Validation Report

Maryland, SPS-5
Task Order 21, CLIN 2
September 4 to 5, 2007

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1 Executive Summary

A visit was made to the Maryland 0500 on September 4 to 5, 2007 for the purposes of conducting a validation of the WIM system located on US 15 south of Frederick, Maryland. The SPS-5 is located in the righthand, northbound lane of a two lane facility. The posted speed limit at this location is 55 mph. The LTPP lane is the only lane that is instrumented at this site. The validation procedures were in accordance with LTPP's SPS WIM Data Collection Guide dated August 21, 2001.

This site was installed in a new portland cement concrete slab in place of the original installation. This is the second validation visit to this location. The site was installed on October 17 to 26, 2005 by IRD.

This site meets all LTPP precision requirements except speed which is not considered sufficient to disqualify the site as having research quality data. The classification data is also of research quality for Traffic Monitoring Guide Classes.

The site is instrumented with bending plate and iSINC electronics. It is installed in portland cement concrete, 400 feet long. The WIM sensors are approximately 350 feet from the pavement transition.

The validation used the following trucks:

1) 5-axle tractor-trailer with a tractor having an air suspension and a trailer with a standard rear tandem and an air suspension loaded to 72,460 lbs., the "golden" truck.
2) 5-axle tractor semi-trailer with a tractor having an air suspension and a trailer with a standard rear tandem and an air suspension loaded to 65,300 lbs., the "partial" truck.

The validation speeds ranged from 43 to 55 miles per hour. The pavement temperatures ranged from 70 to 106 degrees Fahrenheit. The desired speed range was achieved during this validation. The desired 30 degree Fahrenheit temperature range was also achieved.

Table 1-1 Post-Validation results – 240500 – 05-Sep-2007

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	0.5 ± 11%	Pass
Tandem axles	±15 percent	1.3 ± 8.1%	Pass
GVW	±10 percent	1.1 ± 6.9%	Pass
Speed	**±1 mph [2 km/hr]**	**0.2 ± 1.2 mph**	**Fail**
Axle spacing	± 0.5 ft [150mm]	0.0 ± 0.1 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.

No profile data has been collected at this site within a year of the validation. It is not known when a visit is scheduled to collect it. When profile data becomes available WIMIndex values will be computed and an amended report submitted

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*

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

2 Corrective Actions Recommended

There are no corrective actions identified at this time.

The previously observed cross-misclassification of Class 3, 4 and 5 vehicles was not observed during this validation.

The loop lead across the pavement joint should be inspected as a part of routine maintenance activities to check for wear and loss of sealant.

3 Post Calibration Analysis

This final analysis is based on test runs conducted September 5, 2007 from mid-morning to mid-afternoon at test site 240500 on US 15. This SPS-5 site is at milepost 4.7 on the northbound, righthand of a two lane facility. No auto-calibration was used during test runs. The two trucks used for the 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 72,460 lbs., the "golden" truck.
2. 5-axle tractor semi-trailer with a tractor having an air suspension and a trailer with a standard rear tandem and an air suspension loaded to 65,300 lbs., the "partial" truck.

Each truck made a total of 20 passes over the WIM scale at speeds ranging from approximately 43 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 70 to 106 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 3-1.

The statistics in Table 3-1 indicate that the loading data meets the conditions for research quality data. The failure to meet the speed criterion does not affect the determination of research quality loading data.

Table 3-1 Post-Validation Results – 240500 – 05-Sep-2007

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	0.5 ± 11.0%	Pass
Tandem axles	±15 percent	1.3 ± 8.1%	Pass
GVW	±10 percent	1.1 ± 6.9%	Pass
Speed	**±1 mph [2 km/hr]**	**0.2 ± 1.2 mph**	**Fail**
Axle spacing	± 0.5 ft [150mm]	0 ± 0.1 ft	Pass

Prepared: bko *Checked:jrn*

The test runs were conducted from morning to mid-afternoon under sunny skies. The runs were conducted at various speeds to determine the effects of these variables on the

performance of the WIM scale. To investigate these effects, the data set was split into three speed groups and three temperature groups. The distribution of runs by speed and temperature is illustrated in Figure 3-1. The figure indicates that the desired distribution of speed and temperature combinations was achieved for this set of validation runs.

The three speed groups were divided as follows: Low speed – 43 to 45 mph, Medium speed – 46 to 50 mph and High speed – 51 + mph. The three temperature groups were created by splitting the runs between those at 70 to 80 degrees Fahrenheit for Low temperature, 81 to 94 degrees Fahrenheit for Medium temperature and 95 to 106 degrees Fahrenheit for High temperature.

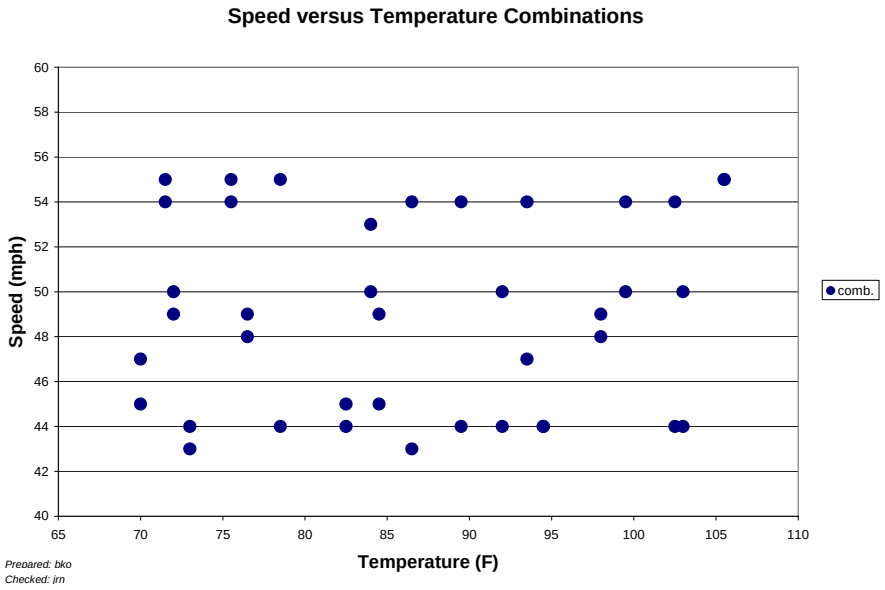

Figure 3-1 Post-Validation Speed-Temperature Distribution – 240500 – 05-Sep-2007

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. There is a slight overestimation at the lower end of the speed range. This overestimation affects approximately three percent of the truck population based on the post-validation speed checks. The majority of the trucks are running at or above the posted speed limit, 55 mph, where the graph shows an apparently unbiased estimate.

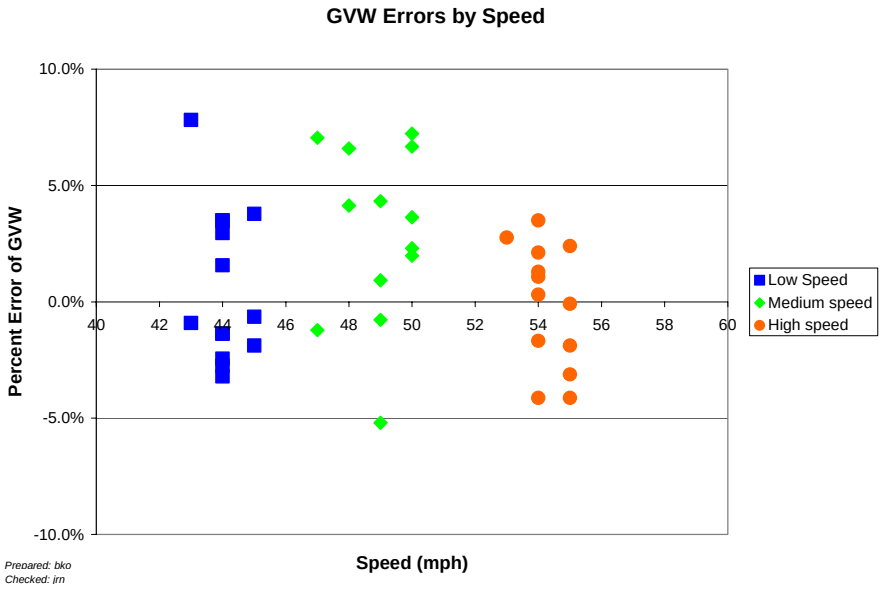

Figure 3-2 Post-validation GVW Percent Error vs. Speed – 240500 – 05-Sep-2007

Figure 3-3 shows the relationship between temperature and GVW percentage error. There is no apparent influence of temperature on the error estimates.

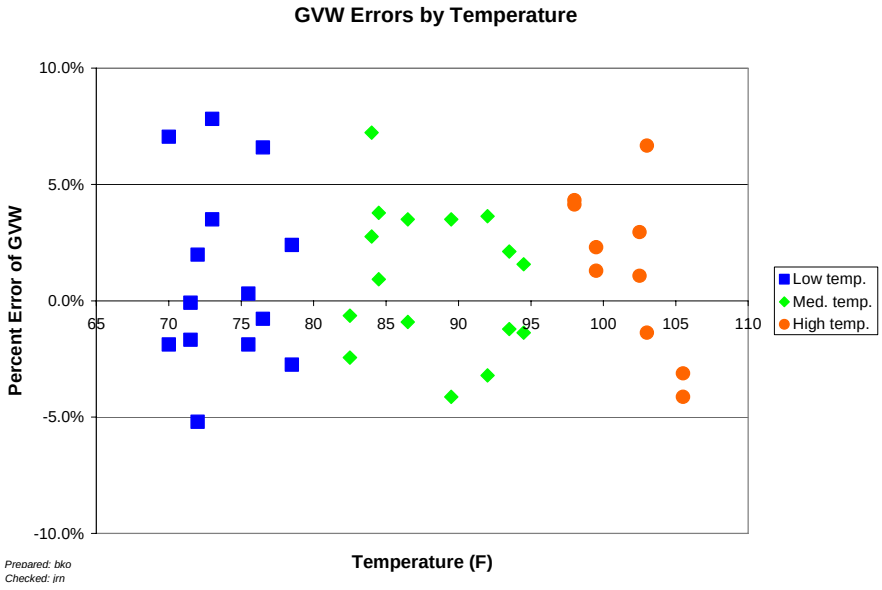

Figure 3-3 Post-Validation GVW Percent Error vs. Temperature – 240500 – 05-Sep-2007

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

drive tandem on a Class 9 vehicle, this is the spacing evaluated and plotted for validations. There is no apparent influence of speed on spacing errors.

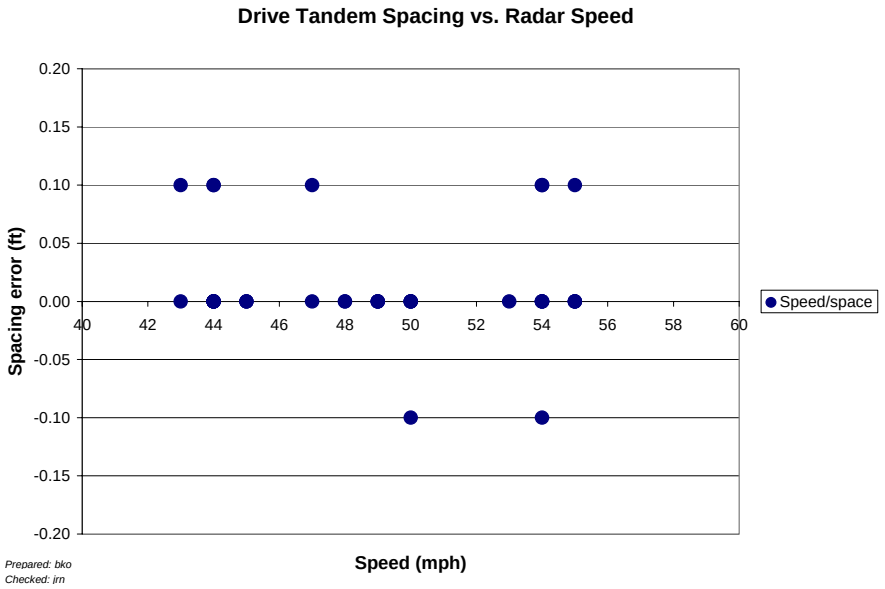

Figure 3-4 Post-Validation Spacing vs. Speed – 240500 – 05-Sep-2007

3.1 Temperature-based Analysis

The three temperature groups were created by splitting the runs between those at 70 to 80 degrees Fahrenheit for Low temperature, 81 to 94 degrees Fahrenheit for Medium temperature and 95 to 106 degrees Fahrenheit for High temperature.

Table 3-2 Post-Validation Results by Temperature Bin – 240500 – 05-Sep-2007

Element	95% Limit	Low Temperature 70 to 80 °F	Medium Temperature 81 to 94 °F	High Temperature 95 to 106 °F
Steering axles	±20 %	0.3 ± 10.8%	1.0 ± 12.7%	0.0 ± 13.0%
Tandem axles	±15 %	1.3 ± 9.4%	1.0 ± 7.8%	1.7 ± 7.8%
GVW	±10 %	1.1 ± 8.6%	0.9 ± 6.6%	1.4 ± 7.8%
Speed	±1 mph	-0.1 ± 1.0 mph	0.3 ± 1.5 mph	0.4 ± 1.2 mph
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft	0.0 ± 0.2 ft

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Table 3-2 shows slight overestimates of approximately the same size for each temperature bin. The variability is very similar in each temperature group.

Figure 3-5 is the distribution of GVW Errors versus Temperature by Truck graph. There is no apparent trend for either truck as a function of temperature.

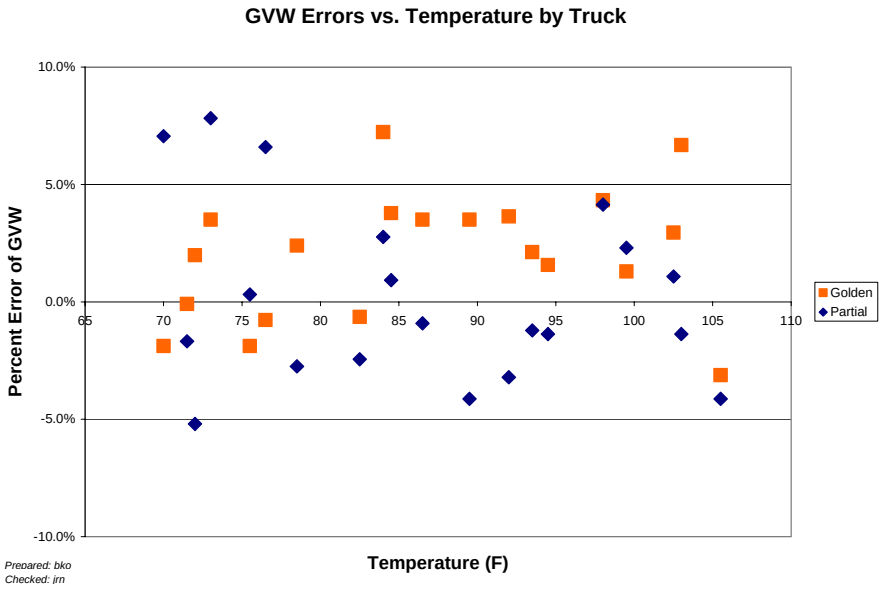

Figure 3-5 Post-Validation GVW Percent Error vs. Temperature by Truck – 240500 – 05-Sep-2007

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 apparently no trend associated with steering axle estimates.

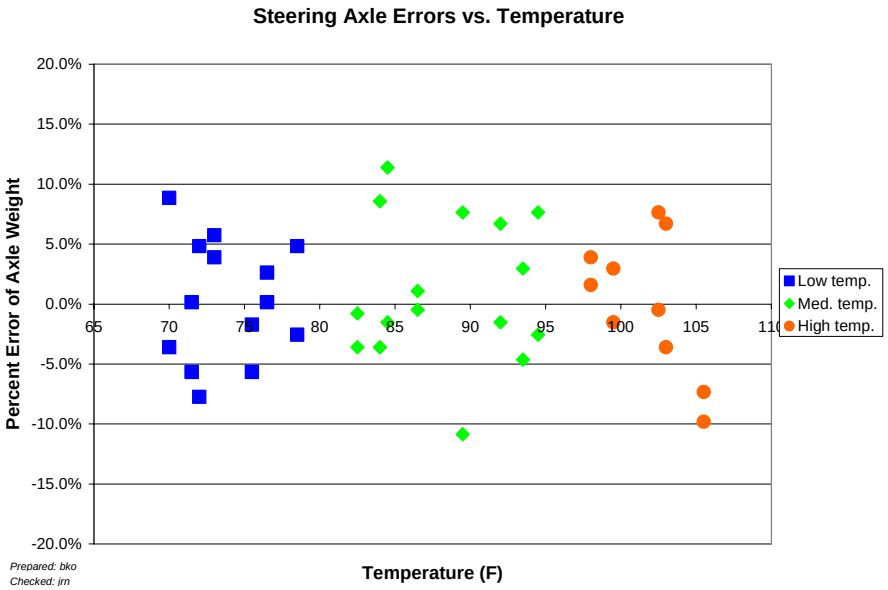

Figure 3-6 Post-Validation Steering Axle Error vs. Temperature by Group – 240500 – 05-Sep-2007

3.2 Speed-based Analysis

The three speed groups were divided using 43 to 45 mph for Low speed, 46 to 50 mph for Medium speed and 51+ mph for High speed.

