Validation Report

Arkansas, SPS-2
Task Order 5, CLIN 2
October 28 to 29, 2008

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1 Executive Summary

A visit was made to the Arkansas 0200 on October 28 to 29, 2008 for the purposes of conducting a validation of the WIM system located on I-30, 39 miles west of Little Rock. The SPS-2 is located in the righthand, westbound lane of a four-lane divided facility. The posted speed limit at this location is 65 mph. The LTPP lane is the only lane that is instrumented at this site. The validation procedures were in accordance with LTPP's SPS WIM Data Collection Guide dated August 21, 2001.

This is thought to be a relocation of the previous site from within a LTPP test section. There is no information currently available to identify the location from which earlier data was collected. This is the second validation visit to this location. The site was installed in mid-winter 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 iSINC electronics. It is installed in portland cement concrete, 400 feet long.

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 77,500 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 a 3 tapered steel leaf suspension loaded to 69,620 lbs., the "partial" truck.

The validation speeds ranged from 53 to 65 miles per hour. The pavement temperatures ranged from 45 to 70 degrees Fahrenheit. The desired speed range was achieved during this validation. The desired 30 degree Fahrenheit temperature range was not achieved.

Table 1-1 - Post-Validation results – 050200 – 28-Oct-2008

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	-0.7 ± 5.1%	Pass
Tandem axles	±15 percent	1.6 ± 6.7%	Pass
GVW	±10 percent	1.3 ± 3.7%	Pass
Axle spacing	± 0.5 ft [150mm]	0 ± 0.1 ft	Pass

Prepared: ea *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.

The upper threshold of short range WIM index and peak short range index were exceeded in one of the runs shifted to the right. This does not appear to have impacted the equipment performance.

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: ea *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 May 16, 2007. We have no information on the rationale or reason for the parameter adjustments.

This site currently needs three years of data to meet the goal of five years of research quality data assuming 210 days of accepted loading data are submitted for 2008.

2 Corrective Actions Recommended

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

3 Post Calibration Analysis

This final analysis is based on test runs conducted October 28, 2008 through out the afternoon at test site 050200 on I-30. This SPS-2 site is at milepost 101.8 on the westbound, righthand of a four-lane divided facility. No auto-calibration was used during test runs. The two trucks used for the validation included:

1. 5-axle tractor-trailer with a tractor having an air suspension and trailer with a standard rear tandem and air suspension loaded to 77,500 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 a 3 tapered steel leaf suspension loaded to 69,620 lbs., the "partial" truck.

Each truck made a total of 20 passes over the WIM scale at speeds ranging from approximately 53 to 65 miles per hour. The desired speed range was achieved during this validation. Pavement surface temperatures were recorded during the test runs ranging from about 45 to 70 degrees Fahrenheit. The desired 30 degree Fahrenheit temperature range was not achieved. The computed values of 95% confidence limits of each statistic for the total population are in Table 3-1.

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

Table 3-1 – Post-Validation Results – 050200 – 28-Oct-2008

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	-0.7 ± 5.1%	Pass
Tandem axles	±15 percent	1.6 ± 6.7%	Pass
GVW	±10 percent	1.3 ± 3.7%	Pass
Axle spacing	± 0.5 ft [150mm]	0 ± 0.1 ft	Pass

Prepared: ea *Checked: bko*

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

The three speed groups were divided as follows: Low speed – 53 to 57 mph, Medium speed – 58 to 61 mph and High speed – 62 + mph. The three temperature groups were created by splitting the runs between those at 45 to 50 degrees Fahrenheit for Low temperature, 51 to 61 degrees Fahrenheit for Medium temperature and 62 to 70 degrees Fahrenheit for High temperature.

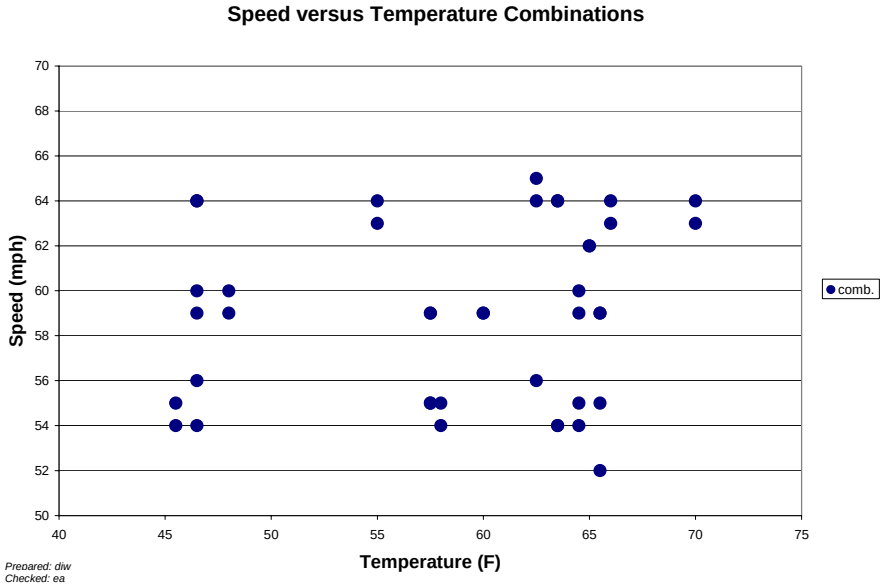

Figure 3-1 - Post-Validation Speed-Temperature Distribution – 050200 – 28-Oct-2008

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

Figure 3-2 shows the GVW Percent Error vs. Speed graph for the population as a whole. It can be seen from Figure 3-2 that the equipment estimates GVW with reasonable accuracy at all speeds. There is a slight increase in overestimation at medium speeds with somewhat less variability than observed at low and high speeds. The high speed group appears the most variable.

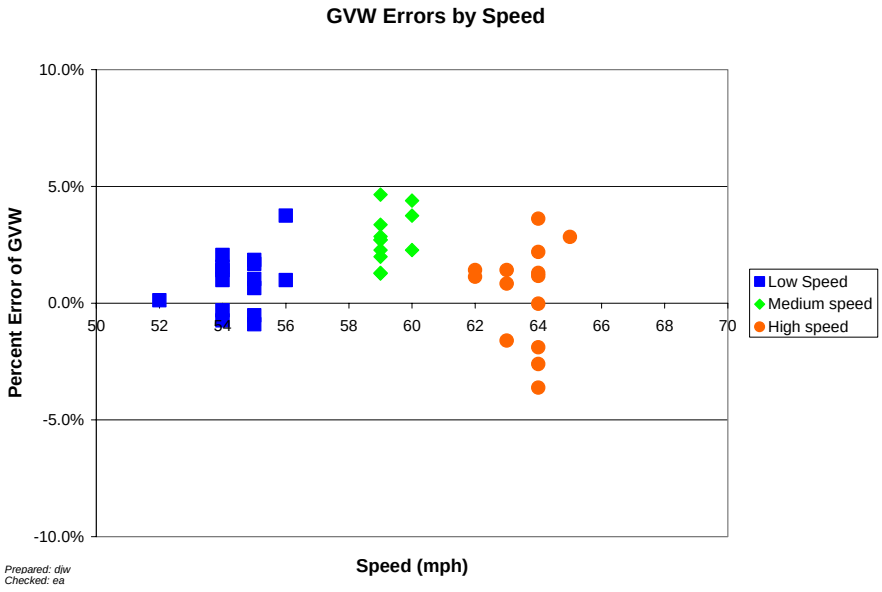

Figure 3-2 - Post-Validation GVW Percent Error vs. Speed – 050200 – 28-Oct-2008

Figure 3-3 shows the relationship between temperature and GVW percentage error. There is no apparent trend with GVW error with temperature. Variability is consistent throughout the entire temperature range.

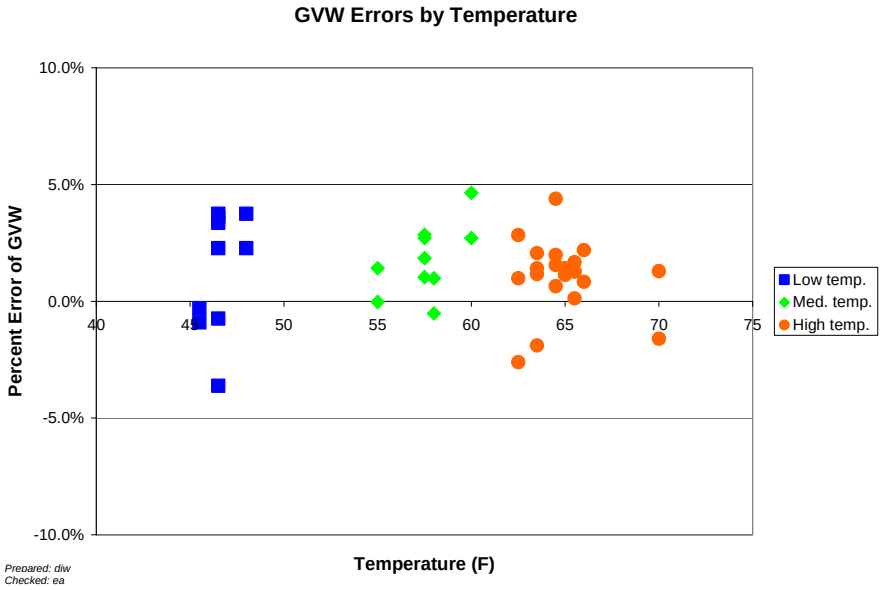

Figure 3-3 - Post-Validation GVW Percent Error vs. Temperature – 050200 – 28-Oct-2008

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

correctly identify spacings on a vehicle. Since the most common reference value is the drive tandem on a Class 9 vehicle, this is the spacing evaluated and plotted for validations. There is no apparent relationship between speed and axle spacing measurements.

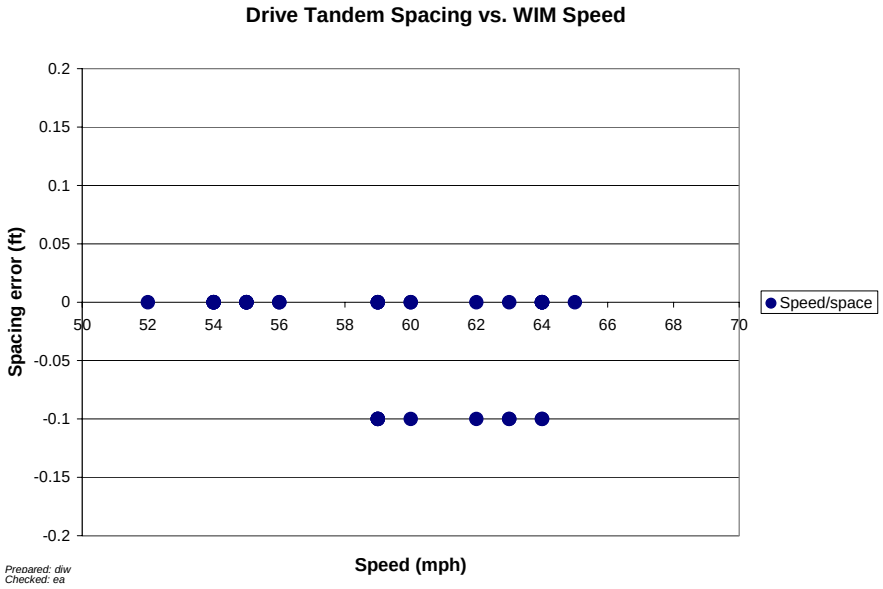

Figure 3-4 - Post-Validation Spacing vs. Speed – 050200 – 28-Oct-2008

3.1 Temperature-based Analysis

The three temperature groups were created by splitting the runs between those at 45 to 50 degrees Fahrenheit for Low temperature, 51 to 61 degrees Fahrenheit for Medium temperature and 62 to 70 degrees Fahrenheit for High temperature.

Table 3-2 - Post-Validation Results by Temperature Bin – 050200 – 28-Oct-2008

Element	95% Limit	Low Temperature 45 to 50 °F	Medium Temperature 51 to 61 °F	High Temperature 62 to 70 °F
Steering axles	±20 %	-0.8 ± 6.4%	0.7 ± 5.1%	-1.3 ± 4.8%
Tandem axles	±15 %	1.7 ± 7.6%	2 ± 6.9%	1.4 ± 6.8%
GVW	±10 %	1.3 ± 5.8%	1.8 ± 3.4%	1.1 ± 3.3%
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft

Prepared: ea *Checked: bko*

From Table 3-2, it can be seen that the equipment overestimates all weights at all temperatures with the exception of steering axles, which shows an underestimation at low and high temperature. Variability is consistent throughout the entire temperature range.

Figure 3-5 is the distribution of GVW Errors versus Temperature by Truck graph. From Figure 3-5 it can be seen that the GVW for both the golden truck (squares) and the partial truck (diamonds) were overestimated. The overestimation for the golden truck appears somewhat greater.

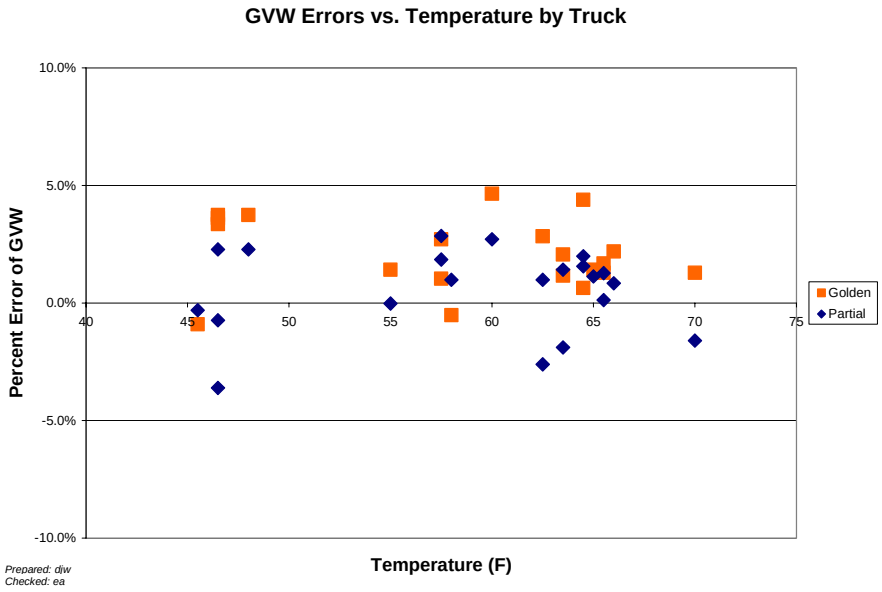

Figure 3-5 - Post-Validation GVW Percent Error vs. Temperature by Truck – 050200 – 28-Oct-2008

Figure 3-6 shows the relation between steering axle errors and temperature. This graph is included due to the frequent use of steering axle weights of Class 9 vehicles for calibration. This site does not use auto-calibration. The steering axles in this graph are associated only with Class 9 vehicles. The steering axle errors trend slightly downward with increasing temperature. Variability appears to remain consistent throughout the entire temperature range.

