Validation Report

Kansas, SPS-2
Task Order 27, CLIN 2
July 29 and 30, 2008

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1 Executive Summary

A visit was made to the Kansas 0200 on July 29 and 30, 2008 for the purposes of conducting a validation of the WIM system located on I-70 at 1 mile east of the Chapman interchange. The SPS-2 is located in the righthand, westbound lane of a four-lane divided facility. The posted speed limit at this location is 70 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 as part of a relocation of the abandoned site located approximately 400 feet west of this site. This is the third validation visit to this location. The site was installed on June 6 to 8, 2006 by International Road Dynamics Inc..

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

The site is instrumented with bending plate and iSync electronics. It is installed in portland cement concrete.

The validation used the following trucks:

1) 5-axle tractor-trailer with a tractor having an air suspension and a trailer with a standard rear tandem and an air suspension loaded to 79,840 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 8 tapered leaf suspension loaded to 68,360 lbs., the "partial" truck.

The validation speeds ranged from 57 to 70 miles per hour. The pavement temperatures ranged from 72 to 103 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 – 200200 – 30-Jul-2008

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	2.5 ± 6.2%	Pass
Tandem axles	±15 percent	0.5 ± 4.2%	Pass
GVW	±10 percent	0.8 ± 2.9%	Pass
Axle spacing	± 0.5 ft [150mm]	0.0 ± 0.0 ft	Pass

Prepared: djw *Checked: bko*

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

avoidance by trucks in the sensor area. Profile data for the site was available and is discussed in Section 4 of the report..

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

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

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

Prepared: djw *Checked: bko*

Upon our arrival at the site, we found the system parameters were not the same as we left them at the conclusion of our last validation on April 17 to 18, 2007. In the week prior to this validation, new weighpad signal analysis software was downloaded and installed. A remote calibration using data downloaded from the site was subsequently performed.

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

2 Corrective Actions Recommended

The broken cable conduit from the leading WIM sensor appears to have been repaired since the prior validation.

Repair of the sunken trench that was reported as a result of the last validation could not be verified during this visit due to extremely dense vegetation that has grown in the area of the trench.

No other corrective actions are required at this time.

3 Post Calibration Analysis

This final analysis is based on test runs conducted July 30, 2008 during the morning and early afternoon hours at test site 200200 on I-70. This SPS-2 site is at milepost 287.5 on the westbound, righthand of a four-lane divided facility. No auto-calibration was used during test runs. The two trucks used for the calibration and for the subsequent validation included:

1. 5-axle tractor-trailer with a tractor having an air suspension and trailer with a standard rear tandem and air suspension loaded to 79,840 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 8 tapered leaf suspension loaded to 68,360 lbs., the "partial" truck.

Each truck made a total of 20 passes over the WIM scale at speeds ranging from approximately 57 to 70 miles per hour. The desired speed range was achieved during this validation. Pavement surface temperatures were recorded during the test runs ranging from about 72 to 103 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.

As shown in Table 3-1, this site meets all of the performance criteria for research quality data.

Table 3-1 Post-Validation Results – 200200 – 30-Jul-2008

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	2.5 ± 6.2%	Pass
Tandem axles	±15 percent	0.5 ± 4.2%	Pass
GVW	±10 percent	0.8 ± 2.9%	Pass
Axle spacing	± 0.5 ft [150mm]	0.0 ± 0.0 ft	Pass

Prepared: djw *Checked: bko*

The test runs were conducted primarily during the morning hours under cloudy weather conditions and early afternoon hours under 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 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 – 57 to 61 mph, Medium speed – 62 to 66 mph and High speed – 67 + mph. The three temperature groups were created by splitting the runs between those at 72 to 79 degrees Fahrenheit for Low temperature, 80 to 89 degrees Fahrenheit for Medium temperature and 90 to 103 degrees Fahrenheit for High temperature.

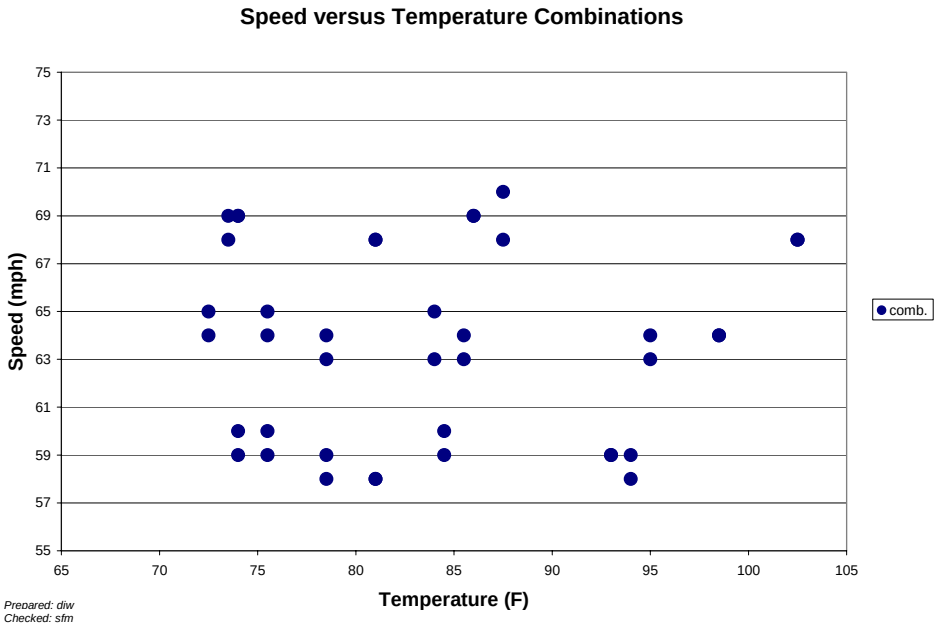

Figure 3-1 Post-Validation Speed-Temperature Distribution – 200200 – 30-Jul-2008

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

Figure 3-2 shows the GVW Percent Error vs. Speed graph for the population as a whole. From the figure, it appears that the equipment estimates GVW with reasonable accuracy over the entire speed range. Variability appears to be slightly greater at the lower speeds. Generally the equipment overestimates GVW.

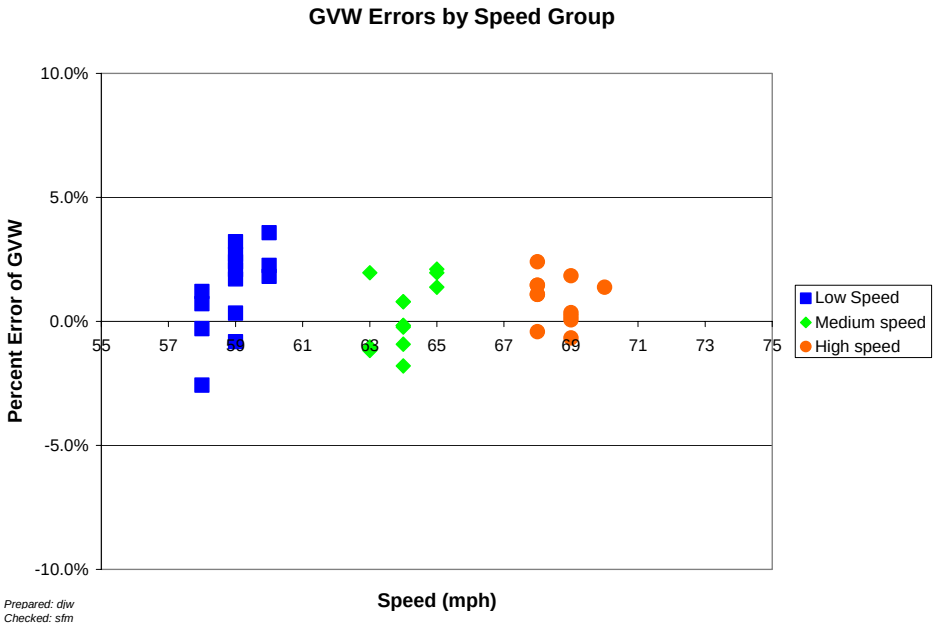

Figure 3-2 Post-validation GVW Percent Error vs. Speed – 200200 – 30-Jul-2008

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

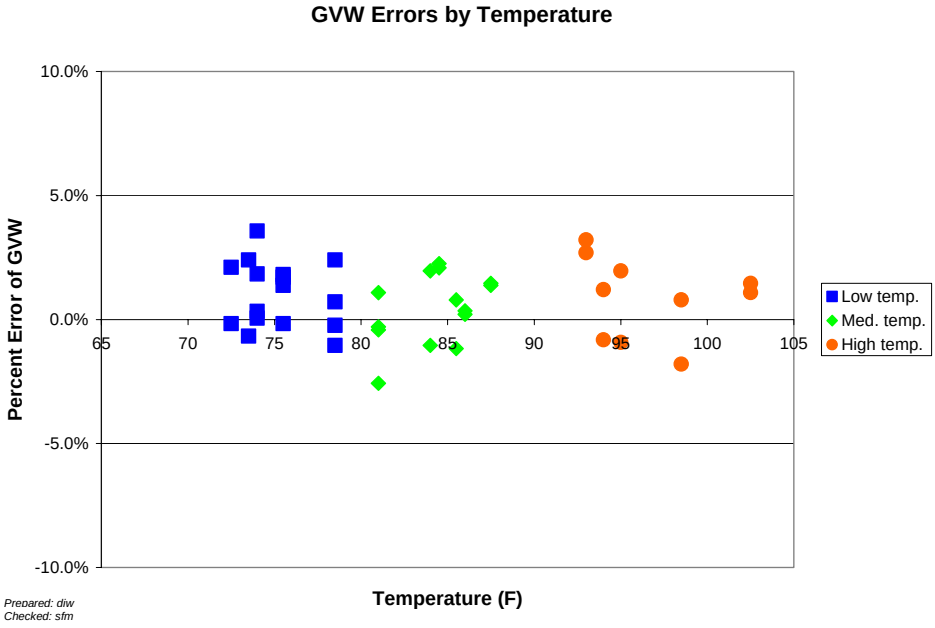

Figure 3-3 Post-Validation GVW Percent Error vs. Temperature – 200200 – 30-Jul-2008

Figure 3-4 shows the relationship between the drive tandem spacing errors in feet and speeds. This graph is used as a potential indicator of classification errors due to failure to

correctly identify spacings on a vehicle. Since the most common reference value is the drive tandem on a Class 9 vehicle, this is the spacing evaluated and plotted for validations. There does not appear to be a relationship between speed and axle spacing measurement.

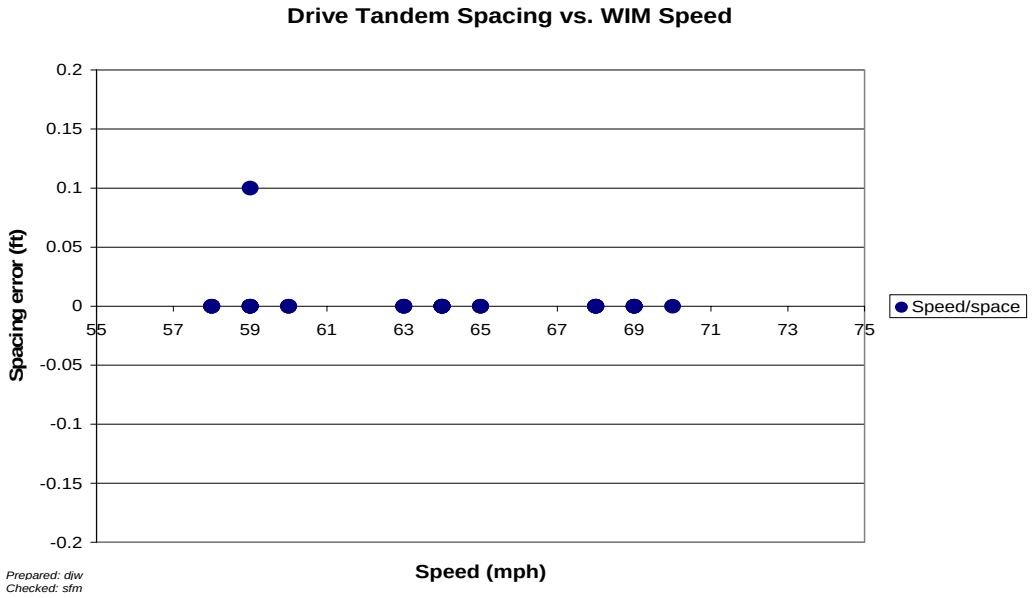

Figure 3-4 Post-Validation Spacing vs. Speed – 200200 – 30-Jul-2008

3.1 Temperature-based Analysis

The three temperature groups were created by splitting the runs between those at 72 to 79 degrees Fahrenheit for Low temperature, 80 to 89 degrees Fahrenheit for Medium temperature and 90 to 103 degrees Fahrenheit for High temperature.

Table 3-2 Post-Validation Results by Temperature Bin – 200200 – 30-Jul-2008

Element	95% Limit	Low Temperature 72 to 79 °F	Medium Temperature 80 to 89 °F	High Temperature 90 to 103 °F
Steering axles	±20 %	3.1 ± 6.9%	2.1 ± 5.7%	2.0 ± 8.0%
Tandem axles	±15 %	0.7 ± 3.6%	0.2 ± 4.5%	0.7 ± 5.2%
GVW	±10 %	1.0 ± 2.8%	0.4 ± 3.1%	0.9 ± 3.7%
Axle spacing	± 0.5 ft	0.0 ± 0.0 ft	0.0 ± 0.0 ft	0.0 ± 0.1 ft

Prepared: djw *Checked: bko*

From Table 3-2, it appears that the equipment overestimates steering axle weights at all temperatures and estimates all other weights with reasonable accuracy at all temperatures. Variability generally increases as temperature increases.

Figure 3-5 is the distribution of GVW Errors versus Temperature by Truck graph. From the figure, it appears that GVW mean error is not particularly affected by temperature. The equipment appears to estimate GVW accurately at all temperatures and variability appears to be consistent over the entire temperature range.

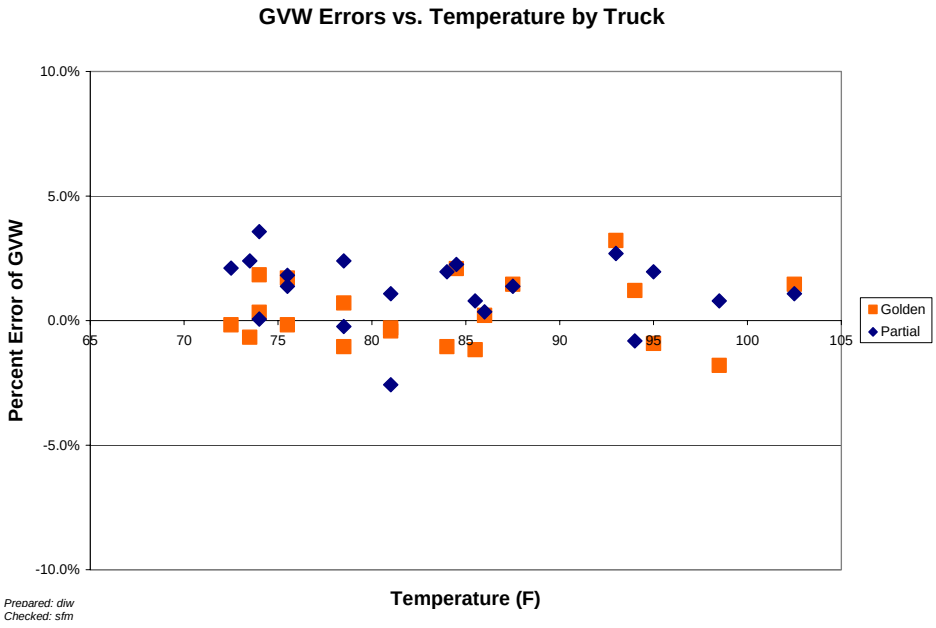

Figure 3-5 Post-Validation GVW Percent Error vs. Temperature by Truck – 200200 – 30-Jul-2008

Figure 3-6 shows the relationship between steering axle errors and temperature. This graph is included due to the frequent use of steering axle weights of Class 9 vehicles for 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 the equipment generally overestimates steering axle weights throughout the temperature range. Variability in steering axle error appears to be consistent at all temperatures.