Table 3-3 Post-Validation Results by Speed Bin – 240500 – 05-Sep-2007

Element	95% Limit	Low Speed 43 to 45 mph	Medium Speed 46 to 50 mph	High Speed 51+ mph
Steering axles	±20 %	1.8 ± 11.4%	2.2 ± 11.1%	-2.5 ± 11.0%
Tandem axles	±15 %	0.4 ± 7.5%	3.1 ± 8.9%	0.4 ± 7.6%
GVW	±10 %	0.6 ± 7.0%	2.9 ± 8.2%	-0.1 ± 5.7%
Speed	±1 mph	0.2 ± 1.3 mph	0.2 ± 1.3 mph	0.1 ± 1.4 mph
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft

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Table 3-3 shows the statistics by speed group. There is slightly greater overestimation at the medium speed group for most statistics. The variability tends to be similar across the various speed groups.

Figure 3-7 has the distribution of errors by truck over the validation speed range. The golden truck (squares) tends to overestimation at the low end of the speed range. The partial truck (diamonds) in contrast with the exception of an outlier tends to have its GVW underestimated.

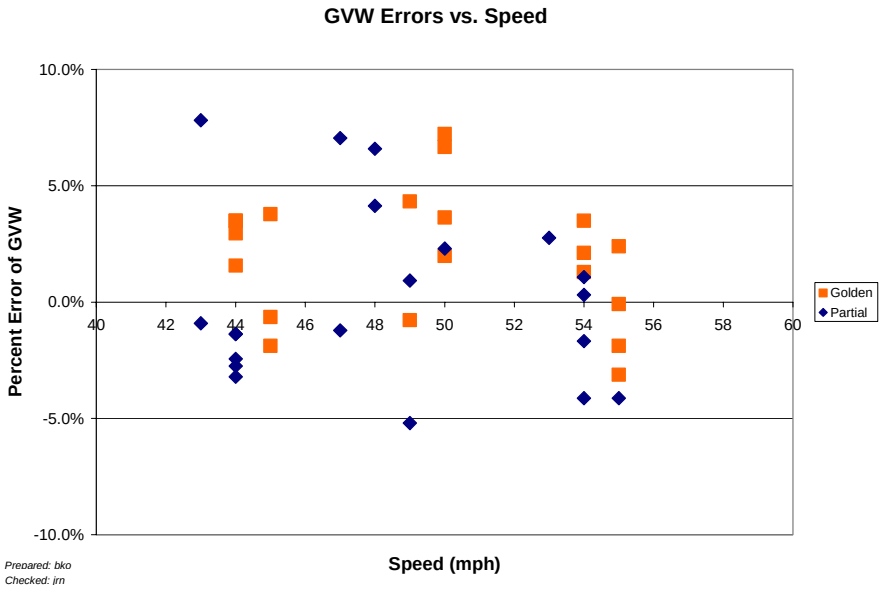

Figure 3-7 Post-Validation GVW Percent Error vs. Speed by Truck – 240500 – 05-Sep-2007

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. Figure 3-8 shows a trend from overestimation to underestimation of steering axle weights with increasing speeds.

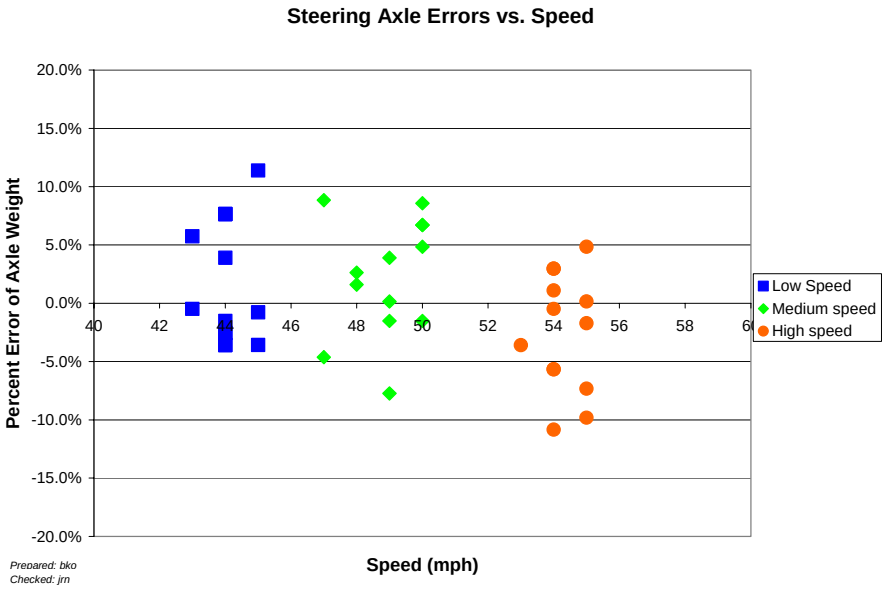

Figure 3-8 Post-Validation Steering Axle Percent Error vs. Speed by Group – 240500 – 05-Sep-2007

3.3 Classification Validation

This LTPP installed site used the FHWA 13-bin classification scheme and the LTPP ETG mod 2 classification algorithm at the time of the previous validation. Classification 15 had been added to define unclassified vehicles. **The site was changed to the mod 3 version at an unknown date. The mod 3 version modified classification of Class 3, 4 and 5 vehicles.**

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

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

Table 3-4 Truck Misclassification Percentages for 240500 – 05-Sep-2007

Class	Percent Error	Class	Percent Error	Class	Percent Error
4	N/A	5	0	6	0
7	0				
8	0	9	0	10	0
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.

Table 3-5 Truck Classification Mean Differences for 240500 – 05-Sep-2007

Class	Mean Difference	Class	Mean Difference	Class	Mean Difference
4	N/A	5	0	6	0
7	0				
8	0	9	0	10	0
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. 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.

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

Profile data collected in the year prior to the site visit do not exist. A site visit to collect profile data has not been scheduled yet. An amended report will be submitted when the data is available.

Profile data was available for the previous validation and is included for reference in this report.

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 June 15, 2006 were processed through the LTPP SPS WIM Index software, version 1.1. This WIM scale is installed on a portland cement concrete pavement.

A total of 15 profiler passes were conducted over the WIM site. Since the issuance of the LTPP directive on collection of longitudinal profile data for SPS WIM sections, the requirements have been a minimum of 3 passes in the center of the lane and one shifted to each side. For this site the RSC has completed 9 passes at the center of the lane, 3 passes shifted to the left side of the lane, and 3 passes shifted to the right side of the lane. Shifts to the sides of the lanes were made such that data were collected as close to the lane edges as was safely possible. For each profiler pass, profiles were recorded under the left wheel path (LWP) and the right wheel path (RWP).

The SPS WIM Index software, version 1.0 was developed with four different indices: LRI, SRI, Peak LRI and Peak SRI. The LRI incorporates the pavement profile starting 25.8 m prior to the scale and ending 3.2 m after the scale in the direction of travel. The SRI incorporates a shorter section of pavement profile beginning 2.74 m prior to the WIM scale and ending 0.46 m after the scale. The LRI and SRI are the index values for the actual location of the WIM scale. Peak LRI is the highest value of LRI, within 30 m prior to the scale. Peak SRI indicates the highest value of SRI that is located between 2.45 m prior to the scale and 1.5 m after the scale. Also, a range for each of the indices was developed to provide the smoothness criteria. The ranges are shown in Table 4-1. When all of the values are below the lower thresholds, it is presumed unlikely that pavement smoothness will significantly influence sensor output. When one or more values exceed an upper threshold there is a reasonable expectation that the pavement smoothness will influence the outcome of the validation. When all values are below the upper threshold but not all below the lower threshold, the pavement smoothness may or may not influence the validation outcome.

Table 4-1 Thresholds for WIM Index Values

Index	Lower Threshold (m/km)	Upper Threshold (m/km)
LRI	0.50	2.1
SRI	0.50	2.1
Peak LRI	0.50	2.1
Peak SRI	0.75	2.9

Prepared: bko *Checked:jrn*

Table 4-2 shows the computed index values for the prior site validation. From the table it can be seen that all but 7 of the indices computed from the profiles are between the upper and lower threshold values. One of the index values is below the lower threshold and the remaining 6 are above the upper threshold. The level of these values indicates that it is likely that the pavement smoothness would interfere with the ability of the sensor to produce accurate data. However, given that the sensors were able to produce reliable and accurate data as noted in this validation, no recommendation is made for remediation of the pavement surface.

Table 4-2 WIM Index Values - 240500 –15-Jun-2006

Profiler Passes			Pass 1	Pass 2	Pass 3	Pass 4	Pass 5	Pass 6	Pass 7	Pass 8	Pass 9	Ave.
Center	LWP	LRI (m/km)	0.943	0.849	0.971	0.860	0.980	0.874	0.968	0.968	0.817	0.914
		SRI (m/km)	0.872	*0.277*	0.574	0.559	0.658	0.554	0.719	0.663	*0.497*	0.597
		Peak LRI (m/km)	1.108	1.033	1.251	1.225	1.293	1.149	1.162	1.156	1.138	1.168
		Peak SRI (m/km)	1.008	*0.645*	1.083	1.185	1.221	0.898	1.117	1.103	0.989	1.028
	RWP	LRI (m/km)	0.886	0.864	0.881	0.847	0.919	0.856	0.846	0.843	0.848	0.866
		SRI (m/km)	0.967	0.731	0.916	0.797	0.941	1.054	0.965	0.941	1.286	0.955
		Peak LRI (m/km)	0.980	1.069	0.981	0.905	0.920	0.930	1.070	0.981	0.850	0.965
		Peak SRI (m/km)	1.304	0.934	0.966	0.983	1.133	1.141	1.058	1.144	1.420	1.120
Left Shift	LWP	LRI (m/km)	0.874	0.840	0.772							0.829
		SRI (m/km)	0.815	0.788	0.584							0.729
		Peak LRI (m/km)	1.031	1.196	1.047							1.091
		Peak SRI (m/km)	0.963	1.127	0.872							0.987
	RWP	LRI (m/km)	0.898	0.951	0.938							0.929
		SRI (m/km)	0.831	0.741	0.561							0.711
		Peak LRI (m/km)	0.955	1.058	0.972							0.995

Profiler Passes			**Pass 1**	**Pass 2**	**Pass 3**	**Pass 4**	**Pass 5**	**Pass 6**	**Pass 7**	**Pass 8**	**Pass 9**	**Ave.**
		Peak SRI (m/km)	1.005	1.071	0.776							0.951
Right Shift	LWP	LRI (m/km)	0.779	0.904	0.960							0.881
		SRI (m/km)	0.599	0.523	0.596							0.573
		Peak LRI (m/km)	0.784	1.023	1.066							0.958
		Peak SRI (m/km)	*0.705*	*0.583*	*0.694*							*0.661*
	RWP	LRI (m/km)	0.857	**2.223**	1.676							1.585
		SRI (m/km)	0.703	**3.639**	**3.951**							**2.764**
		Peak LRI (m/km)	0.863	**2.236**	2.069							1.723
		Peak SRI (m/km)	0.959	**3.651**	**4.009**							2.873

Prepared: bko *Checked:jrn*

4.2 Distress Survey and Any Applicable Photos

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

4.3 Vehicle-pavement Interaction Discussion

A visual observation of the trucks as they approach, traverse and leave the sensor area did not indicate any visible motion of the trucks that would affect the performance of the WIM scales. The slight motion that exists at the transition appears to dissipate prior to crossing the WIM sensors. A photo of the transition is included for reference as Figure 4-1

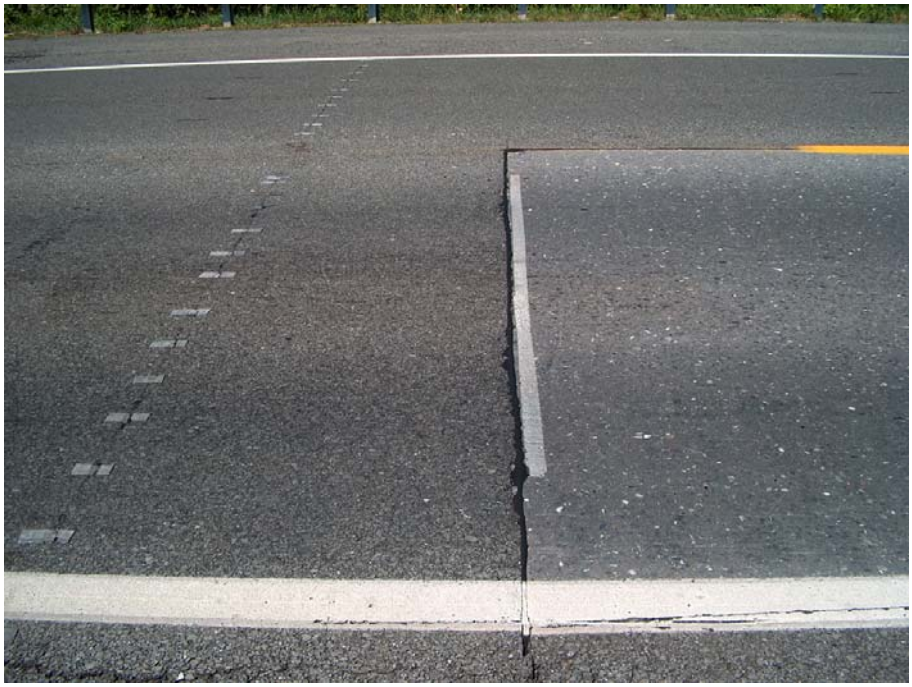

Figure 4-1 Leading Transition Between Asphalt Concrete and Portland Cement Concrete - 240500 - 04-Sep-2007

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

As with the prior validation it was observed that the northbound lane is sometimes used by southbound traffic for passing.

5 Equipment Discussion

The traffic monitoring equipment at this location includes bending plate and iSINC. These sensors are installed in a portland cement concrete pavement about 400 ft in length. The roadway outside this short section is asphalt.

There were no changes in basic equipment operating condition since the validation on March 22, 2006.

5.1 Pre-Evaluation Diagnostics

The electrical components of the system were checked and found to be operating within acceptable limits. It was noted that the loop input cables are not shielded.

Figure 5-1 shows a loop lead across a pavement joint. This wiring should be checked during each site visit to look for possible wear or missing sealant.

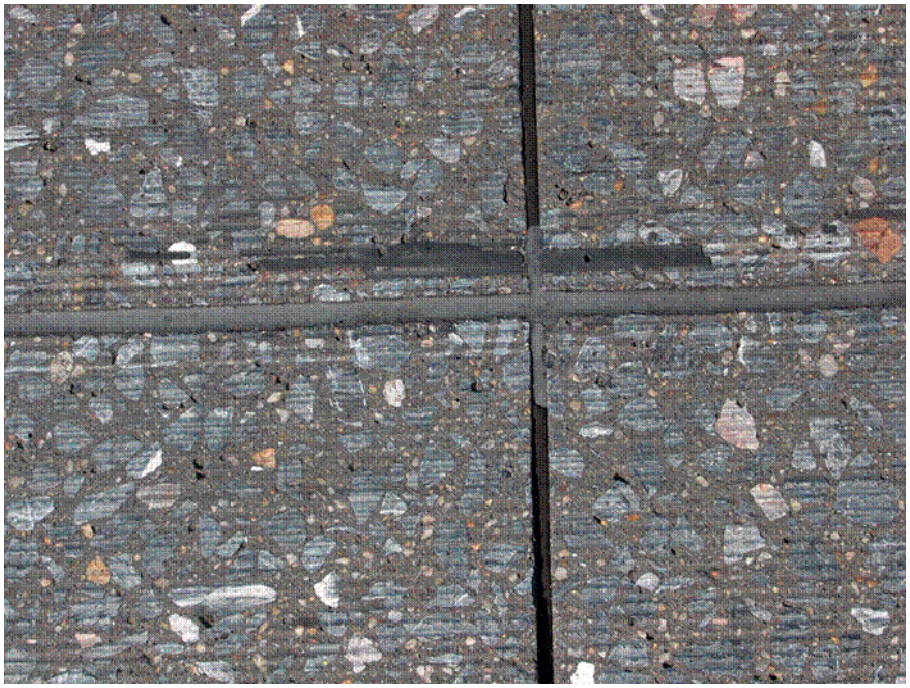

Figure 5-1 Loop Lead Across Pavement Joint - 240500 - 04-Sep-2007

5.2 Calibration Process

The equipment required no iterations of the calibration process between the initial 40 runs and the final 40 runs.

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 5-1 has the information for TRF_CALIBRATION_AVC for Sheet 16s submitted prior to this validation as well as the information for the current visit. Data prior to March 2006 are for previous installations at this location.

Table 5-1 Classification Validation History – 240500 – 05-Sep-2007

Date	Method	Mean Difference				Percent Unclassified
		Class 9	Class 8	Other 1	Other 2	
9/5/2007	Manual	0.0	0.0			0.0
9/4/2007	Manual	0.0	0.0			0.0
3/22/2006	Manual	0.0	0.0	25.0		0.0
3/21/2006	Manual	-3.6	16.7	55.6		0.0
1/4/2005	Manual	0.0	0.0	-2		
5/24/2004	Unknown					
3/7/2003	Unknown					
11/12/1999	Parallel Classifiers	77	132	178	10	0.0

Prepared: bko *Checked:jrn*

Table 5-2 has the information for TRF_CALIBRATION_WIM for Sheet 16s submitted prior to this validation as well as the information for the current visit. Data prior to March 2006 are for previous installations at this location.

