Validation Report

Maine, SPS-5
Task Order 16, CLIN 2
August 14 and 15, 2007

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1 Executive Summary

A visit was made to the Maine 0500 on August 14 and 15, 2007 for the purposes of conducting a validation of the WIM system located on I-95 at approximately 17 miles north of I-395 near Bangor, Maine. The SPS-5 is located in the righthand, northbound lane of a four-lane divided facility. The posted speed limit at this location is 65 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 has been monitored since at least the mid-1990s with a series of three different piezo systems in the vicinity of Argyle. This is the first validation visit to this location. The site was installed on May 22 to 23, 2007 by IRDynamics as part of the Pooled Fund Study.

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 quartz piezo WIM and iSINC electronics. It is installed in asphalt concrete.

The validation used the following trucks:

1) 5-axle tractor-trailer with a tractor having an air suspension and a trailer with a standard rear tandem and an air suspension loaded to 75,200 lbs., the "golden" truck.
2) 5-axle tractor semi-trailer with a tractor having a 15 tapered leaf suspension and a trailer with a standard rear tandem and an air suspension loaded to 65,140 lbs., the "partial" truck.

The validation speeds ranged from 53 to 65 miles per hour. The pavement temperatures ranged from 62 to 73 degrees Fahrenheit. The desired speed range was achieved during this validation. The desired 30 degree Fahrenheit temperature range was not achieved.

Table 1-1 Post-Validation results – 230500 – 15-Aug-2007

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	4.8 ± 8.2%	Pass
Tandem axles	±15 percent	2.0 ± 5.3%	Pass
GVW	±10 percent	2.4 ± 4.1%	Pass
Speed	**±1 mph [2 km/hr]**	**0.1 ± 1.3 mph**	**Fail**
Axle spacing	± 0.5 ft [150mm]	0.0 ± 0.0 ft	Pass

Prepared: djw *Checked: bko*

The pavement condition appeared to be satisfactory for conducting a performance evaluation. There were no distresses observed that would influence truck motions significantly. A visual survey determined that there is no discernable bouncing or avoidance by trucks in the sensor area.

No profile data has been collected at this site since installation. It is not known when a visit is scheduled to collect it.

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

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

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

Prepared: djw *Checked: bko*

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

2 Corrective Actions Recommended

There are no corrective actions required at this site at this time.

3 Post Calibration Analysis

This final analysis is based on test runs conducted August 15, 2007 during the morning and afternoon hours at test site 230500 on I-95. This SPS-5 site is at milepost 200.1 on the northbound, righthand lane of a four-lane divided 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 75,200 lbs., the "golden" truck.
2. 5-axle tractor semi-trailer with a tractor having a 15 tapered leaf suspension and a trailer with a standard rear tandem and an air suspension loaded to 65,140 lbs., the "partial" truck.

Each truck made a total of 20 passes over the WIM scale at speeds ranging from approximately 53 to 65 miles per hour. The desired speed range was achieved during this validation. Pavement surface temperatures were recorded during the test runs ranging from about 62 to 73 degrees Fahrenheit. The desired 30 degree Fahrenheit temperature range was not achieved. The computed values of 95% confidence limits of each statistic for the total population are in Table 3-1.

As shown in Table 3-1, this site meets all LTPP precision requirements except speed which is not considered sufficient to disqualify the site as having research quality data.

Table 3-1 Post-Validation Results – 230500 – 15-Aug-2007

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	4.8 ± 8.2%	Pass
Tandem axles	±15 percent	2.0 ± 5.3%	Pass
GVW	±10 percent	2.4 ± 4.1%	Pass
Speed	**±1 mph [2 km/hr]**	**0.1 ± 1.3 mph**	**Fail**
Axle spacing	± 0.5 ft [150mm]	0.0 ± 0.0 ft	Pass

Prepared: djw *Checked: bko*

The test runs were conducted primarily during the morning and afternoon hours, under mostly cloudy weather conditions, resulting in a narrow range of pavement temperatures. The runs were also conducted at various speeds to determine the effects of these variables on the performance of the WIM scale. To investigate these effects, the dataset was split into three speed groups and two temperature groups. The distribution of runs by speed and temperature is illustrated in Figure 3-1. The figure indicates that the desired distribution of speed and temperature combinations was not achieved for this set of validation runs due to the temperature limitations.

The three speed groups were divided as follows: Low speed – 53 to 57 mph, Medium speed – 58 to 61 mph and High speed – 62 + mph. The two temperature groups were created by splitting the runs between those at 62 to 67 degrees Fahrenheit for Low temperature and 68 to 73 degrees Fahrenheit for High temperature.

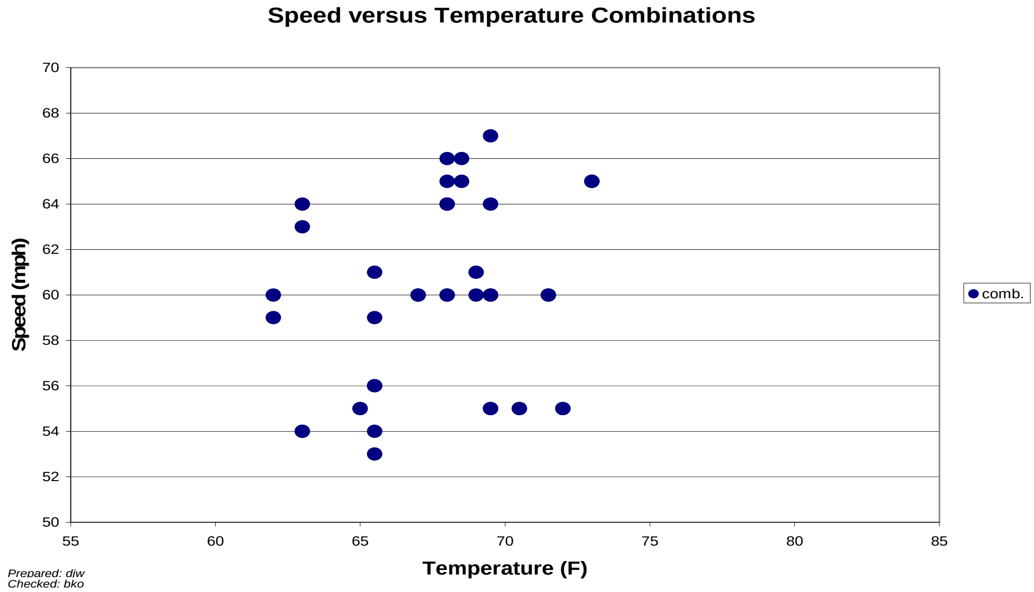

Figure 3-1 Post-Validation Speed-Temperature Distribution – 230500 – 15-Aug-2007

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. From the figure, it appears that the equipment increasingly overestimates GVW as speed increases. Variability also appears to increase as speed increases.

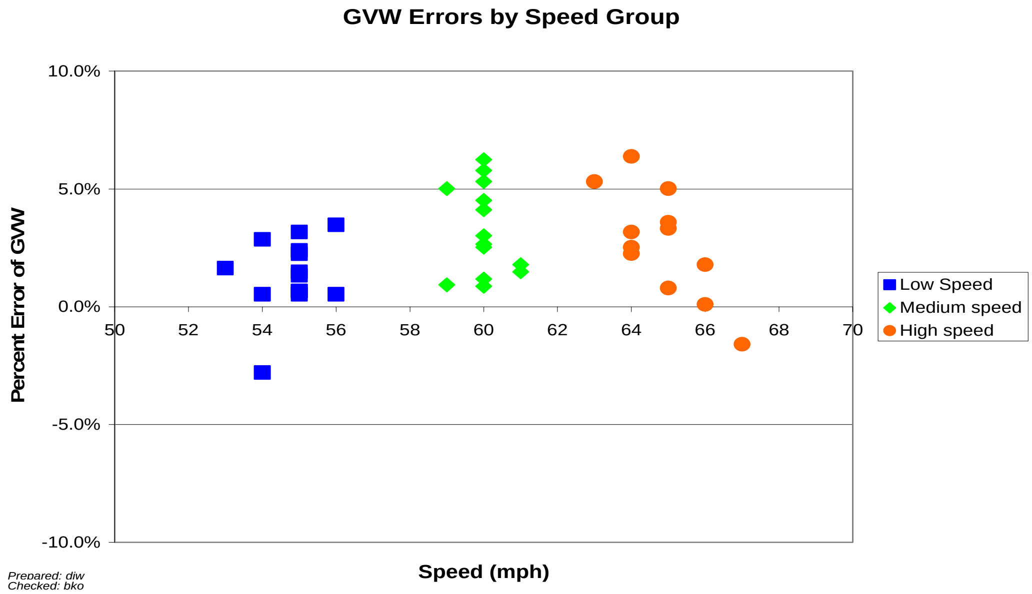

Figure 3-2 Post-validation GVW Percent Error vs. Speed – 230500 – 15-Aug-2007

Figure 3-3 shows a lack of relationship between temperature and GVW percentage error.

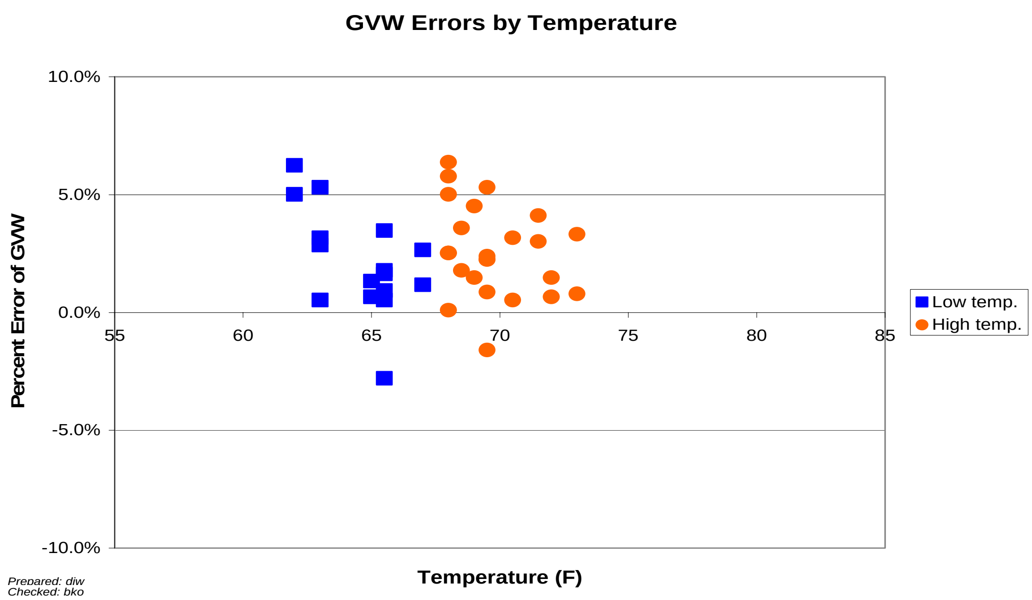

Figure 3-3 Post-Validation GVW Percent Error vs. Temperature – 230500 – 15-Aug-2007

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. The graph indicates that the errors in tandem spacings for the test trucks were not affected by changes in speed.

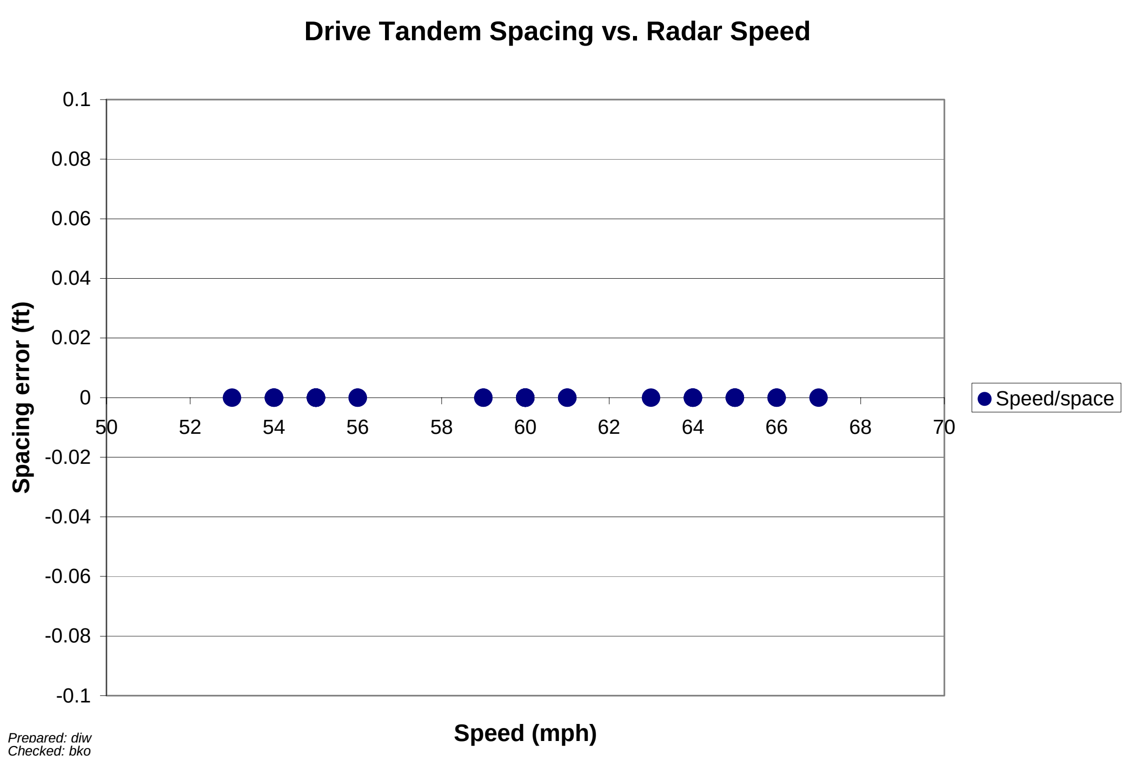

Figure 3-4 Post-Validation Spacing vs. Speed – 230500 – 15-Aug-2007

3.1 Temperature-based Analysis

The two temperature groups were created by splitting the runs between those at 62 to 67 degrees Fahrenheit for Low temperature and 68 to 73 degrees Fahrenheit for High temperature.

Table 3-2 Post-Validation Results by Temperature Bin – 230500 – 15-Aug-2007

Element	95% Limit	Low Temperature 62 to 67 °F	High Temperature 68 to 73 °F
Steering axles	±20 %	6.0 ± 4.6%	4.0 ± 10.0%
Tandem axles	±15 %	1.6 ± 5.6%	2.4 ± 5.2%
GVW	±10 %	2.2 ± 4.7%	2.6 ± 4.0%
Speed	±1 mph	0.4 ± 2.0 mph	0.0 ± 0.4 mph
Axle spacing	± 0.5 ft	0.0 ± 0.0 ft	0.0 ± 0.0 ft

Prepared: djw Checked: bko

From Table 3-2, it appears that the equipment overestimates all weights at all temperatures. Variability in steering axle error is greater at the high temperatures when compared with low temperatures. GVW and tandem variability are reasonably consistent throughout the entire speed range.

Figure 3-5 is the distribution of GVW Errors versus Temperature by Truck graph. From the figure it can be seen that GVW for the truck population as a whole and for each truck individually is overestimated at all temperatures. Variability also appears consistent for the truck population as a whole as well as for each truck individually.

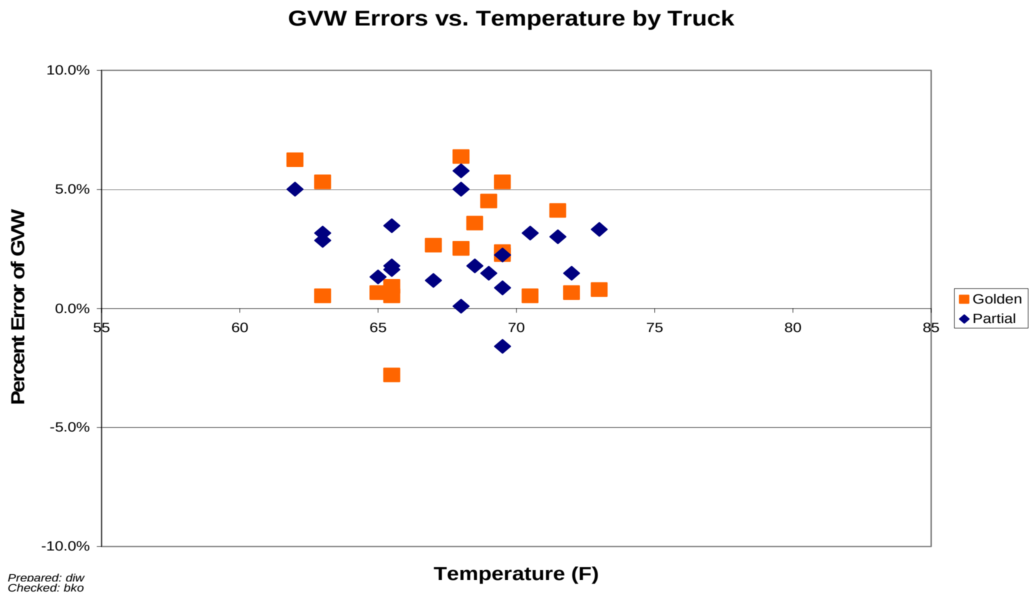

Figure 3-5 Post-Validation GVW Percent Error vs. Temperature by Truck – 230500 – 15-Aug-2007

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.