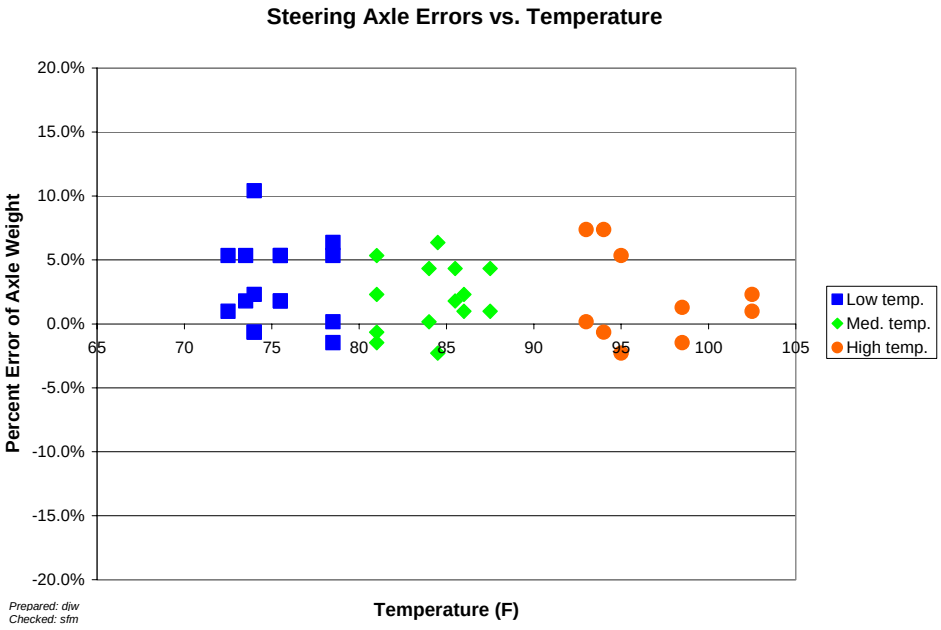

Figure 3-6 Post-Validation Steering Axle Error vs. Temperature by Group – 200200 – 30-Jul-2008

Figure 3-7 shows the relationship between steering axle errors and temperature for each test truck individually. From the figure, it can be seen that the equipment generally overestimates steering axle weights for the partially loaded truck (diamonds) and underestimates steering axle weights for the golden truck (squares) throughout the temperature range. Variability in steering axle error for each truck individually appears to be consistent at all temperatures. The differences in error of estimation of steering axle weight increase the variability in error for the truck population as a whole.

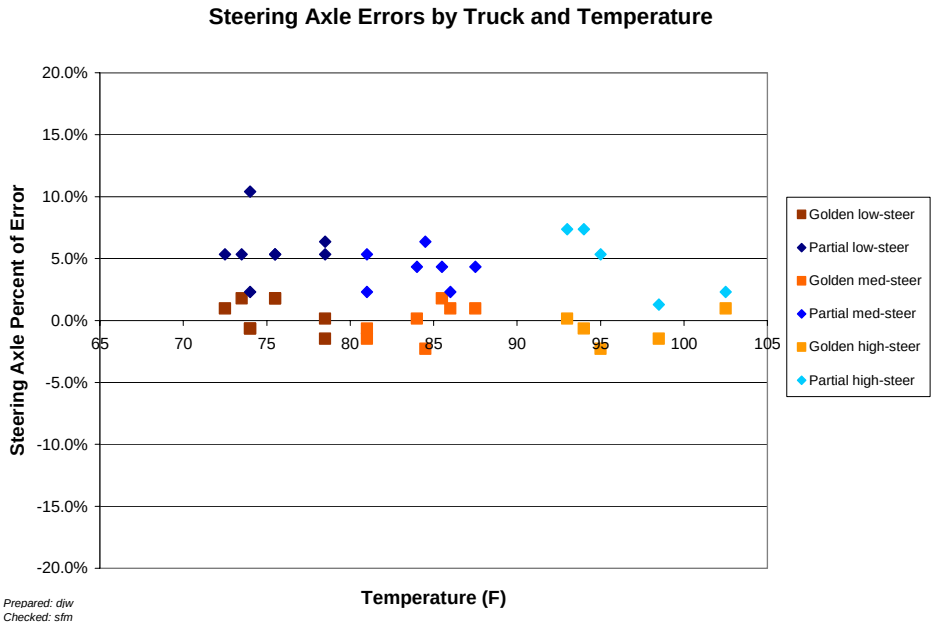

Figure 3-7 Post-Validation Steering Axle Error vs. Temperature by Truck – 200200 – 30-Jul-2008

3.2 Speed-based Analysis

The three speed groups were divided using 57 to 61 mph for Low speed, 62 to 66 mph for Medium speed and 67+ mph for High speed.

Table 3-3 Post-Validation Results by Speed Bin – 200200 – 30-Jul-2008

Element	95% Limit	Low Speed 57 to 61 mph	Medium Speed 62 to 66 mph	High Speed 67+ mph
Steering axles	±20 %	3.3 ± 8.7%	2.2 ± 6.1%	1.8 ± 4.1%
Tandem axles	±15 %	1.0 ± 4.7%	-0.2 ± 4.4%	0.8 ± 3.4%
GVW	±10 %	1.3 ± 3.7%	0.2 ± 2.8%	0.9 ± 2.1%
Axle spacing	± 0.5 ft	0.0 ± 0.1 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 tends to overestimate steering axle weights and estimate all other weights with reasonable accuracy at all speeds. Variability in error for all weights generally decreases as speed increases.

Figure 3-8 illustrates the ability of the equipment to estimate GVW for both trucks with reasonable accuracy at all speeds. Both trucks appear to demonstrate the same speed trends. Variability in error appears to be slightly greater at the lower speeds.

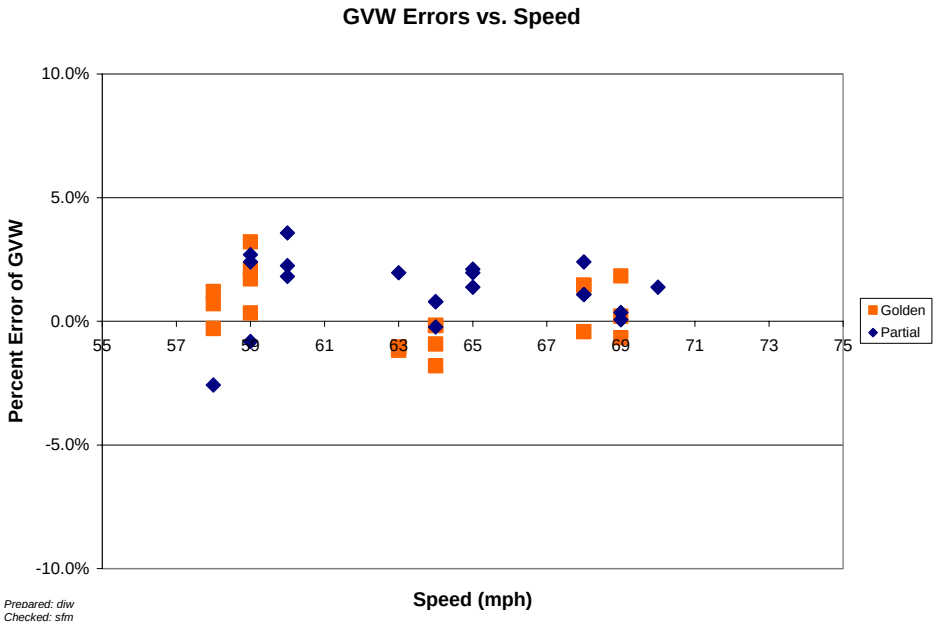

Figure 3-8 Post-Validation GVW Percent Error vs. Speed by Truck – 200200 – 30-Jul-2008

Figure 3-9 shows the relationship between steering axle errors and speed. This graph is included due to the frequent use of steering axle weights of Class 9 vehicles for auto-calibration. This site does not use auto-calibration. The steering axles in this graph are associated only with Class 9 vehicles. From the figure, it appears that the WIM equipment generally overestimates steering axle weights at all speeds. The variability of error seems to be greater at the lower speeds.

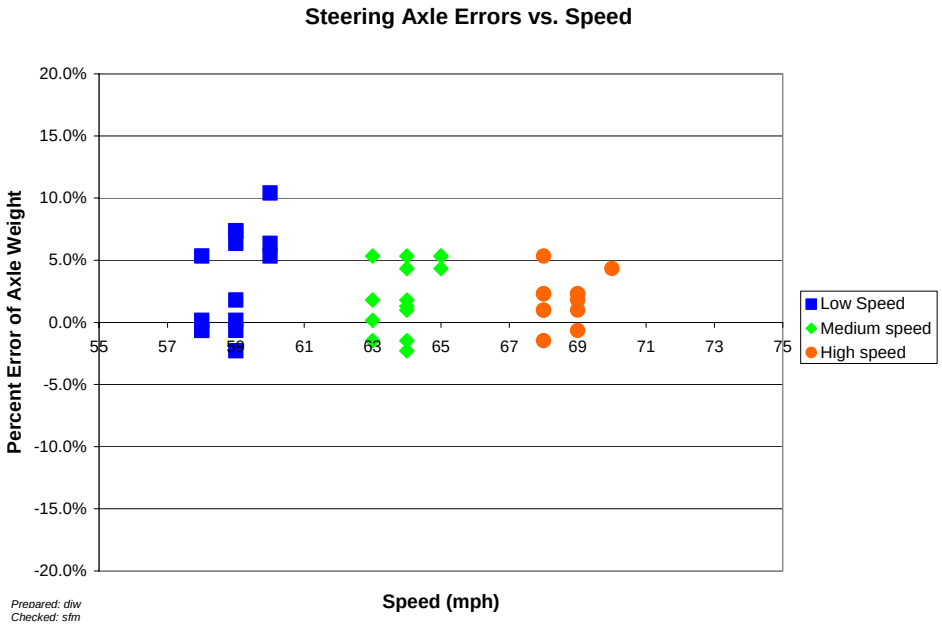

Figure 3-9 Post-Validation Steering Axle Percent Error vs. Speed by Group – 200200 – 30-Jul-2008

In Figure 3-10, it can be seen that the equipment generally overestimates steering axle weights for the partially loaded truck (diamonds) and underestimates steering axle weights for the golden truck (squares) throughout the speed range. Variability in steering axle error for each truck individually appears to be consistent at all speeds. The differences in estimation errors of steering axle weights increase the variability in error for the truck population as a whole.

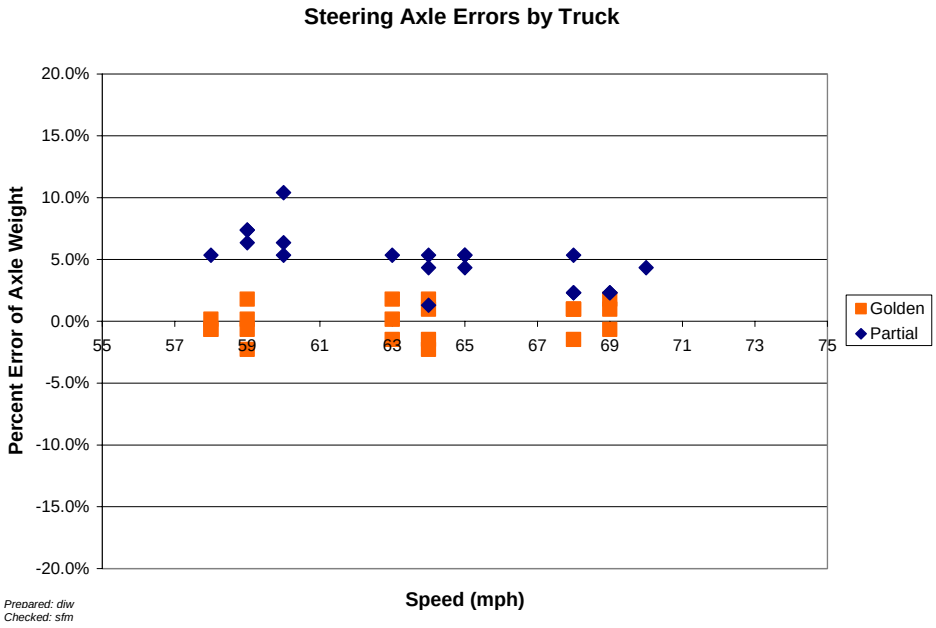

Figure 3-10 Post-Validation Steering Axle Percent Error vs. Speed by Truck – 200200 – 30-Jul-2008

3.3 Classification Validation

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

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

The second check is the ability of the algorithm to correctly distinguish between truck classes with no more than 2% errors in such classifications. Table 3-4 has the classification error rates by class. The overall misclassification rate is 5.8 percent.

Table 3-4 Truck Misclassification Percentages for 200200 – 30-Jul-2008

Class	Percent Error	Class	Percent Error	Class	Percent Error
4	0	5	21	6	0
7	N/A				
8	50	9	1	10	N/A
11	0	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 200200 – 30-Jul-2008

Class	Mean Difference	Class	Mean Difference	Class	Mean Difference
4	0	5	- 21	6	0
7	N/A				
8	100	9	1	10	N/A
11	0	12	0	13	N/A

Prepared: djw *Checked: bko*

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

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

3.4 Evaluation by ASTM E-1318 Criteria

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

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

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

Prepared: djw *Checked: bko*

4 Pavement Discussion

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

4.1 Profile Analysis

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

Profile data collected at the SPS WIM location by Stantec on April 19, 2008 were processed through the LTPP SPS WIM Index software, version 1.1. This is the first profile data collected since site installation in June 2006. This WIM scale is installed on portland cement concrete pavement.

A total of 11 profiler passes were conducted over the WIM site. Since the issuance of the LTPP directive on collection of longitudinal profile data for SPS WIM sections, the requirements have been a minimum of 3 passes in the center of the lane and one shifted to each side. For this site the Regional Support Contractor has completed 5 passes at the center of the lane, 3 passes shifted to the left side of the lane, and 3 passes shifted to the right side of the lane. Shifts to the sides of the lanes were made such that data were collected as close to the lane edges as was safely possible. For each profiler pass, profiles were recorded under the left wheel path (LWP) and the right wheel path (RWP).

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

Table 4-1 Thresholds for WIM Index Values

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

Prepared: als *Checked: jrn*

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

Table 4-2 WIM Index Values – 200200 –19-Apr-2008

Profiler Passes			Pass 1	Pass 2	Pass 3	Pass 4	Pass 5	Ave.
Center	LWP	LRI (m/km)	0.749	0.921	0.892	0.846	1.033	0.888
		SRI (m/km)	0.807	0.630	0.791	1.239	1.476	0.989
		Peak LRI (m/km)	1.025	0.940	0.934	0.849	1.055	0.961
		Peak SRI (m/km)	0.969	0.805	0.856	1.252	1.477	1.072
	RWP	LRI (m/km)	0.891	1.032	0.963	0.884	0.863	0.927
		SRI (m/km)	1.109	0.757	0.834	0.869	*0.254*	0.765
		Peak LRI (m/km)	1.148	1.032	1.002	0.884	0.937	1.001
		Peak SRI (m/km)	1.109	1.130	0.871	0.894	*0.415*	0.884
Left Shift	LWP	LRI (m/km)	1.029	0.970	0.810			0.936
		SRI (m/km)	0.684	0.855	0.978			0.839
		Peak LRI (m/km)	1.135	1.233	0.892			1.087
		Peak SRI (m/km)	0.828	0.946	0.985			0.920
	RWP	LRI (m/km)	0.812	0.836	0.791			0.813
		SRI (m/km)	0.697	0.947	0.890			0.845
		Peak LRI (m/km)	0.892	0.867	1.067			0.942
		Peak SRI (m/km)	1.102	1.006	1.189			1.099
Right Shift	LWP	LRI (m/km)	1.155	0.980	0.826			0.987
		SRI (m/km)	1.291	1.150	0.768			1.070
		Peak LRI (m/km)	1.169	1.026	0.903			1.033
		Peak SRI (m/km)	1.319	1.253	0.783			1.118
	RWP	LRI (m/km)	1.127	1.093	0.894			1.038
		SRI (m/km)	1.045	0.876	0.607			0.843
		Peak LRI (m/km)	1.153	1.159	1.047			1.120
		Peak SRI (m/km)	1.243	1.301	0.907			1.150

Prepared: als *Checked: jrn*

From Table 4-2 it can be seen that all of the indices except one the SRI and Peak SRI for pass 5 of the center path fall between the index limits. The SRI and Peak SRI of pass 5

from the center path fall below the index limits. These data indicate that the pavement roughness may or may not interfere with the calibration of the system.

4.2 Distress Survey and Any Applicable Photos

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

4.3 Vehicle-pavement Interaction Discussion

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

5 Equipment Discussion

The traffic monitoring equipment at this location includes bending plate sensors and iSync electronics. The sensors are installed in a portland cement concrete pavement.