Table 5-2 Weight Validation History – 240500 – 05-Sep-2007

Date	Method	Mean Error and (SD)		
		GVW	Single Axles	Tandem Axles
9/5/2007	Test Trucks (2)	1.1 (3.4)	0.5 (5.5)	1.3 (4.1)
9/4/2007	Test Trucks (2)	0.5 (2.8)	0.3 (4.7)	0.6 (3.4)
3/22/2006	Test Trucks (2)	2.8 (3.1)	2.5 (3.7)	2.9 (3.3)
3/21/2006	Test Trucks (2)	1.0 (2.6)	1.1 (4.2)	0.9 (2.8)
7/22/2005	Test Trucks (1)	0.6 (5.5)	0.9 (3.8)	
1/27/2005	Test Trucks (1)	5.2 (11.6)	-0.3 (10.5)	
5/24/2004	Test Trucks (1)	2.3 (3.7)	1.1 (10.2)	
5/7/2003	Test Trucks (1)	10.6 (18.8)	6.5 (21.1)	
4/30/2002	Test Trucks (2)	-0.1 (11.5)	5.9 (12.9)	
6/12/2001	Test Trucks (2)			
11/12/1999	Traffic Stream (25)			

Prepared: bko *Checked:jrn*

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 September 4, 2007 from mid-morning through mid-afternoon at test site 240500 on US 15. This SPS-5 site is at milepost 4.7 on the northbound, righthand of a two lane 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 72,440 lbs.
2. 5-axle tractor semi-trailer with a tractor having an air suspension and a trailer with a standard rear tandem and an air suspension loaded to 64,930 lbs., the partial truck.

For the initial validation each truck made a total of 20 passes over the WIM scale at speeds ranging from approximately 44 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 84 to 117degrees 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 data in Table 6-1 indicates that the conditions for research quality loading data were met. The failure to meet the speed criterion does not affect that determination.

Table 6-1 Pre-Validation Results – 240500 – 04-Sep-2007

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	0.3 ± 9.5%	Pass
Tandem axles	±15 percent	0.6 ± 6.8%	Pass
GVW	±10 percent	0.5 ± 5.7%	Pass
Speed	**±1 mph [2 km/hr]**	**-0.5 ± 1.9 mph**	**Fail**
Axle spacing	± 0.5 ft [150mm]	0.0 ± 0.0 ft	Pass

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The runs were conducted from mid-morning to mid-afternoon under mostly sunny skies. The site is tree-shaded influencing the range of pavement temperatures possible. The runs were conducted at various speeds to determine the effects of these variables on the performance of the WIM scale. To investigate these effects, the dataset was split into three speed groups and three temperature groups. The distribution of runs within these groupings is illustrated in Figure 6-1. The figure indicates that the desired distribution of speed and temperature combinations was achieved for this set of validation runs.

The three speed groups were divided into 44 to 47 mph for Low speed, 48 to 51 mph for Medium speed and 52+ mph for High speed. The three temperature groups were created by splitting the runs between those at 84 to 100 degrees Fahrenheit for Low temperature, 101 to 110 degrees Fahrenheit for Medium temperature and 111 to 117 degrees Fahrenheit for High temperature. The low temperature group is disproportionately wide due to the limited number of points at the lower end of the range.

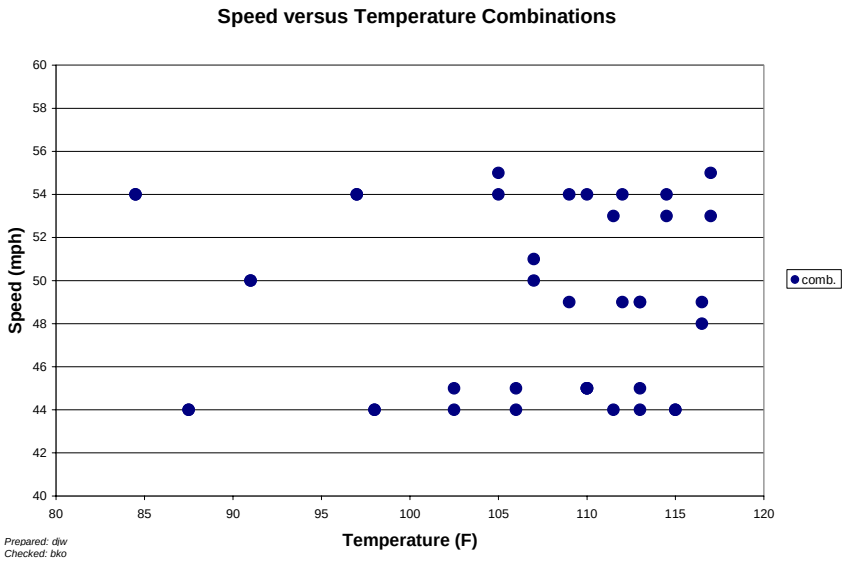

Figure 6-1 Pre-Validation Speed-Temperature Distribution – 240500 – 04-Sep-2007

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

Figure 6-2 shows the GVW Percent Error vs. Speed graph for the population as a whole. The variability of GVW error is relatively similar across the speed groups. It would appear that a tendency to overestimate GVW exists in the low and medium speed groups.

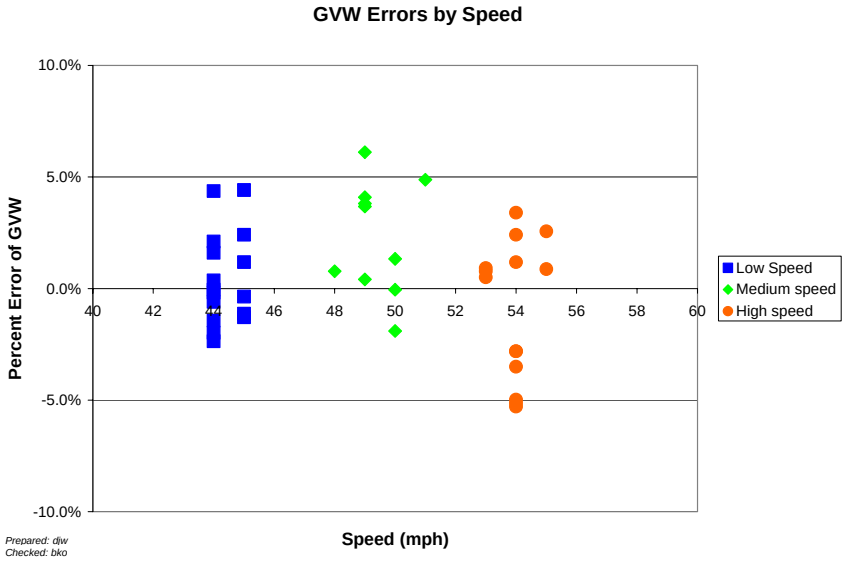

Figure 6-2 Pre-validation GVW Percent Error vs. Speed – 240500 – 04-Sep-2007

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

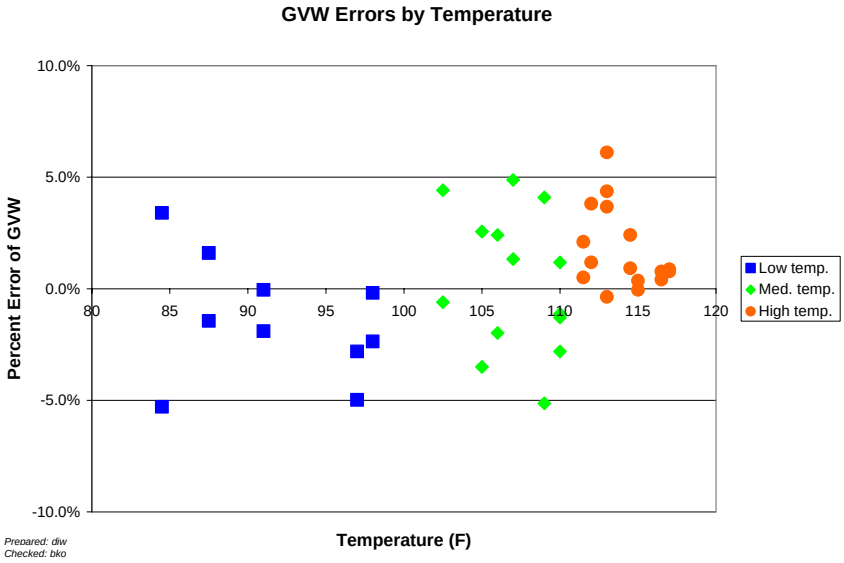

Figure 6-3 Pre-Validation GVW Percent Error vs. Temperature – 240500 – 04-Sep-2007

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

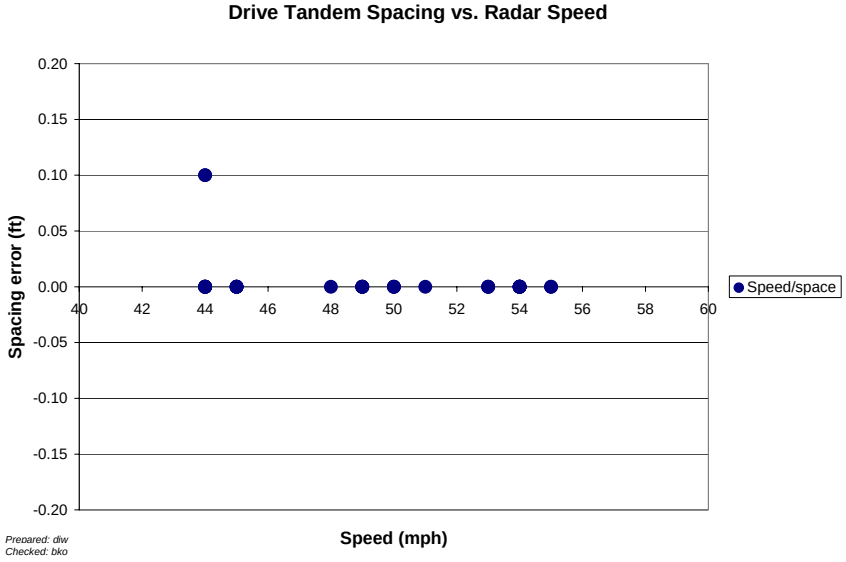

Figure 6-4 Pre-Validation Spacing vs. Speed - 240500 – 04-Sep-2007

6.1 Temperature-based Analysis

The three temperature groups were created by splitting the runs between those at 84 to 100 degrees Fahrenheit for Low temperature, 101 to 110 degrees Fahrenheit for Medium temperature and 111 to 117 degrees Fahrenheit for High temperature.

Table 6-2 Pre-Validation Results by Temperature Bin – 240500 – 04-Sep-2007

Element	95% Limit	Low Temperature 84 to 100 °F	Medium Temperature 101 to 110 °F	High Temperature 111 to 117 °F
Steering axles	±20 %	-1.9 ± 13.2%	0.1 ± 9.7%	1.7 ± 7.9%
Tandem axles	±15 %	-1.2 ± 6.5%	0.4 ± 7.8%	1.9 ± 5.6%
GVW	±10 %	-1.4 ± 6.1%	0.3 ± 6.8%	1.7 ± 3.9%
Speed	±1 mph	-0.4 ± 1.2 mph	0.1 ± 2.9 mph	0.1 ± 1.3 mph
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	0.0 ± 0.0 ft	0.0 ± 0.1 ft

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Table 6-2 has decreasing variability in steering axle weights with increasing temperature. This is influenced by the relatively small sample size of the group. All weight statistics show a trend from underestimation to overestimation as temperatures increase.

Figure 6-5 shows the distribution of GVW Errors versus Temperature by Truck. At the lower temperatures, the partial truck (diamonds) has larger underestimation errors that the

golden truck (squares). The difference in estimation with temperature disappears at the higher end of the range where there are more data points.

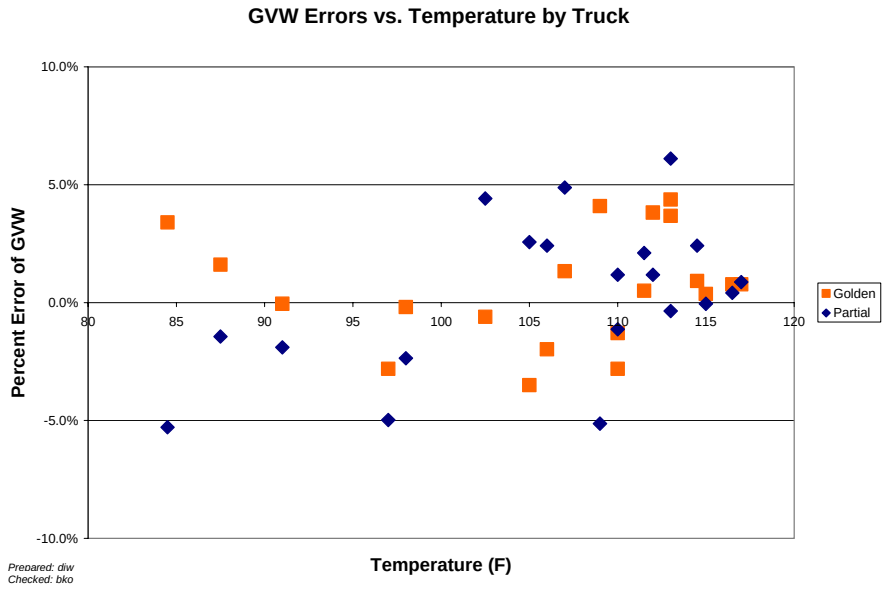

Figure 6-5 Pre-Validation GVW Percent Error vs. Temperature by Truck – 240500 – 04-Sep-2007

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

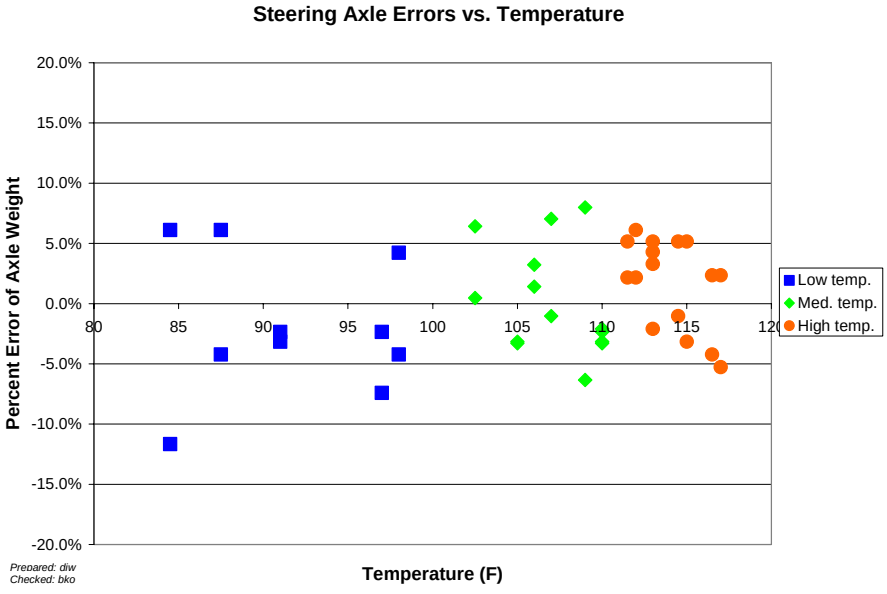

Figure 6-6 Pre-Validation Steering Axle Error vs. Temperature by Group – 240500 – 04-Sep-2007

6.2 Speed-based Analysis

The speed groups were divided as follows: Low speed – 44 to 47 mph, Medium speed – 48 to 51 mph and High speed – 52+ mph.

Table 6-3 Pre-Validation Results by Speed Bin – 240500 – 04-Sep-2007

Element	95% Limit	Low Speed 44 to 47 mph	Medium Speed 48 to 51 mph	High Speed 52+ mph
Steering axles	±20 %	0.6 ± 8.2%	2.2 ± 10.3%	-1.6 ± 11.3%
Tandem axles	±15 %	0.5 ± 5.3%	2.4 ± 7.3%	-0.6 ± 7.7%
GVW	±10 %	0.4 ± 4.4%	2.3 ± 5.8%	-0.8 ± 6.7%
Speed	±1 mph	-0.1 ± 2.7 mph	0.0 ± 1.5 mph	0.1 ± 1.3 mph
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	0.0 ± 0.0 ft	0.0 ± 0.0 ft

Prepared: bko *Checked:jrn*

Table 6-3 shows a slight overestimation at low speed with a larger overestimation at medium speed and then under estimation at high speeds. This tendency exists for all loading statistics. There is a tendency for the variability in errors to increase with increasing speed.

Figure 6-7 illustrates the somewhat convex shape of the scatter of GVW errors with speed. The patterns of the two trucks are similar.