From the figure, it can be seen that with the exception of a few outliers, the equipment generally overestimates steering axle weights at all temperatures.

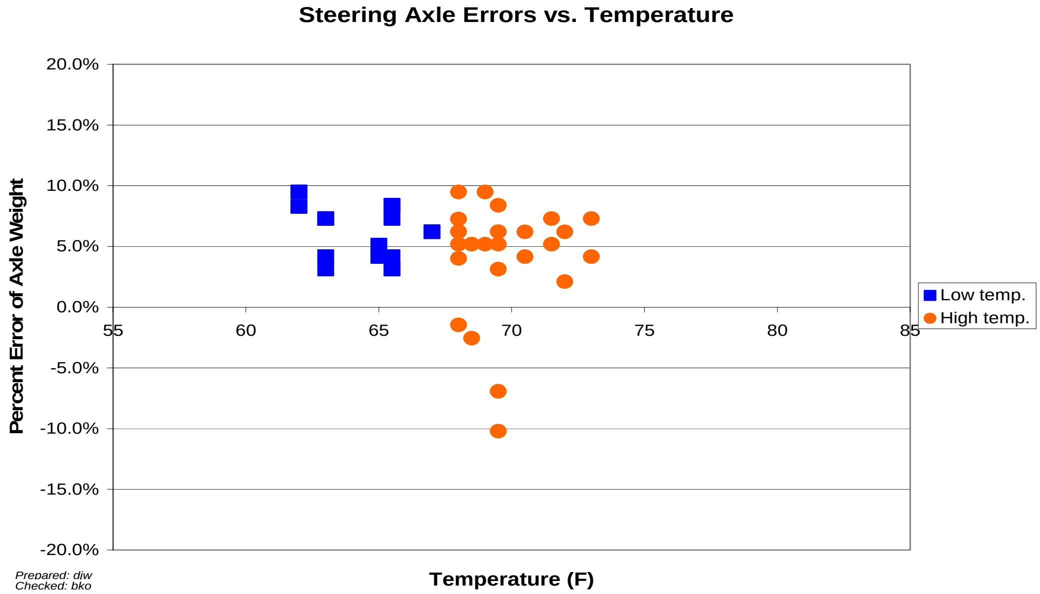

Figure 3-6 Post-Validation Steering Axle Error vs. Temperature by Group – 230500 – 15-Aug-2007

3.2 Speed-based Analysis

The three speed groups were divided using 53 to 57 mph for Low speed, 58 to 61 mph for Medium speed and 62+ mph for High speed.

Table 3-3 Post-Validation Results by Speed Bin – 230500 – 15-Aug-2007

Element	95% Limit	Low Speed 53 to 57 mph	Medium Speed 58 to 61 mph	High Speed 62+ mph
Steering axles	±20 %	5.2 ± 4.5%	6.0 ± 8.9%	3.0 ± 11.6%
Tandem axles	±15 %	0.7 ± 4.3%	2.8 ± 5.4%	2.7 ± 5.8%
GVW	±10 %	1.3 ± 3.4%	3.2 ± 4.1%	2.7 ± 5.0%
Speed	±1 mph	0.2 ± 1.9 mph	0.0 ± 1.2 mph	0.2 ± 0.9 mph
Axle spacing	± 0.5 ft	0.0 ± 0.0 ft	0.0 ± 0.0 ft	0.0 ± 0.0 ft

Prepared: djw *Checked: bko*

From Table 3-3, it can be seen that the equipment overestimates all weights at all speeds. Variability in error appears to increase as speed increases.

Figure 3-7 illustrates the tendency for the equipment to overestimate GVW for both trucks at all speeds. Variability in GVW error for the truck population as a whole and for each truck individually appears to increase as speed increases. Individually, the equipment appears to estimate GVW for the Golden truck (squares) with reasonable accuracy at the low speeds and overestimate at the medium and high speeds. For the Partial truck (diamonds) the equipment appears to overestimate GVW at low and medium speeds while estimating with reasonable accuracy at the high speeds.

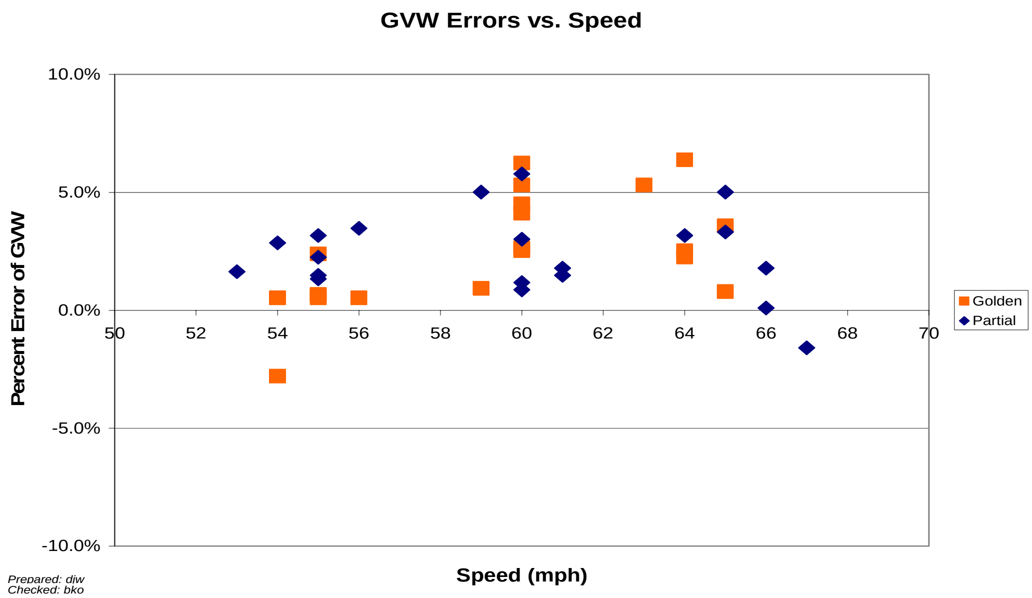

Figure 3-7 Post-Validation GVW Percent Error vs. Speed by Truck – 230500 – 15-Aug-2007

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.

The figure illustrates how the WIM equipment generally overestimates steering axle weights at all speeds. The variability in error appears to increase as speed increases.

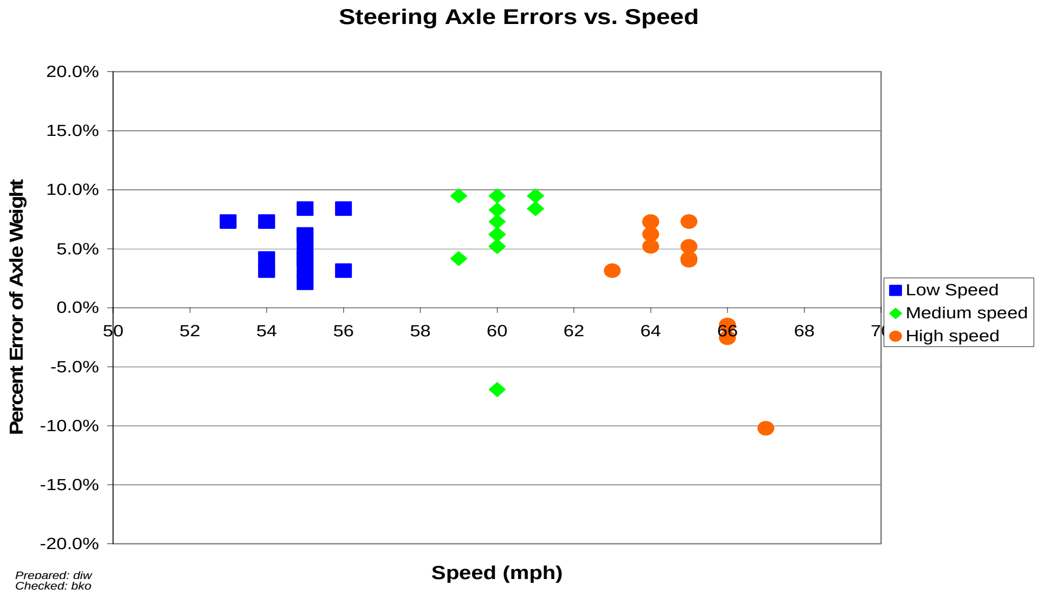

Figure 3-8 Post-Validation Steering Axle Percent Error vs. Speed by Group – 230500 – 15-Aug-2007

3.3 Classification Validation

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

The classification validation is intended to find gross errors in vehicle classification, not to validate the installed algorithm. A sample of three hours (67 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 0 percent unknown vehicles and 0 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 1.5 percent.

Table 3-4 Truck Misclassification Percentages for 230500 – 15-Aug-2007

Class	Percent Error	Class	Percent Error	Class	Percent Error
4	N/A	5	14.3	6	0
7	N/A				
8	0	9	0	10	0
11	N/A	12	N/A	13	N/A

Prepared: djw *Checked: bko*

The misclassification percentage is computed as the probability that a pair containing the class of interest does NOT include a match. Thus if there are eight pairs of observations with at least one Class 9 and only six of them are matches, the error rate is 25 percent.

The percent error and the mean differences reported below do not represent the same statistic. It is possible to have error rates greater than 0 with a mean difference of zero.

Table 3-5 Truck Classification Mean Differences for 230500 – 15-Aug-2007

Class	Mean Difference	Class	Mean Difference	Class	Mean Difference
4	N/A	5	-14.3	6	0
7	N/A				
8	0	9	0	10	0
11	N/A	12	N/A	13	N/A

Prepared: djw Checked: bko

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

3.4 Evaluation by ASTM E-1318 Criteria

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

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

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

Prepared: djw Checked: bko

4 Pavement Discussion

The pavement condition did not 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.

4.2 Distress Survey and Any Applicable Photos

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

4.3 Vehicle-pavement Interaction Discussion

A visual observation of the trucks as they approach, traverse and leave the sensor area did not indicate any visible motion of the trucks that would affect the performance of the WIM scales. Trucks appear to track down the wheel path and daylight cannot be seen between the tires of any of the sensors for the equipment.

5 Equipment Discussion

The traffic monitoring equipment at this location includes quartz piezo WIM and iSINC. These sensors are installed in asphalt concrete pavement.

5.1 Pre-Evaluation Diagnostics

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

5.2 Calibration Process

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 found in TRF_CALIBRATION_AVC for Sheet 16s submitted prior to this validation as well as the information for the current visit.

Table 5-1 Classification Validation History – 230500 – 15-Aug-2007

Date	Method	Mean Difference				Percent Unclassified
		Class 9	Class 8	Other 1	Other 2	
15-Aug-07	Manual	0	0			0
14-Aug-07	Manual	0	0			0
02-Oct-02	Manual					
18-Oct-01	Manual					
18-Oct-00	Manual					

Prepared: djw Checked: bko

Table 5-2 has the information found in TRF_CALIBRATION_WIM for Sheet 16s submitted prior to this validation as well as the information for the current visit.

Table 5-2 Weight Validation History – 230500 – 15-Aug-2007

Date	Method	Mean Error and (SD)		
		GVW	Single Axles	Tandem Axles
15-Aug-07	Test Trucks	2.4 (2.0)	4.8 (4.1)	2.0 (2.7)
14-Aug-07	Test Trucks	1.6 (2.8)	3.2 (4.2)	1.3 (3.2)
02-Oct-02	Test Trucks			
18-Oct-01	Test Trucks			
18-Oct-00	Test Trucks			

Prepared: djw Checked: bko

5.4 Projected Maintenance/Replacement Requirements

Semi-annual preventive maintenance is to be performed at this site under provisions of the Phase II contract.

No other corrective maintenance actions required at this site at this time.

6 Pre-Validation Analysis

This pre-validation analysis is based on test runs conducted August 14, 2007 during the morning and afternoon hours at 230500 on approximately 17 miles north of I-395 near Bangor, Maine. This SPS-5 site is at milepost 200.1 on I-95 in the northbound, righthand of a four-lane divided facility. No auto-calibration was used during test runs. The two trucks used for initial validation included:

1. 5-axle tractor semi-trailer combination with a tractor having an air suspension and trailer with standard rear tandem and an air suspension loaded to 75,500 lbs.
2. 5-axle tractor semi-trailer with a tractor having a 15 tapered leaf suspension and a trailer with a standard rear tandem and an air suspension loaded to 65,450 lbs., the partial truck.

For the initial validation each truck made a total of 20 passes over the WIM scale at speeds ranging from approximately 53 to 65 miles per hour. The desired speed range was achieved during this validation. Pavement surface temperatures were recorded during the test runs ranging from about 74 to 99 degrees Fahrenheit. The desired 30 degree Fahrenheit temperature range was not achieved. The computed values of 95% confidence limits of each statistic for the total population are in Table 6-1.

As shown in Table 6-1 this site meets all LTPP precision requirements except speed which is not considered sufficient to disqualify the site as having research quality data.

Table 6-1 Pre-Validation Results – 230500 – 14-Aug-2007

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	+20 percent	3.2 ± 8.4%	Pass
Tandem axles	+15 percent	1.3 ± 6.3%	Pass
GVW	+10 percent	1.6 ± 5.7%	Pass
Speed	**+1 mph [2 km/hr]**	**0.4 ± 1.4 mph**	**Fail**
Axle spacing	+ 0.5 ft [150mm]	0.0 ± 0.0 ft	Pass

Prepared: djw *Checked: bko*

The test runs were conducted primarily during morning and afternoon hours under mostly sunny weather conditions, resulting in a range of pavement temperatures. The runs were also conducted at various speeds to determine the effects of these variables on the performance of the WIM scale. To investigate these effects, the dataset was split into three speed groups and 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 not achieved for this set of validation runs based on a distribution of all speeds with the varying temperatures.

The three speed groups were divided into 53 to 57 mph for Low speed, 58 to 61 mph for Medium speed and 62+ mph for High speed. The three temperature groups were created by splitting the runs between those at 74 to 80 degrees Fahrenheit for Low temperature, 81 to 89 degrees Fahrenheit for Medium temperature and 90 to 99 degrees Fahrenheit for High temperature.

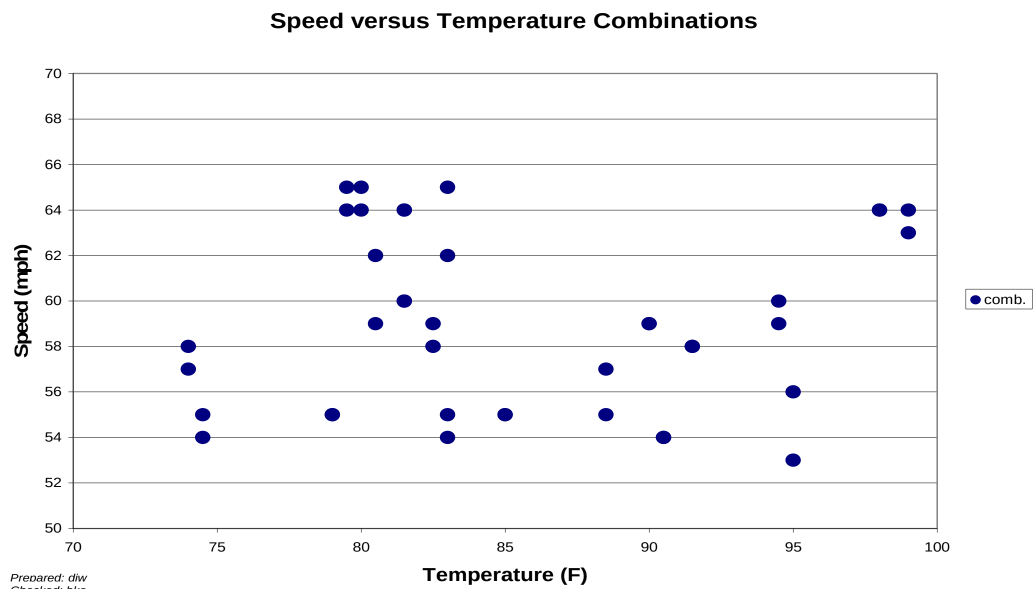

Figure 6-1 Pre-Validation Speed-Temperature Distribution – 230500 – 14-Aug-2007

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 figure illustrates the ability for the equipment to estimate GVW reasonably well at the low speeds but shows a tendency to overestimate at the medium and high speeds. Variability appears to decrease as speed increases.