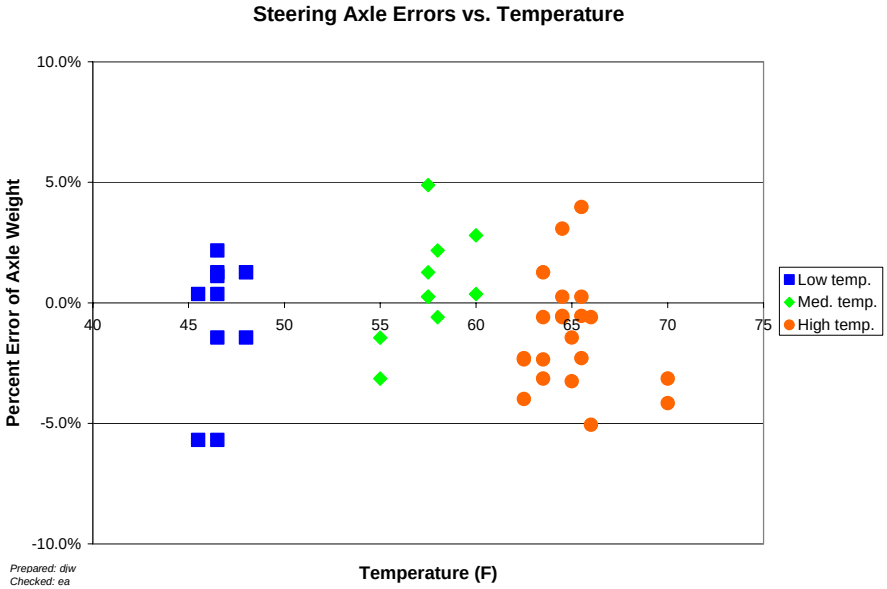

Figure 3-6 - Post-Validation Steering Axle Error vs. Temperature by Group – 050200 – 28-Oct-2008

3.2 Speed-based Analysis

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

Table 3-3 - Post-Validation Results by Speed Bin – 050200 – 28-Oct-2008

Element	95% Limit	Low Speed 53 to 57 mph	Medium Speed 58 to 61 mph	High Speed 62+ mph
Steering axles	±20 %	-0.1 ± 4.6%	1.0 ± 4.6%	-2.8 ± 3.6%
Tandem axles	±15 %	1.1 ± 5.3%	3.1 ± 7.0%	0.9 ± 7.9%
GVW	±10 %	0.9 ± 2.7%	2.8 ± 2.4%	0.4 ± 4.6%
Axle spacing	± 0.5 ft	0.0 ± 0.0 ft	-0.1 ± 0.1 ft	0.0 ± 0.1 ft

Prepared: ea *Checked: bko*

Table 3-3 demonstrates the ability of the equipment to estimate weights with little bias at the low and high speeds in the range. There is a greater degree of overestimation at the medium speed. Steering axles tend to be underestimated at high speeds. Variability is reasonably consistent throughout the entire speed range.

Figure 3-7 illustrates the tendency for the system to overestimate GVW at all speeds. The increase in variability at the high speed end of the range appears to reflect the different responses of the trucks.

Figure 3-7 - Post-Validation GVW Percent Error vs. Speed by Truck – 050200 – 28-Oct-2008

Figure 3-8 shows the relationship between steering axle errors and speed. This graph is included due to the frequent use of steering axle weights of Class 9 vehicles for auto-calibration. This site does not use auto-calibration. The steering axles in this graph are

associated only with Class 9 vehicles. Variability seems to be consistent throughout the entire graph with a downward progression from low to high speeds.

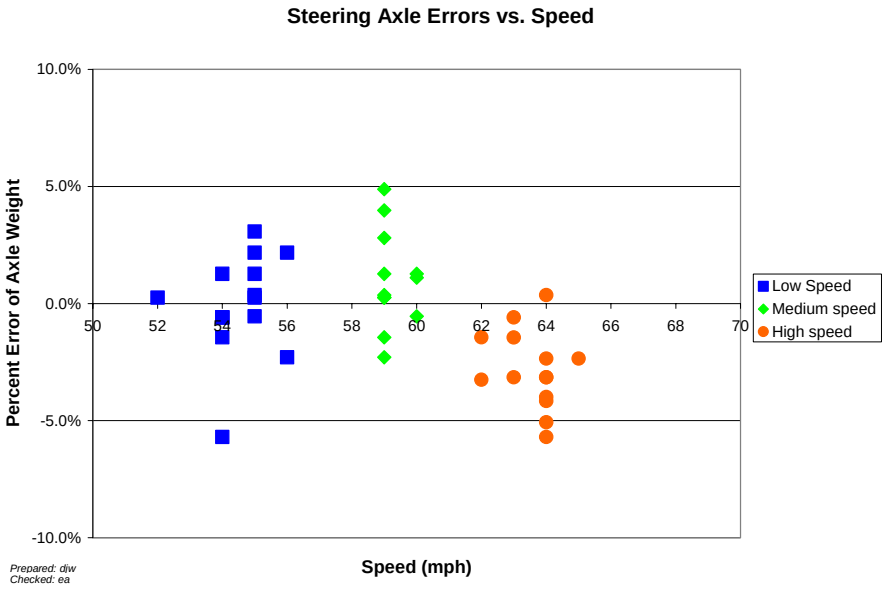

Figure 3-8 - Post-Validation Steering Axle Percent Error vs. Speed by Group – 050200 – 28-Oct-2008

3.3 Classification Validation

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

Table 3-4 - Truck Misclassification Percentages for 050200 – 28-Oct-2008

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

Prepared: ea *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 050200 – 28-Oct-2008

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

Prepared: ea *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, 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: ea *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 Fugro Consultants on September 16, 2008 were processed through the LTPP SPS WIM Index software, version 1.1. This WIM scale is installed on a rigid pavement.

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

The SPS WIM Index software, 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 – 050200 –16-Sep-2008

Profiler Passes			Pass 1	Pass 2	Pass 3	Pass 4	Pass 5	Ave.
Center	LWP	LRI (m/km)	1.324	1.255	1.047	1.680	1.147	1.291
		SRI (m/km)	*0.497*	0.589	0.986	1.558	0.588	0.844
		Peak LRI (m/km)	1.386	1.602	1.568	1.690	1.362	1.522
		Peak SRI (m/km)	0.978	0.853	1.187	1.976	0.773	1.153
	RWP	LRI (m/km)	1.601	1.428	1.189	1.418	0.779	1.283
		SRI (m/km)	1.500	1.164	1.616	1.707	1.092	1.416
		Peak LRI (m/km)	1.683	1.448	1.416	1.566	1.454	1.513
		Peak SRI (m/km)	1.748	1.955	1.906	1.998	1.294	1.780
Left Shift	LWP	LRI (m/km)	1.587	1.029	0.635			1.084
		SRI (m/km)	1.914	0.683	*0.435*			1.011
		Peak LRI (m/km)	1.589	1.436	0.732			1.252
		Peak SRI (m/km)	1.961	1.384	*0.737*			1.361
	RWP	LRI (m/km)	1.272	1.133	0.623			1.009
		SRI (m/km)	1.654	1.207	0.850			1.237
		Peak LRI (m/km)	1.336	1.399	0.687			1.141
		Peak SRI (m/km)	1.731	1.380	0.905			1.339
Right Shift	LWP	LRI (m/km)	0.850	1.177	1.916			1.314
		SRI (m/km)	0.723	1.285	**4.805**			2.271
		Peak LRI (m/km)	0.851	1.488	1.955			1.431
		Peak SRI (m/km)	0.755	1.585	**4.917**			2.419
	RWP	LRI (m/km)	0.762	1.081	1.254			1.032
		SRI (m/km)	0.876	0.580	1.316			0.924
		Peak LRI (m/km)	0.763	1.294	1.433			1.163
		Peak SRI (m/km)	1.031	*0.659*	1.373			1.021

Prepared: als Checked: jrn

From Table 4-2 it can be seen that two of the indices fall are below the lower threshold values and two of the indices fall above the upper threshold values. As the site was able

to be successfully validated, the pavement roughness does not appear to interfere with successful operations of the WIM scale at this location.

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

4.2 Distress Survey and Any Applicable Photos

During a visual survey of the pavement 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 iSINC electronics. The sensors are installed in a portland cement concrete pavement about 400 ft in length.

There were no changes in basic equipment operating condition since the validation on May 16, 2007.

5.1 Pre-Evaluation Diagnostics

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

5.2 Calibration Process

Upon our arrival at the site, we found the system parameters were not the same as we left them at the conclusion of our last validation on May 16, 2007. Apparently the site has had equipment maintenance work or factor adjustments made remotely between our last Validation visit and this one.

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

5.3 Summary of Traffic Sheet 16s

This site has validation information from our previous visit as well as the current one in the tables below. Table 5-1 has the information for TRF_CALIBRATION_AVC for Sheet 16s submitted prior to this validation as well as the information for the current visit. The Sheet 16s available are only for this contractor's validation visits.

Table 5-1 - Classification Validation History – 050200 – 28-Oct-2008

Date	Method	Mean Difference				Percent Unclassified
		Class 9	Class 8	Other 1	Other 2	
10/29/2008	Manual	0	0			0
10/28/2008	Manual	0	0			0
05/16/2007	Manual	0	-50			0
05/15/2007	Manual	0	-63			0

Prepared: ea *Checked: bko*

Table 5-2 has the information for TRF_CALIBRATION_WIM for Sheet 16s submitted prior to this validation as well as the information for the current visit. The Sheet 16s available only for this contractor's validation visits.

Table 5-2 - Weight Validation History – 050200 – 28-Oct-2008

Date	Method	Mean Error and (SD)		
		GVW	Single Axles	Tandem Axles
10/29/2008	Test Trucks	1.3 (1.8)	-0.7 (2.5)	1.6 (3.4)
10/28/2008	Test Trucks	0.9 (2.4)	-1.0 (2.7)	1.2 (3.8)
05/16/2007	Test Trucks	1.1 (1.8)	-2.0 (3.4)	1.6 (2.9)
05/15/2007	Test Trucks	2.0 (3.1)	-0.6 (3.3)	2.5 (4.2)

Prepared: ea *Checked: bko*

5.4 Projected Maintenance/Replacement Requirements

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

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 May 16, 2007. Apparently the site has had equipment maintenance work or factor adjustments made remotely between our last Validation visit and this one.

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 – 050200 – Since 16-May-2007

	Left Sensor #1		Right Sensor #2	
	28-Oct-2008	16-May-2007	28-Oct-2008	16-May-2007
80 kph	3133	3475	3295	3475
88 kph	3224	3576	3391	3576
96 kph	3229	3582	3396	3582
104 kph	3083	3420	3243	3420
112 kph	3077	3413	3236	3413

Prepared: ea *Checked: bko*

This pre-validation analysis is based on test runs conducted October 28, 2008 in the late morning and afternoon at test site 050200 on I-30. This SPS-2 site is at milepost 101.8 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 76,640 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 a 3 tapered steel leaf suspension loaded to 69,050 lbs., the "partial" truck.

For the initial validation each truck made a total of 20 passes over the WIM scale at speeds ranging from approximately 53 to 65 miles per hour. The desired speed range was achieved during this validation. Pavement surface temperatures were recorded during the test runs ranging from about 35 to 64degrees 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.

As shown by Table 6-2 this site passed the weight and spacing precision requirements for research quality data. It was determined that a calibration to improve the statistics was not warranted.

Table 6-2 - Pre-Validation Results – 050200 – 28-Oct-2008

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	-1.0 ± 5.6%	Pass
Tandem axles	±15 percent	1.2 ± 7.7%	Pass
GVW	±10 percent	0.9 ± 4.9%	Pass
Axle spacing	± 0.5 ft [150mm]	0.0 ± 0.1 ft	Pass

Prepared: ea *Checked: bko*

The test runs were conducted primarily during the afternoon and early morning hours, resulting in reasonable range of pavement temperatures. The runs were conducted at various speeds to determine the effects of these variables on the performance of the WIM scale. To investigate these effects, the dataset was split into three speed groups and two temperature groups. The distribution of runs within these groupings is illustrated in Figure 6-1. The figure indicates that the desired distribution of speed and temperature combinations was not achieved for this set of validation runs due to just missing the 30 degree temperature range.

The three speed groups were divided into 53 to 57 mph for Low speed, 58 to 61 mph for Medium speed and 62+ mph for High speed. The two temperature groups were created by splitting the runs between those at 35 to 50 degrees Fahrenheit for Low temperature and 51 to 64 degrees Fahrenheit for High temperature.