The weighpad signal analysis firmware was downloaded and installed and a subsequent remote calibration was performed since the last validation occurred. This occurred the week prior to this validation.

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. As with the prior validations, the trailing loop gave low resistive values between the loop wires and the cable shield; however, the loop appears to working properly.

A complete visual inspection of all WIM system and support components was also conducted. All components appeared to be in good physical condition. It appears that the broken cable conduit observed during the last validation has been repaired.

5.2 Calibration Process

Upon our arrival at the site, we found the system parameters were not the same as we left them at the conclusion of our last validation on April 17 to 18, 2007. In the week prior to this validation, new weighpad signal analysis software was downloaded and installed. A remote calibration using data downloaded from the site was subsequently performed.

No calibration iterations were required. Improvement of the statistics was desired so one iteration of the calibration process was conducted between the initial 40 runs and the final 40 runs.

5.2.1 Calibration Iteration 1

For this equipment, there are 5 speed designated weight compensation factors that are adjusted to directly affect the weight reported by the WIM equipment. To reduce

overestimation of weights these factors are reduced by the same percentage of the overestimation. If the weights are underestimated, these factors are increased by the same percentage as the mean error.

The operating system weight compensation parameters that were in place prior to the Pre-Validation are in Table 5-1.

Table 5-1 Initial System Parameters - 200200 - 29-Jul-2008

Speed Bin	Right Sensor 1	Left Sensor 2
88 kph	3452	3546
96 kph	3589	3689
105 kph	3541	3638
112 kph	3592	3691
120 kph	3718	3820

Prepared: djw *Checked: bko*

As a result of the pre-validation, where GVW error ranged from -3.1% at the lower speeds, to -1.5% at the higher speeds the compensation factors were adjusted as shown in Table 5-2. Factors not adjusted were outside the range of speeds used for validation.

Table 5-2 Calibration 1 - Change in Parameters - 200200 - 30-Jul-2008

Speed Bins	Right Sensor 1	Change	Left Sensor 2	Change
88 kph	3452	0.0%	3546	0.0%
96 kph	3704	+ 3.2%	3807	+ 3.2%
105 kph	3634	+ 2.6%	3733	+ 2.6%
112 kph	3647	+ 1.5%	3747	+ 1.5%
120 kph	3718	0.0%	3820	0.0%

Prepared: djw *Checked: bko*

Table 5-3 shows the results of the first calibration iteration. The average errors went from under estimation to a slight overestimation. Variability was essentially unchanged. No additional iterations were made.

Table 5-3 Calibration Iteration 1 Results – 200200 – 30-Jul-2008 (09:01 AM)

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	1.8 ± 8.1%	Pass
Tandem axles	±15 percent	0.9 ± 3.7%	Pass
GVW	±10 percent	1.0 ± 2.8%	Pass
Axle spacing	± 0.5 ft	0.0 ± 0.0 ft	Pass

Prepared: djw *Checked: bko*

Figure 5-1 graphically shows the calibration iteration results from Table 5-3.

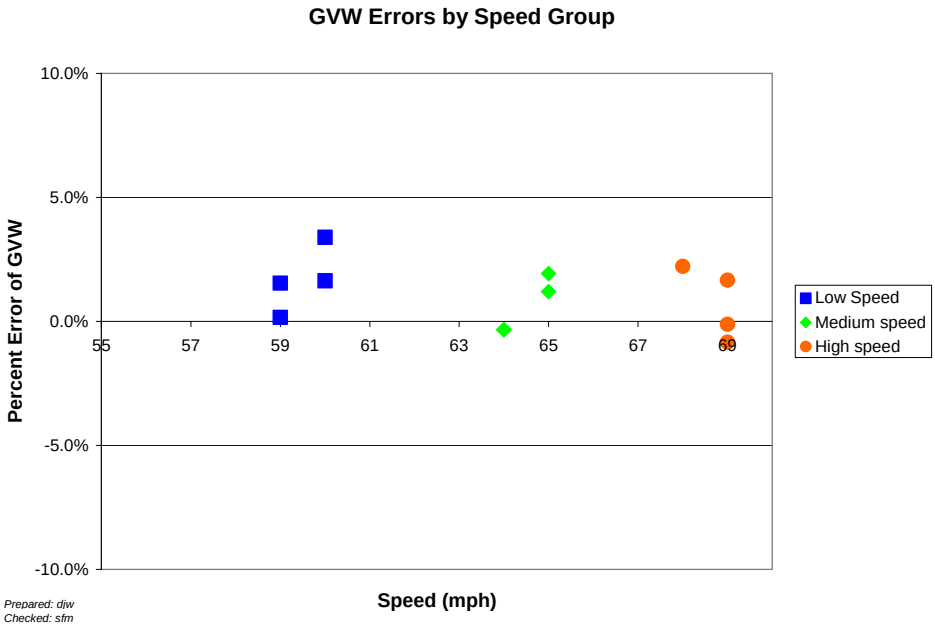

Figure 5-1 Calibration Iteration 1 GVW Percent Error vs. Speed Group – 200200 – 30-Jul-2008 (09:01 AM)

5.3 Summary of Traffic Sheet 16s

This site has validation information from previous visits as well as the current one in the tables below. Table 5-4 has the information for TRF_CALIBRATION_AVC for Sheet 16s submitted prior to this validation as well as the information for the current visit. The Sheet 16s available reflect only this contractor's validation visits.

Table 5-4 Classification Validation History – 200200 – 30-Jul-2008

Date	Method	Mean Difference				Percent Unclassified
		Class 9	Class 8	Other 1	Other 2	
07/30/08	Manual	1	100			0.0
07/29/08	Manual	0	60			0.0
04/18/07	Manual	0.	0			0.0
04/17/07	Manual	-1	0			0.0
11/01/06	Manual	1	0			0.0
10/31/06	Manual	3	22			0.0

Prepared: djw *Checked: bko*

Table 5-5 has the information for TRF_CALIBRATION_WIM for Sheet 16s submitted prior to this validation as well as the information for the current visit. The Sheet 16s available reflect only this contractor's validation visits.

Table 5-5 Weight Validation History – 200200 – 30-Jul-2008

Date	Method	Mean Error and (SD)		
		GVW	Single Axles	Tandem Axles
07/30/08	Test Trucks	0.8 (1.4)	2.5 (2.4)	0.5 (2.1)
07/29/08	Test Trucks	-2.4 (1.3)	-1.3 (2.4)	-2.6 (2.0)
04/18/07	Test Trucks	0.5 (3.1)	-0.3 (5.3)	0.6 (4.6)
04/17/07	Test Trucks	-1.5 (3.9)	-3.0 (8.7)	-1.2 (5.5)
11/01/06	Test Trucks	-1.6 (2.3)	-4.8 (3.8)	-1.1 (2.9)
10/31/06	Test Trucks	-1.2 (3.2)	-3.8 (4.7)	-1.8 (6.7)

Prepared: djw *Checked: bko*

5.4 Projected Maintenance/Replacement Requirements

This site is scheduled for semi-annual maintenance under the installation contract. No other maintenance is required at this site at this time.

6 Pre-Validation Analysis

Upon our arrival at the site, we found the system parameters were not the same as we left them at the conclusion of our last validation on April 17 to 18, 2007. In the week prior to this validation, new weighpad signal analysis software was downloaded and installed. A remote calibration using data downloaded from the site was subsequently performed.

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

Table 6-1 Calibration Factor Change – 200200 – since 18-Apr-2007

	Right Sensor 1		Left Sensors 2	
	29-Jul-2008	*18-Apr-2007*	*29-Jul-2008*	*18-Apr-2007*
88 kph	3452	3784	3546	3784
96 kph	3589	3979	3689	3979
105 kph	3541	4022	3638	4022
112 kph	3592	4060	3691	4060
120 kph	3718	4118	3820	4118

Prepared: djw *Checked: bko*

This pre-validation analysis is based on test runs conducted July 29, 2008 during the morning and early afternoon hours at test site 200200 on I-70. This SPS-2 site is at milepost 287.5 on the westbound, righthand of a four-lane divided facility. No auto-calibration was used during test runs. The two trucks used for initial validation included:

1. 5-axle tractor semi-trailer combination with a tractor having an air suspension and trailer with standard rear tandem and an air suspension loaded to 79,680 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 8 tapered leaf suspension loaded to 68,560 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 57 to 70 miles per hour. The desired speed range was achieved during this validation. Pavement surface temperatures were recorded during the test runs ranging from about 73 to 80 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 6-2.

A shown in Table 6-2, this site met all requirements for research quality data.

Table 6-2 Pre-Validation Results – 200200 – 29-Jul-2008

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	-1.3 ± 4.9%	Pass
Tandem axles	±15 percent	-2.6 ± 3.9%	Pass
GVW	±10 percent	-2.4 ± 2.6%	Pass
Axle spacing	± 0.5 ft [150mm]	0.0 ± 0.0 ft	Pass

Prepared: djw *Checked: bko*

The test runs were conducted primarily during the morning and early afternoon hours under cloudy weather conditions with intermittent rain, resulting in a very narrow range of pavement temperatures. The runs were also conducted at various speeds to determine the effects of these variables on the performance of the WIM scale. To investigate these effects, the dataset was split into three speed groups and one temperature group. The distribution of runs within these groupings is illustrated in Figure 6-1. The figure indicates that the desired distribution of speed and temperature combinations was not achieved for this set of validation runs.

The three speed groups were divided into 57 to 61 mph for Low speed, 62 to 66 mph for Medium speed and 67+ mph for High speed. The one Medium temperature group was created by combining all of the runs, which were between 73 to 80 degrees Fahrenheit.

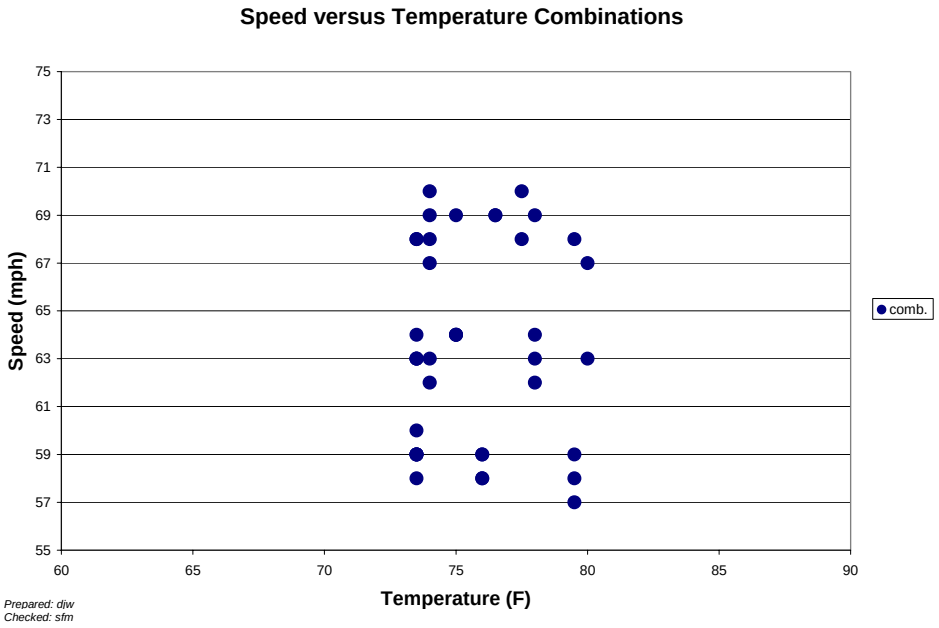

Figure 6-1 Pre-Validation Speed-Temperature Distribution – 200200 – 29-Jul-2008

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

Figure 6-2 shows the GVW Percent Error vs. Speed graph for the population as a whole. The figure illustrates the tendency for the equipment to underestimate GVW at all speeds. There is a slight decrease in the amount of underestimation with increasing speed. Variability appears to be consistent throughout the entire speed range.

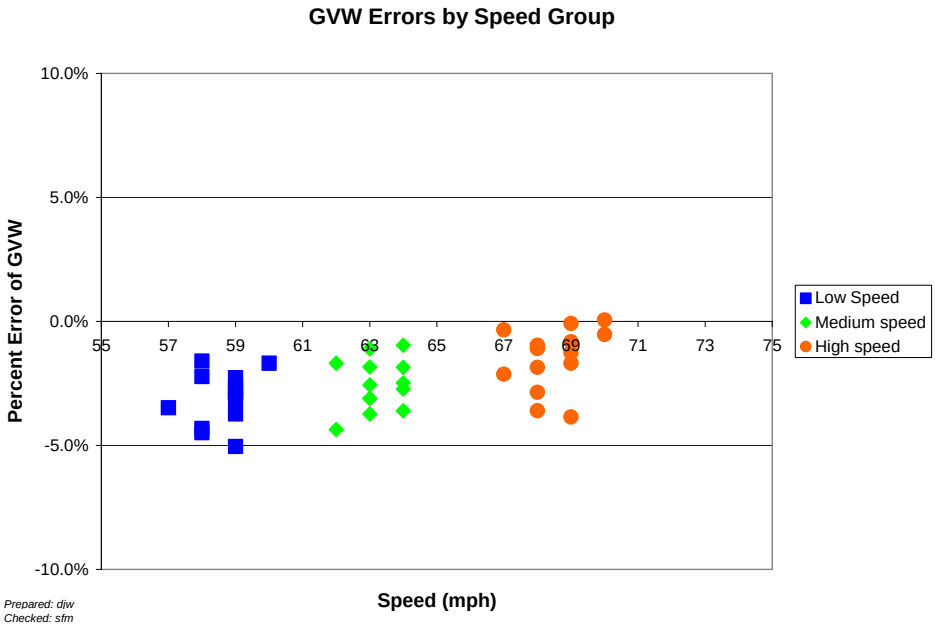

Figure 6-2 Pre-validation GVW Percent Error vs. Speed – 200200 – 29-Jul-2008

Figure 6-3 shows the relationship between temperature and GVW percentage error. From the figure, it appears that the GVW is underestimated at all temperatures. There is insufficient information to determine if any trend exists with temperature.

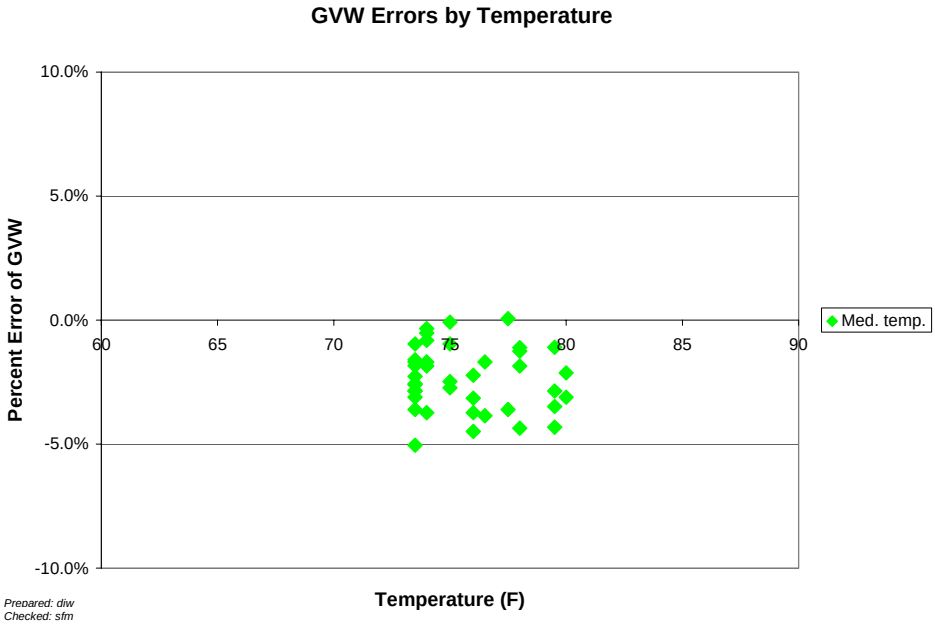

Figure 6-3 Pre-Validation GVW Percent Error vs. Temperature – 200200 – 29-Jul-2008

Figure 6-4 shows the relationship between the drive tandem spacing errors in feet and speeds. This graph is used as a potential indicator of classification errors due to failure to correctly identify spacings on a vehicle. Since the most common reference value is the drive tandem on a Class 9 vehicle, this is the spacing evaluated and plotted for validations. The graph indicates that the errors in tandem spacings for the test trucks were not affected by changes in speed.