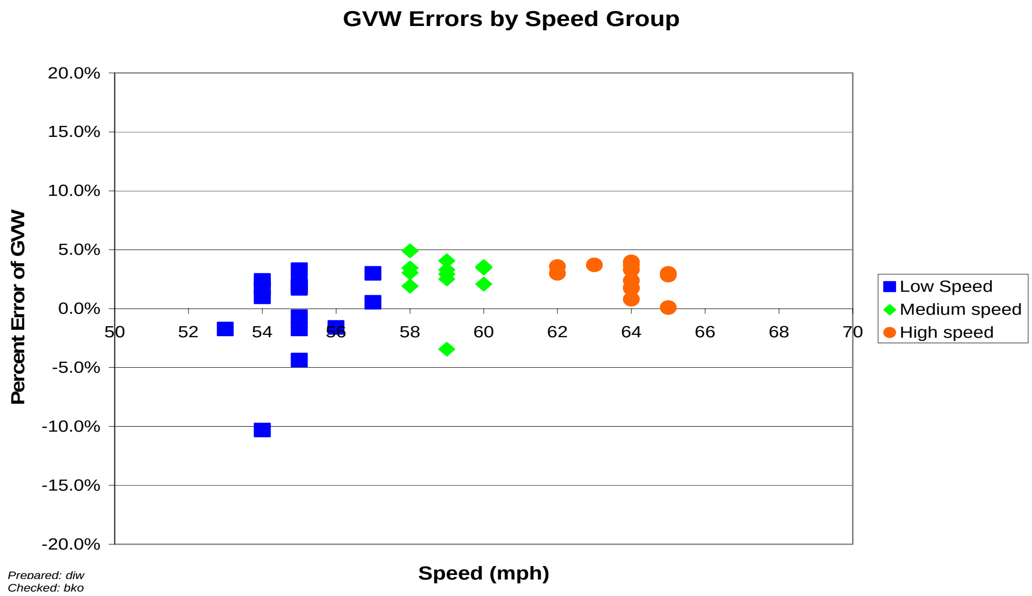

Figure 6-2 Pre-validation GVW Percent Error vs. Speed – 230500 – 14-Aug-2007

Figure 6-3 shows the relationship between temperature and GVW percentage error. It appears that the equipment overestimates GVW at all temperatures Variability in GVW error appears to be fairly consistent over the entire temperature range.

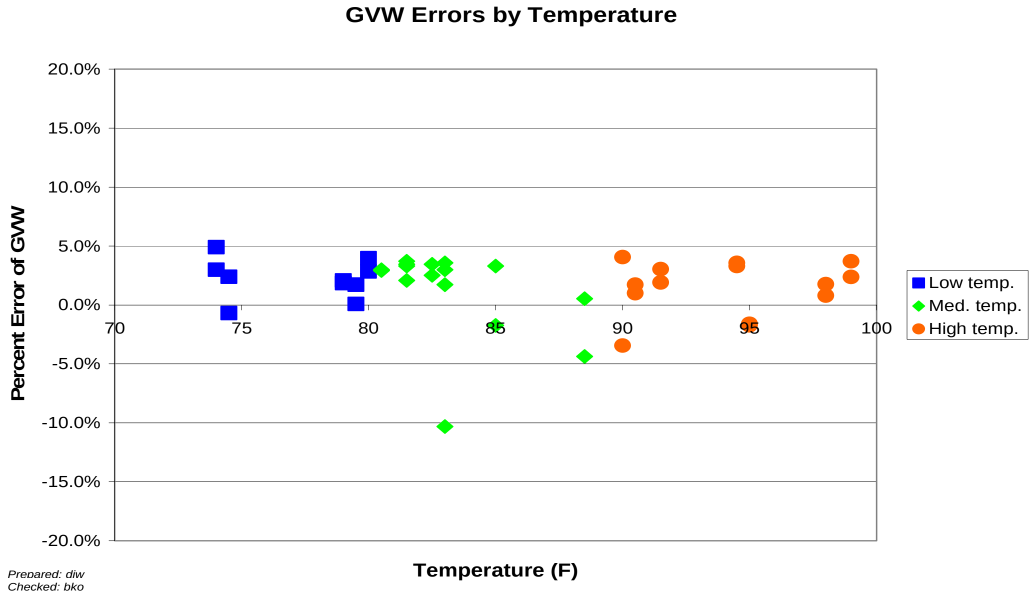

Figure 6-3 Pre-Validation GVW Percent Error vs. Temperature – 230500 – 14-Aug-2007

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. The graph indicates that the errors in tandem spacings for the test trucks were not affected by changes in speed.

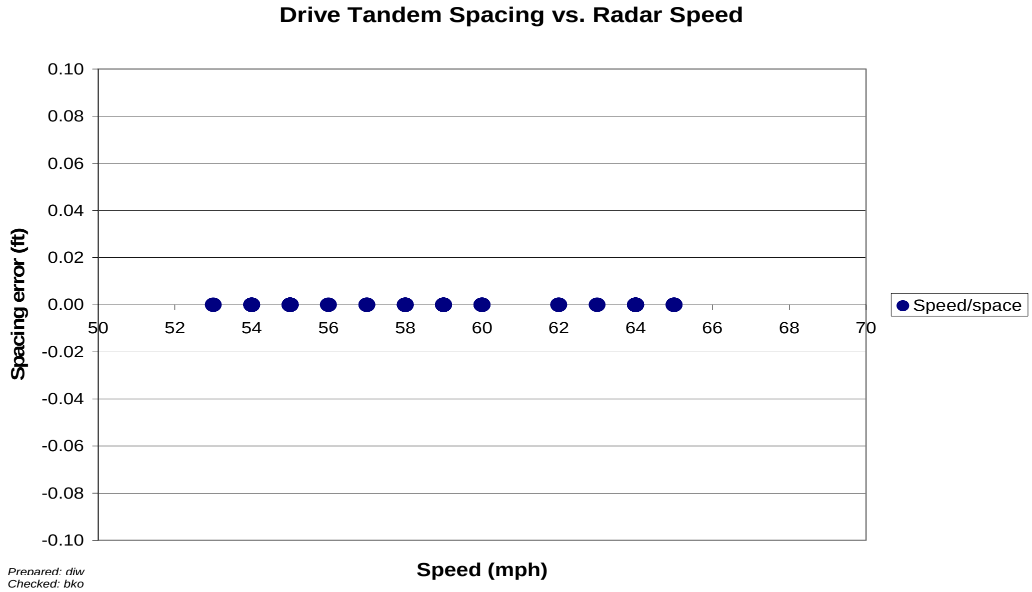

Figure 6-4 Pre-Validation Spacing vs. Speed - 230500 – 14-Aug-2007

6.1 Temperature-based Analysis

The three temperature groups were created by splitting the runs between those at 74 to 80 degrees Fahrenheit for Low temperature, 81 to 89 degrees Fahrenheit for Medium temperature and 90 to 99 degrees Fahrenheit for High temperature.

Table 6-2 Pre-Validation Results by Temperature Bin – 230500 – 14-Aug-2007

Element	95% Limit	Low Temperature 74 to 80 °F	Medium Temperature 81 to 89 °F	High Temperature 90 to 99 °F
Steering axles	±20 %	4.6 ± 6.3%	2.8 ± 8%	2.8 ± 11.6%
Tandem axles	±15 %	1.9 ± 4.5%	1.0 ± 8.3%	1.3 ± 5.2%
GVW	±10 %	2.2 ± 3.7%	1.3 ± 8.1%	1.5 ± 4.9%
Speed	±1 mph	0.4 ± 1.6 mph	0.3 ± 1.8 mph	0.6 ± 1.1 mph
Axle spacing	± 0.5 ft	0.0 ± 0.0 ft	0.0 ± 0.0 ft	0.0 ± 0.0 ft

Prepared: djw *Checked: bko*

From Table 6-2, it appears that the equipment overestimates all weights at all temperatures. For tandem weights and GVW, the variability in error appears to increase at the medium temperatures.

Figure 6-5 shows the distribution of GVW Errors versus Temperature by Truck.
The equipment appears to overestimate GVW for the population as a whole as well as for each truck individually at all temperatures. Variability in GVW error appears to be reasonably similar for both trucks over the entire temperature range.

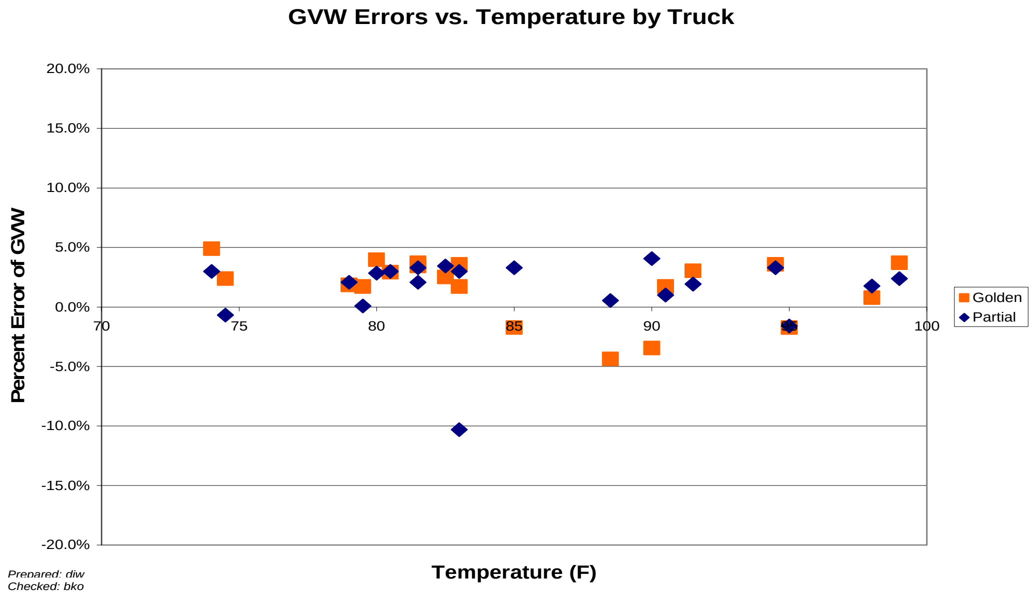

Figure 6-5 Pre-Validation GVW Percent Error vs. Temperature by Truck – 230500 – 14-Aug-2007

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.

The figure shows that steering axle weights are generally overestimated at all temperatures. Variability in error appears to increase as temperature increases.

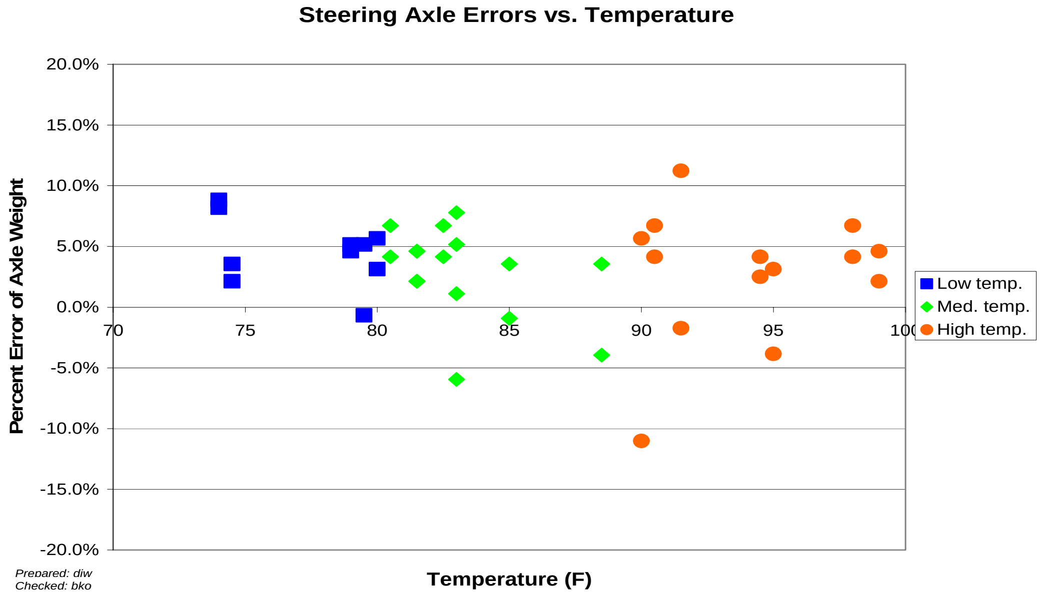

Figure 6-6 Pre-Validation Steering Axle Error vs. Temperature by Group – 230500 – 14-Aug-2007

6.2 Speed-based Analysis

The speed groups were divided as follows: Low speed – 53 to 57 mph, Medium speed – 58 to 61 mph and High speed – 62+ mph.

Table 6-3 Pre-Validation Results by Speed Bin – 230500 – 14-Aug-2007

Element	**95% Limit**	**Low Speed 53 to 57 mph**	**Medium Speed 58 to 61 mph**	**High Speed 62+ mph**
Steering axles	±20 %	2.1 ± 8.9%	3.4 ± 12.2%	4.4 ± 5%
Tandem axles	±15 %	-0.5 ± 7.4%	2.6 ± 5.3%	2.3 ± 3.9%
GVW	±10 %	-0.2 ± 7.6%	2.6 ± 4.6%	2.6 ± 2.6%
Speed	±1 mph	0.4 ± 1.4 mph	0.4 ± 1.1 mph	0.5 ± 2.1 mph
Axle spacing	± 0.5 ft	0.0 ± 0.0 ft	0.0 ± 0.0 ft	0.0 ± 0.0 ft

Prepared: djw *Checked: bko*

From Table 6-3, it can be seen that the equipment overestimates steering axle weights at all speeds and overestimates tandem weights and GVW at the medium and high speeds. Variability in steering axle weight error appears to be higher at the medium speeds. For GVW and tandem weight error, the variability appears to decrease as speed increases

Figure 6-7 illustrates the tendency for the equipment to overestimate GVW for the truck population as a whole as well as for each truck individually at the medium and high speeds. Variability in GVW error appears to be consistent over the entire speed range for the truck population as a whole as well as for each truck individually.

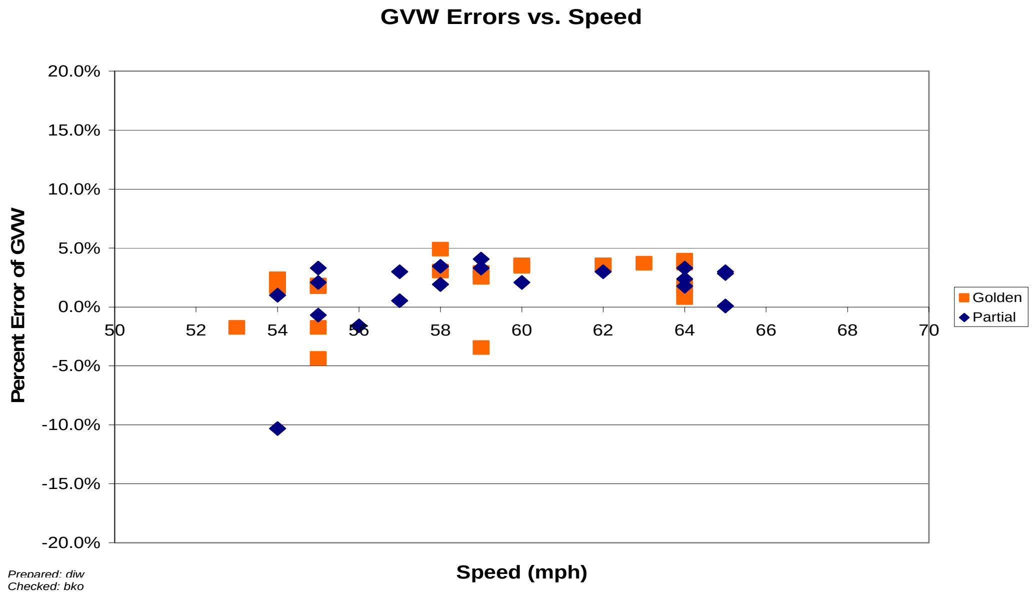

Figure 6-7 Pre-Validation GVW Percent Error vs. Speed Group - 230500 –14-Aug-2007

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.

From the figure, it appears that the equipment overestimates steering axle weights at medium and high speeds. Variability in error appears to decrease as speed decreases.