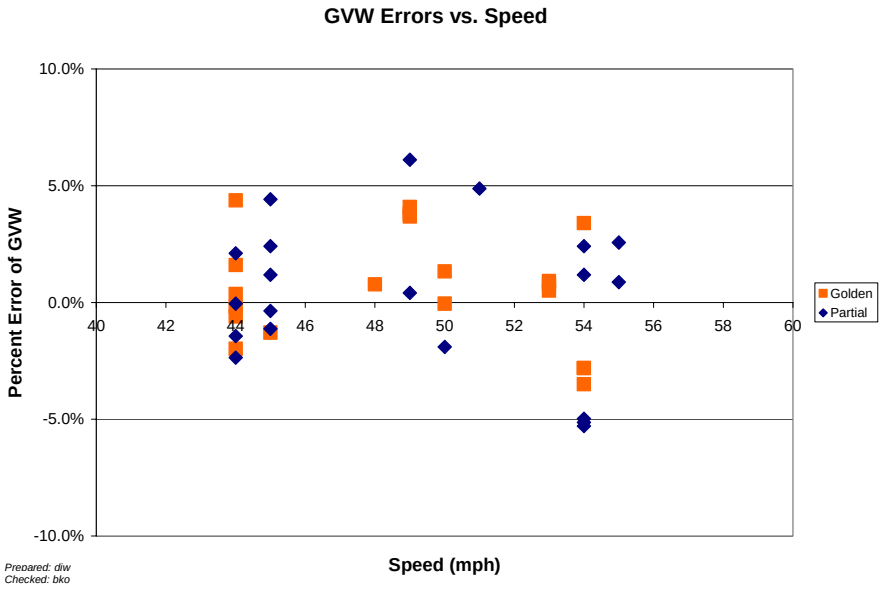

Figure 6-7 Pre-Validation GVW Percent Error vs. Speed Group - 240500 –04-Sep-2007

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

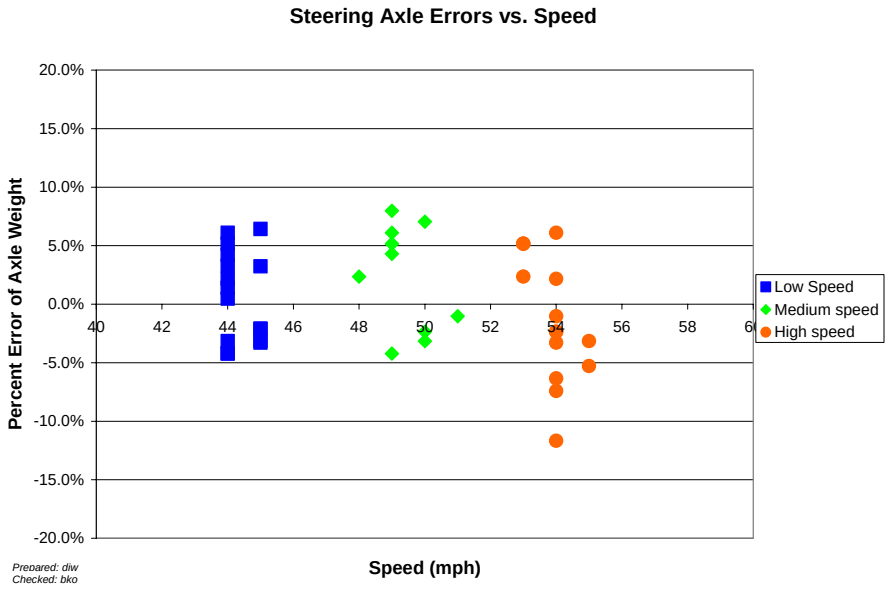

Figure 6-8 Pre-Validation Steering Axle Percent Error vs. Speed Group - 240500 – 04-Sep-2007

The trend for the GVW errors is echoed in the steering axle error graph with its slightly convex scatter of error points.

6.3 Classification Validation

This LTPP installed site used the FHWA 13-bin classification scheme and the LTPP ETG mod 2 classification algorithm at the time of the previous validation. Classification 15 had been added to define unclassified vehicles. **The site was changed to the mod 3 version at an unknown date. The mod 3 version modified classification of Class 3, 4 and 5 vehicles.**

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

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

Table 6-4 Truck Misclassification Percentages for 240500 – 04-Sep-2007

Class	Percent Error	Class	Percent Error	Class	Percent Error
4	N/A	5	0	6	N/A
7	N/A				
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.

Table 6-5 Truck Classification Mean Differences for 240500 – 04-Sep-2007

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

6.4 Evaluation by ASTM E-1318 Criteria

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

Table 6-6 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*

6.5 Prior Validations

The last validation for this site was done March 22, 2006. It was the first validation of the site. The site was producing research quality data. Figure 6-9 shows the GVW Percent Error vs. Speed for the post validation runs. The site was validated with two trucks. The "Golden" truck was loaded to 70,700 lbs. The "partial" truck which had air suspension on both tandems was loaded to 66,690 lbs.

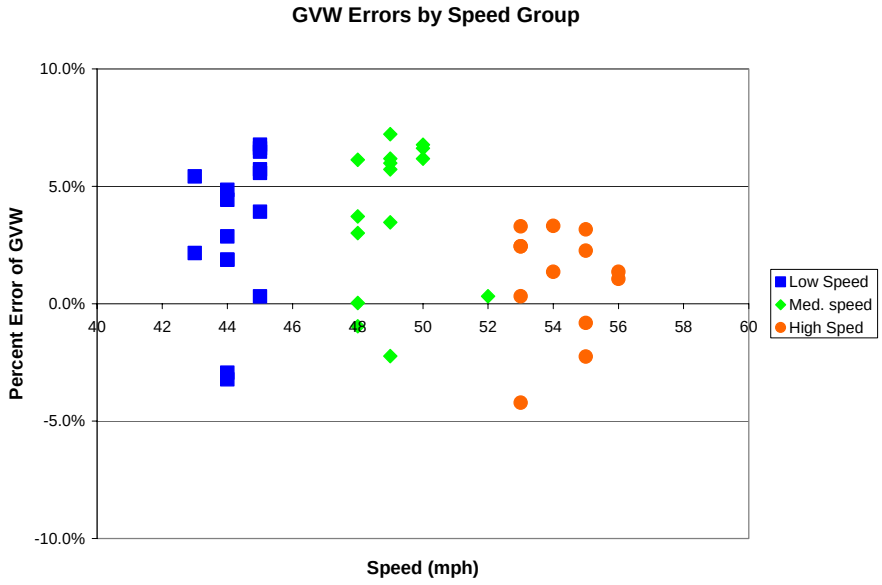

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Figure 6-9 Last Validation GVW Percent Error vs. Speed – 240500 – 22-Mar-2006

Table 6-7 shows the overall results from the last validation. The variability of the pre-validation statistics is slightly greater than at the end of the last validation. The over-estimation observed at the end of the last validation was reduced to nearly unbiased estimates for the pre-validation condition.

Table 6-7 Last Validation Final Results – 240500 – 22-Mar-2006

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	2.5 ± 7.5%	Pass
Tandem axles	±15 percent	2.9 ± 6.5%	Pass
Gross vehicle weights	±10 percent	2.8 ± 6.2%	Pass
Speed	±1 mph [2 km/hr]	0.1 ± 0.8 mph	Pass
Axle spacing	± 0.5 ft [150 mm]	0.0 ± 0.1 ft	Pass

Prepared: bko *Checked:jrn*

Table 6-8 has the results at the end of the last validation by temperature. It appears that changes in temperature do not significantly affect mean errors of weight estimates.

Table 6-8 Last Validation Results by Temperature Bin – 240500 – 22-Mar-2006

Element	95% Limit	Low Temperature 20-42 °F	Medium Temperature 43-20 °F	High Temperature 50-60 °F
Steering axles	±20 %	2.3 ± 8.1%	2.8 ± 8.8%	2.6 ± 7.4%
Tandem axles	±15 %	2.2 ± 6.9%	3.7 ± 5.9%	3.1 ± 7.2%
GVW	±10 %	2.2 ± 6.8%	3.5 ± 6.1%	3.0 ± 7.0%
Speed	±1 mph	0.1 ± 0.5 mph	0.2 ± 1.3 mph	0.0 ± 1.1 mph
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft

Prepared: bko *Checked:jrn*

Through this validation the equipment has been observed at temperatures from 25 to 117 degrees Fahrenheit.

Table 6-9 has the results of the prior post validation by speed groups. It appears that the mean error and the scatter of error for all weights decline at high speeds.

Table 6-9 Last Validation Results by Speed Bin – 240500 – 22-Mar-2006

Element	95% Limit	Low Speed 40 to 46 mph	Medium Speed 47 to 52 mph	High Speed 53+ mph
Steering axles	±20 %	3.3 ± 7.8%	3.7 ± 7.6%	0.2 ± 6.9%
Tandem axles	±15 %	3.4 ± 6.6%	3.8 ± 7.1%	1.1 ± 4.9%
GVW	±10 %	3.3 ± 6.6%	3.9 ± 6.7%	1.0 ± 5.0%
Speed	±1 mph	0.0 ± 0.8 mph	0.2 ± 0.9 mph	0.1 ± 1.1 mph
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	0.0± 0.1 ft	-0.1 ± 0.1 ft

Prepared: bko *Checked:jrn*

7 Data Availability and Quality

As of September 4, 2007 this site does not have at least 5 years of research quality data. Research quality data is defined to be at least 210 days in a year of data of known calibration meeting LTPP's precision requirements.

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

The amount and coverage for the site is shown in Table 7-1. The value for months is a measure of the seasonal variation in the data. The indicator of coverage indicates whether day of week variation has been accounted for on an annual basis. As can be seen from the table 2000 through 2006 have a sufficient quantity to be considered complete years of data. The validations for previous installation do not indicate the existence of research quality data. **As a result, it can be seen that at least four additional years of research quality data are needed to meet the goal of a minimum of 5 years of research weight data.**

Table 7-1 Amount of Traffic Data Available 240500 – 04-Sep-2007

Year	Classification Days	Months	Coverage	Weight Days	Months	Coverage
1994	153	6	Full Week	154	6	Full Week
1996	12	3	Full Week	None		
1999	54	2	Weekday(s)	19	2	Full Week
2000	292	12	Full Week	37	3	Full Week
2001	327	12	Full Week	353	12	Full Week
2002	340	12	Full Week	343	12	Full Week
2003	316	12	Full Week	316	12	Full Week
2004	283	12	Full Week	284	12	Full Week
2005	283	10	Full Week	283	10	Full Week
2006	304	10	Full Week	304	10	Full Week
2007	187	7	Full Week	189	7	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 9 and Class 5 constitute more than 10 percent of the truck population. Based on the data collected 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 – 240500 – 05-Sep-2007

Characteristic	Class 9	Class 5
Percentage Overweights	0%	0%
Percentage Underweights	0%	0%
Unloaded Peak	32,000	
Loaded Peak	76,000	
Peak		12,000

Prepared: bko *Checked:jrn*

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

The graphical screening comparison figures are found in Figure 7-1 through Figure 7-3. These are based on data collected immediately after the validation and may not be wholly representative of the population at the site. They should however provide a sense of the

statistics expected when SPS comparison data is computed for the post-validation Sheet 16.

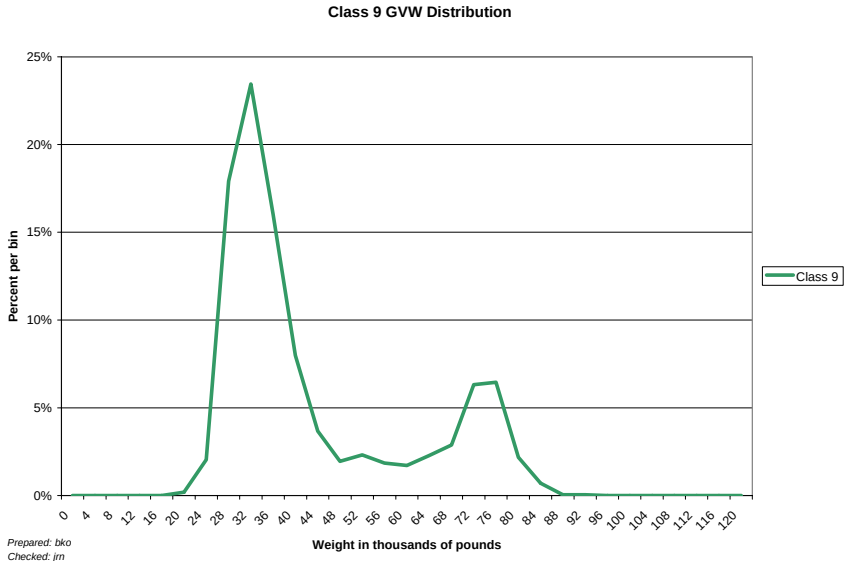

Figure 7-1 Expected GVW Distribution Class 9 – 240500 – 05-Sep-2007

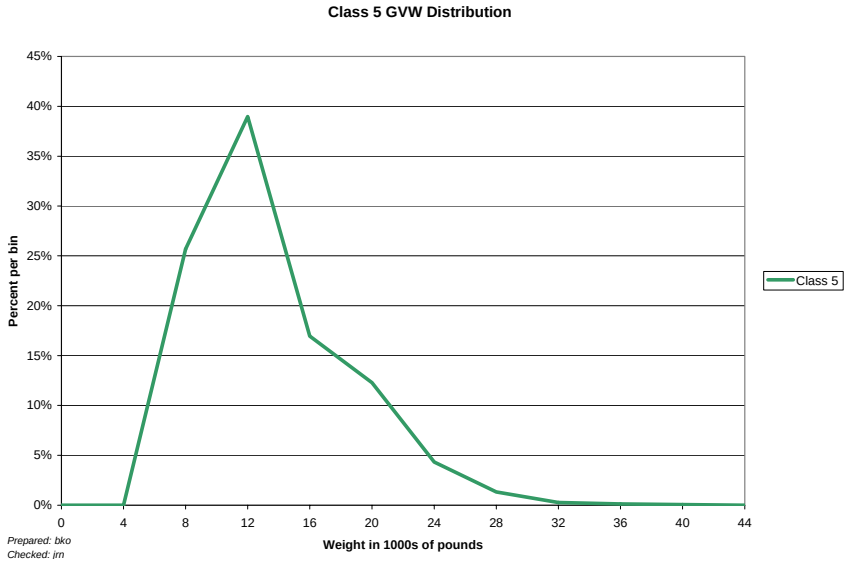

Figure 7-2 Expected GVW Distribution Class 5 – 240500 – 05-Sep-2007

Figure 7-3 is created by finding the frequency distribution of vehicles in classes 4 and greater.

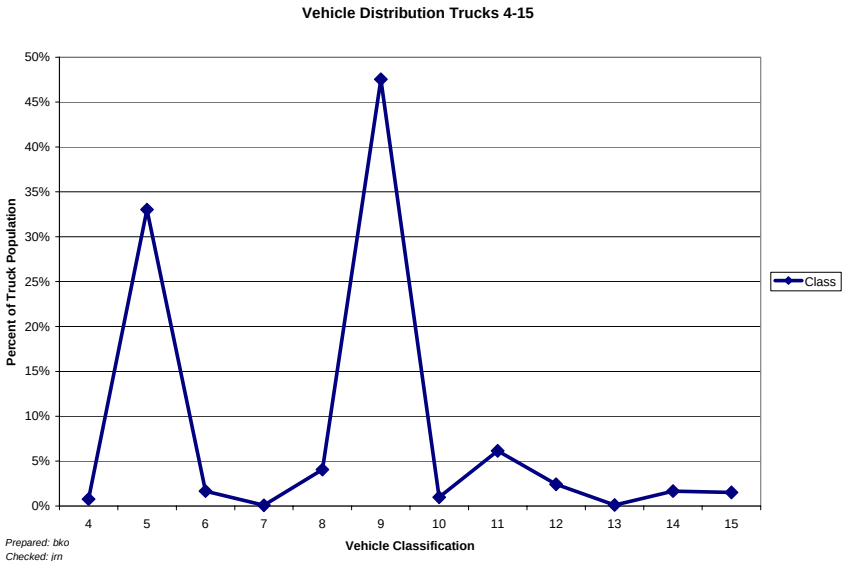

Figure 7-3 Expected Vehicle Distribution – 240500 – 05-Sep-2007

8 Data Sheets

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

Sheet 19 – Truck 1 – 3S2 loaded air suspension (3 pages)
Sheet 19 – Truck 2 – 3S2 partially loaded air suspension (3 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 – Post-Validation (3 pages)

Test Truck Photographs (6 pages)

LTPP Mod 3 Classification Scheme (1 page)

Final System Parameters (1 page)

9 Updated Handout Guide and Sheet 17

A copy of the handout has been included following page 30. It includes a current Sheet 17 with all applicable maps and photographs. There are no significant changes in the information provided.

10 Updated Sheet 18

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

11 Traffic Sheet 16(s)

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

POST-VISIT HANDOUT GUIDE FOR SPS WIM VALIDATION

STATE: Maryland

SHRP ID: 0500

1. General Information 1
2. Contact Information 1
3. Agenda 2
4. Site Location/ Directions 2
5. Truck Route Information 3
6. Sheet 17 – Maryland (240500) 4

Figures

Figure 4-1 - WIM Site Location - 240500 - Maryland 2
Figure 5-1 - Truck Route - 240500 - Maryland 3
Figure 6-1 - 24_0500_Equipment_Layout 7

Site Photos

Photo 6-1 24_0500_Upstream_09_04_07.jpg 7
Photo 6-2 24_0500_Downstream_09_04_07.jpg 8
Photo 6-3 24_0500_Power_Meter_09_04_07.jpg 8
Photo 6-4 24_0500_Telephone_Box_09_04_07.jpg 9
Photo 6-5 24_0500_Cabinet_Exterior_09_04_07.jpg 9
Photo 6-6 24_0500_Cabinet_Interior_Front_09_04_07.jpg 10
Photo 6-7 24_0500_Cabinet_Interior_Rear_09_04_07.jpg 10
Photo 6-8 24_0500_Leading_WIM_Sensor_09_04_07.jpg 11
Photo 6-9 24_0500_Trailing_WIM_Sensor_09_04_07.jpg 11
Photo 6-10 24_0500_Leading_Loop_09_04_07.jpg 12
Photo 6-11 24_0500_Trailing_Loop_Sensor_09_04_07.jpg 12
Photo 6-12 24_0500_WIM_Scales_09_04_07.jpg 13

1. General Information

SITE ID: *240500*

LOCATION: *US-15 North, milepost 4.62, approximately 10 miles south of Frederick, Maryland.*

VISIT DATE: *September 4, 2007 at 9:00 a.m.*

VISIT TYPE: *Validation*

2. Contact Information

POINTS OF CONTACT:

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

Highway Agency: *Rodney Wynn, 410-321-4106, rwynn@sha.state.md.us*

Barry Balzanna, 410-545-5509, bbalzanna@sha.state.md.us

Michael Baxter, 410-545-5511, mbaxter@sha.state.md.us

Jim Brown, 301-624-8252, jbrown@sha.state.md.us

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

FHWA Division Office Liaison: *Azmat Hussain,410-779-7161, azmat.hussain@fhwa.dot.gov*

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

3. Agenda

BRIEFING DATE: *On-Site*

ON SITE PERIOD: *Beginning September 4, 2007 at 9:00 am.*

TRUCK ROUTE CHECK: *Completed at previous validation visit – See Truck Route*

4. Site Location/ Directions

NEAREST AIRPORT: *Washington Dulles International Airport (26.4 miles).*

DIRECTIONS TO THE SITE: *Approximately 10 miles south of Frederick, Maryland on US 15.*