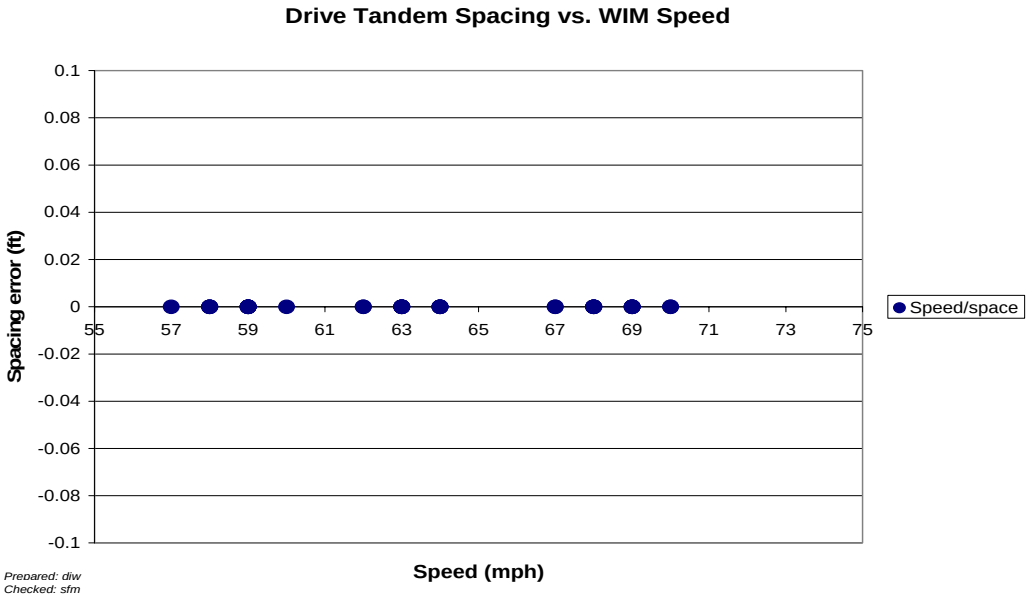

Figure 6-4 Pre-Validation Spacing vs. Speed - 200200 – 29-Jul-2008

6.1 Temperature-based Analysis

The one temperature group was created by combining all of the runs, which were between 73 and 80 degrees Fahrenheit.

Table 6-3 Pre-Validation Results by Temperature Bin – 200200 – 29-Jul-2008

Element	95% Limit	Medium Temperature 73 to 80 °F
Steering axles	±20 %	-1.3 ± 4.9%
Tandem axles	±15 %	-2.6 ± 3.9%
GVW	±10 %	-2.4 ± 2.6%
Axle spacing	± 0.5 ft	0.0 ± 0.0 ft

Prepared: djw *Checked: bko*

From Table 6-3, it can be seen that all weights are underestimated at all temperatures.

Figure 6-5 shows the distribution of GVW Errors versus Temperature by Truck. The equipment underestimates GVW for both trucks at all temperatures.

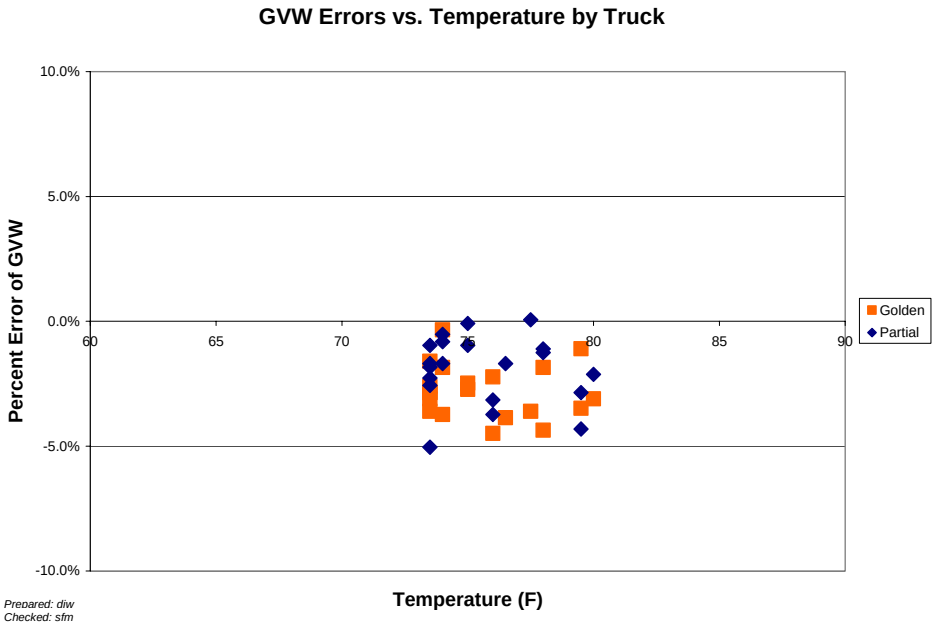

Figure 6-5 Pre-Validation GVW Percent Error vs. Temperature by Truck – 200200 – 29-Jul-2008

Figure 6-6 shows the relationship between steering axle errors and temperature. This graph is included due to the frequent use of steering axle weights of Class 9 vehicles for auto-calibration. This site does not use auto-calibration. The steering axles in this graph are associated only with Class 9 vehicles. The figure shows that steering axle weights are underestimated by the equipment at all temperatures.

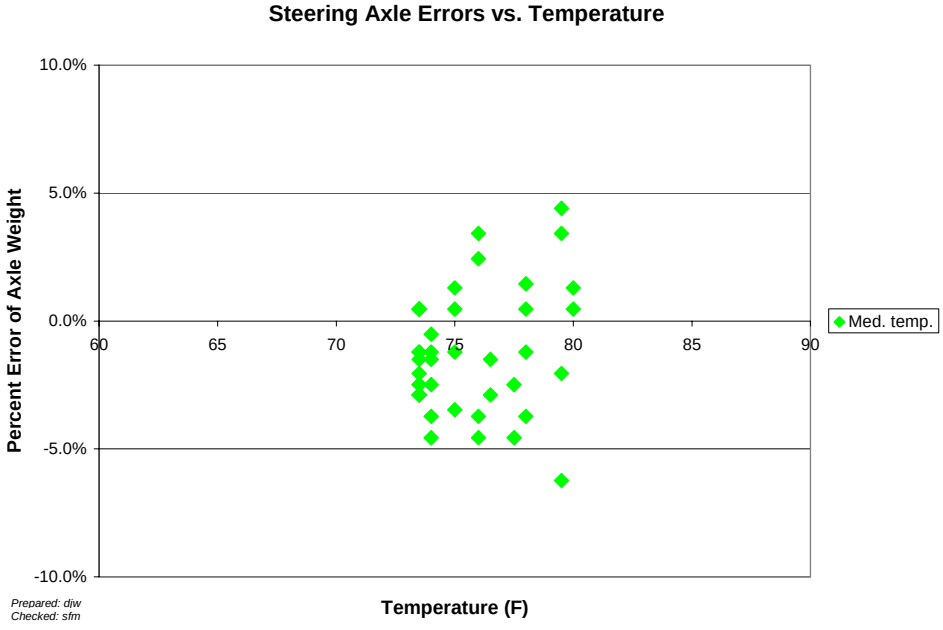

Figure 6-6 Pre-Validation Steering Axle Error vs. Temperature by Group – 200200 – 29-Jul-2008

Figure 6-7 shows the relationship between steering axle errors and temperature by truck. The figure shows that steering axle weights for the golden truck (squares) are generally underestimated by a greater degree than steering axle weights for the partial truck (diamonds). This difference in response increases the variability in error for the truck population as a whole.

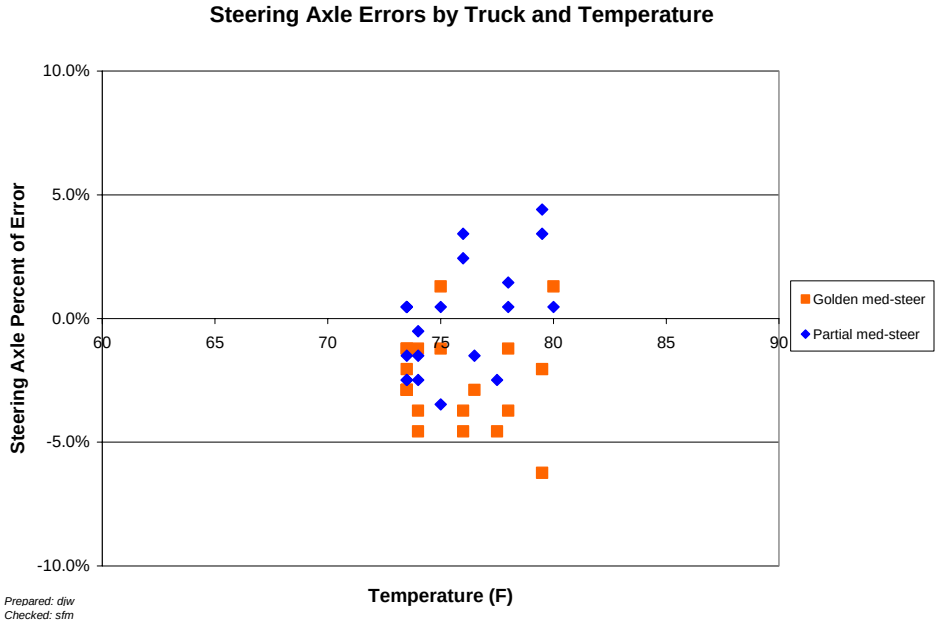

Figure 6-7 Pre-Validation Steering Axle Error vs. Temperature by Truck – 200200 – 29-Jul-2008

6.2 Speed-based Analysis

The speed groups were divided as follows: Low speed – 57 to 61 mph, Medium speed – 62 to 66 mph and High speed – 67+ mph.

Table 6-4 Pre-Validation Results by Speed Bin – 200200 – 29-Jul-2008

Element	95% Limit	Low Speed 57 to 61 mph	Medium Speed 62 to 66 mph	High Speed 67+ mph
Steering axles	±20 %	-0.6 ± 7.4%	-1.0 ± 3.6%	-2.2 ± 3.5%
Tandem axles	±15 %	-3.5 ± 3.4%	-2.9 ± 3.7%	-1.4 ± 4.0%
GVW	±10 %	-3.1 ± 2.3%	-2.5 ± 2.2%	-1.5 ± 2.7%
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 6-4, it can be seen that the equipment underestimates all weights at all speeds. Variability in error is generally consistent throughout the entire speed range for tandem axle weights and GVW. Variability in error for steering axle weights is greater at the lower speeds.

Figure 6-8 illustrates the tendency of the equipment to underestimate GVW for both trucks at all speeds. Variability in GVW error appears to be consistent for both trucks throughout the entire speed range.

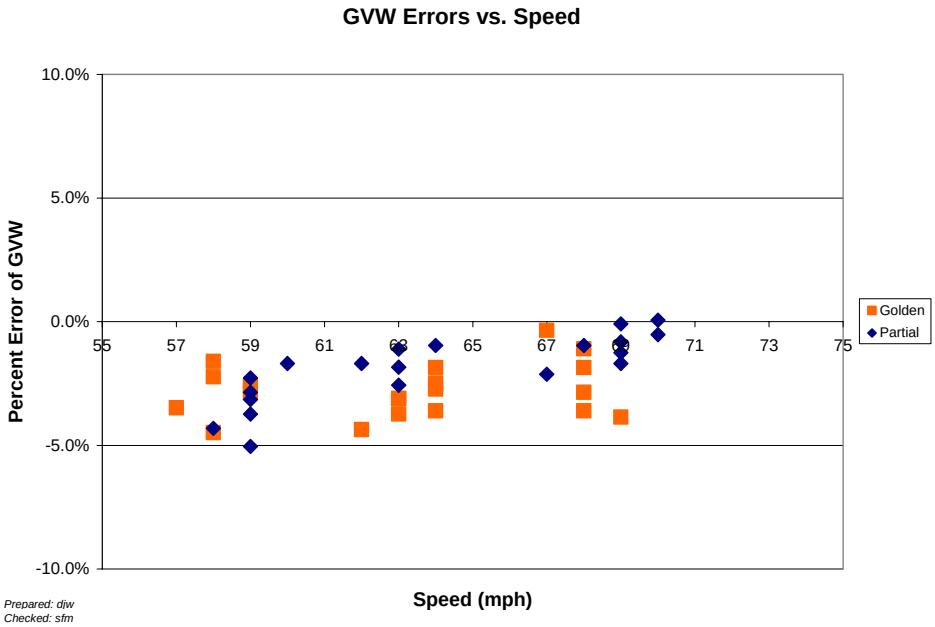

Figure 6-8 Pre-Validation GVW Percent Error vs. Speed Group - 200200 –29-Jul-2008

Figure 6-11 shows the relationship between steering axle errors and speed. This graph is included due to the frequent use of steering axle weights of Class 9 vehicles for calibration. This site does not use auto-calibration. The steering axles in this graph are associated only with Class 9 vehicles. From the figure, it appears that the equipment increasingly underestimates steering axle weights as speed increases. Variability in steering axle error appears to be greater at the lower speeds.

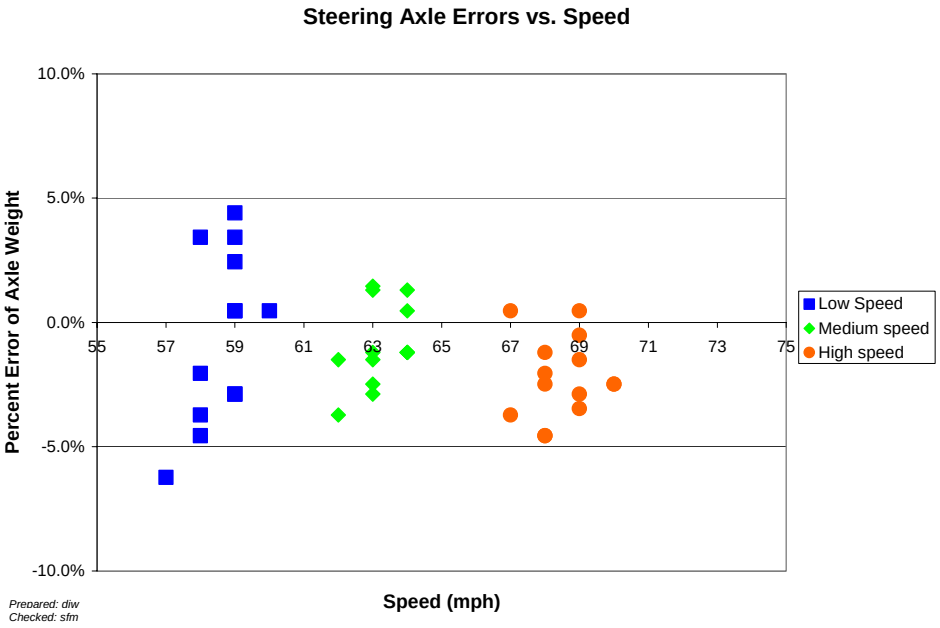

Figure 6-9 Pre-Validation Steering Axle Percent Error vs. Speed Group - 200200 – 29-Jul-2008

Figure 6-10 illustrates the different trends for estimating steering axle weights where steering axle weights for the golden truck (squares) are underestimated while steering axle weights for the partial truck (diamonds) are overestimated. These different estimation errors create a much higher variability in error at the lower speeds.

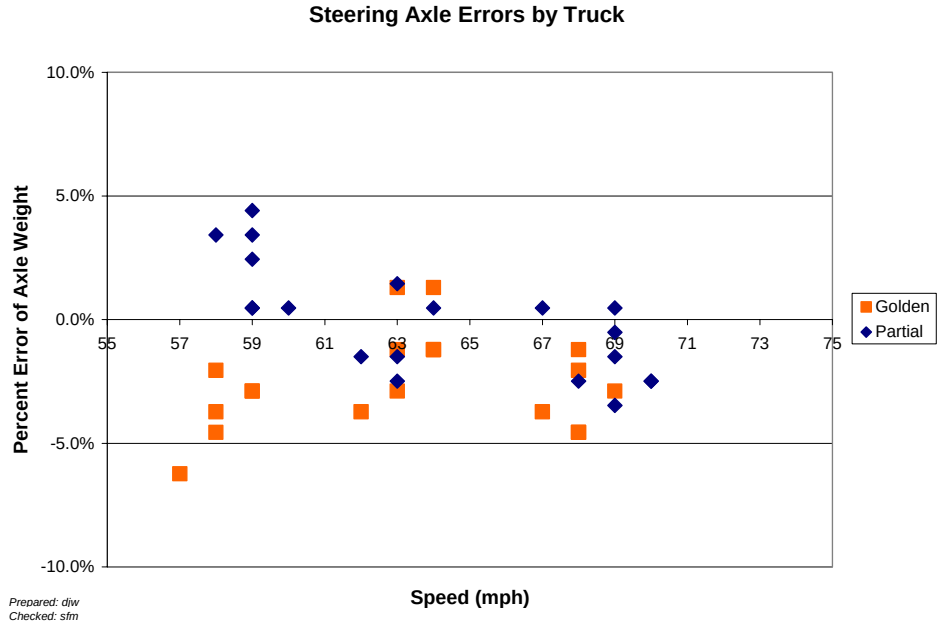

Figure 6-10 Pre-Validation Steering Axle Percent Error vs. Speed Group - 200200 – 29-Jul-2008

6.3 Classification Validation

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

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

The second check is the ability of the algorithm to correctly distinguish between truck classes with no more than 2% errors in such classifications. Table 6-5 has the classification error rates by class. The overall misclassification rate is 5.8 percent.