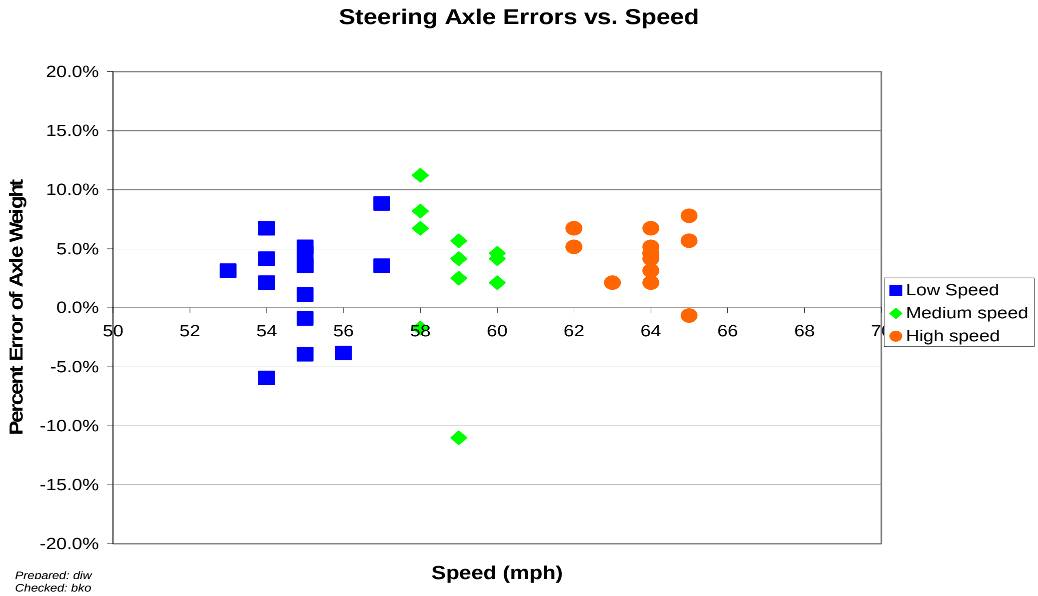

Figure 6-8 Pre-Validation Steering Axle Percent Error vs. Speed Group - 230500 – 14-Aug-2007

6.3 Classification Validation

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

The classification validation is intended to find gross errors in vehicle classification, not to validate the installed algorithm. A sample of three hours (52 trucks) was collected at the site. The classification identification is to identify gross errors in classification, not validate the classification algorithm. Video was taken at the site to provide ground truth for the evaluation. Based on a 100 percent sample it was determined that there are 0 percent unknown vehicles and 0 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 230500 – 14-Aug-2007

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

Prepared: djw Checked: bko

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

Table 6-5 Truck Classification Mean Differences for 230500 – 14-Aug-2007

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

Prepared: djw Checked: bko

These error rates are normalized to represent how many vehicles of the class are expected to be over- or under-counted for every hundred of that class observed by the equipment. Thus a value of 0 means the class is identified correctly on average. A number between –1 and –100 indicates at least that number of vehicles either missed or not assigned to the class by the equipment. It is not possible to miss more than all of them or one hundred out of one hundred. Numbers 1 or larger indicate at least how many more vehicles are assigned to the class than the actual "hundred observed". Classes marked Unknown 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%	97.5%	Pass

Prepared: djw Checked: bko

7 Data Availability and Quality

As of August 14, 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 only 2003 has a sufficient quantity to be considered a complete year of classification data. There are three years, 2001, 2002 and 2003 that have sufficient data to be considered complete years of weight data. **In the absence of previously gathered validation information with quantification of any errors, precision and bias it can be seen that at least five 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 230500 – 14-Aug-2007

Year	Classification Days	Months	Coverage	Weight Days	Months	Coverage
2000	115	5	Full week	134	5	Full week
2001	107	5	Full week	331	12	Full week
2002	98	6	Full week	268	11	Full week
2003	227	11	Full week	258	11	Full week
2004	76	5	Full week	83	6	Full week

Prepared: djw Checked: bko

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

Class 9s, Class 5s and Class 10s constitute more than 10 percent of the truck population based on the post-validation download. Based on the data collected from the end of the last calibration iteration the following are the expected values for these populations. The precise values to be used in data review will need to be determined by the RSC 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 – 230500 – 15-Aug-2007

Characteristic	Class 9	Class 5	Class 10
Overweights	0.3%	0.6%	1.2%
Underweights	0.0%	0.6%	3.6%
Unloaded Peak	36,000 lbs		40,000 lbs
Loaded Peak	76,000 lbs		84,000 lbs
Peak		12,000 lbs	

Prepared: djw *Checked: bko*

The expected percentage of unclassified vehicles is *NN*. 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 7-5. These are based on data collected immediately after the validation and may not be wholly representative of the population at the site. They should however provide a sense of the statistics expected when SPS comparison data is computed for the Post-Validation Sheet 16.

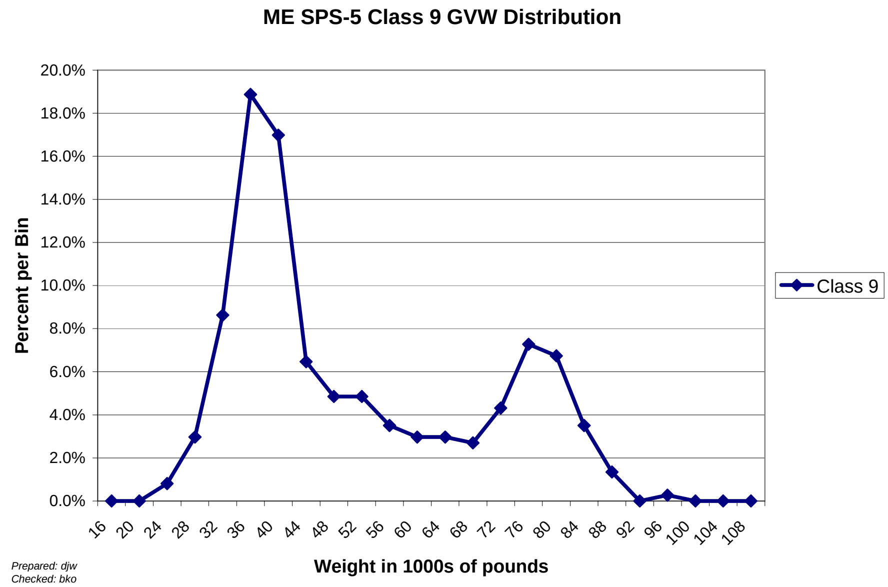

Figure 7-1 Expected GVW Distribution Class 9 – 230500 – 15-Aug-2007

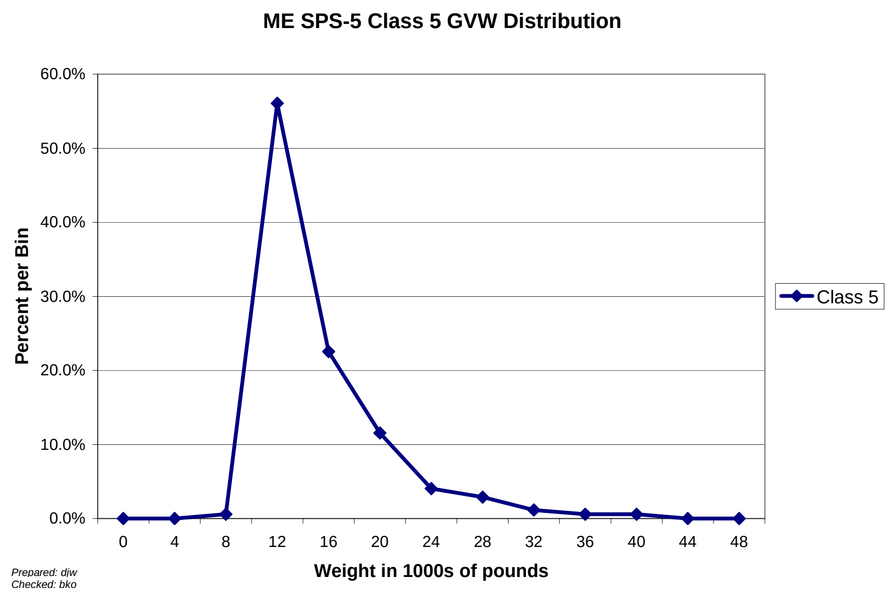

Figure 7-2 Expected GVW Distribution Class 5 – 230500 – 15-Aug-2007

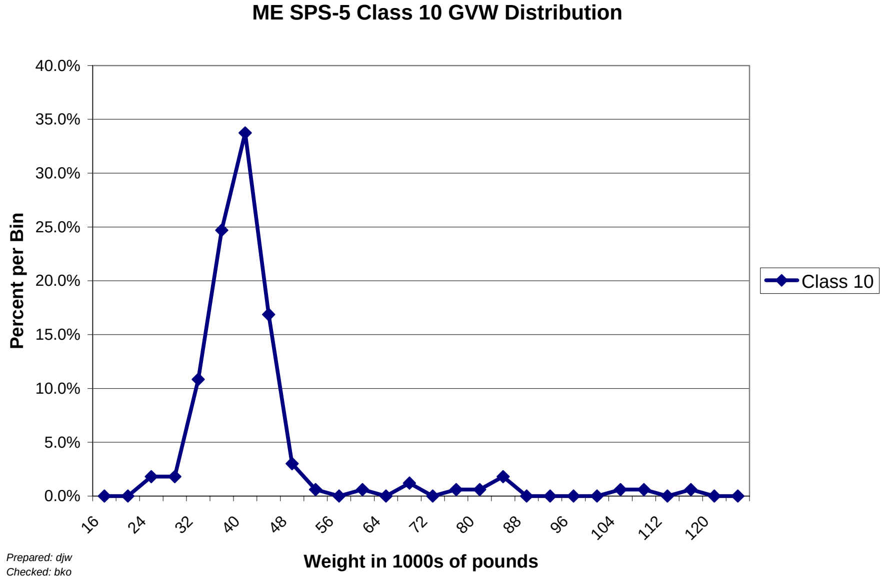

Figure 7-3 Expected GVW Distribution Class 10 – 230500 – 15-Aug-2007

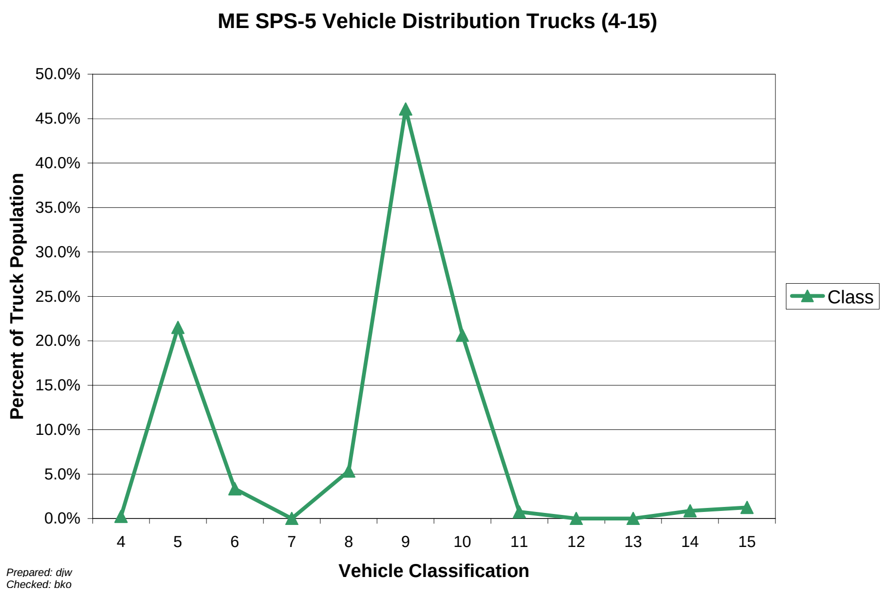

Figure 7-4 Expected Vehicle Distribution – 230500 – 15-Aug-2007

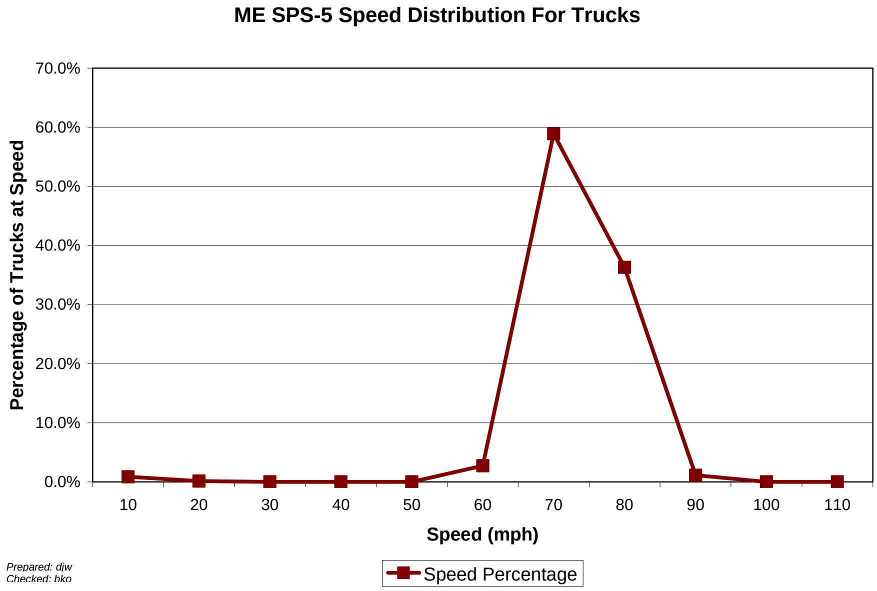

Figure 7-5 Expected Speed Distribution – 230500 – 15-Aug-2007

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 with tapered leaf suspension (3 pages)

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

Sheet 21 – Pre-validation (3 pages)
Sheet 21 – Post-validation (3 pages)

Test Truck Photographs (7 pages)

LTPP Mod 3 Classification Scheme (1 page)

Final System Parameters (1 page)

9 Updated Handout Guide and Sheet 17

A copy of the handout has been included following page 28. It includes a current Sheet 17 with all applicable maps and photographs.

10 Updated Sheet 18

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

11 Traffic Sheet 16(s)

Sheet 16s for the pre-validation and post-validation conditions are attached following the current Sheet 18 information at the very end of the report.

POST-VISIT HANDOUT GUIDE FOR SPS WIM FIELD VALIDATION

STATE: Maine

SHRP ID: 230500

1. General Information 3
2. Contact Information 3
3. Agenda 3
4. Site Location/ Directions 3
5. Truck Route Information 5
6. Sheet 17 – Maine (230500) 7

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Figure 5-2 – Truck Route at 230500 in Maine 6
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1. General Information

SITE ID: *230500*

LOCATION: *I-95, milepost 200.1*

VISIT DATE: *August 14, 2007*

VISIT TYPE: *Validation*

2. Contact Information

POINTS OF CONTACT:

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

Highway Agency: *Ron Cote, 207-624-3620, ron.cote@maine.gov*

Dale Peabody, 207-624-3305, dale.peabody@maine.gov

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

FHWA Division Office Liaison: *Mike Davies, 207-622-8350 ext. 22, mike.davies@fhwa.dot.gov*

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

3. Agenda

BRIEFING DATE: *No briefing requested for this visit.*

ON SITE PERIOD: *August 14 and 15, 2007.*

TRUCK ROUTE CHECK: *Completed at installation calibration.*

4. Site Location/ Directions

NEAREST AIRPORT: *Bangor International Airport, Bangor, Maine*

DIRECTIONS TO THE SITE: *Approximately 17 miles north of Bangor, Maine on I-95.*

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

WIM SITE LOCATION: *I-95, milepost 200.1, approximately 17 miles north of I-395.*

WIM SITE LOCATION MAP: *See Figure 4.1*

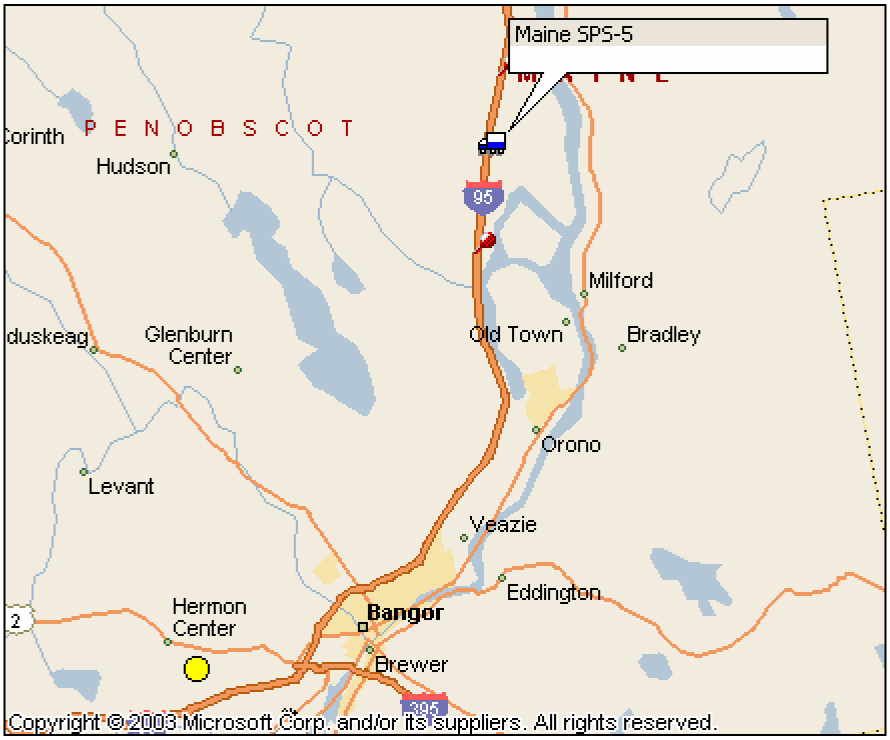

Figure 4-1 – Site 230500 in Maine

5. Truck Route Information

ROUTE RESTRICTIONS: *None*

SCALE LOCATION: *Dysart's Truck Stop, Coldbrook Road, Bangor, Maine off of I-95, exit 180.*