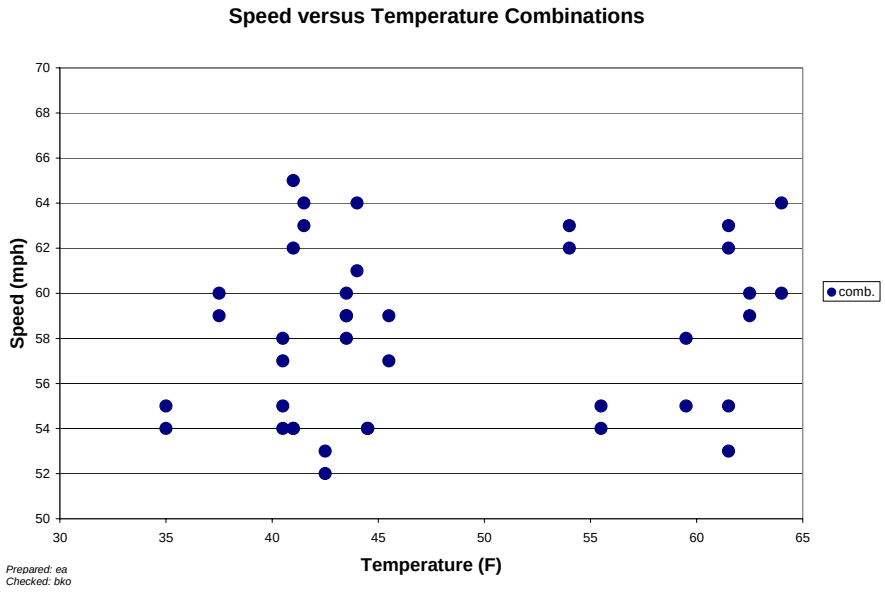

Figure 6-1 - Pre-Validation Speed-Temperature Distribution – 050200 – 28-Oct-2008

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

Figure 6-2 shows the GVW Percent Error vs. Speed graph for the population as a whole. As it can be seen in Figure 6-2, the system generally overestimates the GVW. Variability in error appears to be similar for low and high speeds and slightly larger for medium speeds.

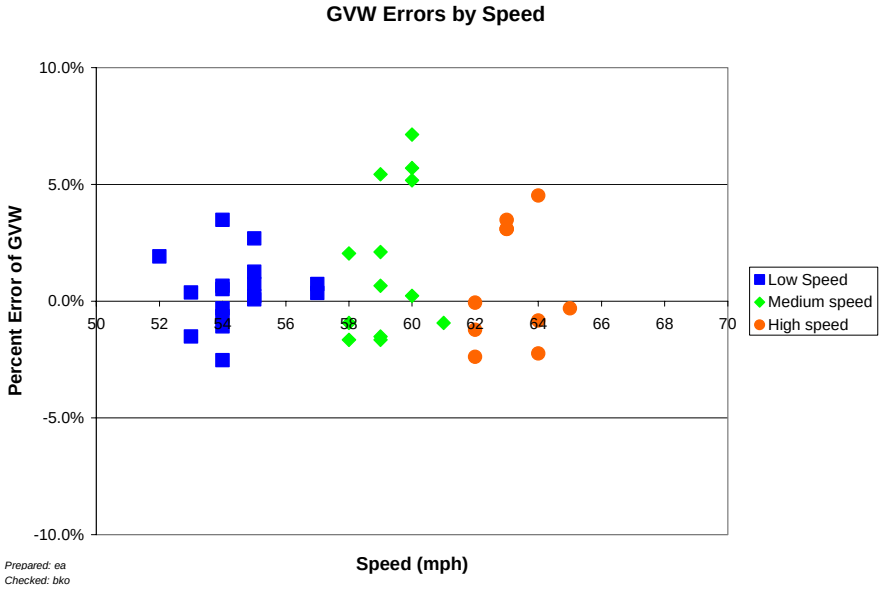

Figure 6-2 - Pre-Validation GVW Percent Error vs. Speed – 050200 – 28-Oct-2008

Figure 6-3 shows the relationship between temperature and GVW percentage error. Figure 6-3 shows that GVW is overestimated slightly more at higher temperatures as compared to lower temperatures. Variability in error appears to remain consistent throughout the entire temperature range.

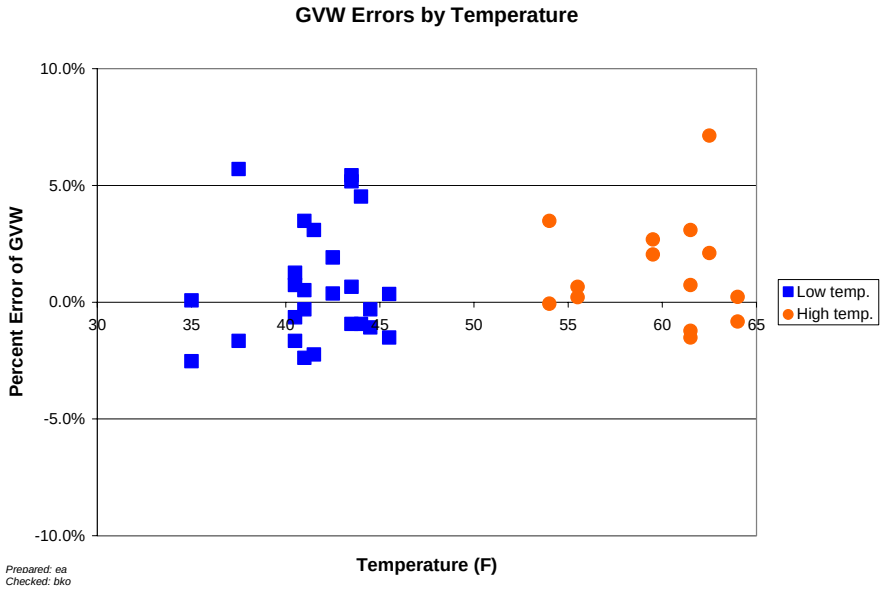

Figure 6-3 - Pre-Validation GVW Percent Error vs. Temperature – 050200 – 28-Oct-2008

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. Figure 6-4 indicates that the errors in tandem spacing were not affected by changes in speed.

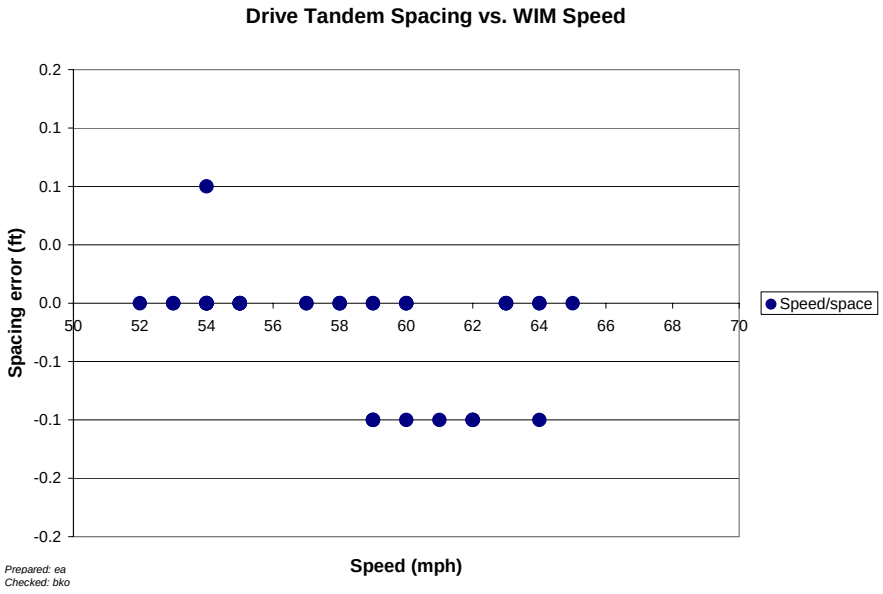

Figure 6-4 - Pre-Validation Spacing vs. Speed - 050200 – 28-Oct-2008

6.1 Temperature-based Analysis

The two temperature groups were created by splitting the runs between those at 35 to 50 degrees Fahrenheit for Low temperature and 51 to 64 degrees Fahrenheit for High temperature.

Table 6-3 - Pre-Validation Results by Temperature Bin – 050200 – 28-Oct-2008

Element	95% Limit	Low Temperature 35 to 50 °F	High Temperature 51 to 64 °F
Steering axles	±20 %	-1.5 ± 5.9%	-0.2 ± 5.3%
Tandem axles	±15 %	1.0 ± 8.1%	1.6 ± 7.1%
GVW	±10 %	0.7 ± 5.1%	1.3 ± 5.0%
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft

From Table 6-3 it is shown that the equipment produces an overestimation of all weights at all temperatures with the exception of steering axles, which is underestimated at lower and higher temperatures.

Figure 6-5 shows the distribution of GVW Errors versus Temperature by Truck.
Figure 6-5 shows the tendency of the equipment to overestimate GVW of the Golden Truck (squares) by a greater degree than the Partial Truck (diamonds) with an upward trend from lower to higher temperatures.

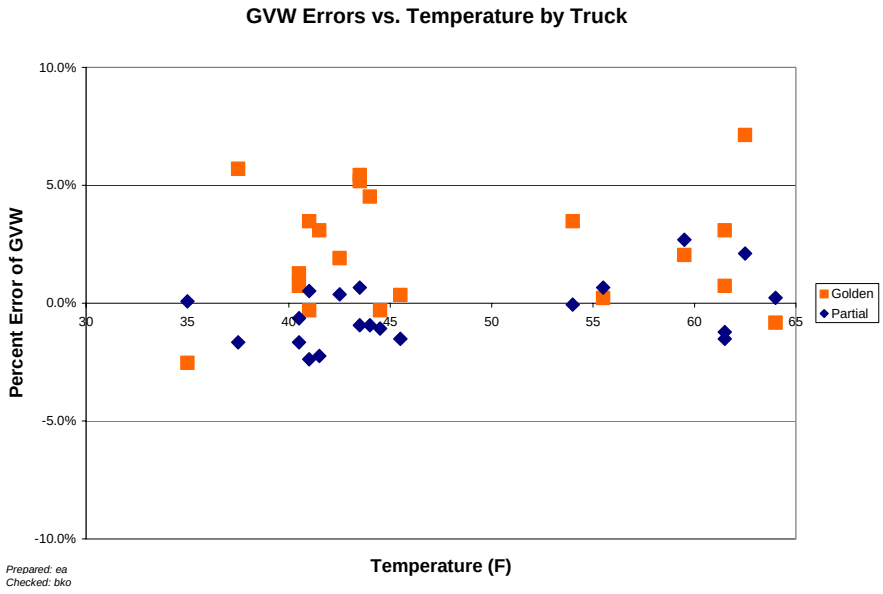

Figure 6-5 - Pre-Validation GVW Percent Error vs. Temperature by Truck – 050200 – 28-Oct-2008

Figure 6-6 shows the relation between steering axle errors and temperature. This graph is included due to the frequent use of steering axle weights of Class 9 vehicles for auto-calibration. This site does not use auto-calibration. The steering axles in this graph are associated only with Class 9 vehicles. The graph illustrates the tendency of the equipment to underestimate steering axle weights in the observed temperature range. The underestimation of the steering axle weights appears to be greater at lower temperatures as compared to higher temperatures. Variability in error appears to remain reasonably consistent throughout the entire temperature range.

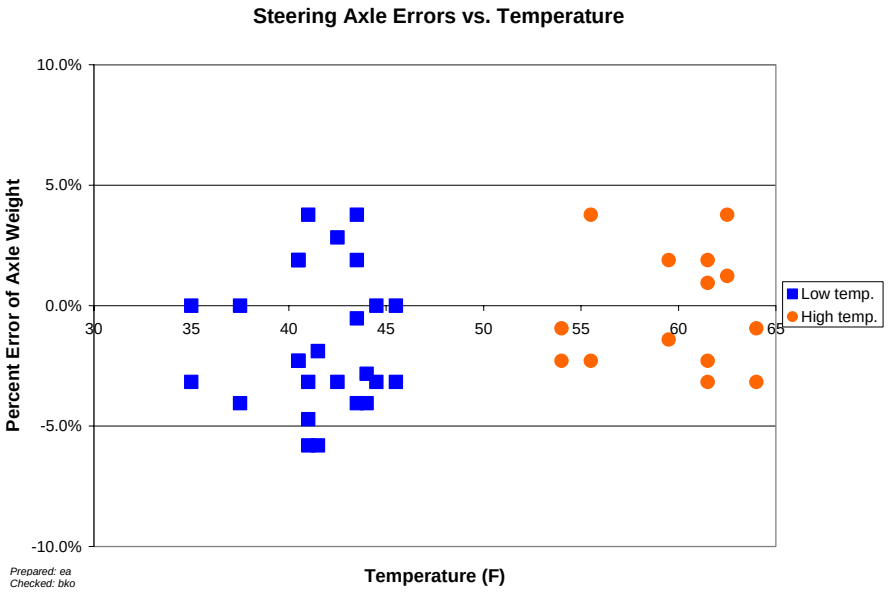

Figure 6-6 - Pre-Validation Steering Axle Error vs. Temperature by Group – 050200 – 28-Oct-2008

6.2 Speed-based Analysis

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

Table 6-4 - Pre-Validation Results by Speed Bin – 050200 – 28-Oct-2008

Element	95% Limit	Low Speed 53 to 57 mph	Medium Speed 58 to 61 mph	High Speed 62+ mph
Steering axles	±20 %	-0.3 ± 5.4%	-0.7 ± 6.5%	-2.7 ± 5.0%
Tandem axles	±15 %	0.6 ± 5.4%	2.0 ± 10.0%	1.2 ± 8.6%
GVW	±10 %	0.4 ± 3.1%	1.7 ± 6.9%	0.7 ± 5.8%
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft

Prepared: ea *Checked: bko*

From Table 6-4 it is shown that the equipment produces an overestimation of all weights at all speeds with the exception of steering axles, which is underestimated at all speeds.

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From Figure 6-7 shows the tendency of the equipment to overestimate Golden Trucks (square) and underestimates Partial Trucks (diamonds). Variability in error appears to be consistent throughout the speed range.