MEETING LOCATION: *On site beginning at 9:00 am.*

WIM SITE LOCATION: *Located in the northbound driving lane of US 15, milepost 4.62. GPS: 39°19.839'N, 77°30.610'W.*

WIM SITE LOCATION MAP:

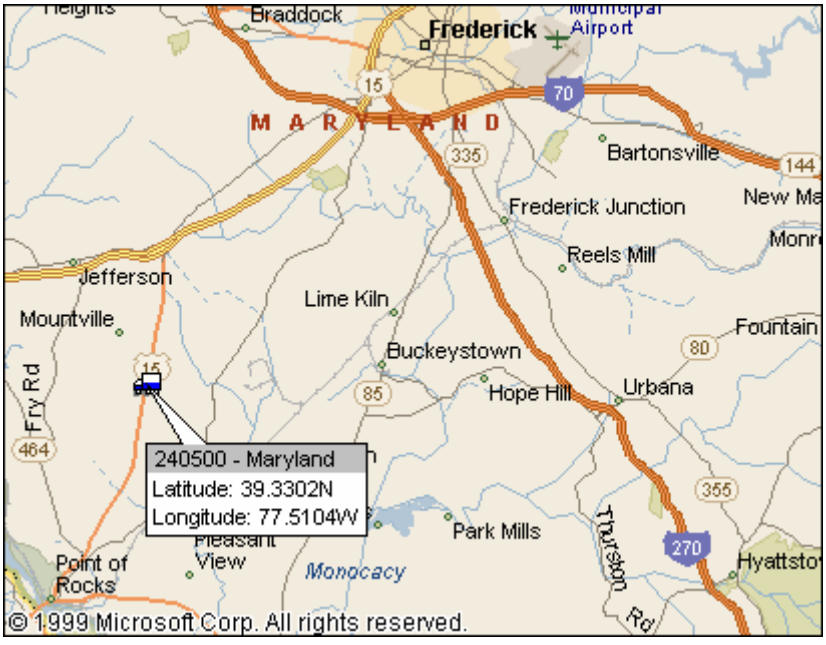

Figure 4-1 - WIM Site Location - 240500 - Maryland

5. Truck Route Information

ROUTE RESTRICTIONS: *None*

SCALE LOCATION: *New Market Certified Scales, I-70, Eastbound side, approximately 8.5 miles east of Frederick, MD.*

Trucks –
Company – William S. Fout, Inc., Frederick, MD
Contact – Jerry Pulliam, 301-662-1989

TRUCK ROUTE:

Southbound turnaround – 3.2 miles to Point of Rocks Road
Northbound turnaround - .6 miles to Mountville Road (MD 28)
Total distance = 7.6 miles
Total time = 10 minutes

Southbound vehicles make a left on Point of Rocks road followed by a left on to Ballenger Creek Pike, a left on East Basford Road and a right on to US 15 northbound. After crossing the scale the trucks proceed northbound on US 15 to interchange at MD 28 (Mountville Road).

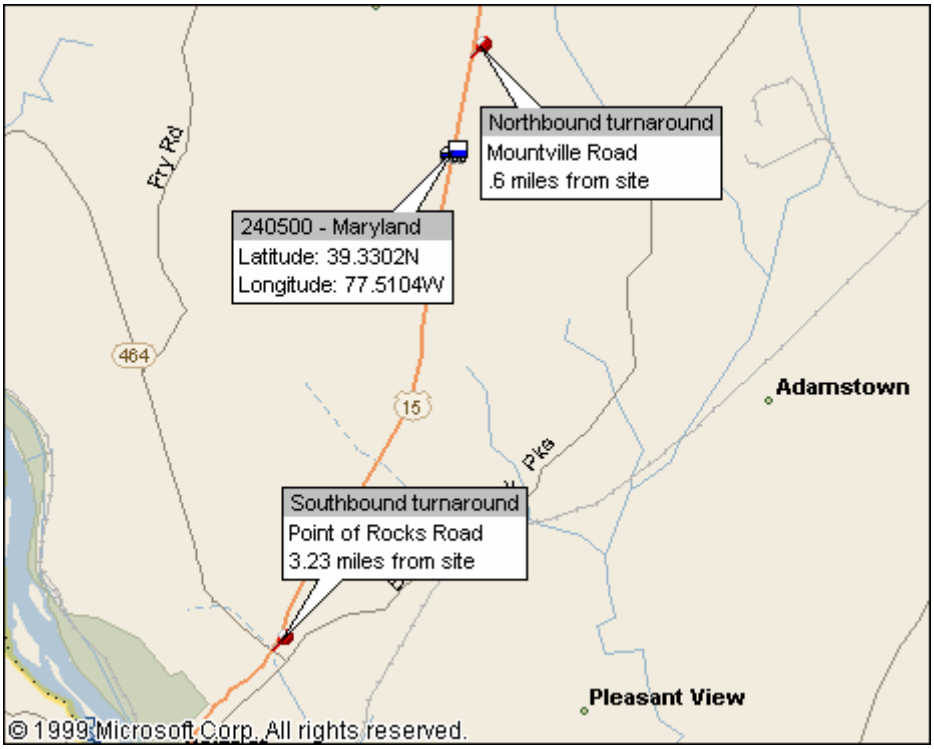

Figure 5-1 - Truck Route - 240500 - Maryland

6. Sheet 17 – Maryland (240500)

1.* ROUTE ___US-15_____ MILEPOST ___4.62____LTPP DIRECTION - N S E W

2.* WIM SITE DESCRIPTION - Grade ___<1%_____ % Sag vertical Y / N
Nearest SPS section upstream of the site ___ 0_5 _6_1 ___
Distance from sensor to nearest upstream SPS Section ___4 _5_0 ___ ft.

3.* LANE CONFIGURATION
Lanes in LTPP direction _1___ Lane width __12__ 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 __10 __ ft

4.* PAVEMENT TYPE _____Portland concrete cement_____ _____ _____

5.* PAVEMENT SURFACE CONDITION – Distress Survey
Date __9/4/2007_____ Distress Photo 24_0500_Upstream_09_04_07.jpg
Date __9/4/2007_____ Distress Photo 24_0500_Downstream_09_04_07.jpg
Date _____ Distress Photo_____

6. * SENSOR SEQUENCE
_____Loop – Bending Plate – Bending Plate – Loop_____
7. * REPLACEMENT AND/OR GRINDING __ __ __ / __ __ / __ __ __ __
REPLACEMENT AND/OR GRINDING __ __ __ / __ __ / __ __ __ __
REPLACEMENT AND/OR GRINDING __ __ __ / __ __ / __ __ __ __

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

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

Clearance under plate ___ __6_. _0__ in
Clearance/access to flush fines from under system Y / N

10. * CABINET LOCATION

Same side of road as LTPP lane Y/N Median Y/N Behind barrier Y/N
Distance from edge of traveled lane __1_8__ ft
Distance from system __ 3_1 __ ft
TYPE _____

CABINET ACCESS controlled by LTPP / STATE / JOINT?
Contact - name and phone number _____
Alternate - name and phone number _____

11. * POWER

Distance to cabinet from drop ___3 _6_5 ___ ft Overhead / underground / solar / AC in cabinet?
Service provider _____ Phone number _____

12. * TELEPHONE

Distance to cabinet from drop ___3 _6_5__ ft Overhead / under ground / cell?
Service provider _____Phone Number _301-874-0732_

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

14. * TEST TRUCK TURNAROUND time __10__ minutes DISTANCE __6.7___ mi.

15. PHOTOS FILENAME

Power source	24_0500_Power_Meter_09_04_07.jpg
Phone source	24_0500_Telephone_Box_09_04_07.jpg
Cabinet exterior	24_0500_Cabinet_Exterior_09_04_07.jpg
Cabinet interior	24_0500_Cabinet_Interior_Front_09_04_07.jpg
	24_0500_Cabinet_Interior_Rear_09_04_07.jpg
Weight sensors	24_0500_Leading_WIM_Sensor_09_04_07.jpg
	24_0500_Trailing_WIM_Sensor_09_04_07.jpg
Classification sensors	_None_____
Other sensors	24_0500_Leading_Loop_09_04_07.jpg
	24_0500_Trailing_Loop_Sensor_09_04_07.jpg

Description ___Loops_____
Downstream direction at sensors on LTPP lane 24_0500_Downstream_09_04_07.jpg
Upstream direction at sensors on LTPP lane 24_0500_WIM_Scales_09_04_07.jpg
24_0500_Upstream_09_04_07.jpg