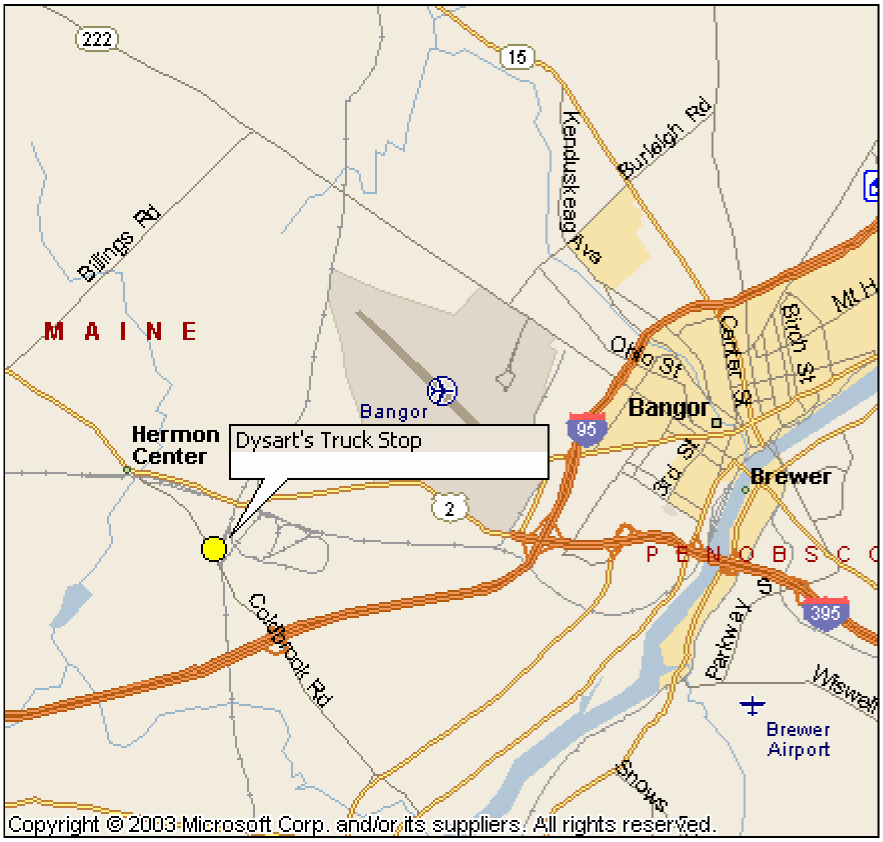

Figure 5-1 – Truck Scale Location for 230500 in Maine

TRUCK ROUTE: *See Figure 5.2*

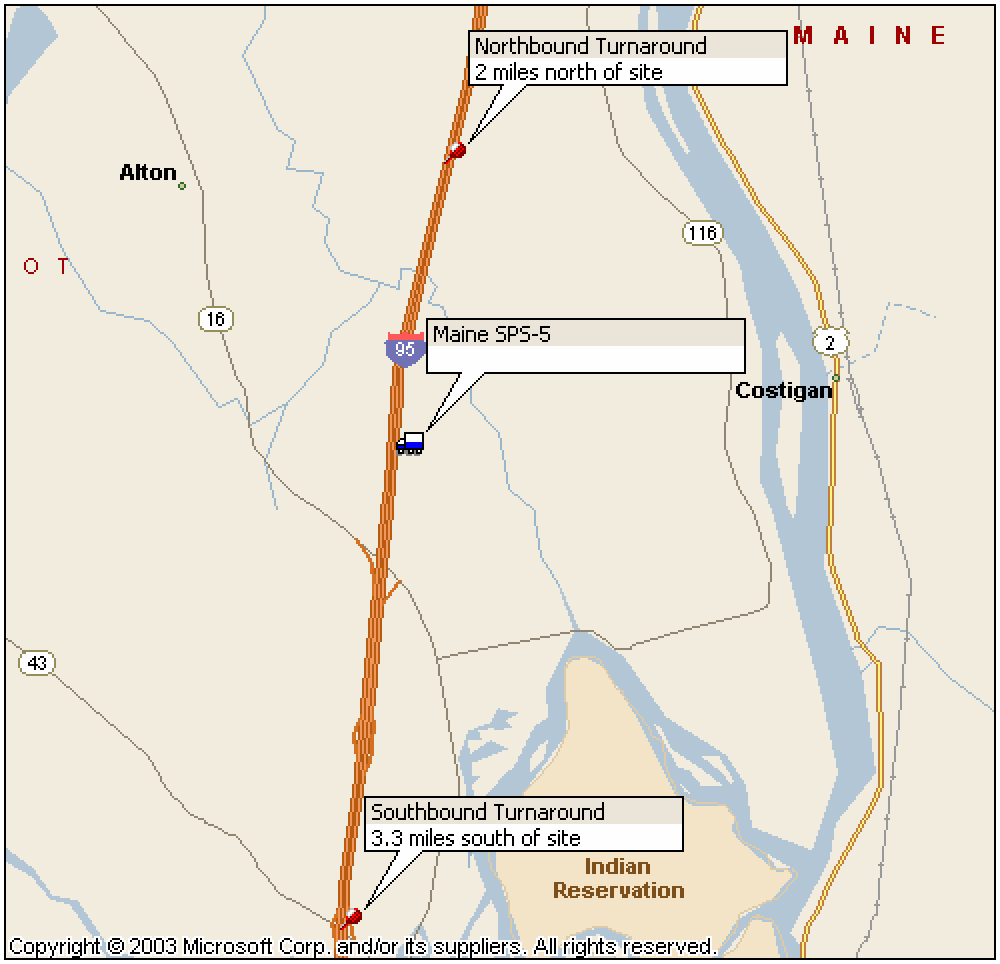

Figure 5-2 – Truck Route at 230500 in Maine

Permission to be granted by the Maine State Police to use median crossover for North turnaround.

NB on I-95 to median turnaround (4.1 miles)
SB on I-95 to exit 197 (3.1 miles)

Total distance = 14.4 miles (18 minutes)

6. Sheet 17 – Maine (230500)

1.* ROUTE ____I-95__ MILEPOST __200.1__ LTPP DIRECTION - N S E W

2.* WIM SITE DESCRIPTION - Grade __<1______ % Sag vertical Y / N
Nearest SPS section upstream of the site _____________
Distance from sensor to nearest upstream SPS Section __3.49 mi

3.* LANE CONFIGURATION
Lanes in LTPP direction __2_ 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 _____Asphalt__________________

5.* PAVEMENT SURFACE CONDITION – Distress Survey
Date __8/14/2007_ Photo Filename: 23_0500_Upstream_08_14_2007.jpg_________
Date __8/14/2007_ Photo Filename: 23_0500_Downstream_08_14_2007.jpg_______
Date __________ Photo Filename: ____

6. * SENSOR SEQUENCE _______Loop – Quartz – Quartz -Loop____

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

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

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

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

10. * CABINET LOCATION

Same side of road as LTPP lane Y / N Median Y/ N Behind barrier Y / N
Distance from edge of traveled lane ___45______ ft
Distance from system __51 __ ft
TYPE _______336_Short ___________________

CABINET ACCESS controlled by LTPP / STATE / JOINT ?
Contact - name and phone number ___Ron Cote 207-624-3620______
Alternate - name and phone number __Roy Czinku__306-653-6627___

11. * POWER

Distance to cabinet from drop ___7____ ft Overhead / underground / solar / AC in cabinet?
Service provider _________________ Phone number __________________

12. * TELEPHONE

Distance to cabinet from drop ___0____ ft Overhead / under ground / cell?
Service provider ______________ Phone Number ________________

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

14. * TEST TRUCK TURNAROUND time __18___minutes Distance __14.4_____ mi.

15. PHOTOS FILENAME

Power source	_23_0500_Solar_Panels_08_14_2007.jpg________
	_23_0500_Service_Mast_08_14_2007.jpg_______
Phone source	_23_0500_Cell_Modem_08_14_2007.jpg________
Cabinet exterior	_23_0500_Cabinet_Exterior_08_14_2007.jpg_____
Cabinet interior	_23_0500_Cabinet_Interior_Front_08_14_2007.jpg
	_23_0500_Cabinet_Interior_Back_08_14_2007.jpg
Weight sensors	_23_0500_Leading_WIM_Sensor_08_14_2007.jpg
	_23_0500_Trailing_WIM_Sensor_08_14_2007.jpg
Classification sensors	__None______________________________________
Other sensors	_23_0500_Leading_Loop_Sensor_08_14_2007.jpg
	_23_0500_Trailing_Loop_Sensor_08_14_2007.jpg

Description _______________________________________
Downstream direction at sensors on LTPP lane
23_0500_Downstream_08_14_2007.jpg_
Upstream direction at sensors on LTPP lane
23_0500_Downstream_08_14_2007.jpg_

