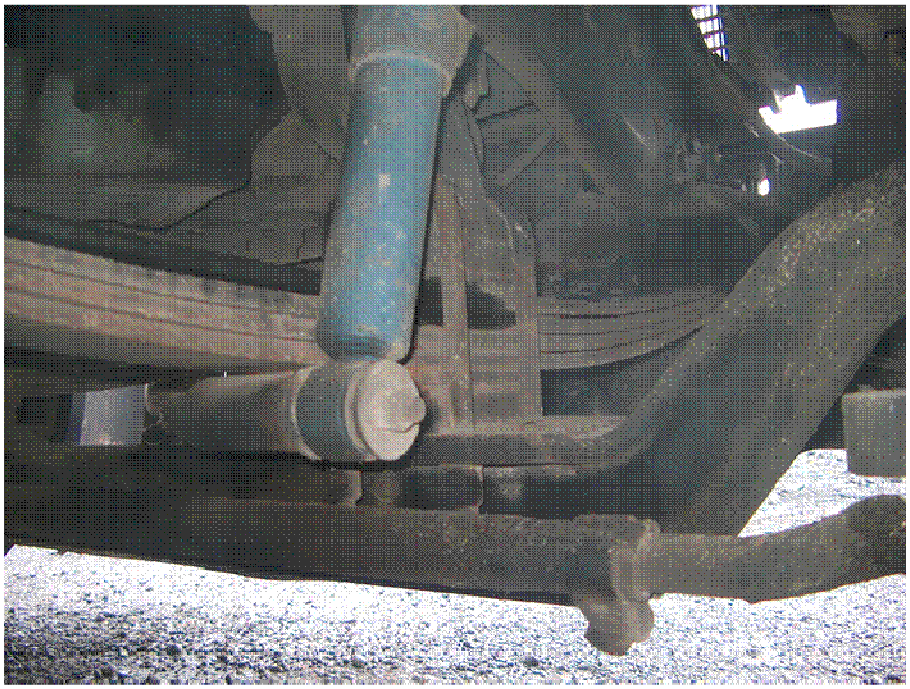

Photo 8 10_0100_Truck_2_day_1_Suspension_1_03_20_2008.jpg

Photo 9 10_0100_Truck_2_day_1_Suspension_2_03_20_2008.jpg

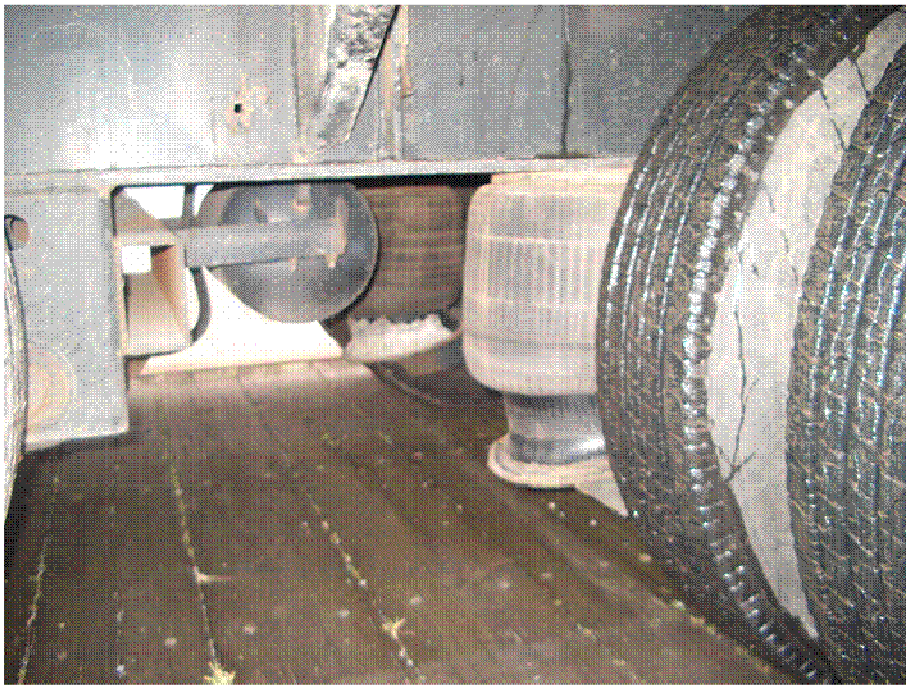

Photo 10 10_0100_Truck_2_day_1_Suspension_3_03_20_2008.jpg

Photo 11 10_0100_Truck_2_day_1_Suspension_4_03_20_2008.jpg

Photo 12 10_0100_Truck_2_day_2_Tractor_03_21_2008.jpg

Photo 13 10_0100_Truck_2_day_2_Trailer_03_21_2008.jpg