COMMENTS _____

COMPLETED BY _____Dean Wolf_____

PHONE _301-210-5105_____DATE COMPLETED _0_9_ /__0__5_ / _2 __0 __0 __7

Sketch of equipment layout

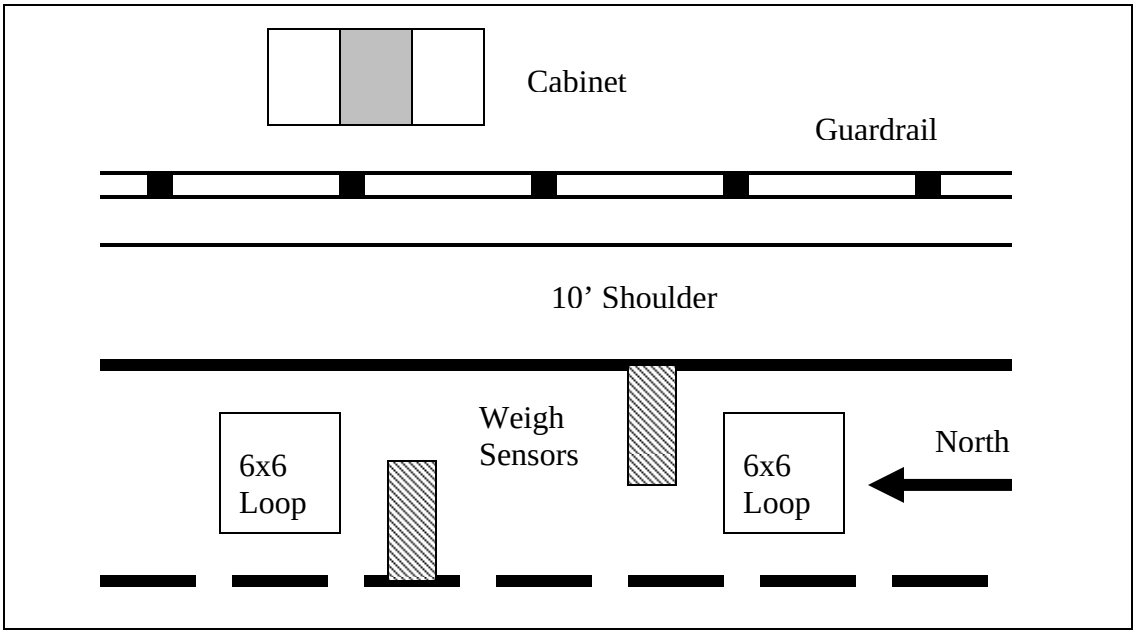

Figure 6-1 - 24_0500_Equipment_Layout

Photo 6-1 24_0500_Upstream_09_04_07.jpg

Photo 6-2 24_0500_Downstream_09_04_07.jpg

Photo 6-3 24_0500_Power_Meter_09_04_07.jpg

Photo 6-4 24_0500_Telephone_Box_09_04_07.jpg

Photo 6-5 24_0500_Cabinet_Exterior_09_04_07.jpg

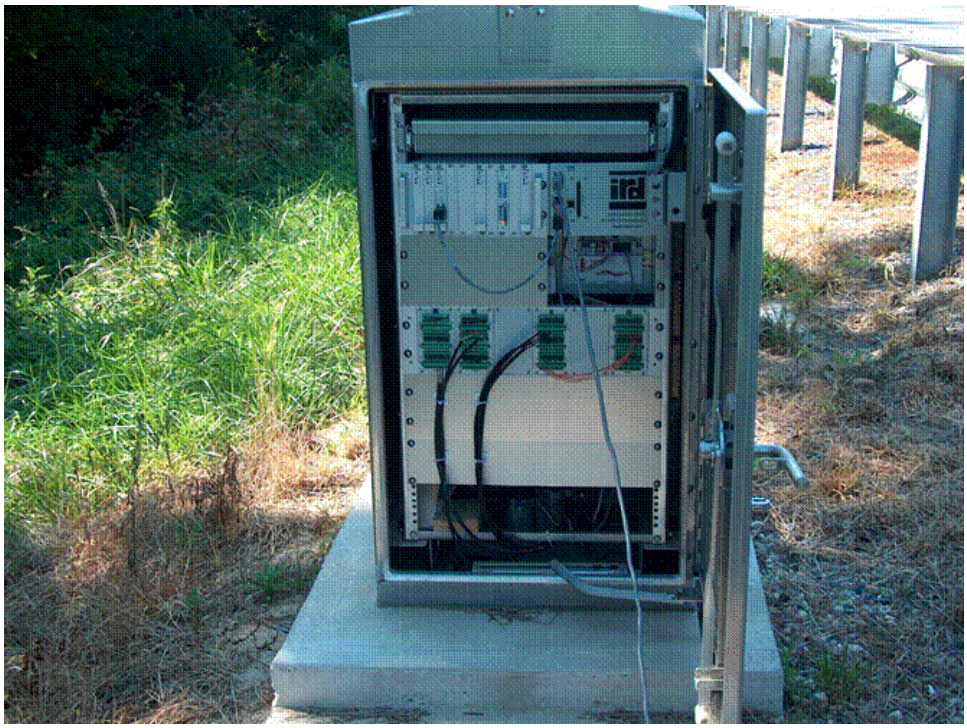

Photo 6-6 24_0500_Cabinet_Interior_Front_09_04_07.jpg

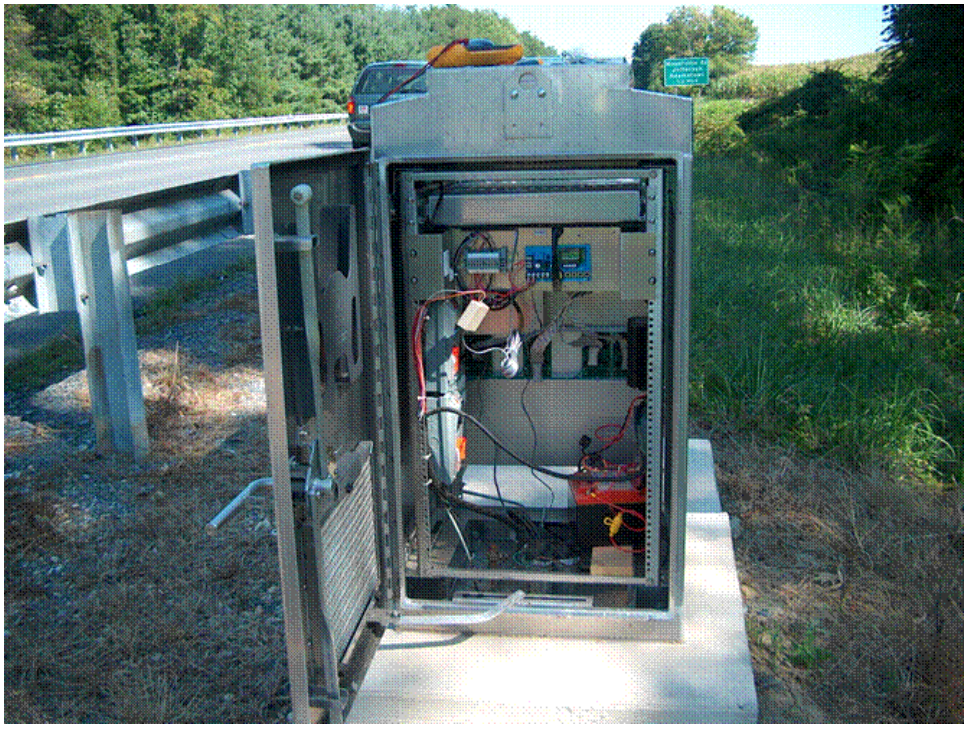

Photo 6-7 24_0500_Cabinet_Interior_Rear_09_04_07.jpg

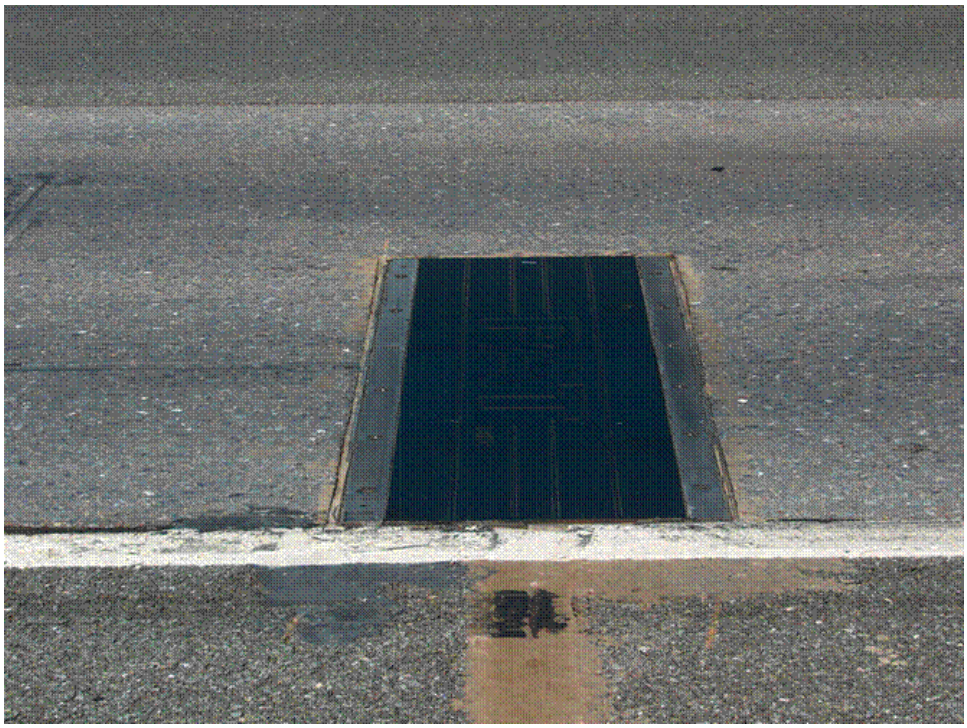

Photo 6-8 24_0500_Leading_WIM_Sensor_09_04_07.jpg

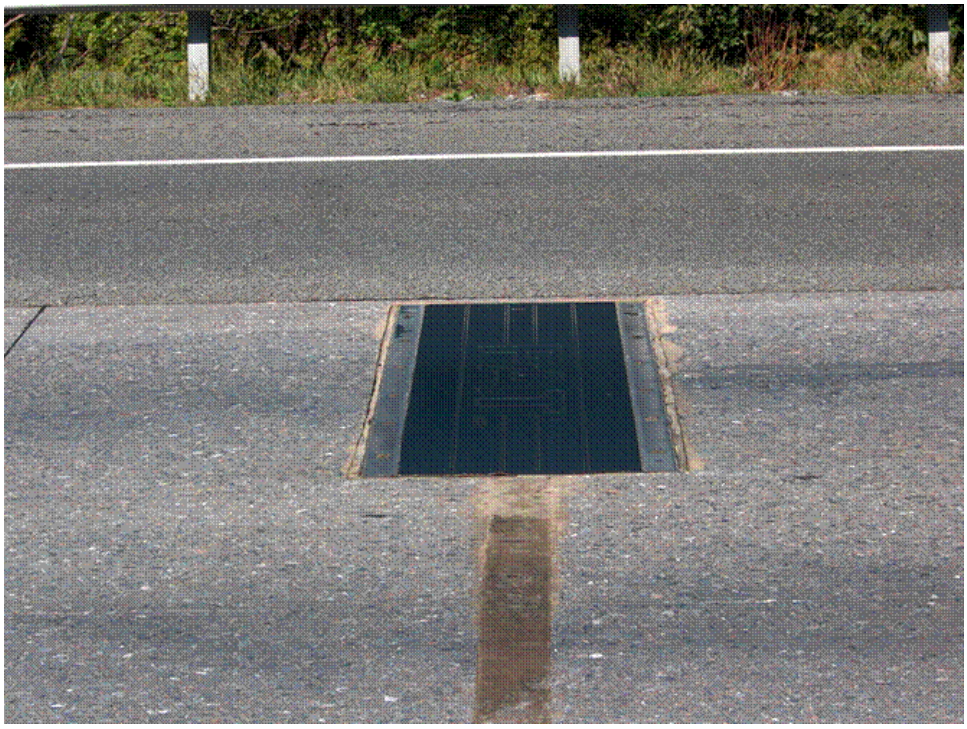

Photo 6-9 24_0500_Trailing_WIM_Sensor_09_04_07.jpg

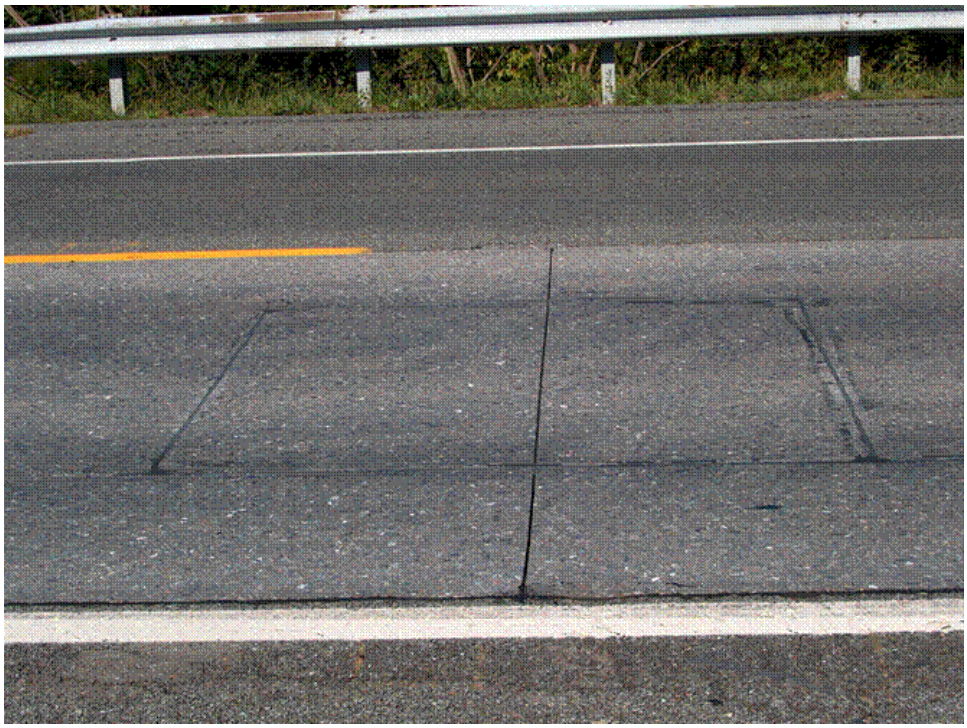

Photo 6-10 24_0500_Leading_Loop_09_04_07.jpg

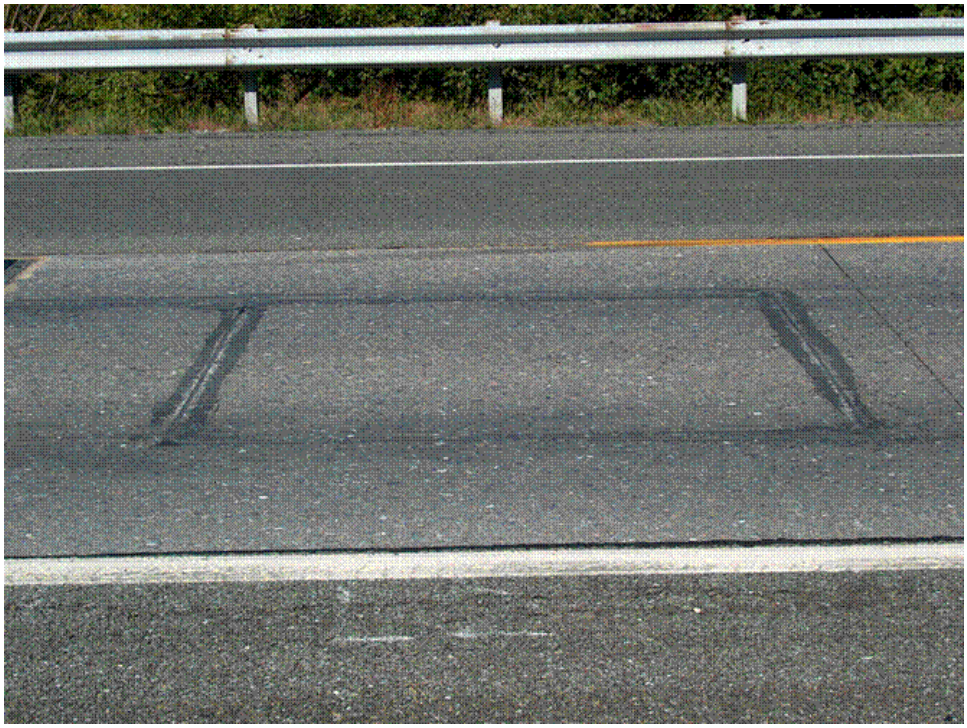

Photo 6-11 24_0500_Trailing_Loop_Sensor_09_04_07.jpg

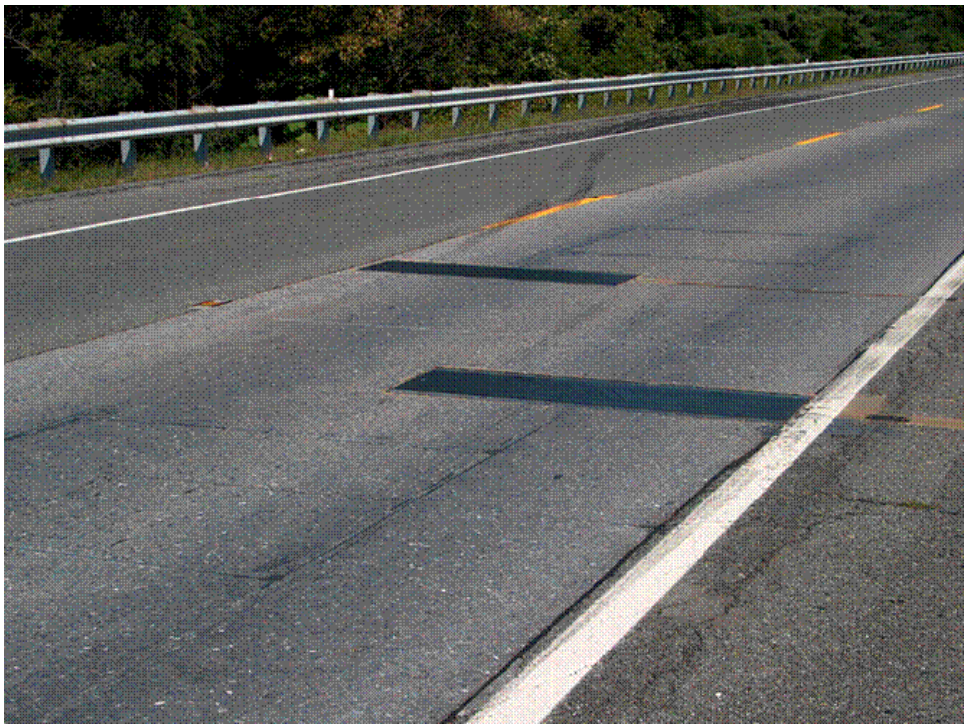

Photo 6-12 24_0500_WIM_Scales_09_04_07.jpg

SHEET 18	STATE CODE [24]
LTPP MONITORED TRAFFIC DATA	SPS PROJECT ID [0500]
WIM SITE COORDINATION	DATE: (mm/dd/yyyy) 9/4/2007

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 _1__ ☐ days ☒ weeks

b. Notice for straightedge and grinding check - __1_ ☐ 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: _____ Location:_____

Phone: _____

SHEET 16 **LTPP MONITORED TRAFFIC DATA** **SITE CALIBRATION SUMMARY**	*STATE ASSIGNED ID [__ __ __ __] *STATE CODE [24] *SHRP SECTION ID [0500]

SITE CALIBRATION INFORMATION

1. * DATE OF CALIBRATION (MONTH/DAY/YEAR) [9/4/2007]

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	___2.8
DYNAMIC AND STATIC SINGLE AXLES	___0.3	STANDARD DEVIATION	___4.7
DYNAMIC AND STATIC DOUBLE AXLES	___0.6	STANDARD DEVIATION	___3.4

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) ___3900___

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	____ 0.0	FHWA CLASS ____	____ ____ _____
*** FHWA CLASS 8	____ 0.0	FHWA CLASS ____	____ ____ _____
		FHWA CLASS ____	____ ____ _____
		FHWA CLASS ____	____ ____ _____

*** PERCENT "UNCLASSIFIED" VEHICLES: ____ 0.0

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

SHEET 16 **LTPP MONITORED TRAFFIC DATA** **SITE CALIBRATION SUMMARY**	*STATE ASSIGNED ID [__ __ __ __] *STATE CODE [24] *SHRP SECTION ID [0500]

SITE CALIBRATION INFORMATION

1. * DATE OF CALIBRATION (MONTH/DAY/YEAR) [9/5/2007]

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

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

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

5. EQUIPMENT MANUFACTURER ___IRD/ PAT Traffic_____

WIM SYSTEM CALIBRATION SPECIFICS**

6.**CALIBRATION TECHNIQUE USED:

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

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

__ 20__ PASSES PER TRUCK

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

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

7. SUMMARY CALIBRATION RESULTS (EXPRESSED AS A PERCENT)

MEAN DIFFERENCE BETWEEN ---

DYNAMIC AND STATIC GVW	___1.1	STANDARD DEVIATION	___3.4
DYNAMIC AND STATIC SINGLE AXLES	___0.5	STANDARD DEVIATION	___5.5
DYNAMIC AND STATIC DOUBLE AXLES	___1.3	STANDARD DEVIATION	___4.1

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) ___3900___

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	____ 0.0	FHWA CLASS ____	____ ____ _____
*** FHWA CLASS 8	____ 0.0	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	24
LTPP Traffic Data	* SPS PROJECT ID	0500
*CALIBRATION TEST TRUCK # 1	* DATE	09/04/07

Rev. 08/31/01

#3546

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: INTERNATIONAL b) * Model: 8600

10.* Trailer Load Distribution Description:

FORKLIFT COUNTERWEIGHTS LOADED OVER LENGTH OF TRAILER

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

b). Trailer Tare Weight (units): _____

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

A to B 12.1 B to C 4.8 C to D 28.2

D to E 9.0 E to F _____

Wheelbase (measured A to last) _____ Computed 48.7

13. *Kingpin Offset From Axle B (units) _____ (+1.4) ✓

(+ is to the rear)

SUSPENSION

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

Sheet 19	* STATE CODE	24
LTPP Traffic Data	* SPS PROJECT ID	0500
*CALIBRATION TEST TRUCK # 1	* DATE	09/04/07

Rev. 08/31/01

PART II

Day 1

*b) Average Pre-Test Loaded weight 72630
*c) Post Test Loaded Weight 72240
*d) Difference Post Test – Pre-test -390

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10720	15000	15000	15960	15960		72640
2	10780	~~14820~~ 14970	~~15020~~ 14970	15950	15950		72620
3	10720	15040	15040	15920	15920		72640
Average	~~10740~~	~~15020~~ 15003	~~15020~~ 15003	~~15940~~ 15943	~~15940~~ 15943		~~72630~~ 72633

Table 6. Raw data – Axle scales –

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

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10560	14880	14880	15960	15960		72240
2							
3							
Average	10560	14880	14880	15960	15960		72240

Measured By DJW Verified By [signature] Weight date 9/4/07

Sheet 19	* STATE CODE	24
LTPP Traffic Data	* SPS PROJECT ID	0500
*CALIBRATION TEST TRUCK # 1	* DATE	09-05-07

Rev. 08/31/01

Day 2

7.2 *b) Average Pre-Test Loaded weight 72650

*c) Post Test Loaded Weight 72280

*d) Difference Post Test – Pre-test -370

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10780	14950	14950	15970	15970		72620
2	10760	15000	15000	15940	15940		72640
3	10820	15020	15020	15910	15910		72680
Average	~~10740~~ 10787	~~14990~~	14990	15940	15940		~~72650~~ 72647

Table 6.2. Raw data – Axle scales –

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

Table 7.2 Raw data – Axle scales – post-test

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10580	14890	14890	15960	15960		72280
2							
3							
Average	10580	14890	14890	15960	15960		72280

Measured By DW Verified By [signature] Weight date 9/5/07

Sheet 19	* STATE_CODE	24
LTPP Traffic Data	* SPS PROJECT ID	0500
*CALIBRATION TEST TRUCK # 2	* DATE	09/04/07

Rev. 08/31/01

#28

PART I.

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

AXLES - units - lbs / 100s lbs / kg

GEOMETRY

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

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

10.* Trailer Load Distribution Description:

FORKLIFT AND COUNTERWEIGHT LOADED MID TO REAR OF TRAILER ✓

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

b). Trailer Tare Weight (units): _____

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

A to B 16.5 B to C 4.5 C to D 33.7

D to E 4.1 E to F _____

Wheelbase (measured A to last) _____ Computed 57.8

13. *Kingpin Offset From Axle B (units) _____ (+2.5)

(+ 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	10R17.5	AIR
E	10R17.5	AIR
F		

Sheet 19	* STATE_CODE	24
LTPP Traffic Data	* SPS PROJECT ID	0500
*CALIBRATION TEST TRUCK # 2	* DATE	09/04/07

Rev. 08/31/01

PART II

Day 1

*b) Average Pre-Test Loaded weight 65010
*c) Post Test Loaded Weight 64860
*d) Difference Post Test – Pre-test -150

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	9500	12860	12860	14900	14900		65020
2	9400	12920	12920	14880	14880		65000
3	9460	12890	12890	14880	14880		65000
Average	~~9450~~ 9453	~~12870~~ 12890	~~12870~~ 12890	~~14890~~ 14887	~~14840~~ 14887		~~65040~~ 65007

Table 6. Raw data – Axle scales –

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	9340	12860	12860	14900	14960		64860
2							
3							
Average	9340	12860	12860	14900	14900		64860

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

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

Measured By DJW Verified By [illegible] Weight date 9/4/07

Sheet 19	* STATE_CODE	24
LTPP Traffic Data	* SPS PROJECT ID	0500
*CALIBRATION TEST TRUCK # 2	* DATE	9/5/07

Rev. 08/31/01

Day 2

7.2 *b) Average Pre-Test Loaded weight 65410

*c) Post Test Loaded Weight 65180

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

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	9720	13010	13010	14850	14850		65440
2	9700	12980	12980	14860	14860		65380
3	9780	12920	12920	14900	14900		65420
Average	~~9730~~ 9733	12970	12970	14870	14870		65410 65413

Table 6.2. Raw data – Axle scales –

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

Table 7.2 Raw data – Axle scales – post-test

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	9560	12950	12950	14860	14860		65180
2							
3							
Average	9560	12950	12950	14860	14860		65180

Measured By DJW Verified By [signature] Weight date 9/5/07

Sheet 20	* STATE_CODE	24
LTPP Traffic Data	*SPS PROJECT_ID	0500 0
Speed and Classification Checks * 1 of* 2	* DATE	9 / 4 / 07

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	13187	53	5	55	9	13416	55	9
52	9	13211	52	9	42	9	13435	41	9
57	9	13216	56	9	57	6	13456	58	6
47	5	13217	52	5	53	9	13457	51	9
47	8	13218	47	8	54	9	13461	53	9
53	9	13222	53	9	50	9	13464	51	9
55	5	13224	54	5	50	8	13476	48	8
54	8	13269	54	8	52	9	13477	53	9
55	9	13285	52	9	60	9	13485	60	9
49	6	13288	50	6	56	9	13496	55	9
48	6	13289	51	6	54	9	13498	54	9
55	9	13293	56	9	57	5	13510	57	85
55	9	13296	56	9	54	5	13541	54	5
56	5	13297	57	5	55	5	13543	54	5
56	9	13299	55	9	59	9	13544	59	9
49	8	13327	49	8	53	9	13561	52	9
62	5	13344	61	5	55	9	13564	51	9
65	9	13348	64	9	51	9	13565	53	9
59	9	13349	58	9	55	9	13572	54	9
51	9	13353	50	9	54	5	13575	54	5
60	9	13393	60	9	53	9	13577	54	9
59	9	13394	58	9	59	9	13587	58	9
57	5	13399	58	5	57	9	13589	57	9
61	8	13401	61	8	54	9	13591	56	9
54	5	13419	54	5	57	9	13597	57	9

Recorded by MARK Z Direction N Lane 1 Time from 12:19pm to 1:26PM

Sheet 20	* STATE_CODE	24
LTPP Traffic Data	*SPS PROJECT_ID	0500
Speed and Classification Checks * 2 of* 2	* DATE	9 / 4 / 07

Rev. 08/31/2001....