COMMENTS ____

______Amenities approximately 7 miles south of site in Orono, Maine, exit 193_______

COMPLETED BY ____Dean J. Wolf__________________

PHONE _301-210-5105______ DATE COMPLETED _0_8_ / _1_4_ / _2_0_0_7__

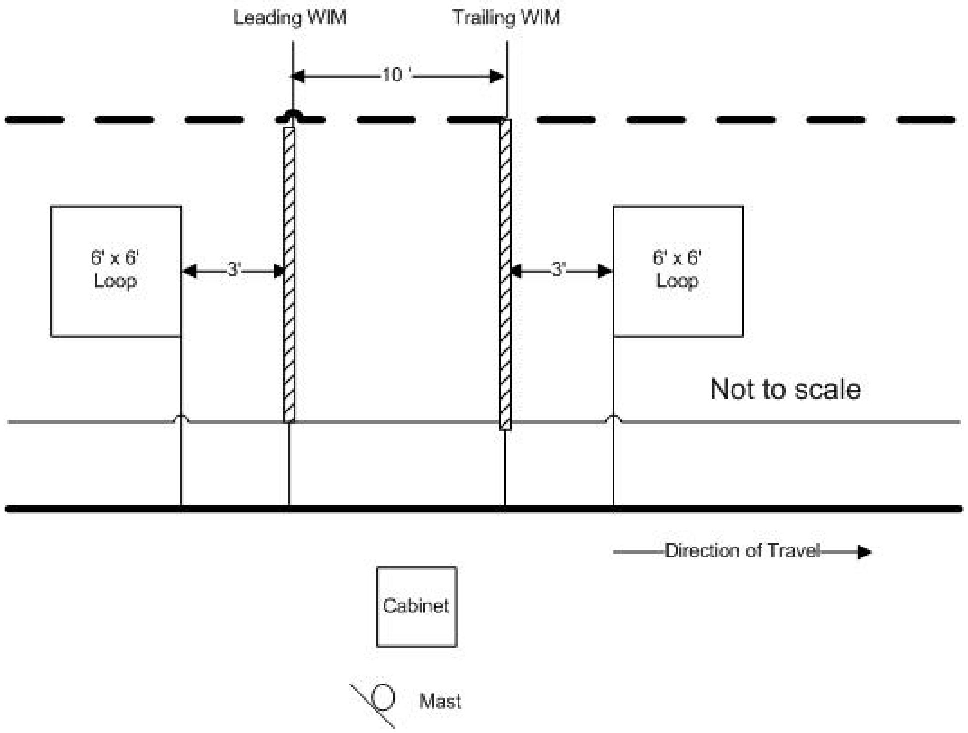

Figure 6-1 Sketch of Equipment Layout -230500

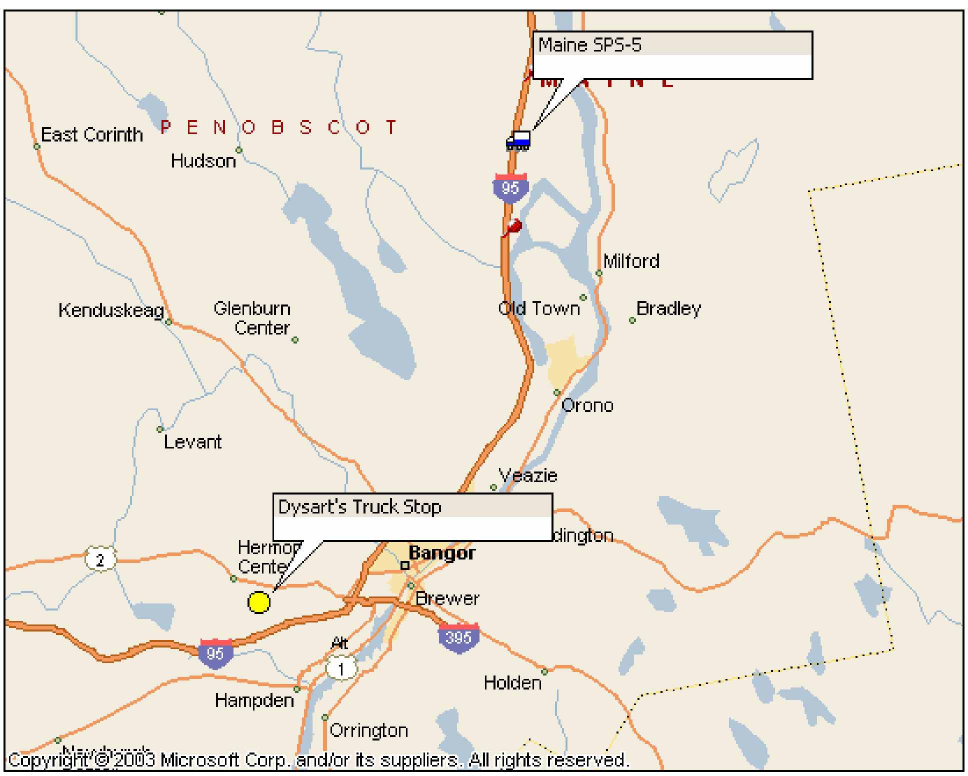

Figure 6-2 - Site Map of 230500 in Maine

Photo 6-1 23_0500_Upstream_08_14_2007.jpg

Photo 6-2 23_0500_Downstream_08_14_2007.jpg

Photo 6-3 23_0500_Solar_Panels_08_14_2007.jpg

Photo 6-4 23_0500_Service_Mast_08_14_2007.jpg

Photo 6-5 23_0500_Cell_Modem_08_14_2007.jpg

Photo 6-6 23_0500_Cabinet_Exterior_08_14_2007.jpg

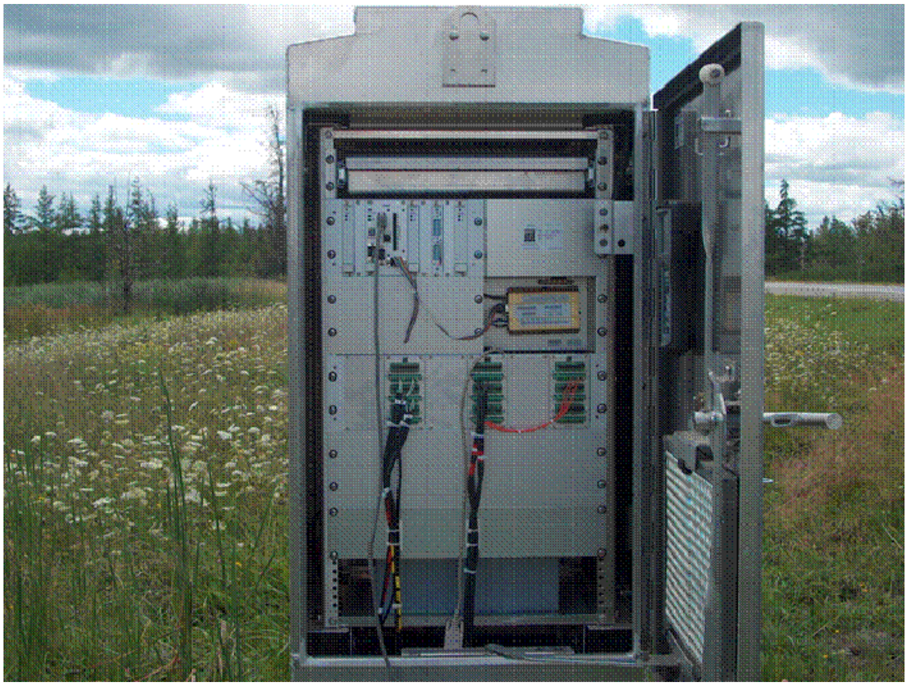

Photo 6-7 23_0500_Cabinet_Interior_Front_08_14_2007.jpg

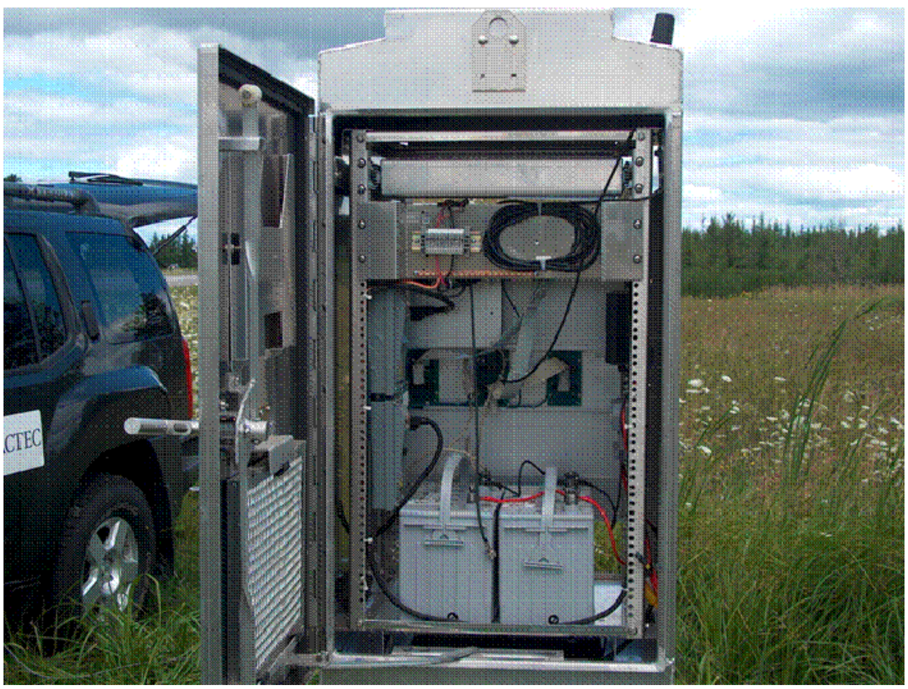

Photo 6-8 23_0500_Cabinet_Interior_Back_08_14_2007.jpg

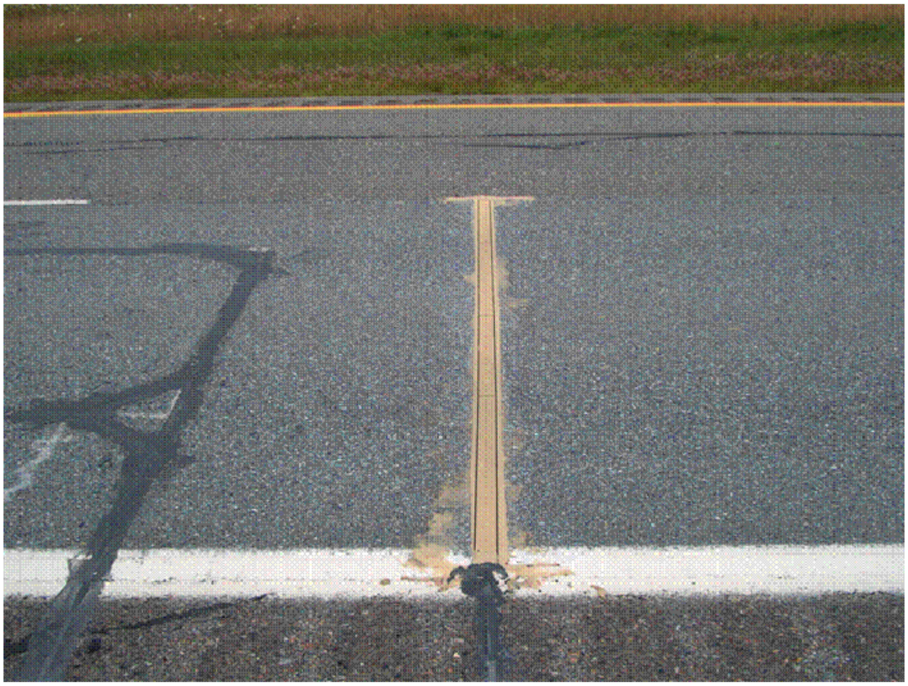

Photo 6-9 23_0500_Leading_WIM_Sensor_08_14_2007.jpg

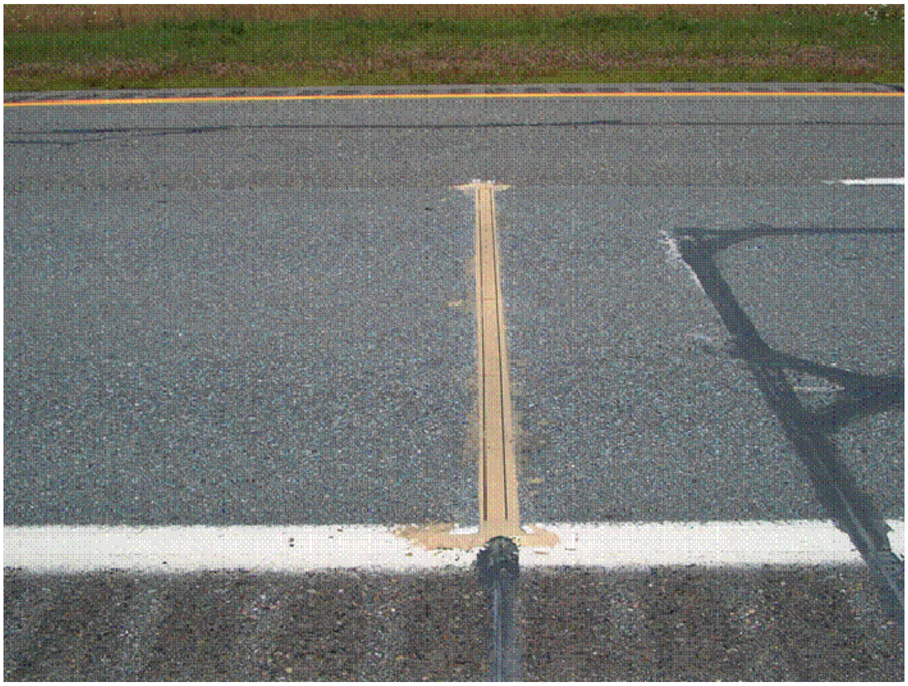

Photo 6-10 23_0500_Trailing_WIM_Sensor_08_14_2007.jpg

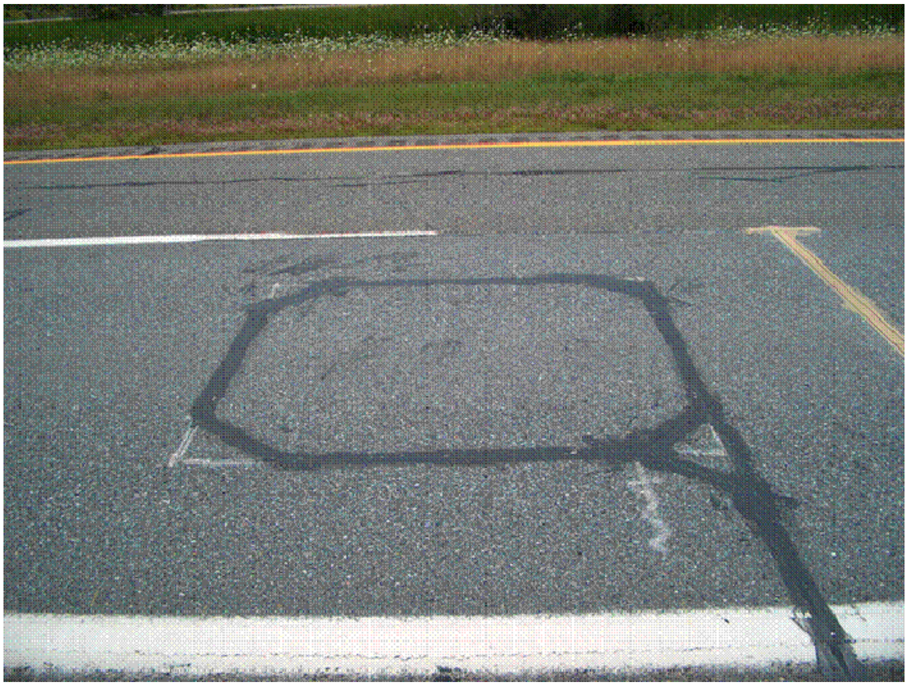

Photo 6-11 23_0500_Leading_Loop_Sensor_08_14_2007.jpg

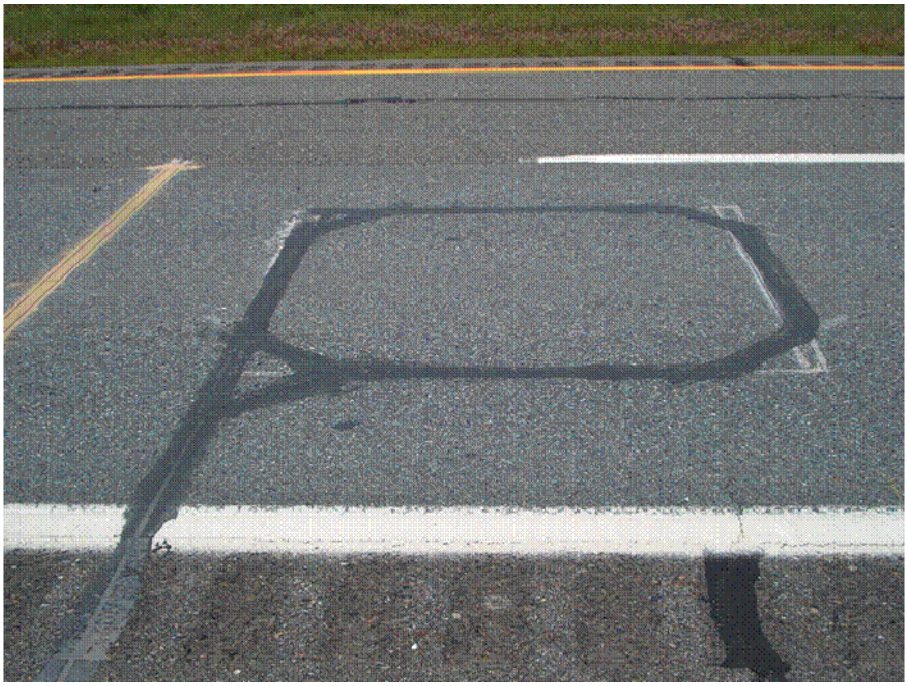

Photo 6-12 23_0500_Trailing_Loop_Sensor_08_14_2007.jpg

SHEET 18	STATE CODE [23230500]
LTPP MONITORED TRAFFIC DATA	SPS PROJECT ID [0500]
WIM SITE COORDINATION	DATE: (mm/dd/yyyy) 8/14/2007

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 _______
      - ☒ Separate contract LTPP – Expiration Date _______
      - ☐ Separate contract State – Expiration Date _______
      - ☐ State personnel

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

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

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

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

g. Communication –
   i. Type –
      ☐ Landline
      ☒ Cellular
      ☐ Other
   ii. Payment –
      ☒ State
      ☐ LTPP
      ☐ N/A

3. PAVEMENT –
   a. Type –
      ☐ Portland Concrete Cement
      ☒ Asphalt Concrete
   b. Allowable rehabilitation activities –
      ☐ Always new
      ☐ Replacement as needed
      ☐ Grinding and maintenance as needed
      ☐ Maintenance only
      ☐ No remediation
   c. Profiling Site Markings –
      ☐ Permanent
      ☒ Temporary

4. ON SITE ACTIVITIES –
   a. WIM Validation Check - advance notice required _2__ ☐ days ☒ weeks
   b. Notice for straightedge and grinding check - ________ ☐ 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:
IRD

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 – _Contact Maine State Police for permission to use crossover for truck turn around Lt. Hussy direct ph# 207-866-5035; switchboard 207-255-8000__

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: Al Fox Phone:207-892-4781

Agency: Fox and Gammon

f. Traffic Control –

Name: _____ Phone:_____

Agency: _____

g. Enforcement Coordination –

Name: _____ Phone:_____

Agency: _____

h. Nearest Static Scale

Name: Dysart's Location: Exit 180, I-95

Phone: _____

SHEET 16 LTPP MONITORED TRAFFIC DATA SITE CALIBRATION SUMMARY	*STATE ASSIGNED ID [__ __ __ __] *STATE CODE [23] *SHRP SECTION ID [0500]

SITE CALIBRATION INFORMATION

1. * DATE OF CALIBRATION (MONTH/DAY/YEAR) [8/14/2007]

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

5. EQUIPMENT MANUFACTURER ____IRD________________

WIM SYSTEM CALIBRATION SPECIFICS**

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

   ___ NUMBER OF TRUCKS COMPARED __2__ NUMBER OF TEST TRUCKS USED

   __20__ PASSES PER TRUCK

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

TRUCK	TYPE	SUSPENSION
1	9	1
2	9	2
3		

7. SUMMARY CALIBRATION RESULTS (EXPRESSED AS A PERCENT)
   MEAN DIFFERENCE BETWEEN ---
   DYNAMIC AND STATIC GVW ___1.6 STANDARD DEVIATION ___2.8
   DYNAMIC AND STATIC SINGLE AXLES ___3.2 STANDARD DEVIATION ___4.2
   DYNAMIC AND STATIC DOUBLE AXLES ___1.3 STANDARD DEVIATION ___3.2

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

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

10. CALIBRATION FACTOR (AT EXPECTED FREE FLOW SPEED) ___3053___

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

CLASSIFIER TEST SPECIFICS***

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

13. METHOD TO DETERMINE LENGTH OF COUNT _X__ TIME ___ NUMBER OF TRUCKS

14. MEAN DIFFERENCE IN VOLUMES BY VEHICLES CLASSIFICATION:
   *** FHWA CLASS 9 ____ 0.0 FHWA CLASS _10_ ____ ____ 0
   *** 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 [23] *SHRP SECTION ID [0500]

SITE CALIBRATION INFORMATION

1. * DATE OF CALIBRATION (MONTH/DAY/YEAR) [8/15/2007]

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 ___ BENDING PLATES
   ___ CHANNELIZED ROUND PIEZO ___ LOAD CELLS _X_ QUARTZ PIEZO
   ___ CHANNELIZED FLAT PIEZO _X_ INDUCTANCE LOOPS ___ CAPACITANCE PADS
   ___ OTHER (SPECIFY) ______________

5. EQUIPMENT MANUFACTURER ___IRD____

WIM SYSTEM CALIBRATION SPECIFICS**

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

   ___ NUMBER OF TRUCKS COMPARED __2__ NUMBER OF TEST TRUCKS USED

   __20__ PASSES PER TRUCK

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

7. SUMMARY CALIBRATION RESULTS (EXPRESSED AS A PERCENT)
   MEAN DIFFERENCE BETWEEN ---

DYNAMIC AND STATIC GVW	2.4	STANDARD DEVIATION	2.0
DYNAMIC AND STATIC SINGLE AXLES	4.8	STANDARD DEVIATION	4.1
DYNAMIC AND STATIC DOUBLE AXLES	2.0	STANDARD DEVIATION	2.7

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

9. DEFINE THE SPEED RANGES USED (MPH) ______ _55_ _60_ _65_ ______ ______ ______ ______
   ______ ______ ______ ______ ______ ______ ______ ______ ______ ______

10. CALIBRATION FACTOR (AT EXPECTED FREE FLOW SPEED) ___3053___

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

CLASSIFIER TEST SPECIFICS***

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

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

14. MEAN DIFFERENCE IN VOLUMES BY VEHICLES CLASSIFICATION:
   *** FHWA CLASS 9 ____ 0.0 FHWA CLASS _10_ ____ ____ 0
   *** 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 23
LTPP Traffic Data	* SPS PROJECT ID 0500
*CALIBRATION TEST TRUCK # 1	* DATE 08-14-07

Rev. 08/31/01

PART I.