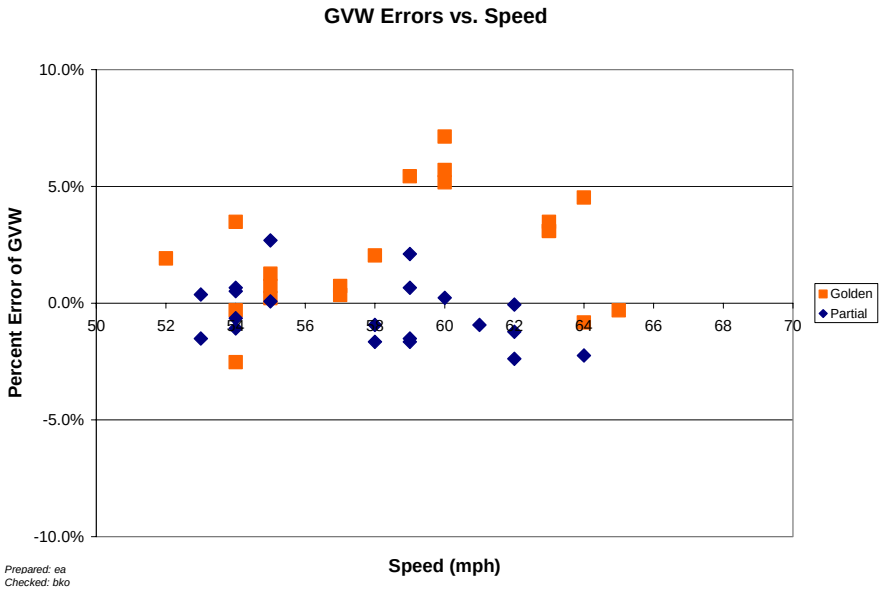


Figure 6-7 - Pre-Validation GVW Percent Error vs. Speed Group - 050200 –28-Oct-2008

Figure 6-8 shows the relation between steering axle errors and speed. This graph is included due to the frequent use of steering axle weights of Class 9 vehicles for calibration. This site does not use auto-calibration. The steering axles in this graph are associated only with Class 9 vehicles. Figure 6-8 shows the tendency of the equipment to increasingly underestimate steering axle weights from lower speeds to higher speeds. Variability in error appears to be consistent throughout the entire speed range.

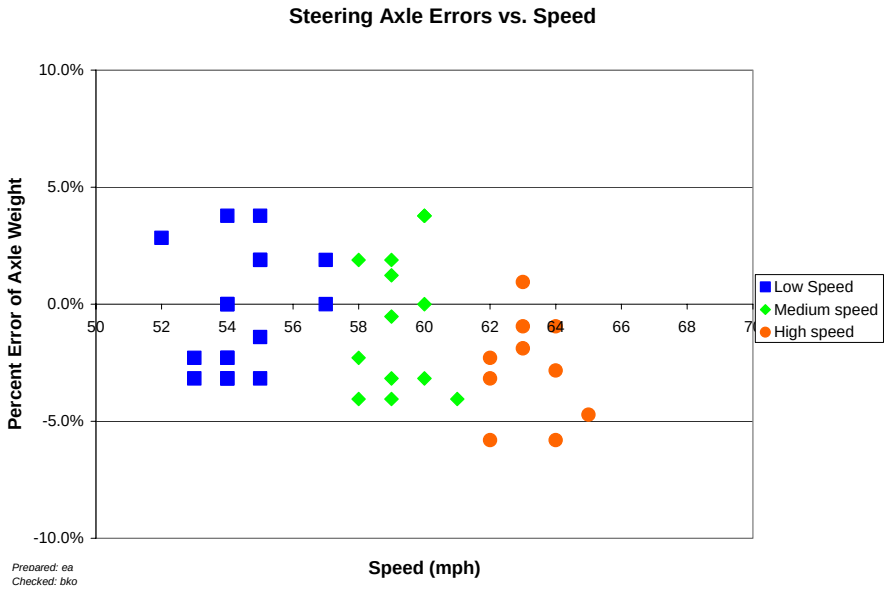


Figure 6-8 - Pre-Validation Steering Axle Percent Error vs. Speed Group - 050200 – 28-Oct-2008

6.3 Classification Validation

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

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

Table 6-5 - Truck Misclassification Percentages for 050200 – 28-Oct-2008

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

Prepared: ea *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 050200 – 28-Oct-2008

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

Prepared: ea *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 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, 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: ea *Checked: bko*

6.5 Prior Validations

The prior validation for this site was completed on May 16, 2007. It was the first validation of the site. The site was producing research quality data. Figure 6-9 shows the GVW Percent Error vs. Speed for the post validation runs. The site was validated with two trucks. The "Golden" truck was loaded to 77,150 lbs. The "partial" truck which had air suspension on both tandems was loaded to 63,040 lbs.

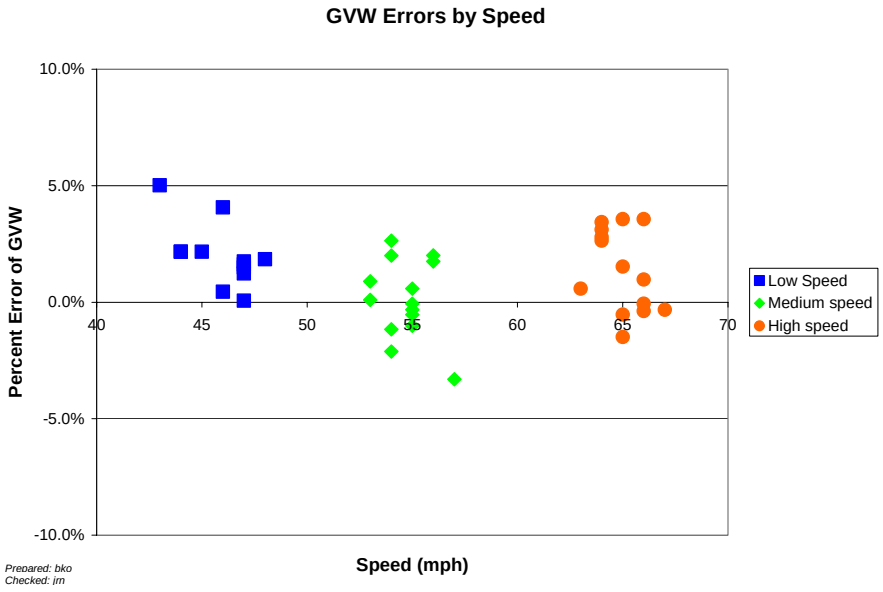


Figure 6-9 - Last Validation GVW Percent Error vs. Speed – 050200 – 16-May-2007

Table 6-8 shows the overall results from the last validation which demonstrated the ability to produce research quality data. Compared to the initial pre-validation results in Table 6-2, Table 6-8 shows smaller under estimation of weights with slightly greater variability. The variability for the current validation is thought to be more dependent on the test trucks used than any other factor.

Table 6-8 - Last Validation Final Results – 050200 – 16-May-2007

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	-2.0 ± 7.0%	Pass
Tandem axles	±15 percent	1.6 ± 5.7%	Pass
Gross vehicle weights	±10 percent	1.1 ± 3.6%	Pass
Axle spacing	± 0.5 ft [150 mm]	0.0 ± 0.0 ft	Pass

Prepared: ea *Checked: bko*

Table 6-9 has the results at the end of the last validation by temperature. There is a higher degree of underestimation of weights for the previous validation which took place at higher temperatures than the current validation. Through this validation the equipment has been observed at temperature from 35 to 112 degrees Fahrenheit.

Table 6-9 – Last Validation Results by Temperature Bin – 050200 – 16-May-2007

Element	95% Limit	Low Temperature 70 to 84 °F	Medium Temperature 85 to 98 °F	High Temperature 99 to 104 °F
Steering axles	±20 %	-1.8 ± 8.5%	-1.6 ± 9.3%	-2.2 ± 6.8%
Tandem axles	±15 %	-0.2 ± 5.4%	1.2 ± 5.3%	2.6 ± 5.6%
GVW	±10 %	-0.4 ± 3.3%	0.9 ± 3.5%	1.9 ± 3.3%
Axle spacing	± 0.5 ft	0.0 ± 0.0 ft	0.0 ± 0.0 ft	0.0 ± 0.0 ft

Prepared: ea *Checked: bko*

Table 6-10 has the results of the prior post validation by speed groups. Table 6-10 includes a wider range of speeds than the current validation. The 15th and 85th percentile speeds bounded the current validation speed ranges. The prior validation targeted on a 20 mph speed range

Table 6-10 - Last Validation Results by Speed Bin – 050200 – 16-May-2007

Element	95% Limit	Low Speed 43 to 49 mph	Medium Speed 50 to 59 mph	High Speed 60+ mph
Steering axles	±20 %	0.7 ± 8.2%	-3.2 ± 7.6%	-3.0 ± 3.4%
Tandem axles	±15 %	2.2 ± 5.7%	0.6 ± 5.7%	1.2 ± 6.1%
GVW	±10 %	2.0 ± 3.0%	0.1 ± 3.7%	1.4 ± 3.8%
Axle spacing	± 0.5 ft	0.0 ± 0.0 ft	0.0 ± 0.0 ft	0.0 ± 0.1 ft

Prepared: ea *Checked: bko*

7 Data Availability and Quality

As of October 28, 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 only 2000, 2007 and 2008; have a sufficient quantity to be considered complete years of data and that years 2000 and 2007 have a sufficient quantity to be considered complete years of weight data. Data for the current year, 2008, is expected to present in sufficient quantity for it to qualify as a year of research quality data. **In the**

absence of previously gathered validation information it can be seen that at least three additional years of research quality data are needed to meet the goal of a minimum of 5 years of research weight data

Table 7-1 - Amount of Traffic Data Available 050200 – 28-Oct-2008

Year	Classification Days	Months	Coverage	Weight Days	Months	Coverage
1996	81	8	Full week	65	5	Full week
1997	77	5	Full week	28	2	Full week
1998	58	4	Full week	26	2	Full week
1999	87	6	Full week	65	4	Full week
2000	317	11	Full week	343	12	Full week
2001	139	5	Full week	140	5	Full week
2002	169	8	Full week	150	7	Full week
2003	121	5	Full week	55	2	Full week
2004	197	8	Full week	4	1	Weekday(s) and Weekend day(s)
2007	252	9	Full week	227	8	Full week
2008	215	7	Full week	161	8	Full week

Prepared: ea *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.

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 – 050200 – 28-Oct-2008

Characteristic	Class 9
Percentage Overweights	0 %
Percentage Underweights	0 %
Unloaded Peak	40,000 lbs
Loaded Peak	72,000 lbs

Prepared: ea *Checked: bko*

The expected percentage of unclassified vehicles is 2.9 percent. This is based on the percentage of unclassified vehicles in the post-validation data download.

The graphical screening comparison figures are found in Figure 7-1 and Figure 7-2. 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.

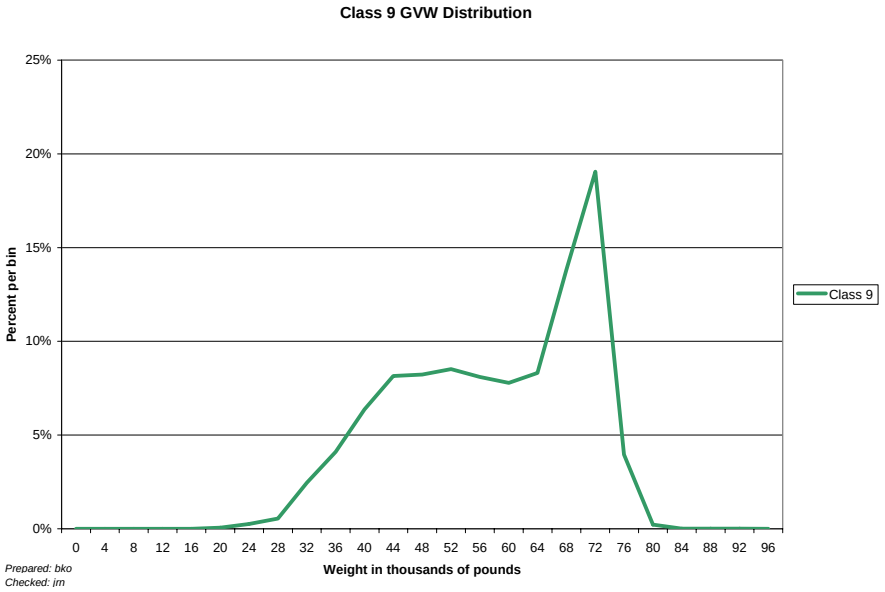


Figure 7-1 - Expected GVW Distribution Class 9 – 050200 – 28-Oct-2008

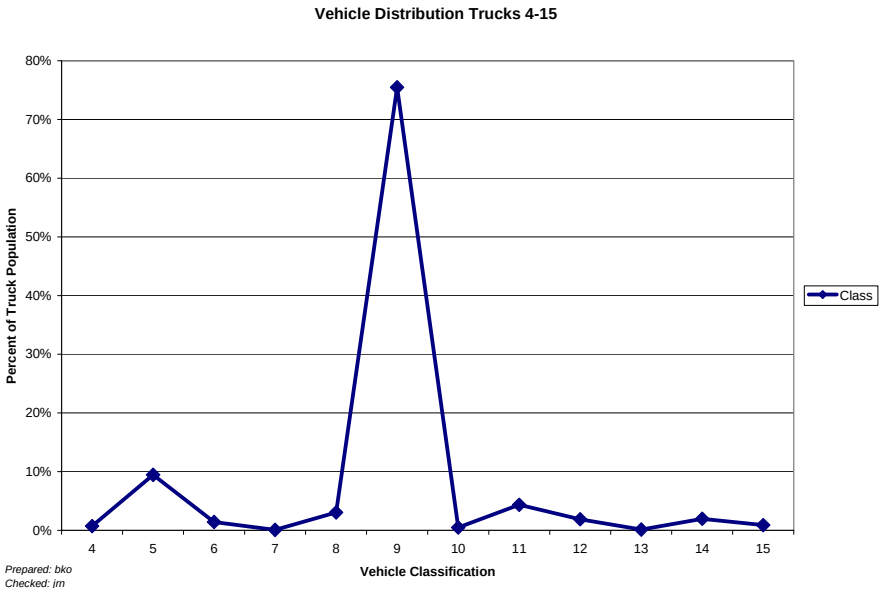


Figure 7-2 - Expected Vehicle Distribution – 050200 – 28-Oct-2008

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 steel suspension (3 pages)

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

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

Test Truck Photographs (6 pages)

LTPP Mod 3 Classification Scheme (1 page)

Final System Parameters (1 page)

9 Updated Handout Guide and Sheet 17

A copy of the handout has been included following page 29. It includes a current Sheet 17 with all applicable maps and photographs. There are no significant changes in the information provided.