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
49	5	13650	47	5	60	9	13850	60	9
57	9	13652	56	9	56	5	13857	55	5
60	9	13655	60	9	57	5	13898	57	5
55	9	13665	57	9	57	9	13901	57	9
52	5	13680	50	5	58	9	13903	58	9
52	5	13682	51	5	59	6	13910	59	6
54	9	13685	54	9	60	5	13915	60	5
54	6	13690	53	6	62	5	13922	62	5
52	9	13703	52	9	47	8	13948	48	8
50	5	13704	51	5	54	6	13949	54	6
61	9	13705	61	9	50	9	13952	50	9
54	9	13722	54	9	47	5	13955	48	5
52	9	13726	52	9	55	6	13958	51	6
55	9	13729	55	9	64	5	13961	64	5
54	5	13739	54	5	44	9	13972	45	9
53	9	13744	55	9	46	9	13975	45	9
57	5	13753	56	5	50	5	13988	49	5
55	5	13800	55	5	55	5	13996	55	5
53	9	13803	54	9	54	9	13998	54	9
59	9	13817	59	9	55	5	14003	56	5
59	5	13820	60	5	57	5	14004	56	5
52	5	13825	52	5	56	8	14018	53	8
52	5	13827	52	5	55	5	14019	56	5
47	5	13833	47	5	55	5	14020	56	5
55	9	13840	55	9	56	5	14030	55	5

Recorded by MARK Z Direction N Lane 1 Time from 1:26 PM to 2:22 PM

Sheet 20	* STATE_CODE 24
LTPP Traffic Data	*SPS PROJECT_ID 0500
Speed and Classification Checks * 1 of* 2	* DATE 09/05/2007

Rev. 08/31/2001....

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
55	9	20947	55	9	50	9	21090	49	9
55	8	20953	55	8	49	7	21091	49	7
50	9	20957	51	9	55	9	21105	54	9
65	5	20962	64	5	54	9	21106	54	9
50	9	20969	50	9	54	5	21112	54	5
52	9	20970	53	9	56	6	21115	56	6
59	9	20971	56	9	54	9	21126	53	9
54	9	20980	54	9	55	5	21131	54	5
58	5	20987	58	5	54	5	21132	54	5
52	5	21003	52	5	61	9	21133	61	9
50	9	21007	50	9	57	9	21134	55	9
58	5	21026	58	5	54	6	21137	54	6
55	9	21028	55	9	54	9	21143	53	9
57	5	21033	58	5	59	6	21153	57	6
57	9	21036	57	9	54	8	21157	54	8
55	5	21039	55	5	47	9	21166	47	9
55	9	21047	57	9	51	9	21183	50	9
50	9	21063	51	9	44	5	21186	45	5
52	5	21075	51	5	61	9	21189	61	9
53	5	21078	53	5	55		21192	54	8
57	5	21080	58	5				54	8
47	9	21082	46	9	57	5	21193	55	5
49	6	21086	49	6	55	9	21195	52	9
45	5	21087	45	5	54	9	21198	54	9
47	6	21089	48	6	54	9	21208	54	9

Recorded by MJZ Direction N Lane 1 Time from 9:AM to 10:50AM
10:13

Sheet 20	* STATE_CODE 24
LTPP Traffic Data	*SPS PROJECT_ID 0500
Speed and Classification Checks * 2 of* 2	* DATE 9 / 05 / 2007

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	6	21212	53	6	55	9	21335	55	9
50	9	21215	51	9	52	9	21336	52	9
49	9	21216	52	9	53	9	21337	52	9
55	5	21219	55	5 9	58	9	21340	56	9
55	9	21221	54	9	59	9	21343	59	9
54	9	21223	54	9	54	9	21345	54	9
54	8	21227	57	8	55	10	21349	55	10
51	5	21234	51	5	52	9	21352	52	9
59	8	21241	58	8	42	5	21357	42	5
64	5	21248	62	5	53	9	21365	53	9
61	9	21253	59	9	49	8	21373	49	8
49	8	21263	48	8	59	9	21386	58	9
46	9	21267	46	9	59	5	21396	56	5
56	9	21281	55	9	57	8	21400	57	8
64	5	21283	62	5	52	5	21405	55	5
60	5	21284	59	5	67	9	21408	67	9
52	9	21291	52	9	59	6	21426	58	6
52	9	21292	52	9	52	5	21431	50	5
50	9	21294	50	9	54	5	21436	53	5
53	5	21296	54	5	47	9	21441	47	9
55	9	21297	55	9	49	9	21443	49	9
50	6	21309	49	6	49	9	21449	48	9
54	8	21311	54	8	49	9	21452	49	9
55	8	21319	55	8	55	9	21477	56	9
60	9	21331	60	9	60	9	21478	59	9
					60	9	21479	59	9

OK

Recorded by MJZ Direction N Lane 1 Time from 10:50 AM to 11:42 AM

Sheet 21	* STATE_CODE	24
LTPP Traffic Data	*SPS PROJECT_ID	0500
WIM System Test Truck Records 1 of 3	* DATE	9/4/07

Rev. 08/31/2001

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
84.5	54	2	1	10:10	12163	54	40/43	56/70	55/65	56/64	81/84		61.5	15.5	4.5	33.8	4.1	
84.5	54	21	1	10:10	12164	53	51/61	74/82	69/84	71/89	89/86		74.9	12.2	4.4	28.3	4.0	
87.5	44	2	2	10:23	12260	43	47/48	58/74	56/73	51/70	81/85		64.0	15.5	4.5	34.0	4.1	
87.5	44	1	2	10:23	12268	44	54/59	73/89	66/80	71/92	71/81		73.6	12.2	4.4	28.5	4.1	
91	50	2	3	10:34	12359	49	36/55	60/71	59/71	49/74	78/84		63.7	15.5	4.5	33.9	4.1	
91	50	21	3	10:34	12360	49	51/53	67/91	65/86	64/94	67/80		72.4	12.2	4.4	28.4	4.0	
87	54	22	4	10:45	12434	54	39/48	52/70	58/73	48/64	70/82		61.7	15.5	4.5	33.8	4.1	
87	54	21	4	10:45	12435	54	49/55	63/82	63/79	60/84	66/89		70.4	12.2	4.4	28.4	4.0	
98	44	2	5	10:56	12512	44	42/48	58/73	57/69	53/68	77/88		63.4	15.5	4.6	33.9	4.1	
98	44	1	5	10:56	12513	44	51/60	70/90	60/78	65/84	79/85		72.3	12.2	4.4	28.6	4.0	
107	51	2	6	11:20	12691	51	45/48	62/78	64/74	53/73	91/91		68.1	15.5	4.5	33.9	4.1	
107	50	1	6	11:20	12692	51	54/63	77/88	66/86	66/92	71/84		73.4	12.2	4.4	28.4	4.0	
102.5	44	2	7	11:31	12776	45	46/54	65/72	63/70	58/69	90/90		67.8	15.5	4.5	33.8	4.1	
102.5	44	1	7	11:32	12777	44	51/56	68/80	61/80	66/85	73/92		72.0	12.2	4.4	28.5	4.0	
105	55	2	8	11:54	12936	54	43/48	62/73	62/74	58/64	93/89		66.6	15.4	4.5	33.8	4.1	
105	54	1	8	11:54	12937	54	48/55	63/83	62/85	58/90	67/87		69.9	12.2	4.4	28.5	4.0	

Recorded by MARK Z.

Checked by

Sheet 21	* STATE CODE 24
LTPP Traffic Data	*SPS PROJECT ID 0500
WIM System Test Truck Records 2 of 3	* DATE 9/4/02

Rev. 08/31/2001

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
106	45	2	9	12:05	13011	45	44/53	61/71	62/69	58/71	83/88		66.5	15.5	4.5	33.9	4.1	
106	49	1	9	12:06	13012	44	51/57	66/93	60/61	69/88	67/78		71.0	12.2	4.4	28.5	4.0	
109	54	2	10	12:17	13079	54	39/49	55/73	53/73	48/62	75/88		61.6	15.5	4.5	33.9	4.1	
109	49	1	10	12:17	13081	49	51/64	75/89	65/86	77/98	71/89		75.4	12.2	4.4	28.4	4.0	
110	45	2	11	12:28	13160	43	45/47	69/72	58/68	55/67	83/86		64.2	15.5	4.5	33.9	4.1	
110	54	1	11	12:28	13161	54	49/55	64/80	62/86	61/89	68/82		70.4	12.2	4.4	28.5	4.0	
110	45	2	12	12:39	13235	49	41/50	61/77	69/72	51/71.6	83/86		65.7	15.5	4.5	33.9	4.1	
110	45	1	12	12:39	13236	45	49/52	66/68	59/85	64/90	67/93		71.5	12.2	4.4	28.5	4.0	
112	54	2	13	12:50	13303	54	45/51	63/73	64/71	57/57	96/81		65.7	15.5	4.5	33.7	4.1	
112	49	1	13	12:50	13304	49	51/62	77/99	66/86	69/94	70/90		75.2	12.2	4.4	28.4	4.0	
111.5	44	2	14	13:01	13363	44	45/51	62/72	69/70	56/72	85/89		66.3	15.5	4.6	33.9	4.1	
111.5	53	1	14	13:02	13364	54	50/62	68/85	65/85	67/89	72/85		72.8	12.2	4.4	28.5	4.0	
113	45	2	15	13:13	13433	44	44/48	61/70	60/71	54/70	82/88		64.7	15.5	4.5	33.8	4.1	
113	44	1	15	13:13	13441	44	51/59	76/91	65/80	79/95	78/83		75.6	12.2	4.4	28.3	4.0	
113	49	2	16	13:25	13507	49	46/52	66/75	67/72	58/72	92/89		68.9	15.5	4.5	33.9	4.1	
113	49	1	16	13:25	13509	49	50/62	73/93	64/87	74/93	74/83		75.1	12.2	4.4	28.4	4.0	

Recorded by MARK 2 Checked by

Sheet 21	* STATE_CODE
LTPP Traffic Data	*SPS PROJECT_ID
WIM System Test Truck Records 3 of 3	* DATE 9/4/97

Rev. 08/31/2001

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
114.5	54	2	17	13:36	13590	54	43/50	61/74	62/75	59/60	90/92		66.5	15.5	4.5	33.9	4.1	
114.5	53	1	17	13:36	13591	54	49/63	79/85	62/83	68/94	72/85		73.1	12.2	4.4	28.5	4.0	
115	44	2	18	13:52	13695	43	44/47	60/70	59/72	53/72	89/90		64.9	15.5	4.5	33.8	4.1	
115	44	1	18	13:52	13696	44	5.1/6.1	70/87	65/81	71/91	68/83		72.7	12.2	4.4	28.4	4.1	
116.5	49	2	19	14:02	13755	49	37/53	60/76	59/75	49/75	76/92		65.2	15.5	4.5	33.9	4.1	
116.5	48	1	19	14:03	13758	49	50/59	67/89	64/85	70/95	68/83		73.0	12.2	4.4	28.4	4.0	
117	55	2	20	14:13	13864	55	42/47	58/73	60/72	60/62	93/88		65.5	15.5	4.5	33.9	4.1	
117	53	1	20	14:13	13865	54	47/62	69/84	68/83	67/92	77/86		73.0	12.2	4.4	28.5	4.0	

Recorded by MARK 2 Checked by

Sheet 21	* STATE_CODE	24
LTPP Traffic Data	*SPS PROJECT_ID	0500
WIM System Test Truck Records 1 of 3	* DATE	9/5/07

Rev. 08/31/2001

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
70	45	1	1	8:56	20308	45	4.9/5.4	6.8/9.1	5.9/8.4	6.6/9.3	6.6/8.0		71.1	12.2	4.4	28.6	4.0	
70	47	2	1	8:57	20316	47	48/57	71/75	69/68	65/66	95/85		69.9	15.6	4.6	33.9	4.2	
72	50	1	2	9:07	20469	50	52/60	69/87	63/88	65/84	71/91		73.9	12.2	4.4	28.5	4.0	
72	48	2	2	9:08	20421	48	35/54	62/76	59/67	50/65	70/86		61.9	15.5	4.5	33.8	4.1	
71.5	54	2	3	9:20	20513	54	4.5/4.6	5.7/7.6	5.6/7.3	5.6/6.3	8.0/9.0		64.2	15.5	4.5	33.8	4.1	
71.5	53	1	3	9:20	20502	53	7.3/15.2	7.2/9.8	7.3/9.9	7.1/9.1	7.3/8.9		75.7	15.9	4.3	34.4	4.0	
71.5	55	1	3	9:18	20506	55	4.9/5.8	6.9/8.6	6.6/8.5	6.3/9.2	6.8/8.7		72.4	12.2	4.4	28.5	4.0	
71.5	54	2	3	9:19	20513	54	4.5/4.6	5.7/7.6	5.6/7.3	5.6/6.3	8.0/9.0		64.2	15.5	4.5	33.8	4.1	
73.0	44	1	4	9:29	20579	44	5.2/5.9	7.1/9.0	6.4/8.6	6.8/9.5	7.1/9.3		75.0	12.2	4.4	28.5	4.0	
73.0	43	2	4	9:30	20588	43	4.7/5.5	7.0/7.5	6.9/7.2	6.1/7.3	9.4/8.8		70.4	15.6	4.6	34.0	4.2	
75.5	55	1	5	9:51	20740	54	4.7/5.8	6.8/9.4	6.1/8.1	6.5/9.3	6.9/7.4		71.1	12.2	4.4	28.5	4.0	
75.5	54	2	5	9:51	20741	54	4.4/4.7	5.7/7.5	6.1/7.1	5.9/6.7	8.6/8.0		65.5	15.5	4.5	33.9	4.1	
82.5	45	1	6	10:01	20806	45	5.1/5.5	6.9/9.7	5.7/8.1	6.5/9.5	6.9/8.0		72.0	12.2	4.4	28.6	4.0	
82.5	44	2	6	10:02	20811	44	4.4/4.9	5.8/7.2	5.8/7.0	5.0/6.7	7.7/9.0		63.7	15.5	4.5	34.0	4.2	
76.5	49	1	7	10:11	20872	50	5.0/5.7	6.2/8.7	6.1/8.9	6.4/9.3	6.5/8.9		71.9	12.2	4.4	28.5	4.0	
76.5	48	2	7	10:13	20877	48	4.6/5.3	6.8/7.5	6.9/7.1	6.4/7.0	9.1/8.9		69.4	15.5	4.5	33.8	4.1	

WRONG TRUCKS

Recorded by MJ2 Checked by

Sheet 21	* STATE_CODE 24
LTPP Traffic Data	*SPS PROJECT_ID 0500
WIM System Test Truck Records 2 of 2	* DATE 09/05/2007