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

AXLES - units - lbs / 100s lbs / kg

GEOMETRY

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

9. a) * Make: MACK b) * Model: CH613

10.* Trailer Load Distribution Description:

FORKLIFT COUNTERWEIGHT OVER TRACTOR TANDEM

FORKLIFT AND COUNTERWEIGHTS LOADED MID TRAILER

PICK-UP LOADED OVER TRAILER TANDEM

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 11.8 B to C 4.4 C to D 32.8

D to E 4.1 E to F ______

Wheelbased (measured A to last) ______ Computed ______

13. *Kingpin Offset From Axle B (units) + 2.0 (______)
(+ is to the rear)

SUSPENSION

Axle	14. Tire Size	15.* Suspension Description (leaf, air, no. of leaves, taper or flat leaf, etc.)
A	11R24.5	3 FULL LEAF
B	11R22.5	AIR
C	11R22.5	AIR
D	10R17.5	AIR
E	10R17.5	AIR
F		

Sheet 19	* STATE_CODE	23
LTPP Traffic Data	* SPS PROJECT ID	0500
*CALIBRATION TEST TRUCK # 1	* DATE	08-14-07

Rev. 08/31/01

PART II

Day 1

*b) Average Pre-Test Loaded weight 757~~10~~ 07

*c) Post Test Loaded Weight 75300

*d) Difference Post Test – Pre-test -41~~0~~ 07

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10080	17130	17130	15690	15690		75720
2	10120	17130	17130	15680	15680		75740
3	9980	17150	17150	15690	15690		75660
Average	10060	171~~40~~ 37	171~~40~~ 37	156~~90~~ 87	156~~90~~ 87		757~~10~~ 07

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	9720	17130	17130	15660	15660		75300
2							
3							
Average	9720	17130	17130	15660	15660		75300

Measured By DAW Verified By MVT Weight date 8-14-07

Sheet 19	* STATE_CODE	23
LTPP Traffic Data	* SPS PROJECT ID	0500
*CALIBRATION TEST TRUCK # 1	* DATE	08-14-07

Rev. 08/31/01

Day 2

7.2 *b) Average Pre-Test Loaded weight ~~75390~~ 75387

*c) Post Test Loaded Weight 75020

*d) Difference Post Test – Pre-test ~~-370~~ 367

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	9800	17060	17060	15730	15730		75380
2	9760	17090	17090	15720	15720		75380
3	9880	17040	17040	15720	15720		75400
Average	9813	17063	17063	15723	15723		~~75390~~ 87

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	~~9720~~ 9580	17000	17000	15720	15720		75020
2							
3							
Average	~~9720~~ 9580	17000	17000	15720	15720		75020

Measured By DJW Verified By MVT Weight date 8/15/07

6420060018_SPSWIM_TO_16_23_2.80_Sheet_19_Axle_Scales_Truck_1.doc

Sheet 19	* STATE_CODE 23
LTPP Traffic Data	* SPS PROJECT ID 0500
*CALIBRATION TEST TRUCK # 2	* DATE 08-14-07

Rev. 08/31/01

PART I.

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

AXLES - units - lbs / 100s lbs / kg

GEOMETRY

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

9. a) * Make: MACK b) * Model: CH613

10.* Trailer Load Distribution Description:

FORKLIFT COUNTERWEIGHTS LOADED OVER TRACTOR AND TRAILER TANDEMS

2 FORKLIFTS LOADED MID TRAILER

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

b). Trailer Tare Weight (units): ______

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

A to B 11.0 B to C 4.3 C to D 33.3

D to E 4.1 E to F ______

Wheelbased (measured A to last) ______ Computed ______

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

(+ is to the rear)

SUSPENSION

Axle	14. Tire Size	15.* Suspension Description (leaf, air, no. of leaves, taper or flat leaf, etc.)
A	75R24.5	3 FULL LEAF
B	80R24.5	15 TAPERED LEAF
C	80R24.5	15 TAPERED LEAF
D	10R17.5	AIR
E	10R17.5	AIR
F		

Sheet 19	* STATE_CODE 23
LTPP Traffic Data	* SPS PROJECT ID 0500
*CALIBRATION TEST TRUCK # 2	* DATE 08-14-07

Rev. 08/31/01

PART II

Day 1

*b) Average Pre-Test Loaded weight 6563~~0~~ 3

*c) Post Test Loaded Weight 65260

*d) Difference Post Test – Pre-test -37~~0~~ 3

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	9740	14770	14770	13160	13160		65600
2	9740	14710	14710	13230	13230		65620
3	9400	14940	14940	13200	13200		65680
Average	96~~30~~ 27	1481~~0~~ 07	148~~10~~ 07	13~~200~~ 197	13~~200~~ 197		656~~30~~ 33

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	9300	14800	14800	13180	13180		65260
2							
3							
Average	9300	14800	14800	13180	13180		65260

Measured By QW Verified By MVT Weight date 8-14-07

Sheet 19	* STATE_CODE 23
LTPP Traffic Data	* SPS PROJECT ID 0500
*CALIBRATION TEST TRUCK # 2	* DATE 08-14-07

Rev. 08/31/01

Day 2

7.2 *b) Average Pre-Test Loaded weight ~~75390~~ 65293

*c) Post Test Loaded Weight 64980

*d) Difference Post Test – Pre-test -313

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

Wrong label

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	9800	17060	17060	15730	15730		75380
2	9760	17090	17090	15720	15720		75380
3	9880	17040	17040	15720	15720		75400
Average	9810	17060	17060	15720	15720		75390

~~Table 6.2. Raw data – Axle scales –~~ Pre-Test Data

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	9140	14910	14910	13170	13170		65300
2	9420	14730	14730	13200	13200		65280
3	9180	14860	14860	13200	13200		65300
Average	9250 47	14833	14833	13190	13190		65293

Table 7.2 Raw data – Axle scales – post-test

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	9020	14800	14800	13180	13180		64980
2							
3							
Average	9020	14800	14800	13180	13180		64980

Measured By DJW Verified By MVT Weight date 8/15/07

Sheet 20	* STATE_CODE 23
LTPP Traffic Data	*SPS PROJECT_ID 0500
Speed and Classification Checks * 1 of* 2	* DATE 08/14/2007

Rev. 08/31/2001….

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
56	8	4349	55	8	70	9	4615	67	9
64	9	4359	63	9	68	9	4625	68	9
64	9	4369	63	9	67	4	4627	65	4
72	10	4370	69	10	72	9	4630	70	9
64	10	4371	64	10	75	10	4635	73	10
64	10	4374	64	10	61	9	4670	60	9
70	10	4377	70	10	65	9	4683	64	9
59	~~8~~ 9	4382	59	9	65	5	4689	65	5
70	5	4413	69	5	71	9	4707	71	9
75	10	4424	74	10	72	10	4713	70	10
70	6	4427	69	6	71	10	4714	69	10
52	10	4436	52	10	69	8	4779	70	8
70	9	4444	70	9	62	9	4787	62	9
65 ~~80~~	10 ~~5~~	4504	65 ~~78~~	10	65	10	4867	64	10
67	9	4505	66	9	75	10	4877	74	10
72	10	4530	72	10	76	10	4878	76	10
67	9	4531	66	9	65	10	4883	65	10
70	10	4536	69	10	64	9	4888	64	9
73	9	4550	69	9	69	9	4892	68	9
67	9	4558	67	9	70	9	4893	69	9
62	10	4572	61	10	62	5	4950	61	5
69	10	4585	69	10	62	9	5046	56	9
70	6	4603	68	6	66	8	5047	65	8
67	5	4604	66	5	56	8	5061	56	8
68	9	4612	67	9	67	10	5065	68	10

Recorded by MT Direction N Lane 1 Time from 10:32 to ~~1332~~ ~~1432~~ ~~1305~~ 13:05

MVT

6420060018_SPSWIM_TO_16_23_2.80_0500_Pre_Sheet_20.doc

Sheet 20	* STATE_CODE 23
LTPP Traffic Data	*SPS PROJECT_ID 0500
Speed and Classification Checks * 2 of* 2	* DATE 08/14/2007

Rev. 08/31/2001….

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
70	9	5066	66	9					
67	9	5120	65	9					

Recorded by MY Direction N Lane 1 Time from 13:05 to ~~[illegible]~~ 13:32

MVT

6420060018_SPSWIM_TO_16_23_2.80_0500_Pre_Sheet_20.doc

Sheet 20	* STATE_CODE 23
LTPP Traffic Data	*SPS PROJECT_ID 0500
Speed and Classification Checks * 1 of* 2	* DATE 08/15/2007

Rev. 08/31/2001….

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
62	9	8235	62	9	64	9 ~~8~~	8439	64	~~8~~ 9
70	9	8241	69	9	66	6	8443	68	6
67	10 ~~9~~	8248	67	~~9~~ 10	67	9	8451	70	9
70	9	8250	69	9	68	5	8452	71	5
68	8	8253	66	8	68	9	8459	69	9
68	6	8264	68	6	74	9	8463	74	9
79	6	8266	79	6	69	9	8480	70	9
66	5 ~~8~~	8295	64	~~8~~ 5	64	8	8483	65	8
68	9	8329	66	9	67	9	8490	66	9
66	5	8332	64	5	62	9	8491	63	9
74	9	8338	74	9	67	5	8494	67	5
61	9	8345	60	9	67	9	8496	67	9
61	9	8346	59	9	68	8	8516	67	8
70	9	8349	67	9	62	9	8557	63	9
62 ~~68~~	9	8368	62 ~~68~~	9	68	9	8577	68	9
72	10	8369	69	10	75	9	8581	74	9
70	9	8373	69	9	71	9	8593	71	9
65	9	8376	66	9	72	8	8596	73	8
67	9	8393	68	9	58	5	8637	59	5
68	9	8396	69	9	68	9	8639	68	9
69	9	8407	70	9	72	9	8646	72	9
64	10	8408	69	10	77	10	8648	78	10
67	9	8427	66	9	65	5	8663	66	5
70	6	8435	70	6	69	10	8705	68	10
64	9	8438	64	9	66	9	8717	67	9

Recorded by MVT Direction N Lane 1 Time from 8:00 to 10:03

DN MVT

Sheet 20	* STATE_CODE 23
LTPP Traffic Data	*SPS PROJECT_ID 0500
Speed and Classification Checks * 2 of* 2	* DATE 08/15/2007

Rev. 08/31/2001….

	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
	67	9	8727	67	9	~~6~~			~~67~~	~~9~~
	73	9	8754	74	9					
	67 ~~69~~	10	8756	68	10					
	62	9	8764	62	9					
*	73	3	8778	74	~~07~~ 05					
	70	9	8786	71	9					
	57	8	8793	59	8					
	68	6	8854	71	6					
	77	10	8857	77	10					
	69	9	8916	69	9					
	67	10	8925	70	10					
	62	9	8926	62	9					
	64	9	8932	64	9					
	73	10	8946	74	10					
	72	9	8949	71	9					
	68	10	8950	69	10					
	67	9	8964	70	9					
	70	10	8968	70	10					

Recorded by MVT Direction N Lane 1 Time from 10:04 to 11:00

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[signature] MVT

Sheet 21	* STATE_CODE	23
LTPP Traffic Data	*SPS PROJECT_ID	0500
WIM System Test Truck Records 1 of 3	* DATE	08/14/2007

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
83	55	1	1	10:26	4314	55	4.8/5.2	8.0/9.0	7.7/9.7	7.9/9.7	7.5/7.3		76.8	11.8	4.4	32.9	4.1	
83	54	2	1	10:26	4316	54	4.6/4.3	6.5/7.2	6.7/6.1	6.6/5.9	5.4/5.5		58.7	11.0	4.3	33.3	4.1	
91.5	58	1	2	10:44	4387	59	5.1/5.9	8.1/9.0	7.9/9.8	8.2/9.4	7.0/7.5		77.8	~~11.0~~ 11.8	~~4.4~~ 4.4	~~17.8~~ 32.8	4.1	
91.5	58	2	2	10:44	4388	59	4.6/4.7	7.2/8.1	7.2/7.5	7.5/7.5	6.0/6.4		66.7	11.0	4.3	33.4	4.1	
83	62	1	3	11:02	4461	64	5.2/5.2	8.5/9.3	7.6/9.5	8.1/9.0	8.1/7.7		78.2	11.8	4.4	32.7	4.1	
83	65	2	3	11:02	4465	65	4.9/5.3	7.4/8.2	7.4/7.1	7.7/7.2	6.1/6.2		67.4	11.0	4.3	33.3	4.1	
74.5	54	1	4	11:27	4573	55	5.1/5.0	8.1/9.4	7.5/9.9	8.3/9.2	7.1/7.7		77.3	11.8	4.4	32.7	4.1	
74.5	55	2	4	11:27	4576	55	4.7/5.1	7.1/8.0	7.5/6.9	7.1/6.7	6.1/5.9		65.0	11.0	4.3	33.3	4.1	
74	58	1	5	11:45	4637	59	5.1/5.6	7.9/9.2	7.5/10.3	8.2/9.9	7.6/7.9		79.2	11.8	4.4	32.8	4.1	
74	57	2	5	11:45	4638	59	4.9/5.4	7.3/8.0	7.5/7.5	7.4/7.0	6.2/6.0		67.4	11.0	4.3	33.3	4.1	
	~~65~~ 64	~~1~~	~~6~~	~~12:04~~	~~4720~~ 19	~~65~~	~~4.8/5.6 4.7/5.3~~	~~7.4/9.2 8.4/7.8~~	~~7.6/9.0 8.1/7.2~~	~~7.5/8.8 7.7/6.5~~	~~6.2/7.3 7.2/6.3~~		~~66.6~~ 76.1	~~11.8~~	~~4.4~~	~~32.7~~	~~4.1~~	
98	64	2	6	12:04	~~4721~~ 4720	~~65~~ 64	4.8/5.3	7.4/7.8	7.6/7.2	7.5/6.5	6.2/6.3		66.6	11.0	4.3	33.2	4.1	
98	64	1	6	12:04	4719	65	4.7/5.6	8.4/9.2	8.1/9.0	7.7/8.8	7.2/7.3		76.1	11.8	4.4	32.7	4.1	
~~78~~ 90.5	54	1	7	12:23	4798	54	5.3/5.0	8.1/9.3	7.5/9.8	8.1/9.0	7.5/7.2		76.8	11.8	4.4	32.8	4.1	
90.5	54	2	7	12:24	4799	55	5.2/4.9	6.9/7.9	7.7/6.9	7.4/6.9	6.1/6.3		66.1	11.0	4.3	33.1	4.1	
90	59	1	8	12:46	4915	60	4.2/4.6	7.5/9.0	6.8/9.2	7.8/9.2	6.6/~~7.0~~		72.9	11.8	4.4	32.8	4.1	

8.0 BWD 8/21/07 per email DIW 8/21/2007

Recorded by MT

Checked by [illegible]

MVT

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Sheet 21	* STATE_CODE	23
LTPP Traffic Data	*SPS PROJECT_ID	0500
WIM System Test Truck Records 2 of 3	* DATE	08/14/2007

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
90	59	2	8	12:47	4916	59	4.9/5.1	7.5/8.5	7.2/7.3	7.6/7.2	6.0/6.7		68.1	11.0	4.3	33.3	4.1	
79.5	64	1	9	13:05	4997	64	4.9/5.5	8.5/8.7	8.0/9.0	8.5/8.7	7.6/7.5		76.8	11.8	4.4	32.9	4.1	
79.5	65	2	9	13:05	4998	65	4.5/4.9	7.2/8.2	6.8/6.8	7.3/7.3	6.1/6.5		65.5	11.0	4.3	33.3	4.1	
79	55	1	10	13:23	5073	55	5.3/5.1	7.9/9.4	7.3/9.9	8.4/8.8	7.5/7.3		76.9	11.8	4.4	32.7	4.1	
79	55	2	10	13:24	5076	55	4.9/5.0	6.8/8.5	7.6/7.2	7.1/7.5	5.8/6.6		66.8	11.1	4.3	33.3	4.1	
82.5	59	1	11	13:42	5168	59	4.9/5.4	7.9/8.8	7.8/9.8	8.1/9.3	8.0/7.4		77.4	11.8	4.4	32.7	4.1	
82.5	58	2	11	13:42	5169	59	5.0/5.1	7.2/8.4	7.6/7.3	7.5/6.8	6.2/6.5		67.7	11.0	4.3	33.2	4.1	
81.5	64	1	12	13:59	5249	65	4.9/5.2	7.9/9.6	8.1/10.6	8.0/8.7	7.2/8.0		78.3	11.8	4.4	32.8	4.1	
81.5	64	2	12	14:00	5251	65	5.0/4.9	7.0/8.4	7.6/6.9	7.7/7.6	5.9/6.6		67.6	11.0	4.3	33.3	4.1	
95	53	1	13	14:28	5411	54	4.8/5.4	7.8/8.4	7.6/9.5	7.7/8.8	7.2/7.0		74.2	11.8	4.4	32.8	4.1	
95	56	2	13	14:28	5412	56	4.5/4.6	6.5/8.3	6.8/7.2	7.5/6.9	5.8/6.3		64.4	11.0	4.3	33.4	4.1	
94.5	60	1	14	15:15	5649	60	4.9/5.4	7.8/9.1	7.7/9.8	8.5/9.3	8.1/7.5		78.2	11.8	4.4	32.7	4.1	
94.5	59	2	14	15:15	5650	59	4.7/5.0	7.0/8.4	7.0/7.4	7.4/7.3	6.3/6.5		67.6	11.0	4.3	33.3	4.1	
99	63	1	15	15:33	5760	64	4.7/5.4	8.1/9.0	8.2/10.2	7.9/9.5	7.4/7.9		78.3	11.8	4.4	32.9	4.1	
99	64	2	15	15:33	5761	65	4.6/5.3	7.2/8.1	7.5/7.1	7.5/7.2	6.1/6.4		67.0	11.0	4.3	33.3	4.1	
85	55 ~~56~~	1	16	15:51	5876	55	4.6/5.2	7.6/8.7	7.5/9.5	8.2/8.3	7.6/7.1		74.2	11.8	4.4	32.8	4.1	

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Sheet 21	* STATE_CODE	23
LTPP Traffic Data	*SPS PROJECT_ID	0500
WIM System Test Truck Records 3 of 3	* DATE	08/14/2007