Table 6-5 Truck Misclassification Percentages for 200200 – 29-Jul-2008

Class	Percent Error	Class	Percent Error	Class	Percent Error
4	N/A	5	18	6	0
7	N/A				
8	38	9	0	10	N/A
11	0	12	N/A	13	N/A

Prepared: djw *Checked: bko*

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

Table 6-6 Truck Classification Mean Differences for 200200 – 29-Jul-2008

Class	Mean Difference	Class	Mean Difference	Class	Mean Difference
4	N/A	5	- 18	6	0
7	N/A				
8	60	9	0	10	N/A
11	0	12	N/A	13	N/A

Prepared: djw *Checked: bko*

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

observer. There is no way to tell how many vehicles of that type might actually exist. N/A means no vehicles of the class were recorded by either the equipment or the observer.

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

6.4 Evaluation by ASTM E-1318 Criteria

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

Table 6-7 Results of Validation Using ASTM E-1318-02 Criteria

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

Prepared: djw *Checked: bko*

6.5 Prior Validations

The last validation for this site was done April 17 to 18, 2007. It was the second validation of the site. The site was producing research quality data. Figure 6-11 shows the GVW Percent Error vs. Speed for the post validation runs. The site was validated with two trucks. The “Golden” truck was loaded to 78,590 lbs. The “partial” truck which had air suspension on the tractor tandem and spring leaf suspension on the trailer tandem was loaded to 66,510 lbs.

Figure 6-11 Last Validation GVW Percent Error vs. Speed – 200200 – 18-Apr-2007

Table 6-8 shows the overall results from the last validation. The site was slightly overestimating GVW and tandem axle weights and underestimating steering axle weights. The remote post software download calibration resulted in underestimates for all statistics.

Table 6-8 Last Validation Final Results – 200200 – 18-Apr-2007

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	-0.3 ± 10.7%	Pass
Tandem axles	±15 percent	0.6 ± 9.2%	Pass
Gross vehicle weights	±10 percent	0.5 ± 6.3%	Pass
Axle spacing	± 0.5 ft [150 mm]	-0.1 ± 0.1 ft	Pass

Prepared: djw *Checked: bko*

Table 6-9 has the results at the end of the last validation by temperature. The sunny weather conditions during the entire testing period resulted in a wide range of pavement temperatures. Through this validation the equipment has been observed at temperature from 33 to 103 degrees Fahrenheit. No particular temperature trend has been observed.

Table 6-9 Last Validation Results by Temperature Bin – 200200 – 18-Apr-2007

Element	95% Limit	Low Temperature 52 to 65 °F	Medium Temperature 66 to 79 °F	High Temperature 80 to 94 °F
Steering axles	±20 %	-1.2 ± 10.0%	-2.0 ± 11.4%	1.1 ± 11.7%
Tandem axles	±15 %	1.4 ± 8.9%	-0.1 ± 9.6%	0.7 ± 9.7%
GVW	±10 %	1.1 ± 7.2%	-0.5 ± 6.7%	0.8 ± 6.8%
Axle spacing	± 0.5 ft	-0.1 ± 0.1 ft	-0.1 ± 0.2 ft	-0.1 ± 0.1 ft

Prepared: djw *Checked: bko*

Table 6-10 has the results of the prior post validation by speed groups. All weights were estimated with reasonable accuracy at all speeds at the time of the prior validation. Variability appeared to increase as speed increased.

Table 6-10 Last Validation Results by Speed Bin – 200200 – 18-Apr-2007

Element	95% Limit	Low Speed 54 to 59 mph	Medium Speed 60 to 67 mph	High Speed 68+ mph
Steering axles	±20 %	1.7 ± 7.2%	-2.8 ± 12.2%	1.0 ± 12.2%
Tandem axles	±15 %	-0.3 ± 8.2%	0.5 ± 9.8%	1.7 ± 10.3%
GVW	±10 %	0.0 ± 6.6%	0.0 ± 6.2%	1.6 ± 8.0%
Axle spacing	± 0.5 ft	0.0 ± 0.2 ft	-0.1 ± 0.1 ft	-0.1 ± 0.0 ft

Prepared: djw *Checked: bko*

7 Data Availability and Quality

As of July 29, 2008 this site does not have at least 5 years of research quality data. Research quality data is defined to be at least 210 days in a year of data of known calibration meeting LTPP's precision requirements.

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

The amount and coverage for the site is shown in Table 7-1. The value for months is a measure of the seasonal variation in the data. The indicator of coverage indicates whether day of week variation has been accounted for on an annual basis. As can be seen from the table (based on the October 2007 upload), none of the years have a sufficient quantity to be considered complete years of data. **Together with the previously gathered calibration information it can be seen that at least 5 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 200200 – 29-Jul-2008

Year	Classification Days	Months	Coverage	Weight Days	Months	Coverage
1992	191	9	Full Week	79	4	Full Week
1993	70	5	Full Week	51	4	Full Week
1994	104	4	Full Week	4	1	Weekdays and weekend days
2006	182	7	Full Week	199	7	Full Week
2007	123	6	Full Week	124	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.

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

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

- Class 9 overweights are defined as the percentage of vehicles greater than 88,000 pounds
- Class 9 underweights are defined as the percentage of vehicles less than 20,000 pounds.
- Class 9 unloaded peak is the bin less than 44,000 pounds with the greatest percentage of trucks.
- Class 9 loaded peak is the bin 60,000 pounds or larger with the greatest percentage of trucks.

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

Table 7-2 GVW Characteristics of Major sub-groups of Trucks – 200200 – 30-Jul-2008

Characteristic	Class 9
Percentage Overweights	0.2%
Percentage Underweights	0.2%
Unloaded Peak	36,000 lbs
Loaded Peak	76,000 lbs

Prepared: djw *Checked: bko*

The expected percentage of unclassified vehicles is 0.0. This is based on the percentage of unclassified vehicles in the post-validation data download.

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

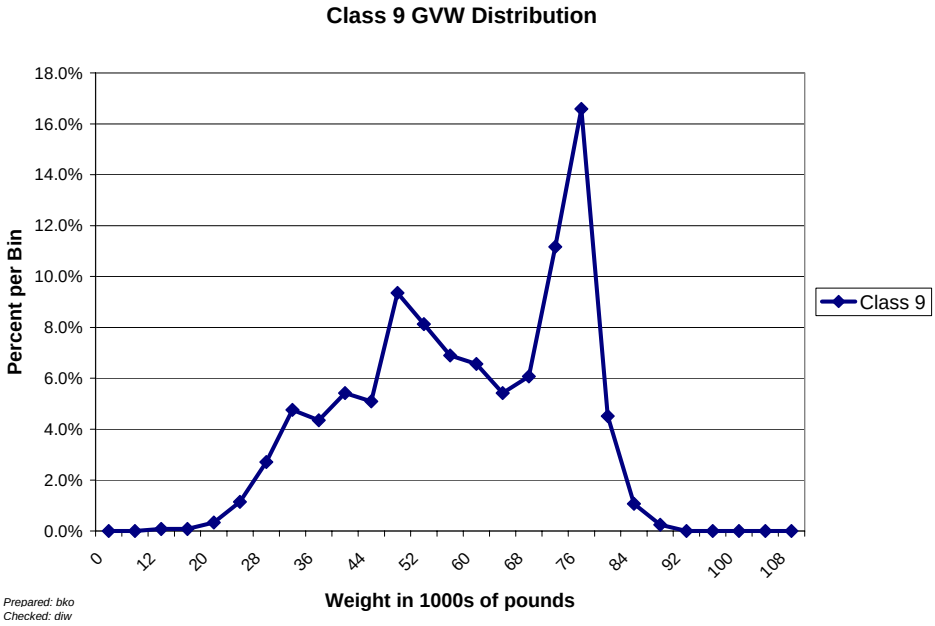

Figure 7-1 Expected GVW Distribution Class 9 – 200200 – 30-Jul-2008

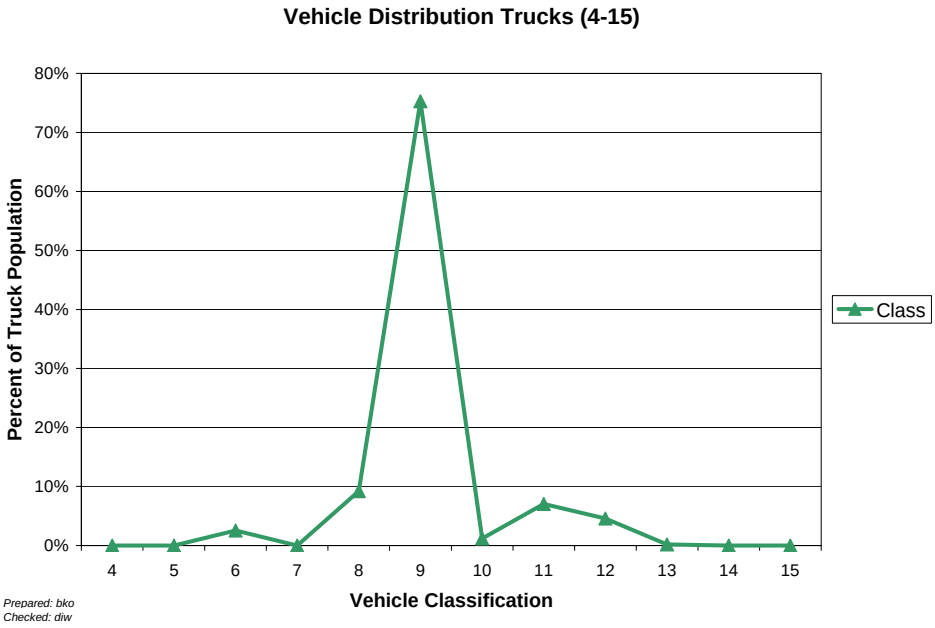

Figure 7-2 Expected Vehicle Distribution – 200200 – 30-Jul-2008

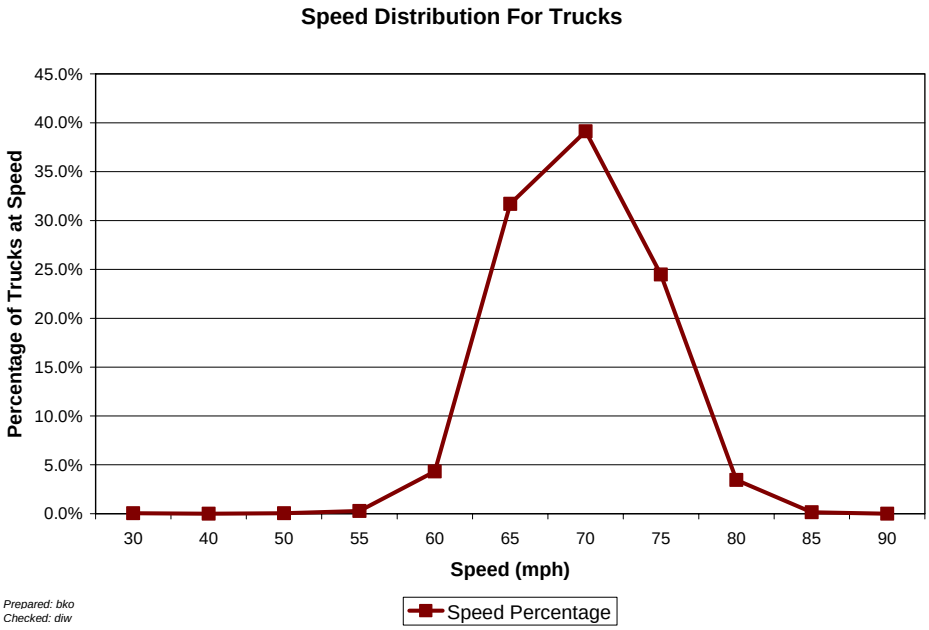

Figure 7-3 Expected Speed Distribution – 200200 – 30-Jul-2008

8 Data Sheets

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

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

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

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

Calibration Iteration 1 Worksheets – (1 page)

Test Truck Photographs (6 pages)

LTPP Mod 3 Classification Scheme (1 page)

Final System Parameters (1 page)

9 Updated Handout Guide and Sheet 17

A copy of the handout has been included following this page. It includes a current Sheet 17 with all applicable maps and photographs. Directions to the site and updated FHWA Liaison information have been updated since the Pre-Visit Handout Guide.

10 Updated Sheet 18

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

11 Traffic Sheet 16(s)

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

POST-VISIT HANDOUT GUIDE FOR SPS WIM FIELD VALIDATION

STATE: Kansas

SHRP ID: 0200

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2. Contact Information 3
3. Agenda 3
4. Site Location/ Directions 4
5. Truck Route Information 5
6. Sheet 17 – Kansas (200200) 6

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1. General Information

SITE ID: *200200*

LOCATION: *Interstate 70 West at M.P. 287.48*

VISIT DATE: *July 29 and 30, 2008*

VISIT TYPE: *Validation*

2. Contact Information

POINTS OF CONTACT:

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

Highway Agency: *Bill Hughes, 785-296-6863, bhughes@ksdot.org*

Bill Parcells, 785-291-3846, billp@ksdot.org

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

FHWA Division Office Liaison: *Tom Deddens, 785-228-2544 x214, tom.deddens@fhwa.dot.gov*

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

3. Agenda

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

ON SITE PERIOD: *July 29 and 30, 2008*

TRUCK ROUTE CHECK: *Completed.*

4. Site Location/ Directions

NEAREST AIRPORT: *Kansas City International Airport, Kansas City, Kansas.*

DIRECTIONS TO THE SITE: *1 mile east of Chapman Interchange approximately 12 miles, east of Abilene, Kansas*

MEETING LOCATION: *On site at 9:00am, July 29, 2008*

WIM SITE LOCATION: *Interstate 70 West at M.P. 287.48* (*Latitude: 38.9902^0 and Longitude:*
-97.0003^0)

WIM SITE LOCATION MAP:*See Figure 4.1*

Figure 4-1 – Site 200200 Location in Kansas

5. Truck Route Information

ROUTE RESTRICTIONS: *None.*

SCALE LOCATION: *De Bruce Grain, 513 W. First St., Abilene, Kansas. Manager – Brent Martin, phone: (785) 263-7275. Open from 7:30 a.m. to 5:00 p.m. (14.1 miles from site)*

TRUCK ROUTE:

East – 2.7 miles to exit 290 on I-70 (Milford Lake Road)
West – 1.1 miles to exit 286 on I-70 (Chapman)
Length of truck turnaround is 3.8 miles