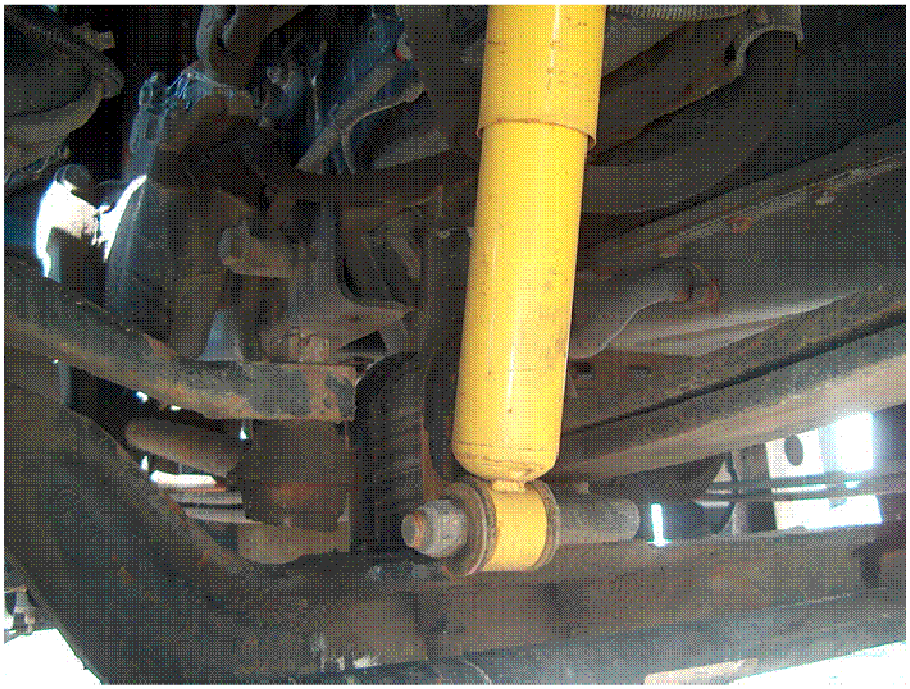

Photo 14 10_0100_Truck_2_day_2_Suspension_1_03_21_2008.jpg

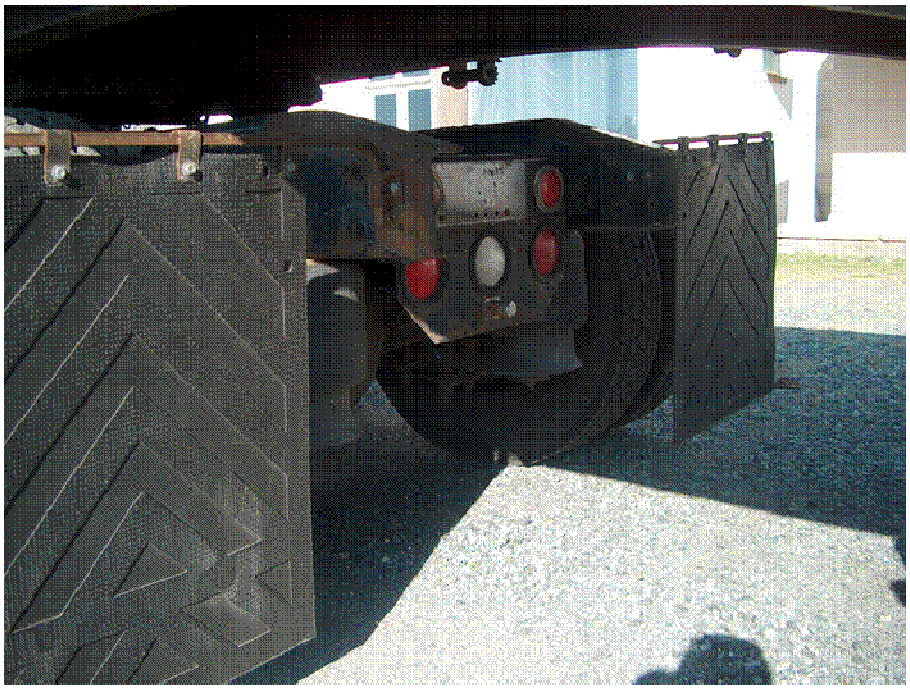

Photo 15 10_0100_Truck_2_day_2_Suspension_2_03_21_2008.jpg

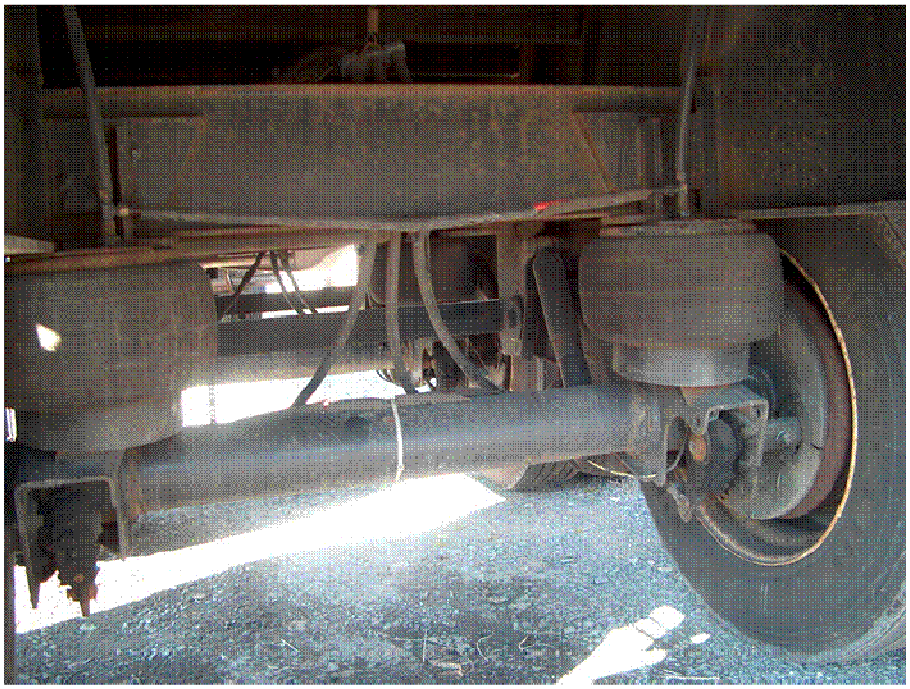

Photo 16 10_0100_Truck_2_day_2_Suspension_3_03_21_2008.jpg

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

Delaware SPS-1 (Lane 1)

Validation Visit – March 21, 2008

Calibration factors for sensor #1:

	21 March 2008	20 March 2008	8 August 2007
65 kph:	3172	3172	3253
72 kph:	3304	3172	3253
80 kph:	3441	3303	3388
88 kph:	3335	3335	3421
105 kph:	3369	3369	3455

Calibration factors for sensor #2:

	21 March 2008	20 March 2008	8 August 2007
65 kph:	3473	3473	3388
72 kph:	3618	3743	3388
80 kph:	3768	3617	3529
88 kph:	3653	3653	3564
105 kph:	3684	3689	3599