10 Updated Sheet 18

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

11 Traffic Sheet 16(s)

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

POST-VISIT HANDOUT GUIDE FOR SPS WIM FIELD VALIDATION

STATE: Arkansas

SHRP ID: 050200

Figures

Photos

1. General Information

SITE ID: *050200*

LOCATION: *I-30, Milepost 101.8*

VISIT DATE: *October 28, 2008*

VISIT TYPE: *Validation*

2. Contact Information

POINTS OF CONTACT:

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

Highway Agency: *Mark Greenwood, 501-569-2552,*
mark.greenwood@arkansashighways.com

Michael Benson, 501-569-2185,
michael.benson@arkansashighways.com

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

FHWA Division Office Liaison: *Lester Frank, 501-324-6428,*
lester.frank@fhwa.dot.gov

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

3. Agenda

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

ON SITE PERIOD: *October 28 and 29, 2008*

TRUCK ROUTE CHECK: *Completed, see Truck Route.*

4. Site Location/ Directions

NEAREST AIRPORT: *Little Rock National Airport*

DIRECTIONS TO THE SITE: *I-30, 39 miles south of Little Rock, AR*

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

WIM SITE LOCATION: *Just north of SR74 overpass; Latitude: 34.43768 N, Longitude: -92.78052 W*

WIM SITE LOCATION MAP: *See Figure 4.1*

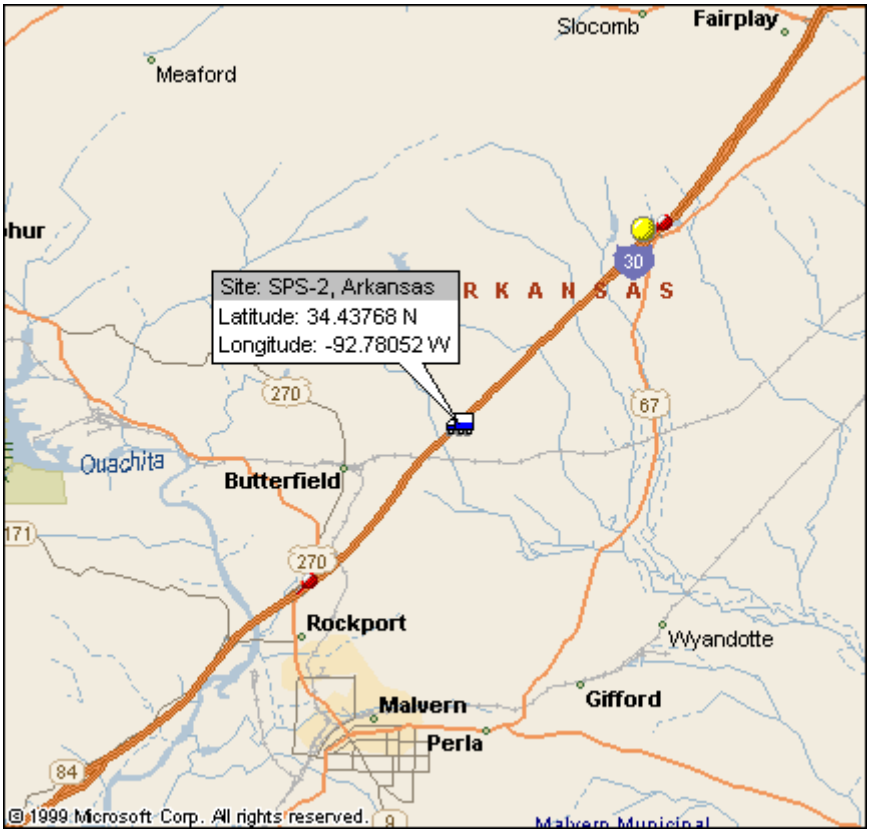


Figure 4-1 – Site 050200 in Arkansas

5. Truck Route Information

ROUTE RESTRICTIONS: *None*

SCALE LOCATION: *JJ's Truck Stop (501)-778-229; I-30 and Exit 106, Malvern, AR; open 24 hrs; $8.50 per weight, $1.00 per reweigh (501)-778-2295.*

Latitude: 34.484280 N, Longitude: -92.726150 W

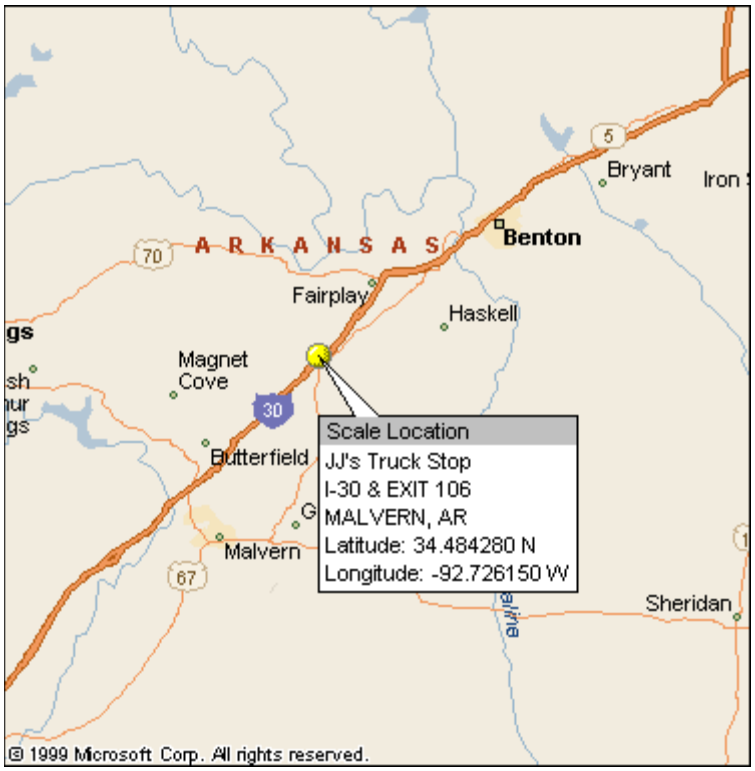


Figure 5-1 – Truck Scale Location for 050200 in Arkansas

TRUCK ROUTE:

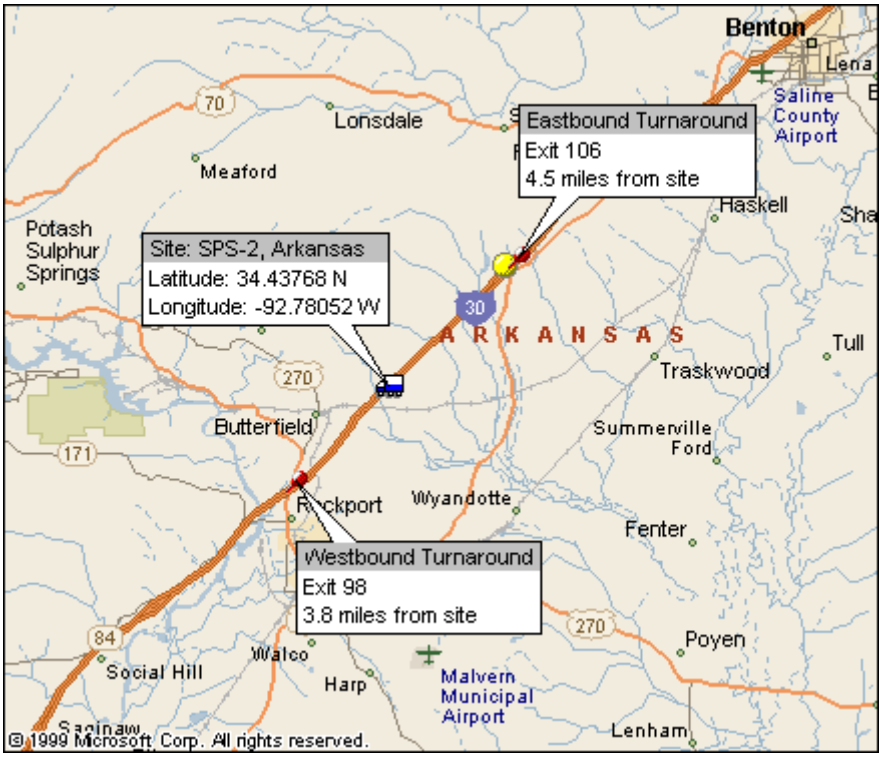


Figure 5-2 – Truck Route for 050200 in Arkansas

WB distance =3.8 miles
NB distance =4.5 miles

Total distance = 17.0 miles (15 minutes)

6. Sheet 17 – Arkansas (050200)

1.* ROUTE __I-30_____ MILEPOST ___101.8__ LTPP DIRECTION - N S E W

2.* WIM SITE DESCRIPTION - Grade __<1_____ % Sag vertical Y / N
Nearest SPS section upstream of the site _050221_
Distance from sensor to nearest upstream SPS Section _6.0_ miles

3.* LANE CONFIGURATION
Lanes in LTPP direction _2_ Lane width 12_ ft

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

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

Shoulder width __10_ ft

4.* PAVEMENT TYPE ___PCC_____

5.* PAVEMENT SURFACE CONDITION – Distress Survey
Date 10/28/2008_ Photo: Filename 05_0200_Upstream_10_28_08.jpg
Date 10/28/2008_ Photo: Filename 05_0200_Downstream_10_28_08.jpg
Date _____ Photo: _____

6. * SENSOR SEQUENCE _____loop – bending plate – bending plate - loop_____

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

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

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

Clearance under plate ___ __4 . _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 _44__ ft
Distance from system __125_ ft
TYPE ____3R_____

CABINET ACCESS controlled by LTPP / STATE / JOINT ?
Contact - name and phone number _Roy Czinku__306-653-6627
Alternate - name and phone number _Mark Greenwood__501-569-2552

11. * POWER

Distance to cabinet from drop __555__ ft Overhead / underground / solar / AC in cabinet?
Service provider _____ Phone number _____

12. * TELEPHONE

Distance to cabinet from drop __555__ ft Overhead / under ground / cell?
Service provider _____ Phone Number _____

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

14. * TEST TRUCK TURNAROUND time _15_minutes_____Distance _17.0_ mi.

15. PHOTOS	FILENAME
Power source	05_0200_Power_Cabinet_10_28_08.jpg
Phone source	05_0200_Telephone_Service_Pedestal_10_28_08.jpg
Cabinet exterior	05_0200_Cabinet_Exterior_10_28_08.jpg
Cabinet interior	05_0200_Cabinet_Interior_Front_10_28_08.jpg
	05_0200_Cabinet_Interior_Back_10_28_08_.jpg
Weight sensors	05_0200_Leading_WIM_Sensor_10_28_08.jpg
	05_0200_Trailing_WIM_Sensor_10_28_08.jpg
Classification sensors	__None_
Other sensors	05_0200_Leading_Loop_Sensor_10_28_08.jpg
	05_0200_Trailing_Loop_Sensor_10_28_08.jpg
Description	Loops

Downstream direction at sensors on LTPP lane
__05_0200_Downstream_10_28_08.jpg
Upstream direction at sensors on LTPP lane
__05_0200_Upstream_10_28_08.jpg

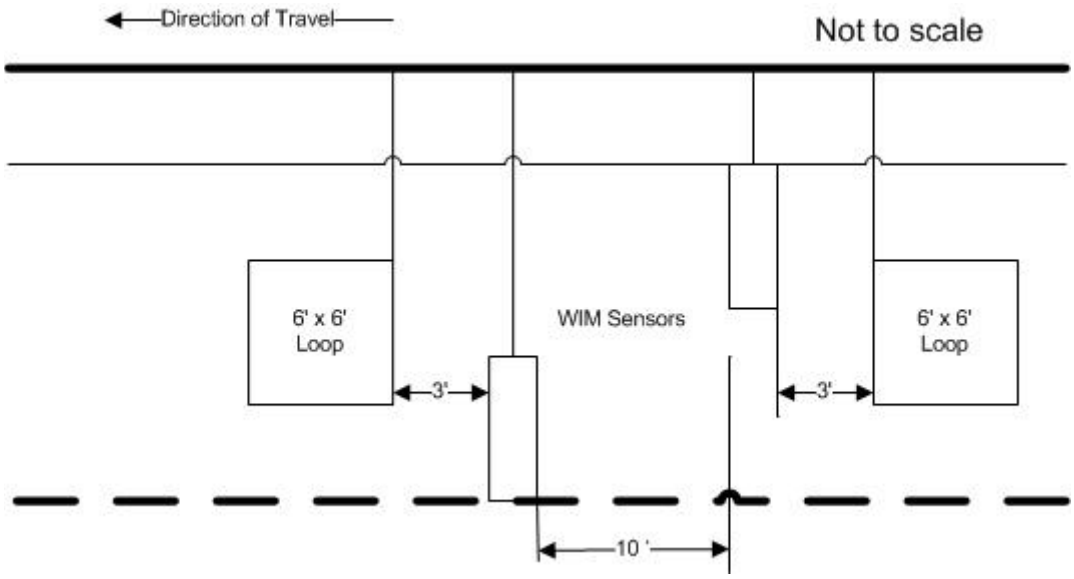
COMMENTS __Cabinet is difficult to get to with a generic vehicle; recommend an SUV as area is muddy when wet or be prepared to call a tow vehicle.
__Have a 100’ connection cable available.