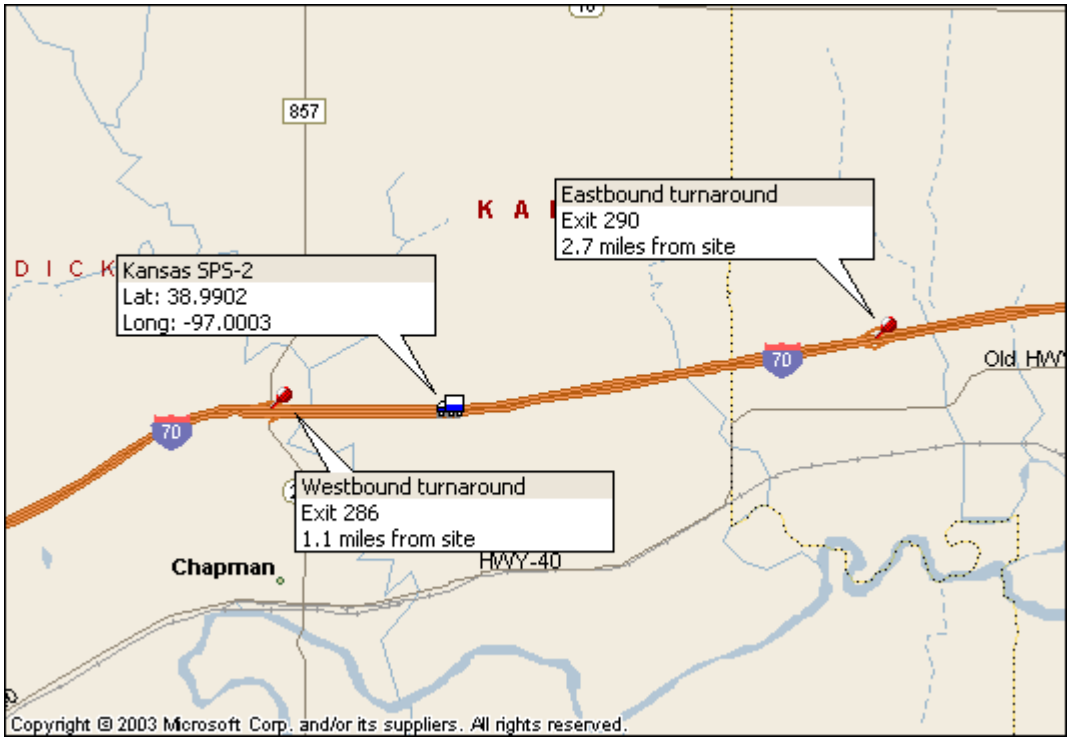

Figure 5-1 – Truck Route of 200200 in Kansas

6. Sheet 17 – Kansas (200200)

1.* ROUTE ___I-70_____MILEPOST ___287.48__LTPP DIRECTION - N S E W

2.* WIM SITE DESCRIPTION - Grade __~ 1_____ % Sag vertical Y / N
Nearest SPS section upstream of the site ____2_0_0_2_1_2_____
Distance from sensor to nearest upstream SPS Section ___7_8_2_ _____ ft

3.* LANE CONFIGURATION
Lanes in LTPP direction __2__ Lane width _1_2_ ft

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

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

Shoulder width _10_____ ft

4.* PAVEMENT TYPE _____Portland Cement Concrete_____

5.* PAVEMENT SURFACE CONDITION – Distress Survey
Date 07_29_08 Filename:
_20_0200_Upstream_07_29_08_____
Date 07_29_08 Filename:
_20_0200_Downstream_07_29_08_____
Date _____ Filename:
_____

6. * SENSOR SEQUENCE _____loop – weighpad – weighpad – 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 _7_2_ ft

Distance from system ___7_8_ ft

TYPE _____3R_____

CABINET ACCESS controlled by LTPP / STATE / JOINT?

Contact - name and phone number ____Bill Hughes (785) 296-6863 ____

Alternate - name and phone number ___Bill Parcells (785) 291-3846

_____

11. * POWER

Distance to cabinet from drop ___4_3_8_____ ft Overhead / underground / solar / AC in cabinet?

Service provider _____ Phone number _____

12. * TELEPHONE

Distance to cabinet from drop ____1_____ ft Overhead / underground / cell?

Service provider _____ Phone Number_(785) 922-6231___

13.* SYSTEM (software & version no.)-____iSINC_____

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

14. * TEST TRUCK TURNAROUND time __12_____ minutes DISTANCE _7.6_mi.

15. PHOTOS FILENAME

Power source 20_0200_Power_Meter_07_29_08.jpg_____

Phone source 20_0200_Telephone_Box_07_29_08.jpg_____

Cabinet exterior 20_0200_Cabinet_Exterior_07_29_08.jpg_____

Cabinet interior 20_0200_Cabinet_Interior_Front_07_29_08.jpg _____

20_0200_Cabinet_Interior_Back_07_29_08.jpg_____

Weight sensors 20_0200_Leading_WIM_Sensor_07_29_08.jpg _____

20_0200_Trailing_WIM_Sensor_07_29_08.jpg _____

Classification sensors _____

Other sensors 20_0200_Leading_Loop_Sensor_07_29_08.jpg _____

20_0200_Trailing_Loop_Sensor_07_29_08.jpg_____

Description __Loops_____

__20_0200_2.110_Old_Site_Cabinet_07_29_08_____

20_0200_2.110_Old_Site_Sensors_07_29_08_____

_20_0200_2.110_Old_Site_Sensors_2_07_29_08_____

Downstream direction at sensors on LTPP lane
20_0200_Downstream_07_29_08
Upstream direction at sensors on LTPP lane
20_0200_Upstream_07_29_08

COMMENTS _
GPS Coordinates: Latitude: 38.9902^0 and Longitude: 97.9992^0

Amenities:

West: exit 275 on I-70, Abilene – 12.1 miles from site
BP Gas, Holiday Inn Express, Super 8, various restaurants

East: exit 295 on I-70 – 6.9 miles from site
Motel 6, Phillips 66 Gas, Conoco Gas

exit 296 on I-70 – 8.5 miles from site
Comfort Inn, Ramada Ltd, Days Inn, various gas stations & restaurants

exit 298 on I-70 – 9.9 miles from site
Holiday Inn Express, various gas stations & restaurants, Wal-Mart

Speed Limit – 70 mph
Site Phone No: 785-922-6420

Test Truck Recommendations:
Types of Trucks: Two Class 9s
Truck 1: Class 9, 72,000 to 80,000 legal limit on gross and axles, air suspension

Truck 2: Class 9, 45,000 to 55,000 lbs

Expected Speeds: 60, 65 and 70 mph

broken conduit
caved in trench

COMPLETED BY Dean J. Wolf

PHONE 301-210-5105 DATE COMPLETED 07 /29 / 2008

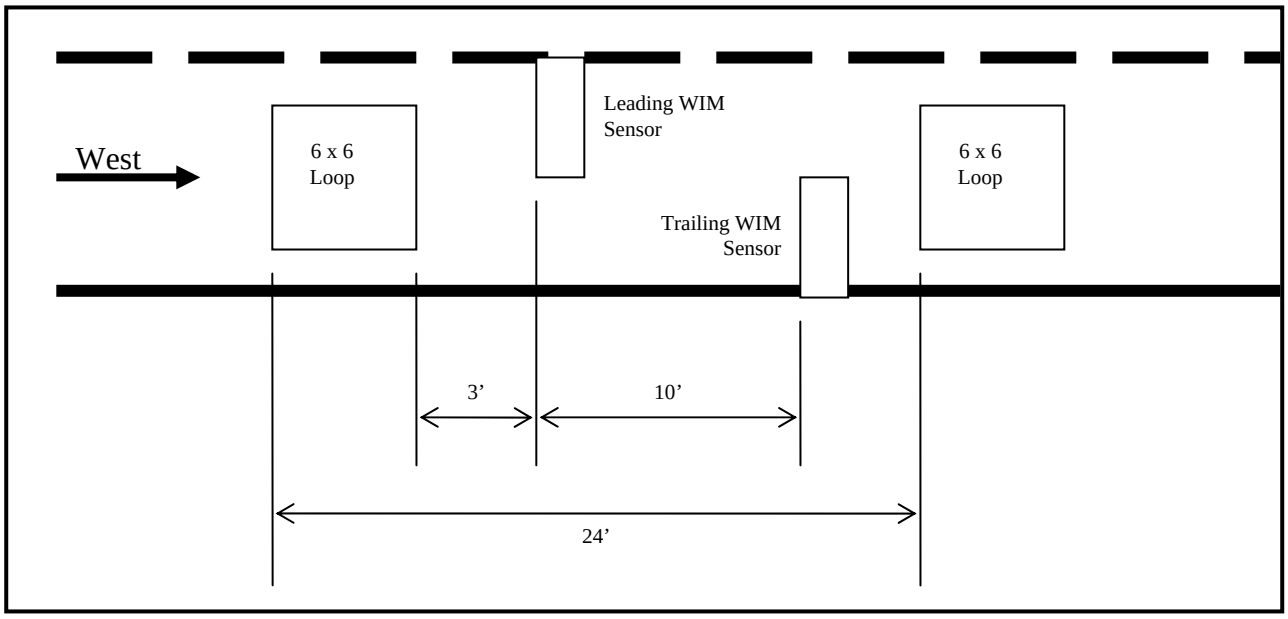

Figure 6-1 – Equipment Layout of Site 200200 in Kansas

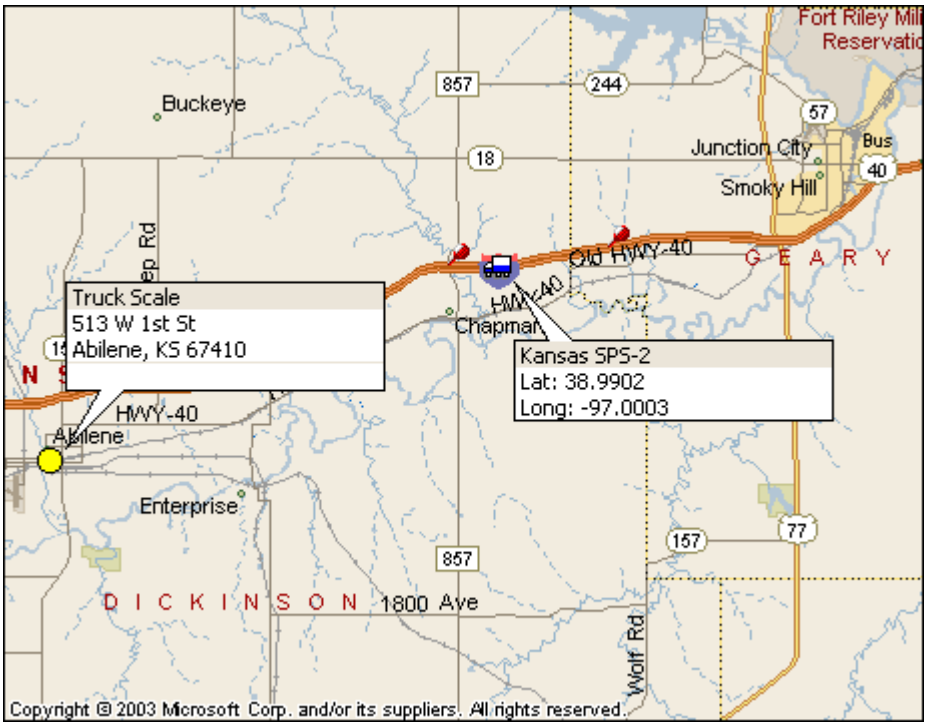

Figure 6-2: Site Map of 200200 in Kansas

Photo 1 - 20_0200_Upstream_07_29_08.jpg

Photo 2 - 20_0200_Downstream_07_29_08.jpg

Photo 3 - 20_0200_Power_Service_07_29_08.jpg

Photo 4 - 20_0200_Telephone_Service_07_29_08.jpg

Photo 5 - 20_0200_Cabinet_Exterior_07_29_08.jpg

Photo 6 - 20_0200_Cabinet_Interior_Front_07_29_08.jpg

Photo 7 - 20_0200_Cabinet_Interior_Back_07_29_08.jpg

Photo 8 - 20_0200_Leading_WIM_Sensor_07_29_08.jpg

Photo 9 - 20_0200_Trailing_WIM_Sensor_07_29_08.jpg

Photo 10 - 20_0200_Leading_Loop_Sensor_07_29_08.jpg

Photo 11 - 20_0200_Traling_Loop_Sensor_07_29_08.jpg

Photo 12 - 20_0200_Old_Site_Cabinet_07_29_08.jpg

Photo 13 - 20_0200_Old_Site_Sensors_07_29_08.jpg

Photo 14 - 20_0200_Old_Site_Sensors_2_07_29_08.jpg

SHEET 18	STATE CODE [20]
LTPP MONITORED TRAFFIC DATA	SPS PROJECT ID [0200]
WIM SITE COORDINATION	DATE: (mm/dd/yyyy) 7/29/2008

Rev. 05/15/07

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

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

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

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

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

   c. Maintenance –
      - ☐ Contract with purchase – Expiration Date _____
      - ☒ 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 ☐ 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/PAT Traffic

b. Maintenance (equipment) –

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

Agency: IRD/PAT Traffic

c. Data Processing and Pre-Visit Data –

Name: Basel Abukhater Phone:(716)-632-0804

Agency: Stantec

d. Construction schedule and verification –

Name: Bill Hughes Phone:(785)296-6863

Agency: _____

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

Name: DeBruce Grain Phone:(785) 263-7275

Agency: John

f. Traffic Control –

Name: _____ Phone:_____

Agency: _____

g. Enforcement Coordination –

Name: _____ Phone:_____

Agency: _____

h. Nearest Static Scale

Name: DeBruce Grain Location:513 W. First St., Abilene, Kansas

Phone: John - (785) 263-7275

SHEET 16 **LTPP MONITORED TRAFFIC DATA** **SITE CALIBRATION SUMMARY**	*STATE ASSIGNED ID [__ __ __ __] *STATE CODE [20] *SHRP SECTION ID [0200]

SITE CALIBRATION INFORMATION

1. * DATE OF CALIBRATION (MONTH/DAY/YEAR) [07/29/08]

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

	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 1.3
   DYNAMIC AND STATIC SINGLE AXLES -1.3 STANDARD DEVIATION 2.4
   DYNAMIC AND STATIC DOUBLE AXLES -2.6 STANDARD DEVIATION 2.0

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

9. DEFINE THE SPEED RANGES USED (MPH) _____ 60 65 70 _____ __ __ _____ _____
   _____ _____ _____ _____ _____ _____ _____ _____ _____ _____

10. CALIBRATION FACTOR (AT EXPECTED FREE FLOW SPEED) 3592, 3691

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 5 ___ ___ -18
   *** FHWA CLASS 8 ___ 6.0 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 [20] *SHRP SECTION ID [0200]

SITE CALIBRATION INFORMATION

1. * DATE OF CALIBRATION (MONTH/DAY/YEAR) [07/30/08]

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	2
	3		

7. SUMMARY CALIBRATION RESULTS (EXPRESSED AS A PERCENT)
   MEAN DIFFERENCE BETWEEN ---
   DYNAMIC AND STATIC GVW 0.8 STANDARD DEVIATION 1.4
   DYNAMIC AND STATIC SINGLE AXLES 2.5 STANDARD DEVIATION 3.1
   DYNAMIC AND STATIC DOUBLE AXLES 0.5 STANDARD DEVIATION 2.1

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

9. DEFINE THE SPEED RANGES USED (MPH) _____ 60 65 70 _____ __ __ _____ _____
   _____ _____ _____ _____ _____ _____ _____ _____ _____ _____

10. CALIBRATION FACTOR (AT EXPECTED FREE FLOW SPEED) 3647, 3747

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 ____ 1.0 FHWA CLASS 5 ____ ____ -21
   *** FHWA CLASS 8 ____ 100.0 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	20
LTPP Traffic Data	* SPS PROJECT ID	0200
*CALIBRATION TEST TRUCK # 1	* DATE	7/29/08

Rev. 08/31/01

PART I.