Rev. 08/31/2001

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
78.5	55	1	8	10:22	20934	55	4.9/6.3	7.3/9.2	7.0/8.1	6.7/9.0	7.4/8.0		74.2	12.2	4.4	28.4	4.0	
78.5	44	2	8	10:23	20937	44	4.0/5.4	5.7/7.2	5.6/7.2	4.9/7.1	7.5/8.9		63.5	15.5	4.5	33.9	4.1	
84.5	45	1	9	10:33	20990	44	5.4/6.5	7.2/8.8	6.7/8.5	7.3/9.4	7.5/7.9		75.2	12.2	4.4	28.5	4.0	
84.5	49	2	9	10:33	20991	49	4.5/5.0	6.2/7.7	6.3/7.1	5.3/7.2	8.3/8.3		65.9	15.5	4.5	33.9	4.1	
84.0	50	1	10	10:43	21051	50	5.2/6.4	7.5/9.8	6.4/8.9	7.5/9.5	7.2/9.1		77.7	12.2	4.4	28.5	4.0	
84.0	53	2	10	10:44	21067	52	4.5/4.8	6.0/7.6	6.2/7.7	5.3/7.1	8.1/8.8		67.1	15.5	4.5	33.9	4.1	
86.5	54	1	11	10:52	21107	54	4.9/5.9	7.4/9.2	6.8/8.4	7.0/8.9	8.2/8.4		75.0	12.2	4.4	28.4	4.0	
86.5	43	2	11	10:54	21117	44	4.6/5.0	5.9/7.2	5.9/7.1	5.3/6.8	8.2/8.8		64.7	15.5	4.5	33.9	4.1	
89.5	44	1	12	11:03	21184	45	5.2/6.3	7.0/9.0	6.6/8.4	7.1/9.0	7.6/8.7		75.0	12.2	4.4	28.5	4.0	
89.5	54	2	12	11:05	21191	55	4.1/4.5	5.8/7.4	5.9/7.4	5.0/6.3	7.6/8.6		62.6	15.5	4.6	34.0	4.1	
92	50	1	13	11:14	21254	50	5.2/6.2	6.9/8.8	6.7/8.9	7.4/9.3	7.3/8.4		75.1	12.2	4.4	28.6	4.0	
92	44	2	13	11:15	21256	44	4.1/5.4	5.8/7.0	5.7/7.0	5.0/6.8	7.2/9.1		63.2	15.5	4.5	33.9	4.1	
93.5	54	1	14	11:25	21306	55	4.9/6.1	7.2/8.7	6.9/8.4	6.6/8.9	7.6/8.7		74.0	12.2	4.4	28.5	4.0	
93.5	47	2	14	11:26	21308	48	3.9/5.3	6.0/7.6	6.0/7.0	5.1/7.2	7.6/8.8		64.5	15.5	4.5	33.9	4.1	
94.5	44	1	15	11:36	21358	45	5.2/6.3	7.0/9.1	6.4/8.6	6.6/8.9	7.5/8.0		73.6	12.2	4.4	28.6	4.0	
94.5	44	2	15	11:37	21359	44	4.3/4.9	6.0/7.1	6.0/7.0	5.3/6.8	8.1/8.7		64.4	15.6	4.6	33.9	4.1	

Recorded by DJW

Checked by _____

Sheet 21	* STATE_CODE 24
LTPP Traffic Data	*SPS PROJECT_ID 0500
WIM System Test Truck Records 3 of 3	* DATE 09/05/2007

Rev. 08/31/2001

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
98	49	1	16	11:46	21409	50	5.2/5.9	7.3/9.2	6.3/8.7	6.8/9.6	7.4/9.1		75.6	12.2	4.4	28.5	4.0	
98	48	2	16	11:47	21422	49	4.6/5.2	6.6/7.6	6.0/7.1	5.7/7.2	8.7/8.7		68.0	15.5	4.5	33.8	4.1	
99.5	54	1	17	12:05	21535	54	4.9/6.1	7.2/8.3	6.7/8.5	7.0/9.1	8.1/7.5		73.4	12.2	4.3	28.4	4.0	
99.5	50	2	17	12:05	21536	50	4.6/4.9	6.3/7.5	6.5/7.2	5.4/7.3	8.6/8.7		66.8	15.5	4.5	33.8	4.1	
102.5	44	1	18	12:15	21590	45	5.1/6.4	7.3/8.6	6.9/8.3	7.3/9.3	7.8/8.0		74.6	12.2	4.4	28.5	4.0	
102.5	54	2	18	12:15	21593	55	4.4/5.2	6.2/7.4	5.9/7.2	6.0/6.3	8.7/8.8		66.0	15.5	4.6	33.8	4.1	
103	50	1	19	12:25	21652	50	5.1/6.3	7.4/9.0	6.7/8.8	7.3/9.6	8.1/8.7		77.3	12.2	4.3	28.4	4.0	
103	44	2	19	12:26	21654	44	4.4/4.9	5.9/7.3	5.6/7.1	5.3/6.7	8.0/9.1		64.4	15.6	4.6	33.9	4.1	
105.5	55	1	20	12:35	21724	55	4.5/5.4	6.4/8.7	5.9/8.5	6.3/9.4	6.7/8.4		70.2	12.2	4.4	28.6	4.0	
105.5	55	2	20	12:36	21726	55	4.1/4.6	5.7/7.4	5.9/7.3	5.0/6.3	7.6/8.5		62.6	15.5	4.6	34.0	4.1	

Recorded by DSW

Checked by _____

TEST VEHICLE PHOTOGRAPHS FOR SPS WIM VALIDATION

September 4-5, 2007

STATE: Maryland

SHRP ID: 0500

Photo 1 - Truck_1_Tractor_ 24_0500_09_04_07.JPG 2
Photo 2 - Truck_1_Trailer_1_24_0500_09_04_07.JPG 2
Photo 3 - Truck_1_Suspension_1_24_0500_09_04_07.JPG 3
Photo 4 - Truck_1_Suspension_2_24_0500_09_04_07.JPG 3
Photo 5 - Truck_1_Suspension_3_24_0500_09_04_07.JPG 4
Photo 6 - Truck_2_Tractor_24_0500_09_04_07.JPG 4
Photo 7 - Truck_2_Trailer_24_0500_09_04_07.JPG 5
Photo 8 - Truck_2_Suspension_1_24_0500_09_04_07.JPG 5
Photo 9 - Truck_2_Suspension_2_24_0500_09_04_07.JPG 6
Photo 10 - Truck_2_Suspension_3_24_0500_09_04_07.JPG 6

Photo 1 - Truck_1_Tractor_ 24_0500_09_04_07.JPG

Photo 2 - Truck_1_Trailer_1_24_0500_09_04_07.JPG

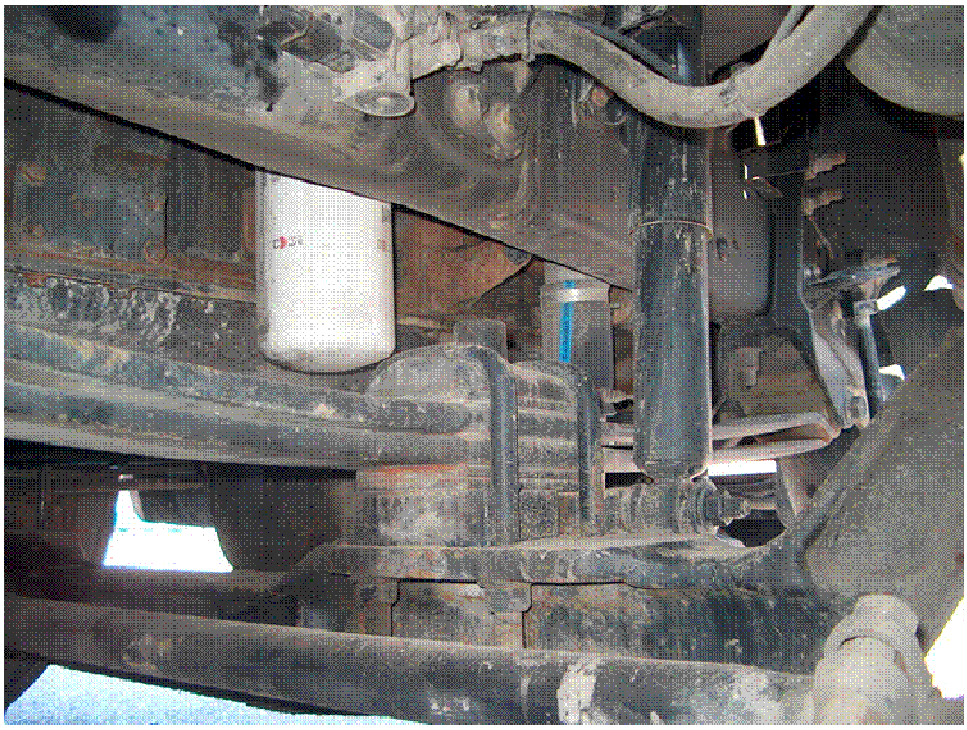

Photo 3 - Truck_1_Suspension_1_24_0500_09_04_07.JPG

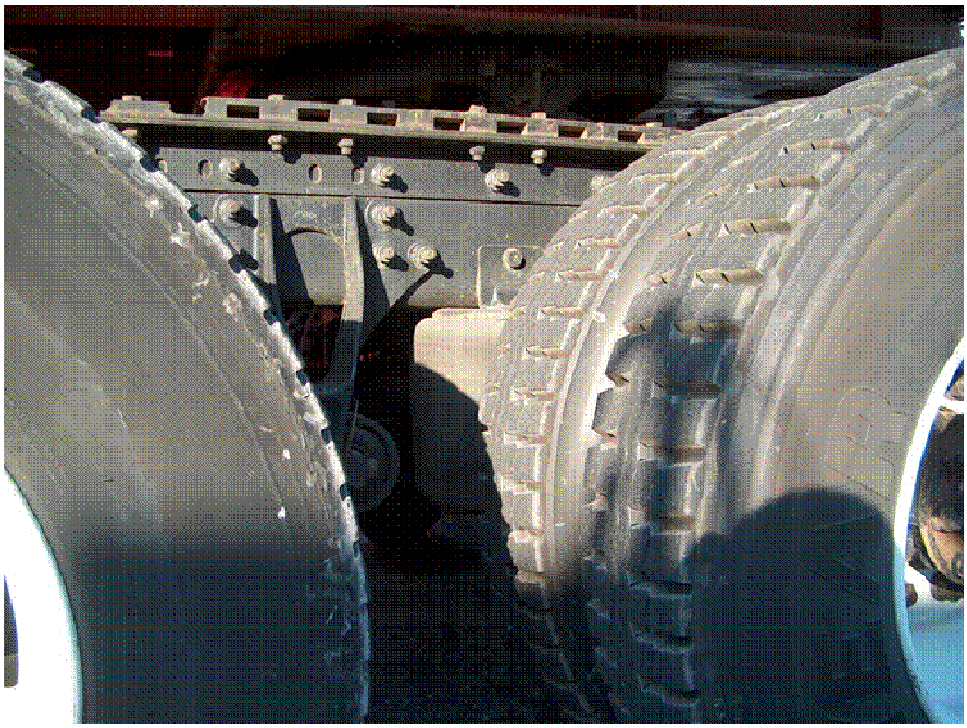

Photo 4 - Truck_1_Suspension_2_24_0500_09_04_07.JPG

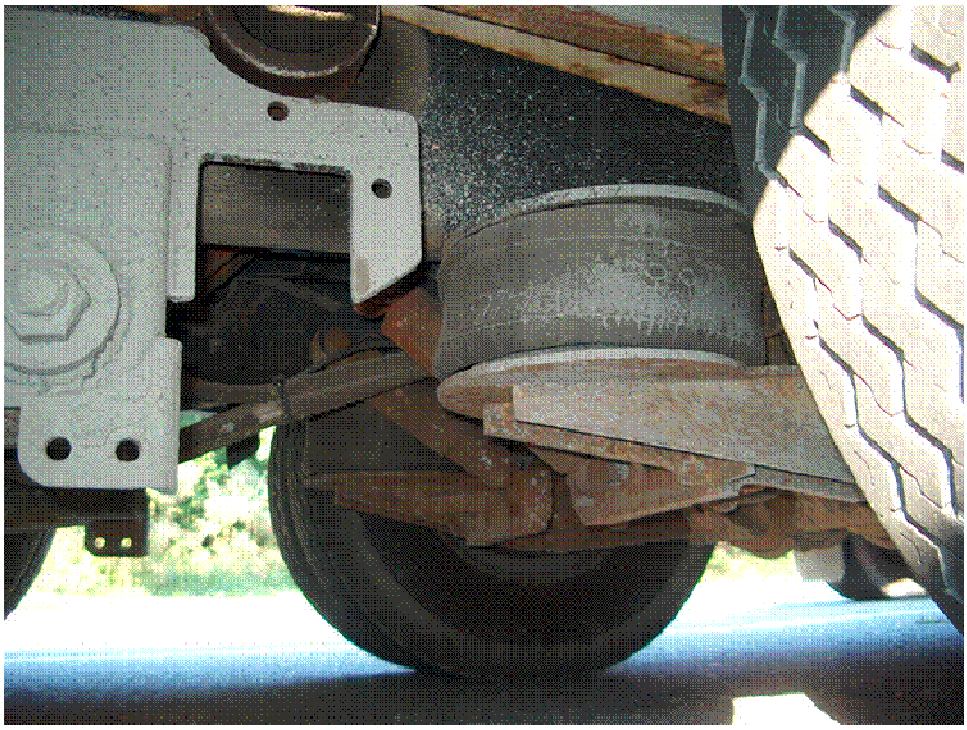

Photo 5 - Truck_1_Suspension_3_24_0500_09_04_07.JPG

Photo 6 - Truck_2_Tractor_24_0500_09_04_07.JPG

Photo 7 - Truck_2_Trailer_24_0500_09_04_07.JPG

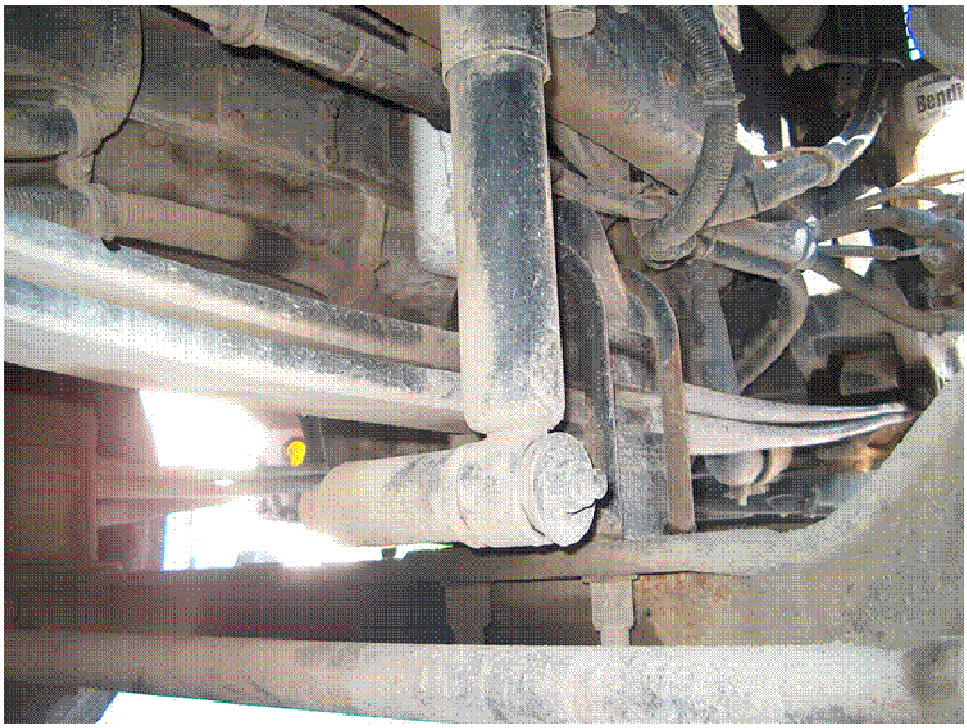

Photo 8 - Truck_2_Suspension_1_24_0500_09_04_07.JPG

Photo 9 - Truck_2_Suspension_2_24_0500_09_04_07.JPG

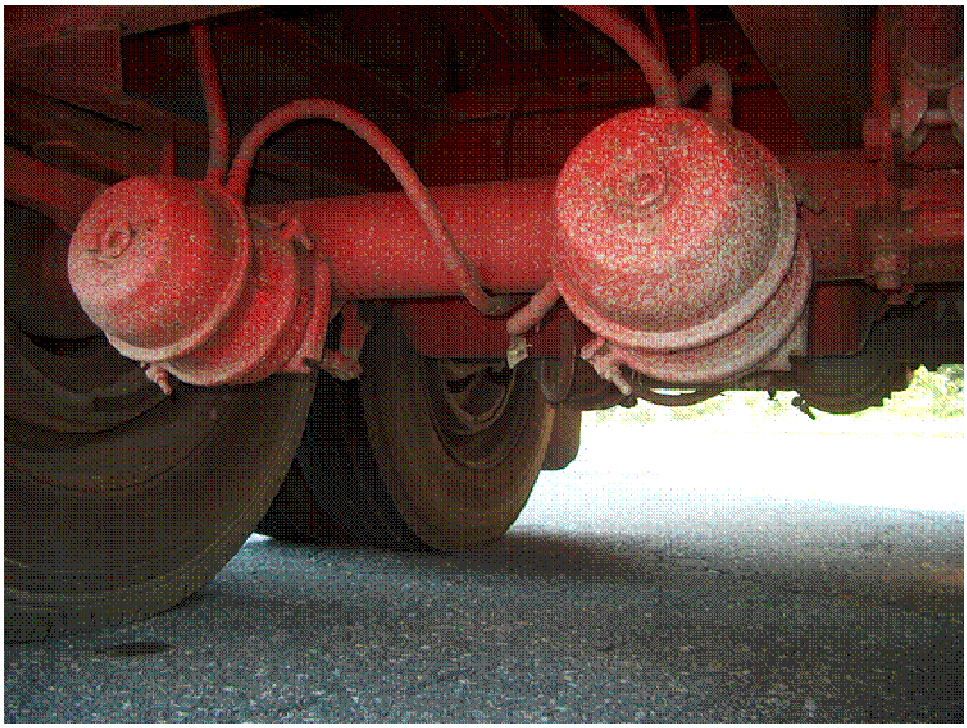

Photo 10 - Truck_2_Suspension_3_24_0500_09_04_07.JPG

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

Maryland SPS-5

Validation Visit – September 4, 2007

Calibration factors for Sensor #1

45 mph – 3775
50 mph – 3850
55 mph – 3900
60 mph – 3900
65 mph – 3900

Calibration factors for Sensor #2

45 mph – 3775
50 mph – 3850
55 mph – 3900
60 mph – 3900
65 mph – 3900

Validation Visit – 1 December 2005

Calibration factors for Sensor #1

45 mph – 3775
50 mph – 3850
55 mph – 3900
60 mph – 3900
65 mph – 3900

Calibration factors for Sensor #2

45 mph – 3775
50 mph – 3850
55 mph – 3900
60 mph – 3900
65 mph – 3900