____Power/phone drops located 340’ west then 115’ north

COMPLETED BY ____Dean J. Wolf_____

PHONE _301-210-5105_____ DATE COMPLETED _1 _0 _ /_2 _9 _ / _2 _0 _0 _8

Sketch of equipment layout



Site Map

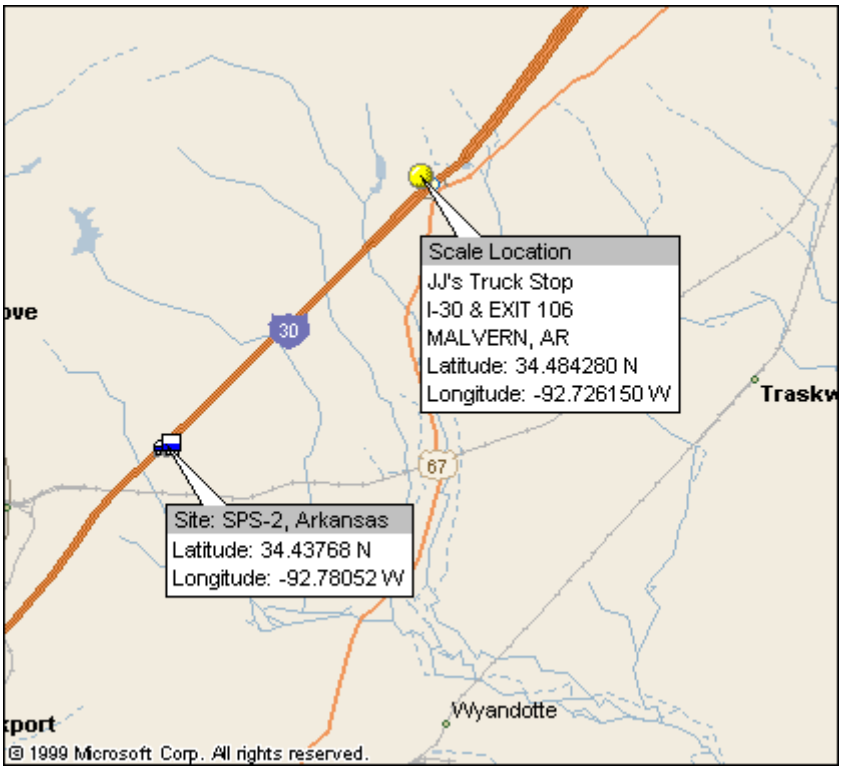


Figure 6-1 - Site Map for 050200 in Arkansas

Photo 1 - 05_0200_Upstream_10_28_08.jpg

Photo 2 - 05_0200_Downstream_10_28_08.jpg

Photo 3 - 05_0200_WIM_Site_1_10_28_08.jpg

Photo 4 - 05_0200_WIM_Site_2_10_28_08.jpg

Photo 5 - 05_0200_Power_Cabinet_10_28_08.jpg

Photo 6 - 05_0200_Power_Circuit_Breaker_10_28_08.jpg

Photo 7 - 05_0200_Power_Service_Meter_10_28_08.jpg

Photo 8 - 05_0200_Telephone_Service_Drop_10_28_08.jpg

Photo 9 - 05_0200_Telephone_Service_Pedestal_10_28_08.jpg

Photo 10 - 05_0200_Cabinet_Exterior_10_28_08.jpg

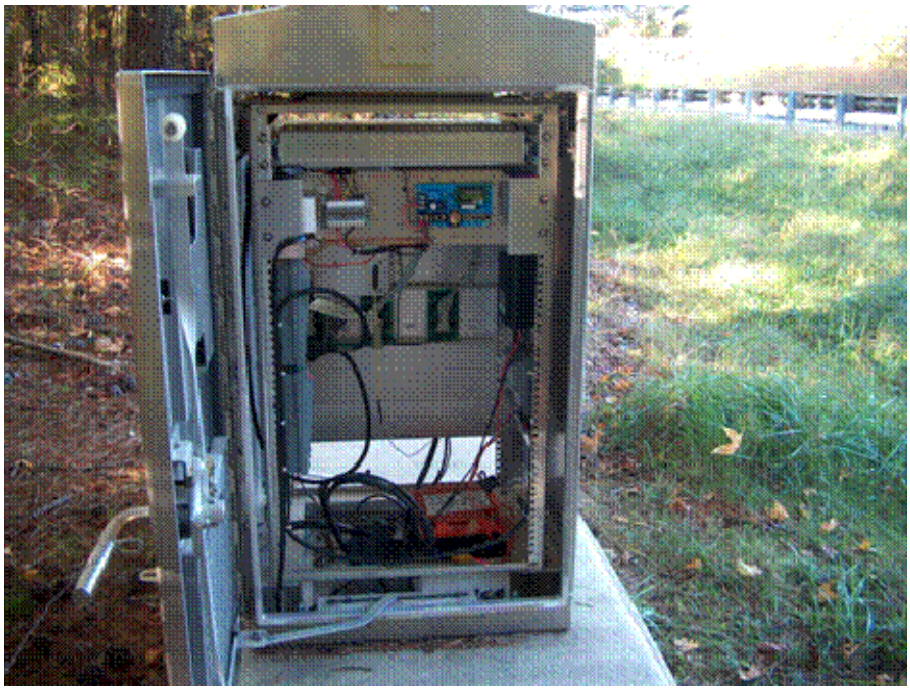


Photo 11 - 05_0200_Cabinet_interior_Back_10_28_08.jpg

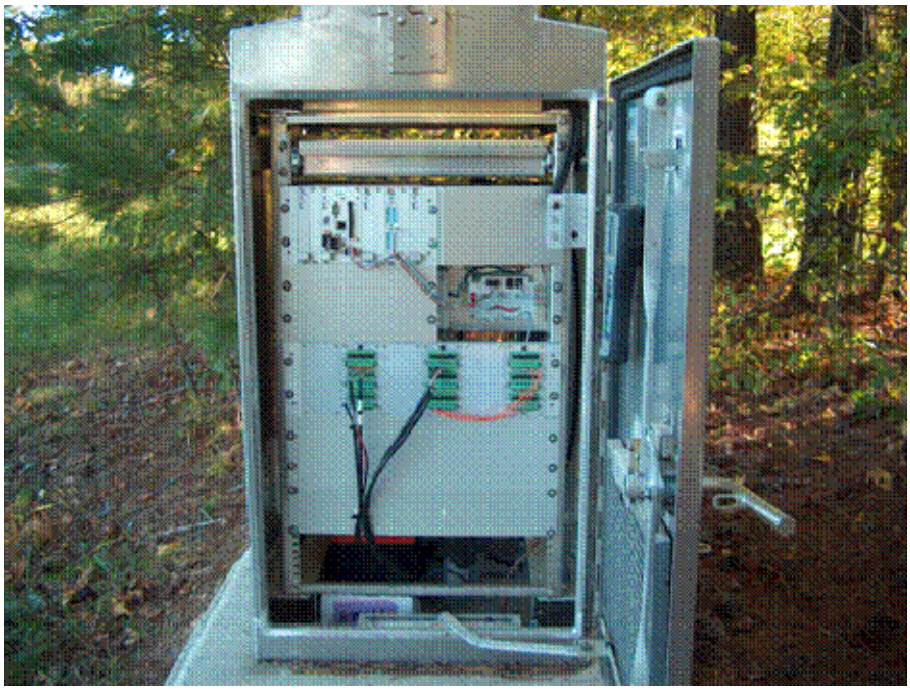


Photo 12 - 05_0200_Cabinet_Interior_Front_10_28_08.jpg

Photo 13 - 05_0200_Leading_Loop_10_28_08.jpg

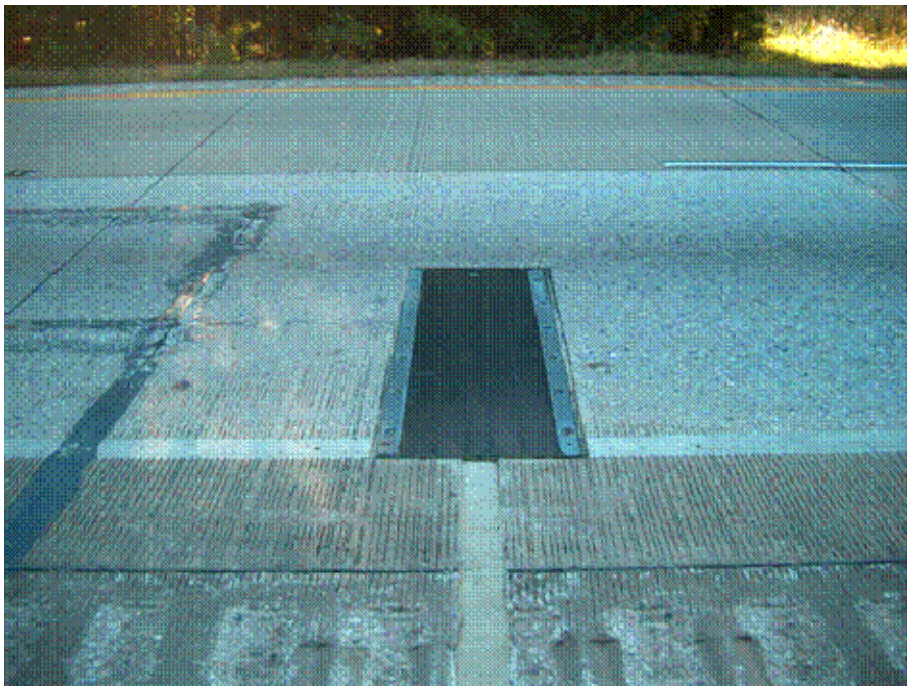


Photo 14 - 05_0200_Leading_WIM_Sensor_10_28_08.jpg

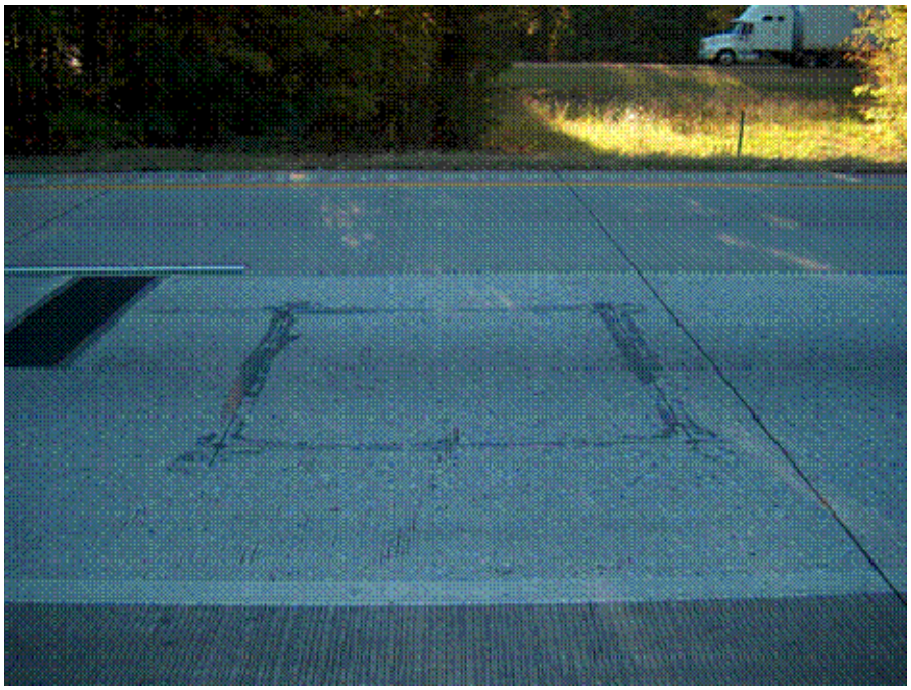


Photo 15 - 05_0200_Trailing_Loop_Sensor_10_28_08.jpg

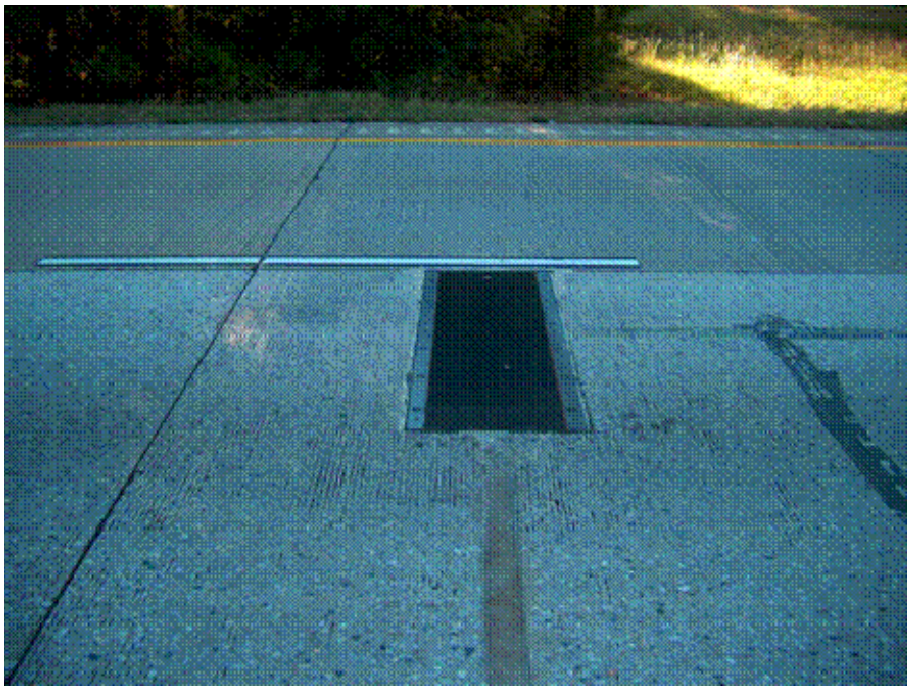


Photo 16 - 05_0200_Trailing_WIM_Sensor_10_28_08.jpg

SHEET 18	STATE CODE [5]
LTPP MONITORED TRAFFIC DATA	SPS PROJECT ID [0200]
WIM SITE COORDINATION	DATE: (mm/dd/yyyy) 10/28/2008

Rev. 05/15/07

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

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

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

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

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

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

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

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

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

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

g. Communication –

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

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

3. PAVEMENT –

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

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

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

4. ON SITE ACTIVITIES –

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

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

i. On site lead –
- ☐ State
- ☒ LTPP

ii. Accept grinding –
- ☐ State
- ☒ LTPP

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

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

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

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

   _____

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

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

i. Traffic Control Required – ☐ Yes ☒ No

j. Enforcement Coordination Required – ☐ Yes ☒ No

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

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

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

      Agency: IRD

b. Maintenance (equipment) –

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

Agency: IRD

c. Data Processing and Pre-Visit Data –

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

Agency: IRD

d. Construction schedule and verification –

Name: _____ Phone:_____

Agency: _____

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

Name: Leon Campbell Phone: 501-490-1481

Agency: McConnell Heavy Hauling

f. Traffic Control –

Name: _____ Phone:_____

Agency: _____

g. Enforcement Coordination –

Name: _____ Phone:_____

Agency: _____

h. Nearest Static Scale

Name: JJ'S Truck Stop Location:I -30 Exit 106 (Malvern, AR)