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

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

GEOMETRY

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

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

10.* Trailer Load Distribution Description:

WHEAT GRAIN LOADED EVENLY ALONG TRAILER

11. a) Tractor Tare Weight (units): 28700

b). Trailer Tare Weight (units): _____

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

A to B 19.8 B to C 4.9 C to D 30.8

D to E 4.1 E to F _____

Wheelbase (measured A to last) _____ Computed _____

13. *Kingpin Offset From Axle B (units) _____ (+.7)

(+ is to the rear)

SUSPENSION

Axle	14. Tire Size	15.* Suspension Description (leaf, air, no. of leaves, taper or flat leaf, etc.)
A	80R24.5	2 FULL LEAF
B	80R24.5	AIR
C	80R24.5	AIR
D	11R24.5	AIR
E	11R24.5	AIR
F		

Sheet 19	* STATE_CODE	2_0_
LTPP Traffic Data	* SPS PROJECT ID	0_2_0_0_
*CALIBRATION TEST TRUCK #_1_	* DATE	7/29/08

Rev. 08/31/01

PART II

Day 1

*b) Average Pre-Test Loaded weight 79740
*c) Post Test Loaded Weight 79610
*d) Difference Post Test – Pre-test -130

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	12020	17430	17430	16430	16430		79740
2	11920	17440	17440	16470	16470		79740
3							
Average	11970	17435	17435	16450	16450		79740

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	11900	17420	17420	16440	16440		79640
2	11940	17410	17410	16420	16420		79500
3							
Average	11920	17415	17415	16430	16430		79540

Measured By _____ Verified By _____ Weight date 7/29/08

Sheet 19	* STATE_CODE	_2_0_
LTPP Traffic Data	* SPS PROJECT ID	_0_2_0_0_
*CALIBRATION TEST TRUCK #_1_	* DATE	07/30/08

Rev. 08/31/01

Day 2

7.2 *b) Average Pre-Test Loaded weight ~~80040~~ 79970

*c) Post Test Loaded Weight 79730 ~~78660~~ 79700

*d) Difference Post Test – Pre-test -310 ~~1310~~ -270

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	12900 ~~12620~~	17175 ~~16820~~	17175 ~~16830~~	16375 ~~16390~~	16375 ~~16390~~		~~80000~~ ~~80060~~
2	~~12320~~	~~17420~~	~~17420~~	~~16430~~	~~16430~~		~~80020~~
3	12160	17480	17480	16410	16410		79940
Average	~~12526~~	~~17425~~	~~17425~~	~~16410~~	~~16410~~		~~80040~~
	12530	17328	17328	16393	16393		79970

Table 6.2. Raw data – Axle scales –

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

Table 7.2 Raw data – Axle scales – post-test

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	~~12180~~ 12060	~~17270~~ 17415	~~17370~~ 17415	~~16410~~ 16935	~~16410~~ 16935		~~79840~~ 79680
2	~~12000~~	~~17420~~	12420	~~16410~~ OK	~~16410~~ OK		~~79720~~ OK
3	12000	~~16410~~ 17450	~~16410~~ 17450				
Average	~~12120~~	~~17395~~	~~17295~~	16410	16410		79730
	12030	~~16913~~ 17433	~~16913~~ 17433	16403	16403		~~78660~~ 79700

Measured By _____ Verified By _____ Weight date 7/30/08

Changes take during review to impact on validation conclusions

Sheet 19	* STATE_CODE	_2_0_
LTPP Traffic Data	* SPS PROJECT ID	_0_2_0_0_
*CALIBRATION TEST TRUCK #_2_	* DATE	07/29/08

Rev. 08/31/01

PART I.

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

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

GEOMETRY

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

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

10.* Trailer Load Distribution Description:

Wheat grain loaded along trailer

11. a) Tractor Tare Weight (units): 25940

b). Trailer Tare Weight (units): _____

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

A to B 16.2 B to C 4.3 C to D 31.0

D to E 4.1 E to F _____

Wheelbase (measured A to last) _____ Computed _____

13. *Kingpin Offset From Axle B (units) _____ (41.1 FT.)

(+ is to the rear)

SUSPENSION

Axle	14. Tire Size	15.* Suspension Description (leaf, air, no. of leaves, taper or flat leaf, etc.)
A	11R 22.5	3 full leaf
B	11R 22.5	3 full leaf
C	11R 22.5	3 full leaf
D	295R 245	3 tapered leaf
E	295R 245	3 tapered leaf
F	_____	_____

Sheet 19	* STATE_CODE	_2_0_
LTPP Traffic Data	* SPS PROJECT ID	_0_2_0_0_
*CALIBRATION TEST TRUCK #_2_	* DATE	07/29/08

Rev. 08/31/01

PART II

Day 1

*b) Average Pre-Test Loaded weight 68660
*c) Post Test Loaded Weight 68460
*d) Difference Post Test – Pre-test - 200

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10240	15150	15150	14060	14060		68660
2	10280	15140	15140	14050	14050		68660
3							
Average	10260	15145	15145	14055	14055		68660

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	~~10090~~ ~~10240~~	~~14950~~ ~~15150~~ 15045	~~14950~~ ~~15150~~ 15045	14150	14150		~~68480~~	68480
2	~~10120~~	~~15080~~	~~15080~~	14080	14080		~~68340~~	68440
3	10000	15140	15140					
Average	~~10160~~ 10045	~~15025~~ 15093	~~15035~~ 15093	15115	15115		~~68460~~	68460

Measured By dlw Verified By [signature] Weight date 7/29/08

changes at post review no impact on cal factor BKD

Sheet 19	* STATE_CODE	_2_0_
LTPP Traffic Data	* SPS PROJECT ID	_0_2_0_0_
*CALIBRATION TEST TRUCK #_2_	* DATE	07/30/09

Rev. 08/31/01

Day 2

7.2 *b) Average Pre-Test Loaded weight ~~68580~~ 68480
*c) Post Test Loaded Weight 68390 68240
*d) Difference Post Test – Pre-test 170 -240

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	~~9100~~ 9950	~~15220~~ 15170	~~15220~~ 15170	~~14120~~ 14095	~~14120~~ 14095		~~68580~~ 68480
2	~~9100~~ 9950	~~15160~~ 15155	~~15160~~ 15155	~~14120~~ 14110 14120	~~14120~~ 14110		~~68520~~ 68480
3							
Average	~~9100~~ 9930	~~15250~~	~~15250~~	~~14120~~	~~14120~~ 14120		~~68520~~ 68480
	9950	15163	15163	14103	14103		68480

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	~~9700~~ 9830	~~15160~~ 15100	~~15160~~ 15100	~~14130~~ 14105	~~14130~~ 14105		~~68520~~	68240
2	~~9700~~ 9760	~~15240~~	~~15240~~	~~14130~~	~~14130~~		~~68520~~	68240
3		15160	15160	14093	14093			
Average	~~9700~~	~~15240~~	~~15240~~	~~14130~~	~~14130~~		~~68520~~	68240
	9795	15130	15130	14093	14093			

Measured By JW Verified By [signature] Weight date 7/30/09

Changes made during post visit review did not affect conclusions

Sheet 20	* STATE_CODE	2_0_
LTPP Traffic Data	*SPS PROJECT_ID	0_2_0_0_
Speed and Classification Checks * 1 of* 2	* DATE	7 / 29 / 08

Rev. 08/31/2001

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
75	9	33432	75	9	71	9	33570	71	9
64	9	33433	64	9	67	5	33574	67	5
68	9	33435	70	9	59	5	33576	59	5
69	9	33437	70	9	64	5	33577	63	5
75	9	33439	76	9	65	9	33598	66	9
70	9	33439	72	9	68	9	33600	67	9
60	9	33441	61	9	68	9	33603	67	9
68	9	33444	68	9	62	9	33608	62	9
68	9	33446	67	9	67	9	33611	65	9
67	9	33447	67	9	70	9	33616	67	9
70	9	33476	68	9	64	9	33617	64	9
64	9	33496	65	9	71	6	33619	70	6
60	9	33497	60	9	64	5	33625	64	5
64	9	33500	64	9	75	9	33627	73	9
65	9	33511	65	9	69	5	33628	70	5
66	9	33533	67	9	64	9	33631	64	9
65	11	33538	66	11	71	9	33633	71	9
62	9	33539	62	9	67	9	33641	67	9
62	9	33540	61	9	62	9	33674	63	9
59	8	33548	59	5	64	8	33676	65	8
62	9	33550	62	9	65	5	33681	64	5
70	5	33553	70	5	64	9	33695	64	9
62	9	33558	63	9	64	9	33706	64	9
77	5	33564	75	9	64	9	33713	64	9
64	9	33569	64	9	69	8	33716	69	8

Recorded by MARK 2 Direction W Lane 1 Time from 1:30AM to 12:20AM

Sheet 20	* STATE_CODE 20
LTPP Traffic Data	*SPS PROJECT_ID 0200
Speed and Classification Checks * 2 of* 2	* DATE 2/29/08

Rev. 08/31/2001

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	
71	5	33722	70	5	70	9	33844	69	9	
70	9	33728	69	9	68	9	33845	68	9	
74	5	33749	73	5	70	5	33846	70	5	
69	9	33752	69	9	64	5	33849	64	5	
70	9	33753	70	9	70	8	33858	71	8	
62	9	33754	63	9	62	9	33861	63	9	
67	11	33769	67	11	62	8	33862	62	5	*
64	9	33772	64	9	62	9	33864	62	9	
66	5	33775	66	5	62	9	33868	62	9	
68	9	33776	68	9	65	9	33871	64	9	
68	9	33778	66	9	68	9	33876	68	9	
64	5	33779	64	5	65	9	33881	66	9	
67	9	33780	66	9	68	5	33882	68	5	
62	9	33781	63	9	64	11	33886	64	11	
67	9	33782	69	9	64	6	33887	65	6	
72	9	33787	72	9	65	8	33893	65	5	*
65	11	33788	66	11	71	9	33900	71	9	
67	11	33791	67	11	73	9	33901	72	9	
62	9	33797	62	9	61	9	33905	61	9	
68	9	33799	68	9	64	9	33907	64	9	
63	9	33820	63	9	65	9	33908	65	9	
64	9	33824	64	9	64	9	33915	64	9	
74	8	33827	74	8	62	9	33918	62	9	
65	9	33828	65	9	65	9	33922	65	9	
65	9	33838	64	9	70	8	33924	72	8	

Recorded by MARK Z Direction W Lane 1 Time from 12:20 AM to 12:54 AM

Sheet 20	* STATE_CODE	20
LTPP Traffic Data	*SPS PROJECT_ID	0200
Speed and Classification Checks * 1 of* ____	* DATE	7/30/08

Rev. 08/31/2001

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
68	6	38751	68	6	65	9	38904	63	9
68	9	38754	68	9	74	5	38907	74	5
64	9	38755	64	9	68	9	38912	68	9
72	9	38758	73	9	65	9	38918	64	9
73	9	38759	72	9	67	9	38921	67	9
67	9	38763	67	9	72	9	38925	70	9
69	9	38764	70	9	72	9	38929	70	9
70	9	38767	68	9	73	9	38931	73	9
67	9	38772	70	9	64	9	38938	63	9
60	5	38773	59	5	62	11	38941	62	11
67	9	38779	66	9	67	8	38942	67	8
72	9	38781	72	9	73	9	38948	71	9
65	11	38784	66	11	67	9	38968	65	9
65	9	38785	65	9	70	9	38969	67	9
68	9	38792	67	9	69	9	38972	68	9
67	9	38833	68	9	62	11	38975	62	11
62	12	38834	62	12	73	9	38980	73	9
68	5	38845	68	5	73	5	38987	73	5
73	9	38849	73	9	73	5	38989	72	5
71	9	38853	70	9	70	9	38991	69	9
68	8	38854	69	8	64	9	38993	63	9
65	11	38860	66	11	62	9	38994	60	9
68	9	38865	68	9	73	5	39007	72	5
60	12	38896	60	12	70	9	39008	69	9
* 63	8	38897	61	5	73	9	39009	73	9

Recorded by MARK 2 Direction W Lane 1 Time from 9:14 AM to 9:52 AM

Sheet 20	* STATE_CODE	2_0
LTPP Traffic Data	*SPS PROJECT_ID	0_2_0_0
Speed and Classification Checks * 2 of* 2	* DATE	2 / 30 / 08

Rev. 08/31/2001

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
73	9	39012	72	9	60	9	39167	61	5 *
62	9	39016	62	9	68	8	39171	66	5 *
65	9	39018	65	9	64	9	39173	63	9
64	9	39020	64	9	65	9	39181	65	9
65	9	39023	65	9	68	9	39190	67	9
63	9	39024	63	6	67	4	39191	67	4
64	9	39054	65	9	63	9	39215	62	9
67	9	39069	68	9	70	9	39228	69	9
70	9	39071	70	9	72	9	39229	70	9
70	9	39073	71	9	67	12	39230	68	12
73	5	39077	73	5	71	9	39231	67	9
70	12 9	39081	70	12 9	70	5	39232	68	5
64	9	39082	66	9	65	11	39233	68	11
73	9	39083	73	9	70	9	39242	69	9
68	6	39087	68	6	62	9	39245	61	9
67	9	39089	66	9	70	9	39246	68	9
58	5	39092	58	5	70	9	39247	68	9
62	11	39100	62	11	63	9	39248	62	9
71	9	39105	70	9	68	9	39249	67	9
64	9	39106	64	9	64	9	39251	63	9
68	9	39107	66	9	64	11	39252	66	11
74	5	39109	72	5	67	11	39254	67	11
70	9	39157	72	9	70	9	39255	70	9
72	5	39162	71	5	73	9	39262	73	9
65	9	39163	60	9	67	9	39263	67	9

Recorded by MARK Z Direction W Lane 1 Time from 9:52 AM to 10:32 AM

Sheet 21	* STATE_CODE 20
LTPP Traffic Data	*SPS PROJECT_ID 0200
WIM System Test Truck Records 1 of 3	* DATE 7/22/08

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
73.5	59	1	1	10:04	32982	59	58/58	93/78	80/91	77/84	75/83		77.6	19.9	4.3	30.9	4.0	
73.5	59	2	1	10:04	32983	59	53/49	73/73	67/79	75/65	68/67		67.0	16.2	4.3	31.1	4.1	
73.5	62	1	2	10:16	33053	63	58/58	90/81	81/92	74/81	74/83		77.2	19.8	4.3	30.9	4.0	
73.5	62	2	2	10:16	33054	63	51/49	76/70	71/77	78/64	66/71		67.3	16.2	4.3	31.0	4.0	
73.5	68	1	3	10:27	33116	68	59/59	87/81	79/84	77/81	70/85		77.4	19.8	4.3	30.9	4.0	
73.5	68	2	3	10:27	33117	68	49/50	78/79	76/75	74/69	66/70		67.9	16.2	4.3	31.1	4.1	
73.5	60	1	4	10:39	33178	59	58/58	96/74	81/89	78/80	80/80		77.4	19.8	4.3	30.8	4.0	
73.5	61	2	4	10:39	33179	60	53/49	76/72	68/79	79/64	68/67		67.4	16.1	4.3	31.1	4.1	
75	64	1	5	10:51	33241	64	59/59	90/82	81/95	77/75	76/81		77.5	19.8	4.3	30.8	4.0	
75	65	2	5	10:51	33242	64	50/52	77/72	72/77	79/62	69/68		67.9	16.1	4.3	31.0	4.0	
75	64	1	6	11:05	33319	64	61/60	89/76	89/94	76/86	72/83		77.7	19.9	4.3	30.8	4.1	
75	69	2	6	11:05	33320	69	51/47	82/72	78/72	73/67	67/74		68.5	16.1	4.3	31.1	4.1	
74	63	1	7	11:29	33451	63	59/59	87/75	82/94	71/78	78/84		76.7	19.9	4.3	30.9	4.0	
74	64	2	7	11:29	33452	62	52/48	76/71	79/78	79/63	66/69		67.4	16.1	4.3	31.1	4.1	
74	69	1	8	11:41	33513	67	56/59	85/85	80/98	78/86	79/89		78.4	19.9	4.3	30.8	4.0	
74	69	2	8	11:41	33514	69	59/51	79/72	75/76	79/67	66/75		68.0	16.2	4.3	31.1	4.1	

Recorded by MARK Z

Checked by

Sheet 21	* STATE_CODE 20
LTPP Traffic Data	*SPS PROJECT_ID 0200
WIM System Test Truck Records 2 of 3	* DATE 7/29/08

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
73.5	59	1	9	11:53	33579	58	60/57	90/84	79/90	75/85	78/85		78.4	19.8	4.3	30.9	4.1	
73.5	59	2	9	11:53	33580	59	53/49	68/73	63/79	76/60	64/66		65.1	16.2	4.3	31.2	4.1	
73.5	64	1	10	12:06	33648	64	59/59	88/76	81/94	73/83	74/80		76.8	19.9	4.3	30.9	4.0	
73.5	64	2	10	12:06	33649	63	50/49	79/70	70/77	79/59	67/67		66.8	16.1	4.3	31.0	4.0	
74	70	1	11	12:18	33735	68	56/58	88/84	80/93	79/85	81/78		78.2	19.9	4.3	30.9	4.0	
74	71	2	11	12:18	33736	70	53/46	83/68	81/73	76/65	66/71		68.2	16.1	4.3	31.0	4.1	
76	58	1	12	12:30	33802	58	57/57	88/73	79/90	74/80	79/83		76.1	19.8	4.3	30.9	4.0	
76	59	2	12	12:30	33803	59	54/51	68/75	64/79	75/62	65/67		66.0	16.2	4.3	31.2	4.1	
78	64	1	13	12:49	33915	64	58/60	92/83	80/93	77/79	79/80		78.2	19.8	4.3	31.0	4.0	
78	69	2	13	12:49	33916	69	52/50	78/75	75/75	71/68	67/72		67.7	16.2	4.3	31.2	4.1	
77.5	68	1	14	13:01	33982	68	56/58	89/77	78/93	79/76	80/82		76.8	19.9	4.3	30.9	4.0	
77.5	70	2	14	13:01	33983	70	50/49	83/72	76/75	73/69	67/72		68.6	16.1	4.3	31.1	4.1	
79.5	57	1	15	13:29	34162	57	55/57	93/77	89/89	74/81	79/84		76.9	19.8	4.3	30.8	4.0	
79.5	59	2	15	13:29	34164	59	55/51	77/72	65/79	77/64	65/68		66.6	16.2	4.3	31.2	4.1	
80	62	1	16	13:42	34232	63	61/60	86/80	81/93	74/80	77/82		77.2	19.9	4.3	30.8	4.0	
80	69	2	16	13:42	34233	67	59/51	79/66	76/72	75/64	68/69		67.1	16.1	4.3	31.0	4.1	