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
85	55	2	16	15:51	5877	56	5.0/4.8	7.3/8.5	7.6/7.2	7.4/7.4	5.9/6.5		67.6	11.0	4.3	33.3	4.1	
81.5	60	1	17	16:09	5980	60	4.8/5.3	7.9/9.3	7.6/9.7	8.3/9.5	7.4/8.2		78.1	11.8	4.4	32.8	4.1	
81.5	60	2	17	16:09	5981	60	4.7/5.2	7.3/7.8	7.9/7.2	7.6/7.0	6.0/6.1		66.8	11.0	4.3	33.3	4.1	
80	64	1	18	16:28	6085	64	5.0/5.2	8.1/9.3	8.2/10.2	8.0/9.3	7.4/7.7		78.5	11.8	4.4	32.8	4.1	
80	65	2	18	16:28	6086	65	4.8/5.2	7.2/8.0	7.9/7.0	7.8/6.8	6.4/6.1		67.3	11.0	4.3	33.3	4.1	
88.5	~~54~~ 55	1	19	16:58	6277	55	4.5/5.0	7.7/8.8	7.3/9.3	7.8/7.6	7.2/6.9		72.2	11.8	4.4	32.7	4.1	
88.5	57	2	19	16:58	6278	57	4.7/5.1	7.4/7.9	7.4/7.0	7.4/6.8	6.1/6.0		65.8	11.0	4.3	33.3	4.1	
80.5	59	1	20	17:16	6396	59	5.0/5.3	8.1/9.1	7.8/9.8	8.6/8.6	7.4/8.0		77.7	11.8	4.4	32.7	4.1	
80.5	62	2	20	17:16	6397	60	5.2/4.9	7.0/8.3	7.9/7.3	7.6/6.9	6.4/5.9		67.4	11.0	4.3	33.3	4.1	

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MVT

Sheet 21	* STATE_CODE 23
LTPP Traffic Data	*SPS PROJECT_ID 0500
WIM System Test Truck Records 1 of 3	* DATE 08/15/2007

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
63	54	1	1	7:33	8123	54	4.8/5.3	7.8/8.7	7.5/10.1	7.7/9.0	7.4/7.3		75.6	11.9	4.4	32.8	4.1	
63	54	2	1	7:33	8124	55	5.0/4.8	6.8/8.4	7.5/7.2	7.5/7.5	6.0/6.5		67.0	11.0	4.3	33.3	4.1	
62	60	1	2	7:52	8201	60	5.0/5.5	8.2/9.3	7.8/10.3	8.3/9.9	7.6/8.0		79.9	11.8	4.4	32.8	4.1	
62	59	2	2	7:52	8202	60	5.0/5.0	7.1/8.4	7.5/7.4	7.7/7.2	6.2/6.7		68.4	11.0	4.3	33.3	4.1	
63	63	1	3	8:10	8270	64	4.9/5.1	8.0/9.3	8.3/10.7	8.2/9.0	7.4/8.4		79.2	11.8	4.4	32.8	4.1	
63	64	2	3	8:11	8271	65	4.5/5.3	7.4/7.9	7.9/7.0	7.7/7.2	6.1/6.2		67.2	11.0	4.3	33.2	4.1	
65.5	54	1	4	8:28	8351	55	4.6/5.4	7.7/8.4	7.8/9.6	8.3/7.3	7.3/6.8		73.1	11.8	4.4	32.7	4.1	
65.5	53	2	4	8:29	8352	55	5.1/4.7	6.8/8.1	7.3/7.3	7.4/7.0	6.0/6.3		66.2	11.0	4.3	33.3	4.1	
65.5	59	1	5	8:46	8412	60	4.7/5.4	8.2/8.8	8.1/9.1	8.5/8.3	7.2/7.7		75.9	11.8	4.4	32.7	4.1	
65.5	61	2	5	8:46	8413	60	4.7/5.2	7.1/8.1	7.7/7.0	7.7/7.0	6.0/5.9		66.3	11.0	4.3	33.3	4.1	
68	64 ~~66~~	1	6	9:04	8492	64	5.0/5.2	8.1/9.6	8.0/10.8	8.4/9.2	7.7/8.0		80.0	11.8	4.4	32.7	4.1	
68	66 ~~63~~	2	6	9:04	8493	66	4.4/4.6	6.7/8.2	6.7/6.9	7.5/7.5	6.4/6.2		65.2	11.0	4.3	33.4	4.1	
69.5	55	1	7	9:29	8603	55	5.0/5.0	7.9/9.4	7.5/9.9	7.9/8.9	7.2/8.1		77.0	11.8	4.4	32.8	4.1	
69.5	55	2	7	9:29	8604	55	4.9/5.0	7.1/7.9	7.5/7.2	7.5/7.1	6.0/6.3		66.6	11.0	4.3	33.3 ~~32.7~~	4.1	
69	60	1	8	9:48	8675	60	5.2/5.0	8.0/9.0	7.7/9.9	8.8/9.1	7.5/8.2		78.6	11.8	4.4	32.7	4.1	
69	61	2	8	9:48	8676	60	4.7/5.3	7.2/7.9	7.8/7.0	7.5/6.7	6.1/5.8		66.1	11.0	4.3	33.2	4.1	

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Sheet 21	* STATE_CODE 23
LTPP Traffic Data	*SPS PROJECT_ID 0500
WIM System Test Truck Records 2 of 3	* DATE 08/15/2007

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
69.5	64	1	9	10:06	8731	64	4.8/5.5	8.5/9.0	8.0/9.3	8.0/9.2	8.0/6.7		76.9	11.8	4.4	32.8	4.1	
69.5	67	2	9	10:06	8733	67	4.0/4.2	7.0/8.1	7.0/7.0	7.2/7.1	6.0/6.5		64.1	11.0	4.3	33.3	4.1	
72	55	1	10	10:24	8811	55	4.9/5.0	7.9/9.3	7.7/9.5	7.9/8.8	7.2/7.4		75.7	11.8	4.4	32.8	4.1	
72	55	2	10	10:25	8812	55	4.8/4.9	7.0/7.9	7.4/7.3	7.6/7.1	6.0/6.2		66.1	11.0	4.3	33.2	4.1	
71.5	60	1	11	10:42	8889	60	5.0/5.2	7.9/9.4	7.4/9.6	8.4/9.3	7.9/8.2		78.3	11.8	4.4	32.9	4.1	
71.5	60	2	11	10:42	8891	60	4.8/5.0	7.0/8.4	7.5/7.3	7.4/7.2	6.0/6.5		67.1	11.0	4.3	33.3	4.1	
73	65	1	12	11:01	8977	65	4.6/5.5	8.3/9.0	7.8/8.9	8.4/8.5	7.5/7.3		75.8	11.8	4.4	32.7	4.1	
73	65	2	12	11:01	8978	65	4.5/5.3	7.4/7.9	7.7/7.1	7.7/7.1	6.3/6.3		67.3	11.0	4.3	33.3	4.1	
70.5	55	1	13	11:19	9054	55	4.8/5.3	7.7/8.7	7.6/9.8	8.1/8.8	7.5/7.2		75.6	11.8	4.4	32.8	4.1	
70.5	55	2	13	11:19	9056	55	4.9/4.8	6.9/8.2	7.7/7.3	7.4/7.4	6.2/6.5		67.2	11.0	4.3	33.3	4.1	
68	60	1	14	11:38	9132	60	4.6/5.7	8.2/9.1	8.1/9.1	8.4/8.7	7.9/7.2		77.1	11.8	4.4	32.7	4.1	
68	60	2	14	11:38	9133	60	5.0/5.0	7.2/8.6	7.6/7.6	7.7/7.4	6.2/6.7		68.9	11.1	4.3	33.4	4.1	
68	64	1	15	11:56	9215	64	4.9/5.5	8.1/8.8	7.7/9.3	8.2/8.9	7.5/8.3		77.1	11.8	4.4	32.8	4.1	
68	65	2	15	11:56	9216	65	4.9/4.6	7.1/8.6	7.5/7.6	7.7/7.2	6.3/6.7		68.4	11.0	4.3	33.3	4.1	
65.5	56	1	16	12:15	9304	54	4.7/5.3	7.7/9.0	7.3/9.5	7.7/9.2	7.3/7.8 ~~6.7~~		75.6	11.8	4.4	32.7	4.1	
65.5	56	2	16	12:15	9305	57	4.9/5.0	6.9/8.5	7.6/7.3	7.3/7.3	6.1/6.5		67.4	11.1	4.3	33.3	4.1	

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Sheet 21	* STATE_CODE 23
LTPP Traffic Data	*SPS PROJECT_ID 0500
WIM System Test Truck Records 2 of 3	* DATE 08/15/2007

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
67	60	1	17	12:40	9407	60	4.7/5.6	8.0/8.8	7.6/9.7	8.6/8.7	7.7/7.9		77.2	11.8	4.4	32.8	4.1	
67	60	2	17	12:40	9408	60	4.6/5.1	7.7/7.8	7.2/7.0	7.4/6.8	6.0/6.2		65.9	11.0	4.3	33.4	4.1	
68.5	65	1	18 18	12:58	9495	65	4.8/5.4	8.0/9.3	8.0/10.0	7.7/9.7	7.6/7.5		77.9	11.8	4.4	32.9	4.1	
68.5	66	2	18	12:58	9498	66	4.2/4.7	6.8/8.4	7.3/7.0	7.7/7.6	6.2/6.3		66.3	11.0	4.3	33.4	4.1	
65	55	1	19 ~~18~~	13:17	9594	55	4.9/5.2	7.8/9.0	7.2/9.2	7.8/9.8	7.1/7.6		75.7	11.8	4.4	32.7	4.1	
65	55	2	19	13:17	9595	55	4.8/4.8	6.8/7.9	7.4/7.3	7.2/7.2	6.0/6.5		66.0	11.0	4.3	33.3	4.1	
69.5	60	1	20	13:35	9708	60	4.9/5.3	7.8/9.7	7.6/9.9	8.4/10.0	7.6/7.9		79.2	11.8	4.4	32.7	4.1	
69.5	60	2	20	13:35	9711	60	4.2/4.3	6.9/8.2	7.2/7.5	7.4/7.3	5.9/6.6		65.7	11.0	4.3	33.4	4.1	

good record

Recorded by MVT

Checked by [signature]

TEST VEHICLE PHOTOGRAPHS FOR SPS WIM VALIDATION

August 14, 2007

STATE: Maine

SHRP ID: 0500

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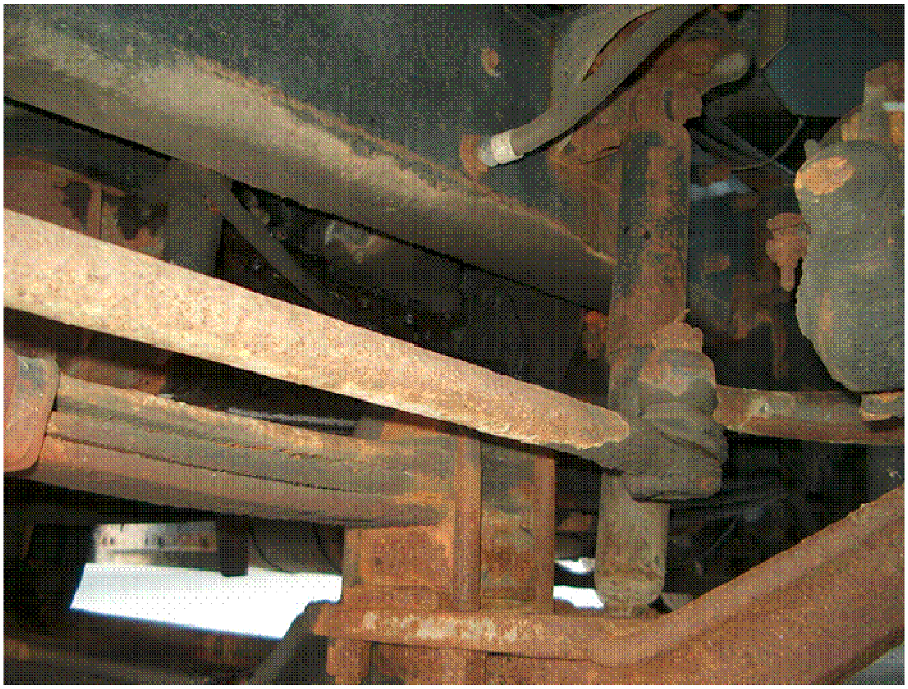

Photo 3 - 23_0500_Truck_1_Suspension_1_08_14_2007.jpg

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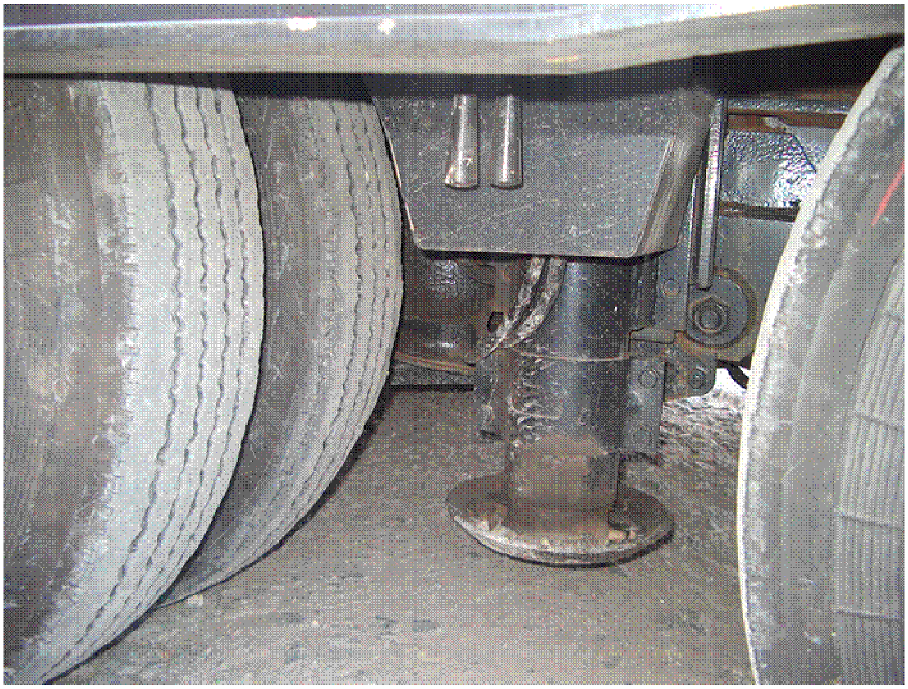

Photo 5 - 23_0500_Truck_1_Suspension_3_08_14_2007.jpg

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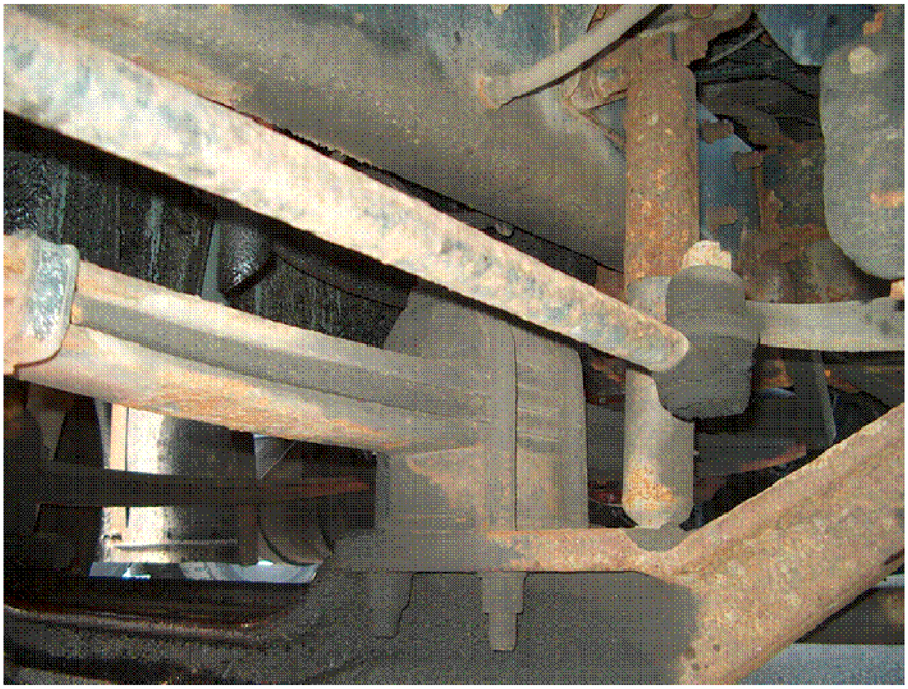

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ETG LTPP CLASS SCHEME, MOD 3

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

Maine SPS-5 (Lane 1)

Validation Visit – 14 August, 2007

Calibration factor for sensor #1:

80 kph:	3053
88 kph:	2991
96 kph:	3084
105 kph:	3053
112 kph:	3053

Calibration factor for sensor #2:

80 kph:	3053
88 kph:	2991
96 kph:	3084
105 kph:	3053
112 kph:	3053