Phone: 501-778-2295

SHEET 16 **LTPP MONITORED TRAFFIC DATA** **SITE CALIBRATION SUMMARY**	*STATE ASSIGNED ID [__ __ __ __] *STATE CODE [0 5] *SHRP SECTION ID [0200]

SITE CALIBRATION INFORMATION

1. * DATE OF CALIBRATION (MONTH/DAY/YEAR) [10/28/2008]

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

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

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

5. EQUIPMENT MANUFACTURER ___IRD/ PAT Traffic

WIM SYSTEM CALIBRATION SPECIFICS**

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

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

   __ 20__ PASSES PER TRUCK

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

TRUCK	TYPE	SUSPENSION
1	9	1
2	9	2
3		

7. SUMMARY CALIBRATION RESULTS (EXPRESSED AS A PERCENT)
   MEAN DIFFERENCE BETWEEN ---
   DYNAMIC AND STATIC GVW ___0.9 STANDARD DEVIATION ___2.4
   DYNAMIC AND STATIC SINGLE AXLES ___-1.0 STANDARD DEVIATION ___2.7
   DYNAMIC AND STATIC DOUBLE AXLES ___1.2 STANDARD DEVIATION ___3.8

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

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

10. CALIBRATION FACTOR (AT EXPECTED FREE FLOW SPEED) ___3083 / 3243___

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

CLASSIFIER TEST SPECIFICS***

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

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

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

PERSON LEADING CALIBRATION EFFORT: __Dean J. Wolf, MACTEC
CONTACT INFORMATION: ____301-210-5105 rev. November 9, 1999

SHEET 16 **LTPP MONITORED TRAFFIC DATA** **SITE CALIBRATION SUMMARY**	*STATE ASSIGNED ID [__ __ __ __] *STATE CODE [05] *SHRP SECTION ID [0200]

SITE CALIBRATION INFORMATION

1. * DATE OF CALIBRATION (MONTH/DAY/YEAR) [10/29/2008]

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

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

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

5. EQUIPMENT MANUFACTURER ___IRD/ PAT Traffic

WIM SYSTEM CALIBRATION SPECIFICS**

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

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

   __ 20__ PASSES PER TRUCK

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

TRUCK	TYPE	SUSPENSION
1	9	1
2	9	2
3		

7. SUMMARY CALIBRATION RESULTS (EXPRESSED AS A PERCENT)
   MEAN DIFFERENCE BETWEEN ---
   DYNAMIC AND STATIC GVW 1.3 STANDARD DEVIATION 1.8
   DYNAMIC AND STATIC SINGLE AXLES -0.7 STANDARD DEVIATION 2.5
   DYNAMIC AND STATIC DOUBLE AXLES 1.6 STANDARD DEVIATION 3.4

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

9. DEFINE THE SPEED RANGES USED (MPH) _____ ___ 55 60 65 __ __ _____ _____
   _____ _____ _____ _____ _____ _____ _____ _____ _____ _____

10. CALIBRATION FACTOR (AT EXPECTED FREE FLOW SPEED) 3083 / 3243

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

CLASSIFIER TEST SPECIFICS***

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

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

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

PERSON LEADING CALIBRATION EFFORT: Dean J. Wolf, MACTEC
CONTACT INFORMATION: 301-210-5105 rev. November 9, 1999

APPENDIX A

Sheet 19	* STATE_CODE 05
LTPP Traffic Data	* SPS PROJECT ID 0200
*CALIBRATION TEST TRUCK # 1	* DATE 10/28/08

Rev. 08/31/01

PART I.

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

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

GEOMETRY

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

9. a) * Make: Kenworth b) * Model: 97

10.* Trailer Load Distribution Description:

concrete barriers loaded evenly along trailer

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

b). Trailer Tare Weight (units): _____

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

A to B 19.4 B to C 4.3 C to D 37.1

D to E 4.5 E to F _____

Wheelbase (measured A to last) _____ Computed 56.6

13. *Kingpin Offset From Axle B (units) +1.8 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 24.5	4 FULL LEAF
B	11R 24.5	air
C	11R 24.5	air
D	70R 22.5	air
E	70R 22.5	air
F		

Sheet 19	* STATE_CODE 05
LTPP Traffic Data	* SPS PROJECT ID 0200
*CALIBRATION TEST TRUCK # 1	* DATE 10/28/08

Rev. 08/31/01

PART II

Day 1

*b) Average Pre-Test Loaded weight 76770
*c) Post Test Loaded Weight 76500
*d) Difference Post Test – Pre-test × 270

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10660	16160	16160	16900	16900		76780
2	10600	16190	16190	16890	16890		76760
3							
Average	10630	16175	16175	16895	16895		76770

Table 6. Raw data – Axle scales –

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

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10560	16070	16070	16900	16900		76500
2	10580	16030	16030	16930	16930		76500
3							
Average	10570	16050	16050	16915	16915		76500

Measured By MJW Verified By EA Weight date 10/28/08

Sheet 19	* STATE_CODE 05
LTPP Traffic Data	* SPS PROJECT ID 0200
*CALIBRATION TEST TRUCK # 1	* DATE 10/29/08

Rev. 08/31/01

Day 2

7.2 *b) Average Pre-Test Loaded weight 77740

*c) Post Test Loaded Weight 77260

*d) Difference Post Test – Pre-test -480

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	11160	16390	16390	16900	16900		77740
2	11200	16360	16360	16910	16910		77740
3							
Average	11180	16375	16375	16905	16905		77740

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	10920	16280	16280	16890	16890		77260
2	10960	16250	16250	16900	16900		77260
3							
Average	10940	16265	16265	16895	16895		77260

Measured By djw Verified By SA. Weight date 10/29/08

Sheet 19	* STATE_CODE	05
LTPP Traffic Data	* SPS PROJECT ID	0200
*CALIBRATION TEST TRUCK # 2	* DATE	10/28/08

Rev. 08/31/01

PART I.

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

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

GEOMETRY

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

9. a) * Make: Kenworth b) * Model: 97

10.* Trailer Load Distribution Description:

Concrete barriers loaded evenly along trailer

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

b). Trailer Tare Weight (units): _____

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

A to B 16.1 B to C 4.4 C to D 32.0

D to E 4.1 E to F _____

Wheelbase (measured A to last) _____ Computed 56.6

13. *Kingpin Offset From Axle B (units) +1.8 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 24.5	4 FULL LEAF
B	11R 24.5	air
C	11R 24.5	air
D	10.00R 15 TR	~~AIR~~ 3 TAPERED LEAF
E	10.00R 15TR	3 TAPERED LEAF
F	_____	_____

Sheet 19	* STATE_CODE	05
LTPP Traffic Data	* SPS PROJECT ID	0200
*CALIBRATION TEST TRUCK #_2_	* DATE	10/28/08

Rev. 08/31/01

PART II

Day 1

*b) Average Pre-Test Loaded weight 69010

*c) Post Test Loaded Weight 69080

*d) Difference Post Test – Pre-test +70 (fuel)

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	11300	14980	14980	13870	13870		69000
2	11320	14930	14930	13920	13920		69020
3							
Average	11310	14955	14955	13895	13895		69010

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	11400	14960	14860	13980	13980		69080
2	11420	14830	14830	14000	14000		69080
3							
Average	11410	14945	14845	13990	13990		69080

Measured By M.W Verified By SA Weight date 10/28/08

Sheet 19	* STATE_CODE	05
LTPP Traffic Data	* SPS PROJECT ID	0200
*CALIBRATION TEST TRUCK #_2_	* DATE	

Rev. 08/31/01

Day 2

7.2 *b) Average Pre-Test Loaded weight 69830

*c) Post Test Loaded Weight 69400

*d) Difference Post Test – Pre-test -430

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	11920	14980	14980	13980	13980		69840
2	11880	14990	14990	13980	13980		69820
3							
Average	11900	14985	14985	13980	13980		69830

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	11640	14860	14860	14020	14020		69400
2	11640	14890	14890	13990	13990		69400
3							
Average	11640	14875	14875	14005	14005		69400

Measured By NJW Verified By EA Weight date 10/29/08

Sheet 20	* STATE_CODE	05__
LTPP Traffic Data	*SPS PROJECT_ID	0200____
Speed and Classification Checks */ of 2	* DATE	10/28/2008

Rev. 08/31/2001

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
67	9	49778	65	9	64	9	49946	63	9
65	9	49785	65	9	59	9	49948	57	9
63	9	49790	63	9	69	6	49954	68	6
65	9	49794	63	9	63	9	49956	63	9
62	9	49796	62	9	65	9	50009	64	9
64	9	49800	63	9	67	9	50012	67	9
61	5	49802	61	5	63	5	50018	62	5
60	9	49804	59	9	67	9	50019	68	9
68	9	49813	68	9	67	9	50020	66	9
62	9	49884	62	9	65	9	50022	65	9
62	9	49888	62	9	63	9	50026	64	9
59	9	49892	59	9	65	9	50028	64	9
67	9	49895	67	9	63	9	50035	65	9
64	8	49896	63	8	66	9	50036	67	9
65	11	49902	65	11	68	9	50039	68	9
68	9	49906	66	9	64	9	50040	64	9
65	9	49908	64	9	62	9	50044	60	9
68	9	49911	65	9	65	9	50047	66	9
68	9	49912	70	9	65	9	50049	65	9
65	9	49915	63	9	66	9	50054	64	9
66	9	49922	66	9	65	11	50056	64	11
65	9	49926	65	9	67	9	50058	64	9
68	12	49928	66	12	63	9	50063	64	9
65	9	49937	64	9	65	9	50067	64	9
65	9	49944	63	9	64	9	50069	63	9

Recorded by MARK Z Direction N Lane 1 Time from 11:05AM to 11:38 AM

Sheet 20	* STATE_CODE	05
LTPP Traffic Data	*SPS PROJECT_ID	0200
Speed and Classification Checks *2 of 2	* DATE	10/28/2008

Rev. 08/31/2001

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
64	9	50357	63	9	69	9	50423	69	9
68	9	50358	65	9	63	4	50427	60	4
65	9	50361	66	9	67	9	50431	67	9
64	9	50364	64	9	64	11	50497	63	11
64	9	50366	68	9	66	8	50503	65	8
65	9	50367	65	9	65	9	50508	65	9
64	9	50368	63	9	64	9	50511	64	9
64	9	50370	63	9	65	9	50512	64	9
55	8	50371	54	8	64	9	50515	63	9
67	9	50372	65	9	68	11	50519	68	11
66	9	50384	65	9	67	9	50521	67	9
72	9	50386	71	9	65	9	50526	63	9
68	9	50389	68	9	55	9	50539	53	9
60	9	50391	59	9	62	9	50542	64	9
65	9	50394	64	9	64	9	50548	64	9
64	9	50397	65	9	70	12	50550	69	12
62	10	50398	63	10	68	9	50558	65	9
59	9	50399	58	9	64	9	50559	63	9
71	5	50405	71	5	65	9	50565	63	9
65	9	50406	65	9	73	5	50567	69	5
62	9	50409	62	9	67	9	50572	67	9
70	9	50410	71	9	70	9	50574	68	9
64	9	50414	63	9	68	9	50577	67	9
64	12	50418	62	12	61	9	50579	60	9
59	9	50420	60	9	64	9	50581	63	9

Recorded by MARK B Direction N Lane 1 Time from ~~12:50 PM~~ 1207 PM to 1232 PM

Sheet 20	* STATE_CODE	05
LTPP Traffic Data	*SPS PROJECT_ID	0 2 0 0
Speed and Classification Checks * 1 of* 2	* DATE	10/29/2008

Rev. 08/31/2001

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
61	11	025	59	11	52	6	210	52	6
65	9	030	64	9	67	12	217	67	12
66	9	032	65	9	63	9	220	61	9
67	9	036	66	9	62	9	222	60	9
67	9	037	65	9	63	9	227	62	9
63	9	038	61	9	60	9	229	60	9
59	9	040	55	9	68	9	230	66	9
66	9	044	65	9	62	9	231	61	9
64	9	142	64	9	69	9	234	67	9
61	9	150	61	9	71	9	257	67	9
68	9	151	68	9	61	9	262	61	9
61	9	153	60	9	60	9	281	57	9
67	9	157	65	9	65	9	350	64	9
69	9	160	67	9	65	9	352	64	9
60	9	165	57	9	67	9	354	65	9
68	7	172	66	7	71	9	362	71	9
70	9	180	70	9	65	9	368	64	9
64	9	183	62	9	65	9	374	62	9
64	9	185	62	9	68	9	376	68	9
65	9	188	65	9	70	9	377	70	9
64	11	191	63	11	64	9	380	63	9
70	9	194	67	9	64	9	382	63	9
63	9	198	62	9	60	9	384	57	9
67	9	205	65	9	62	9	386	61	9
62	9	207	60	9	68	9	388	66	9

Recorded by MARK Z Direction W Lane 1 Time from 2:14PM to 2:53 PM

Sheet 20	* STATE_CODE	05
LTPP Traffic Data	*SPS PROJECT_ID	0 2 0 0
Speed and Classification Checks * 2 of* 2	* DATE	10/29/2008

Rev. 08/31/2001

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
64	9	549	64	9	64	9	666	63	9
64	9	553	62	9	67	9	667	66	9
64	9	554	62	9	67	9	676	66	9
64	9	555	62	9	62	9	680	61	9
65	9	558	63	9	66	12	682	64	12
68	9	559	65	9	66	9	684	65	9
65	9	562	64	9	61	9	687	60	9
62	9	566	60	9	59	9	696	57	9
63	9	569	62	9	64	9	704	66	9
65	9	570	63	9	60	9	766	60	9
64	8	573	64	8	62	8	771	61	8
67	9	575	67	9	65	9	774	64	9
66	9	578	66	9	63	9	775	61	9
66	11	581	64	11	64	9	778	62	9
65	9	584	65	9	65	9	785	64	9
67	9	586	64	9	69	9	788	69	9
66	12	587	66	12	67	9	827	66	9
60	9	591	60	9	62	8	830	61	8
59	9	594	57	9	73	9	833	72	9
68	9	599	68	9	69	9	835	66	9
64	9	605	63	9	64	12	842	62	12
67	9	656	65	9	64	11	846	62	11
64	9	658	62	9	60	9	848	59	9
62	9	661	61	9	64	9	850	61	9
64	9	665	61	9	67	8	852	67	8