Recorded by MARK Z

Checked by

Sheet 21	* STATE_CODE	20
LTPP Traffic Data	*SPS PROJECT_ID	0200
WIM System Test Truck Records 3 of 3	* DATE	2/22/03

Pvmt temp	Radar Speed	Truck	Pass,	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
79.5	68	1	17	13:54	34322	68	57/60	88/80	80/96	79/88	77/84		78.8	19.8	4.3	30.9	4.0	
79.5	58	2	17	13:54	34323	58	54/51	64/71	67/79	75/61	65/68		65.6	16.1	4.3	31.1	4.1	
78	62	1	18	14:18	34555	62	56/59	89/78	78/93	70/52	74/81		76.2	19.8	4.3	30.9	4.1	
78	61	2	18	14:18	34556	63	51/52	75/70	71/78	78/64	67/71		67.8	16.2	4.3	31.0	4.1	
76.5	69	1	19	14:29	34587	69	56/60	91/84	76/95	69/79	74/83		76.6	19.9	4.3	30.9	4.1	
76.5	67	2	19	14:29	34588	69	52/48	76/69	75/76	76/64	63/73		67.4	16.1	4.3	31.2	4.1	
76	60	1	20	14:41	34662	58	54/59	88/80	80/92	76/83	77/89		77.9	19.9	4.3	30.9	4.1	
76	59	2	20	14:41	34663	59	53/51	68/72	65/79	76/66	65/69		66.4	16.1	4.3	31.1	4.1	

Recorded by MARK Z

Checked by

Sheet 21	* STATE_CODE	2 0
LTPP Traffic Data	*SPS PROJECT_ID	0 2 0 0
WIM System Test Truck Records 1 of 1	* DATE	7 / 30 / 08

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight	Axle B weight	Axle C weight	Axle D weight	Axle E weight	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
74	59	1	1	9:01	38720	59	60/62	95/77	85/96	75/84	81/85		80.1	19.8	4.3	30.9	4.1	
74	59	2	1	9:01	38721	60	57/52	79/76	73/81	78/71	71/71		70.8	16.1	4.3	31.0	4.1	
72.5	64	1	2	9:14	38798	64	61/63	90/80	80/96	78/86	77/85		79.7	19.9	4.3	31.0	4.1	
72.5	63	2	2	9:14	38799	65	54/50	82/72	75/76	80/65	74/69		69.8	16.1	4.3	31.0	4.1	
72.5	68	1	3	9:26	38869	69	61/64	86/80	79/96	79/88	75/87		79.3	19.9	4.3	31.0	4.1	
73.5	68	2	3	9:26	38870	68	53/51	81/73	81/75	78/66	70/73		70.0	16.1	4.3	31.1	4.1	
75.5	59	1	4	9:39	38949	59	62/63	96/87	83/93	77/86	79/87		81.2	19.8	4.3	30.9	4.1	
75.5	59	2	4	9:39	38950	60	53/51	75/79	67/79	82/80	72/71		69.6	16.1	4.3	31.1	4.1	
75.5	63	1	5	9:51	39029	64	63/62	93/82	84/96	73/81	82/83		79.7	19.9	4.3	30.9	4.0	
75.5	63	2	5	9:51	39030	65	53/51	80/72	72/78	82/64	71/70		69.3	16.1	4.3	31.0	4.1	
74	60	1	6	10:04	39113	60	60/62	93/84	82/96	79/88	79/89		81.3	19.8	4.3	31.0	4.1	
74	70	2	6	10:04	39114	69	51/50	79/74	78/75	75/66	64/71		68.4	16.1	4.3	31.1	4.1	

Recorded by MARK B Checked by

Sheet 21	* STATE_CODE 20
LTPP Traffic Data	*SPS PROJECT_ID 0200
WIM System Test Truck Records 1 of 2	* DATE 2/20/08

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
78.5	58	1	7	10:17	39193	58	68/61	96/79	83/93	70/85	79/87		80.4	19.8	4.3	30.7	4.1	
78.5	60	2	7	10:17	39194	59	53/52	78/74	71/81	79/69	71/71		70.0	16.1	4.3	31.0	4.1	
78.5	63	1	8	10:29	39271	63	59/62	90/84	81/96	68/88	73/90		79.0	19.7	4.3	30.8	4.0	
78.5	63	2	8	10:29	39272	64	53/51	81/68	74/78	89/63	71/66		68.2	16.1	4.3	31.0	4.1	
WRONG VEHICLES	93	1	9	10:45	39382	78	62/59	80/85	78/89									
	20	2	9	10:45	39383	70												
81	68	1	9	10:52	39418	68	60/61	84/81	84/100	73/85	77/89		79.5	19.8	4.3	30.9	4.0	
81	68	2	9	10:52	39419	68	52/49	82/70	79/72	77/67	71/74		69.1	16.1	4.3	31.0	4.1	
81	58	1	10	11:04	39513	58	61/61	89/82	83/93	79/83	80/86		79.6	19.8	4.3	30.9	4.1	
81	58	2	10	11:04	39514	58	54/50	70/75	67/79	76/62	65/68		66.6	16.2	4.3	31.1	4.1	
84	63	1	11	11:17	39610	63	61/62	90/83	82/94	77/83	77/82		79.0	19.8	4.3	30.8	4.0	
84	65	2	11	11:17	39611	65	52/51	82/68	74/78	82/67	74/69		69.7	16.1	4.3	31.1	4.1	
86	69	1	12	11:30	39696	69	58/66	88/85	83/98	77/82	77/86		80.0	19.8	4.3	30.9	4.1	
86	69	2	12	11:30	39697	69	53/48	82/68	77/73	75/69	67/73		68.6	16.1	4.3	31.1	4.1	
84.5	58	1	13	11:42	39782	59	59/61	93/84	83/97	79/90	80/89		81.5	19.9	4.3	31.0	4.1	
84.5	58	2	13	11:42	39783	60	54/51	76/75	68/82	80/69	72/70		69.9	16.1	4.3	31.1	4.1	

Recorded by MARK

Checked by

Sheet 21	* STATE_CODE	2_6_
LTPP Traffic Data	*SPS PROJECT_ID	0_2_0_0
WIM System Test Truck Records 2 of 2	* DATE	7 / 30 / 08

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
85.5	62	1	14	11:54	39855	63	63/62	93/77	84/95	73/83	77/82		78.9	19.8	4.3	30.8	4.0	
85.5	63	2	14	11:54	39856	64	52/51	77/72	69/79	81/65	72/71		68.9	16.1	4.3	31.1	4.1	
87.5	66	1	15	12:06	39939	68	60/64	93/83	85/97	79/84	76/80		81.0	19.8	4.3	30.8	4.0	
87.5	68	2	15	12:06	39940	70	52/51	77/79	75/77	75/67	66/75		69.3	16.2	4.3	31.1	4.1	
93	58	1	16	12:45	40194	59	61/62	94/85	86/96	81/86	82/91		82.4	19.9	4.3	30.8	4.1	
93	59	2	16	12:45	40195	59	55/51	77/75	73/78	78/71	71/73		70.2	16.1	4.3	30.9	4.1	
98.5	64	1	17	12:57	40291	64	59/62	91/81	80/95	78/81	75/81		78.4	19.8	4.3	30.8	4.0	
98.5	63	2	17	12:57	40292	64	51/49	76/73	72/80	80/65	78/70		68.9	16.2	4.3	31.1	4.1	
102.5	68	1	18	13:10	40374	68	61/63	93/87	84/99	77/84	78/85		81.0	19.9	4.3	30.9	4.1	
102.5	68	2	18	13:10	40375	68	51/50	83/69	80/72	76/65	70/75		69.1	16.0	4.3	31.0	4.1	
94	57	1	19	13:26	40487	57	59/63	94/83	82/93	77/89	79/90		80.8	19.8	4.3	30.8	4.1	
94	58	2	19	13:26	40488	59	53/53	69/78	63/84	77/67	64/70		67.8	16.2	4.4	31.2	4.1	
95	64	1	20	13:40	40593	64	59/61	95/81	81/98	72/84	76/84		79.1	19.9	4.3	31.0	4.1	
95	63	2	20	13:40	40594	63	53/51	78/75	72/80	79/70	69/72		69.7	16.1	4.3	31.0	4.1	

Recorded by MARK E

Checked by RN

Calibration Worksheet

Site: __200200___

Calibration Iteration _____ Date 7/29/08

Beginning factors:

Speed Point (mph)	Name	Left Sensor 1 / ~~3~~	Right Sensor 2 / ~~4~~
Overall			
Front Axle			
Distance	DISTANCE	270	
1 – (55)	88 KPH	3452	3546
2 – (60)	96 KPH	3589	3689
3 – (65)	105 KPH	3541	3638
4 – (70)	112 KPH	3592	3691
5 – (75)	120 KPH	3718	3820

Errors:

	Speed Point 1 (60)	Speed Point 2 (65)	Speed Point 3 (70)	Speed Point 4 ( )	Speed Point 5 ( )
F/A	- 0.9	-1.2	-2.5		
Tandem	-3.5	-2.9	-1.4		
GVW	-3.1	-2.5	-1.5		

Adjustments:

	Raise	Lower	Percentage
Overall	☐	☐	_____
Front Axle	☐	☐	_____
Speed Point 1	☐	☐	_____
Speed Point 2	☑	☐	3.2%
Speed Point 3	☑	☐	2.6%
Speed Point 4	☑	☐	1.5%
Speed Point 5	☐	☐	_____

extrapolated gvw error to 75 mph (120 kph) = 0

End factors:

Speed Point (mph)	Name	Left Sensor 1 / ~~3~~	Right Sensor 2 / ~~4~~
Overall			
Front Axle			
Distance	Distance	271 (not changed) - shift 270	
1 – (55)	88 kph	3452	3546
2 – (60)	96 kph	3704	3807
3 – (65)	105 kph	3634	3733
4 – (70)	112 kph	3647	3747
5 – (75)	120 kph	3718	3820

TEST VEHICLE PHOTOGRAPHS FOR SPS WIM VALIDATION

July 29, 2008

STATE: Kansas

SHRP ID: 200200

Photo 1 - 20_0200_Truck_1_Tractor_07_29_08.jpg 2
Photo 2 - 20_0200_Truck_1_Trailer_07_29_08.jpg 2
Photo 3 - 20_0200_Truck_1_Suspension_1_07_29_08.jpg 3
Photo 4 - 20_0200_Truck_1_Suspension_2_07_29_08.jpg 3
Photo 5 - 20_0200_Truck_1_Suspension_3_07_29_08.jpg 4
Photo 6 - 20_0200_Truck_2_Tractor_07_29_08.jpg 4
Photo 7 - 20_0200_Truck_2_Trailer_07_29_08.jpg 5
Photo 8 - 20_0200_Truck_2_Suspension_1_07_29_08.jpg 5
Photo 9 - 20_0200_Truck_2_Suspension_2_07_29_08.jpg 6
Photo 10 - 20_0200_Truck_2_Suspension_3_07_29_08.jpg 6

Photo 1 - 20_0200_Truck_1_Tractor_07_29_08.jpg

Photo 2 - 20_0200_Truck_1_Trailer_07_29_08.jpg

Photo 3 - 20_0200_Truck_1_Suspension_1_07_29_08.jpg

Photo 4 - 20_0200_Truck_1_Suspension_2_07_29_08.jpg

Photo 5 - 20_0200_Truck_1_Suspension_3_07_29_08.jpg

Photo 6 - 20_0200_Truck_2_Tractor_07_29_08.jpg

Photo 7 - 20_0200_Truck_2_Trailer_07_29_08.jpg

Photo 8 - 20_0200_Truck_2_Suspension_1_07_29_08.jpg

Photo 9 - 20_0200_Truck_2_Suspension_2_07_29_08.jpg

Photo 10 - 20_0200_Truck_2_Suspension_3_07_29_08.jpg

ETG LTPP CLASS SCHEME, MOD 3

Class	Vehicle Type	No. Axles	Spacing 1	Spacing 2	Spacing 3	Spacing 4	Spacing 5	Spacing 6	Spacing 7	Spacing 8	Gross Weight Min-Max	Axle 1 Weight Min *
1	Motorcycle	2	1.00-5.99								0.10-3.00	
2	Passenger Car	2	6.00-10.10								1.00-7.99	
3	Other (Pickup/Van)	2	10.11-23.09								1.00-7.99	
4	Bus	2	23.10-40.00								12.00 >	
5	2D Single Unit	2	6.00-23.09								8.00 >	2.5
2	Car w/ 1 Axle Trailer	3	6.00-10.10	6.00-25.00							1.00-11.99	
3	Other w/ 1 Axle Trailer	3	10.11-23.09	6.00-25.00							1.00-11.99	
4	Bus	3	23.10-40.00	3.00-7.00							20.00 >	
5	2D w/ 1 Axle Trailer	3	6.00-23.09	6.30-30.00							12.00-19.99	2.5
6	3 Axle Single Unit	3	6.00-23.09	2.50-6.29							12.00 >	3.5
8	Semi, 2S1	3	6.00-23.09	11.00-45.00							20.00 >	3.5
2	Car w/ 2 Axle Trailer	4	6.00-10.10	6.00-30.00	1.00-11.99						1.00-11.99	
3	Other w/ 2 Axle Trailer	4	10.11-23.09	6.00-30.00	1.00-11.99						1.00-11.99	
5	2D w/ 2 Axle Trailer	4	6.00-26.00	6.30-40.00	1.00-20.00						12.00-19.99	2.5
7	4 Axle Single Unit	4	6.00-23.09	2.50-6.29	2.50-12.99						12.00 >	3.5
8	Semi, 3S1	4	6.00-26.00	2.50-6.29	13.00-50.00						20.00 >	5.0
8	Semi, 2S2	4	6.00-26.00	8.00-45.00	2.50-20.00						20.00 >	3.5
3	Other w/ 3 Axle Trailer	5	10.11-23.09	6.00-25.00	1.00-11.99	1.00-11.99					1.00-11.99	
5	2D w/ 3 Axle Trailer	5	6.00-23.09	6.30-35.00	1.00-25.00	1.00-11.99					12.00-19.99	2.5
7	5 Axle Single Unit	5	6.00-23.09	2.50-6.29	2.50-6.29	2.50-6.30					12.00 >	3.5
9	Semi, 3S2	5	6.00-30.00	2.50-6.29	6.30-65.00	2.50-11.99					20.00 >	5.0
9	Truck+FullTrailer (3-2)	5	6.00-30.00	2.50-6.29	6.30-50.00	12.00-27.00					20.00>	3.5
9	Semi, 2S3	5	6.00-30.00	16.00-45.00	2.50-6.30	2.50-6.30					20.00 >	3.5
11	Semi+FullTrailer, 2S12	5	6.00-30.00	11.00-26.00	6.00-20.00	11.00-26.00					20.00 >	3.5
10	Semi, 3S3	6	6.00-26.00	2.50-6.30	6.10-50.00	2.50-11.99	2.50-10.99				20.00 >	5.0
12	Semi+Full Trailer, 3S12	6	6.00-26.00	2.50-6.30	11.00-26.00	6.00-24.00	11.00-26.00				20.00 >	5.0
13	7 Axle Multi's	7	6.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00			20.00 >	5.0
13	8 Axle Multi's	8	6.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00		20.00 >	5.0
13	9 Axle Multi's	9	6.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00	20.00 >	5.0

Spacings in feet
Weights in kips (Lbs/1000)
* Suggested Axle 1 minimum weight threshold if allowed by WIM system's class algorithm programming

System Operating Parameters

Kansas SPS-2 (Lane 1)

Validation Visit – July 29, 2008

Calibration factors for sensor #1:

	30 July 2008	29 July 2008	18 April 2007
88 kph:	3452	3452	3784
96 kph:	3704	3589	3901
104 kph:	3634	3541	3943
112 kph	3647	3592	3980
120 kph	3718	3718	3922

Calibration factor for sensor #2

	30 July 2008	29 July 2008	18 April 2007
88 kph:	3546	3546	3784
96 kph:	3807	3689	3901
104 kph:	3733	3638	3943
112 kph	3747	3691	3980
120 kph	3820	3820	3922