Recorded by MARK B Direction W Lane 1 Time from ~~2:38~~ 3:05 PM to 3:37 PM

Sheet 21	* STATE_CODE	05
LTPP Traffic Data	*SPS PROJECT_ID	0200
WIM System Test Truck Records 1 of 3	* DATE	10/28/2008

Rev. 08/31/2001

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
40.5	55	1	1	10:57	49670	55	56/52	81/84	81/77	81/85	81/80		77.6	19.4	4.3	37.1	4.5	
40.5	54	2	1	10:57	49671	54	59/52	78/76	80/74	67/61	68/70		68.6	16.1	4.4	32.0	4.1	
40.5	59	1	2	11:13	49814	57	56/52	79/82	80/81	83/83	85/88		77.2	19.4	4.3	37.0	4.4	
40.5	58	2	2	11:13	49815	58	58/53	78/77	78/72	64/50	69/80		67.9	16.1	4.4	32.1	4.1	
41	65	1	3	11:29	49971	65	51/50	78/82	79/81	85/92	74/92		76.4	19.4	4.3	37.0	4.4	
41	62	2	3	11:29	49972	62	55/52	75/77	75/77	64/64	67/66		67.4	16.1	4.3	31.7	4.1	
41	54	1	4	11:45	50135	54	56/54	79/85	80/81	86/103	77/91		79.3	19.4	4.3	37.0	4.5	
41	55	2	4	11:45	50136	54	56/54	81/76	78/74	67/64	70/72		69.4	16.1	4.4	31.8	4.1	
43.5	59	1	5	12:01	50290	59	55/53	85/84	83/86	84/94	89/93		80.8	19.5	4.3	37.1	4.5	
43.5	58	2	5	12:01	50291	58	57/52	79/75	83/74	66/59	65/73		68.4	16.1	4.4	32.0	4.1	
44	65	1	6	12:17	50449	64	51/52	81/83	82/82	90/97	85/96		80.1	19.4	4.3	37.0	4.5	
44	62	2	6	12:17	50450	61	57/52	75/78	79/76	67/65	65/70		68.4	16.0	4.3	31.7	4.1	
42.5	53	1	7	12:33	50597	52	56/53	81/86	82/79	80/92	79/93		78.1	19.5	4.3	37.1	4.5	
42.5	53	2	7	12:33	50598	53	56/54	77/77	78/73	66/65	75/73		69.3	16.1	4.4	31.9	4.1	
43.5	59	1	8	12:48	50749	60	55/55	84/86	84/85	86/92	90/89		80.6	19.5	4.3	37.0	4.5	
43.5	59	2	8	12:48	50750	59	56/57	79/78	81/80	59/64	68/75		69.5	16.1	4.3	31.8	4.1	

Recorded by MARK Z

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Sheet 21	* STATE_CODE	05
LTPP Traffic Data	*SPS PROJECT_ID	0200
WIM System Test Truck Records 2 of 3	* DATE	10/28/2008

Rev. 08/31/2001

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
DONE [illegible]																		
54	65	1	9	13:04	50898	63	57/58	58/64	67/58	76/84	75/77							
54	65	1	9	13:04	50899	63	53/52	81/83	86/85	87/91	81/94		79.3	19.4	4.3	37.0	4.9	
54	62	2	9	13:04	50899	62	55/56	76/79	79/80	63/63	67/72		69.0	16.0	4.3	31.7	4.1	
55.5	55	1	10	13:19	51053	55	57/53	83/80	82/78	79/93	76/88		76.8	19.5	4.3	37.2	4.5	
55.5	53	2	10	13:19	51054	54	60/51	80/74	78/69	73/66	75/70		69.5	16.1	4.4	32.0	4.1	
59.5	58	1	11	14:12	51574	58	55/53	86/81	83/82	82/88	80/90		78.2	19.4	4.3	36.9	4.4	
59.5	55	2	11	14:12	51575	55	55/56	80/77	74/78	68/70	76/75		70.9	16.1	4.4	31.9	4.1	
61.5	64	1	12	14:27	51725	63	54/53	82/85	81/82	83/89	85/96		79.0	19.4	4.3	36.9	4.4	
61.5	62	2	12	14:27	51726	62	54/54	77/77	79/77	69/54	70/80		68.2	16.0	4.3	31.7	4.1	
61.5	55	1	13	14:44	51890	55	56/52	88/83	82/77	77/91	76/90		77.2	19.4	4.3	37.1	4.5	
61.5	53	2	13	14:44	51891	53	58/53	78/75	74/73	67/64	69/69		68.0	16.1	4.4	31.9	4.1	
62.5	60	1	14	15:01	52059	60	55/55	89/84	88/85	98/99	81/87		82.1	19.4	4.3	37.0	4.5	
62.5	59	2	14	15:01	52060	59	58/57	79/78	76/77	65/67	73/74		70.5	16.1	4.3	31.8	4.1	
64	64	1	15	15:17	52221	64	53/52	80/85	79/81	66/91	83/90		76.0	19.4	4.3	37.0	4.4	
64	62	2	15	15:17	52222	60	56/54	78/77	83/75	61/60	71/77		69.2	16.1	4.3	31.8	4.1	
35	53	1	16	8:43 AM	58626	54	55/51	78/77	82/79	74/92	75/86		74.7	19.5	4.3	37.2	4.4	

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Sheet 21	* STATE_CODE	05
LTPP Traffic Data	*SPS PROJECT_ID	0200
WIM System Test Truck Records 3 of 3	* DATE	10/29/2008

Rev. 08/31/2001

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
35	55	2	16	8:43 AM	58627	55	56/54	79/76	81/74	64/60	72/76		69.1	16.1	4.4	32.0	4.1	
37.5	60	1	17	8:59	58761	60	51/55	86/85	83/84	90/80	81/96		81.0	19.5	4.3	37.1	4.5	
37.5	59	2	17	8:59	58762	59	55/54	77/78	78/74	63/67	69/64		67.9	16.1	4.3	31.8	4.1	
41.5	64	1	18	9:15	58906	63	53/51	81/84	83/83	80/97	84/95		79.0	19.4	4.3	37.1	4.4	
41.5	63	2	18	9:15	58907	64	55/52	75/77	78/72	70/68	62/67		67.5	16.1	4.3	31.7	4.1	
44.5	55	1	19	9:31	59059	54	54/52	81/84	80/78	74/87	81/94		76.4	19.5	4.4	37.3	4.5	
44.5	54	2	19	9:31	59060	54	56/54	78/77	77/77	69/52	67/75		68.3	16.1	4.4	32.0	4.1	
45.5	57	1	20	9:47	59214	57	55/51	83/86	81/81	75/83	84/90		76.9	19.4	4.3	37.0	4.4	
45.5	59	2	20	9:47	59215	59	57/53	79/77	81/73	67/61	68/65		68.0	16.1	4.4	31.8	4.1	

Recorded by MARK Z

Checked by

Sheet 21	* STATE_CODE	05
LTPP Traffic Data	*SPS PROJECT_ID	0200
WIM System Test Truck Records 1 of 2	* DATE	10/29/2008

Rev. 08/31/2001

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
45.5	55	1	1	11:45	60335	55	55/56	81/83	85/80	77/89	75/88		76.8	19.4	4.3	37.2	4.5	
45.5	54	2	1	11:45	60336	54	59/52	78/77	78/73	69/65	71/72		69.4	16.1	4.4	31.9	4.1	
46.5	61	1	2	12:01	60490	59	56/56	87/87	82/84	88/93	84/84		80.1	19.5	4.3	37.1	4.5	
46.5	61	2	2	12:01	60491	60	59/60	76/81	77/81	64/74	70/70		71.2	16.1	4.3	31.7	4.1	
46.5	64	1	3	12:17	60657	64	55/56	84/85	83/85	86/93	84/93		80.3	19.5	4.3	37.0	4.4	
46.5	64	2	3	12:17	60658	64	58/53	77/78	74/75	64/62	60/70		67.1	16.1	4.4	31.6	4.1	
46.5	56	1	4	12:33	60809	56	57/56	87/88	81/81	88/10.1	78/87		80.4	19.5	4.3	37.2	4.5	
46.5	55	2	4	12:33	60810	54	61/55	81/76	75/74	61/62	77/70		69.1	16.1	4.4	31.9	4.1	
48	60	1	5	12:49	60961	60	56/56	88/88	87/86	87/89	87/89		80.4	19.5	4.3	37.1	4.5	
48	59	2	5	12:49	60962	59	58/58	78/80	79/79	66/64	70/79		71.2	16.1	4.3	31.8	4.1	
55	63	1	6	13:05	61114	63	55/54	87/84	86/85	89/89	77/89		78.6	19.5	4.3	37.0	4.4	
55	64	2	6	13:05	61115	64	58/56	77/80	74/77	64/65	71/74		69.6	16.1	4.3	31.8	4.1	
57.5	55	1	7	13:21	61264	55	56/56	93/88	82/81	72/86	81/97		78.3	19.4	4.3	37.2	4.5	
57.5	55	2	7	13:21	61265	55	65/58	80/77	82/75	70/61	69/78		70.9	16.1	4.4	32.0	4.0	
60	59	1	8	13:36	61441	59	53/58	89/88	88/86	87/95	81/86		81.1	19.4	4.3	36.9	4.5	
60	59	2	8	13:36	61442	59	60/61	80/79	76/81	67/67	66/78		71.5	16.1	4.3	31.8	4.1	

Recorded by MARK Z Checked by

Sheet 21	* STATE_CODE	05
LTPP Traffic Data	*SPS PROJECT_ID	0200
WIM System Test Truck Records 2 of 3	* DATE	10/29/2008

Rev. 08/31/2001

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
62.5	65	1	9	13:52	61589	65	55/53	83/85	82/83	84/92	83/97		79.7	19.5	4.3	37.1	4.4	
62.5	64	2	9	13:52	61590	64	58/55	76/79	[illegible]	[illegible]	69/70		67.8	16.0	4.3	31.6	4.1	
62.5		1	10						73/74	64/60								
62.5	56	2	10	14:07	61760	56	57/58	80/77	77/78	61/59	75/81		70.3	16.1	4.4	32.0	4.1	
65.5	59	1	11	14:17	106	59	57/58	87/87	84/85	72/80	79/88		78.5	19.4	4.3	36.9	4.5	
65.5	60	2	11	14:17	107	59	59/56	81/78	80/79	65/67	70/70		70.5	16.1	4.3	31.8	4.1	
66	64	1	12	14:33	286	64	50/55	83/87	84/85	85/90	79/93		79.2	19.4	4.3	37.1	4.4	
66	63	2	12	14:33	287	63	58/59	77/81	75/79	68/70	65/69		70.2	16.1	4.3	31.7	4.1	
64.5	55	1	13	14:49	457	55	58/56	80/82	81/81	81/90	78/94		78.0	19.4	4.3	37.1	4.5	
64.5	54	2	13	14:49	458	54	60/57	77/78	79/74	67/65	78/71		70.7	16.1	4.4	31.9	4.1	
70	64	1	14	15:20	792	64	51/55	85/88	80/84	79/94	80/89		78.5	19.4	4.3	37.1	4.4	
70	63	2	14	15:20	793	63	57/57	76/80	76/77	57/58	70/77		68.5	16.1	4.3	31.7	4.1	
65.5	55	1	15	15:35	952	55	54/56	84/86	82/84	71/88	82/100		78.8	19.4	4.3	37.1	4.4	
65.5	53	2	15	15:35	953	52	59/59	78/77	74/76	63/62	77/72		69.7	16.0	4.4	31.8	4.1	
64.5	60	1	16	15:51	1145	60	53/57	89/88	88/87	86/89	83/89		80.9	19.4	4.3	37.1	4.5	
64.5	59	2	16	15:51	1146	59	60/58	80/79	78/79	55/66	77/77		71.0	16.1	4.3	31.7	4.0	

Recorded by MARK B

Checked by

6420070022 _SPSWIM_TO_5_05_2.114_0200_post-Validation_sheet_21

Sheet 21	* STATE_CODE	05
LTPP Traffic Data	*SPS PROJECT_ID	0200
WIM System Test Truck Records 3 of 3	* DATE	10/29/2008

Rev. 08/31/2001

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
65	63	1	17	~~16:37~~ ~~15:49~~	1319	62	53/54	85/86	82/85	76/93	79/92		78.6	19.4	4.3	36.9	4.4	
65	62	2	17	~~16:37~~	1320	62	59/57	77/79	79/79	67/65	69/73		70.4	16.1	4.3	31.7	4.1	
63.5	54	1	18	16:24	1507	54	58/54	86/81	81/78	77/97	84/97		79.1	19.4	4.3	37.1	4.5	
63.5	54	2	18	16:24	1508	54	61/56	79/77	75/79	72/56	74/78		70.6	16.1	4.4	31.9	4.1	
63.5	65	1	19	16:57	1848	64	55/53	85/83	81/81	82/90	81/93		78.4	19.4	4.3	36.9	4.4	
63.5	64	2	19	16:57	1849	64	57/57	74/80	75/74	60/64	68/73		68.3	16.1	4.4	31.7	4.1	
58	~~58~~ 55	1	20	17:14	2034	55	58/55	~~78~~ 78/84	85/82	75/86	76/92		77.1	19.4	4.3	37.1	4.4	
58	~~54~~	2	20	17:14	2035	54	61/56	82/77	77/77	59/71	76/66		70.3	16.1	4.4	31.9	4.1	
57.5	59	1	21	17:30	2206	59	58/58	85/88	86/85	74/91	82/90		79.6	19.4	4.3	37.0	4.5	
57.5	59	2	21	17:30	2207	59	59/59	80/80	78/80	63/66	76/76		71.6	16.1	4.3	31.8	4.1	

Recorded by MARK Z

Checked by

TEST VEHICLE PHOTOGRAPHS FOR SPS WIM VALIDATION

October 28, 2008

STATE: ARKANSAS

SHRP ID: 050200

Photo 1 - 05_0200_Truck_1_Tractor_10_28_08.jpg

Photo 2 - 05_0200_Truck_1_Trailer_10_28_08.jpg

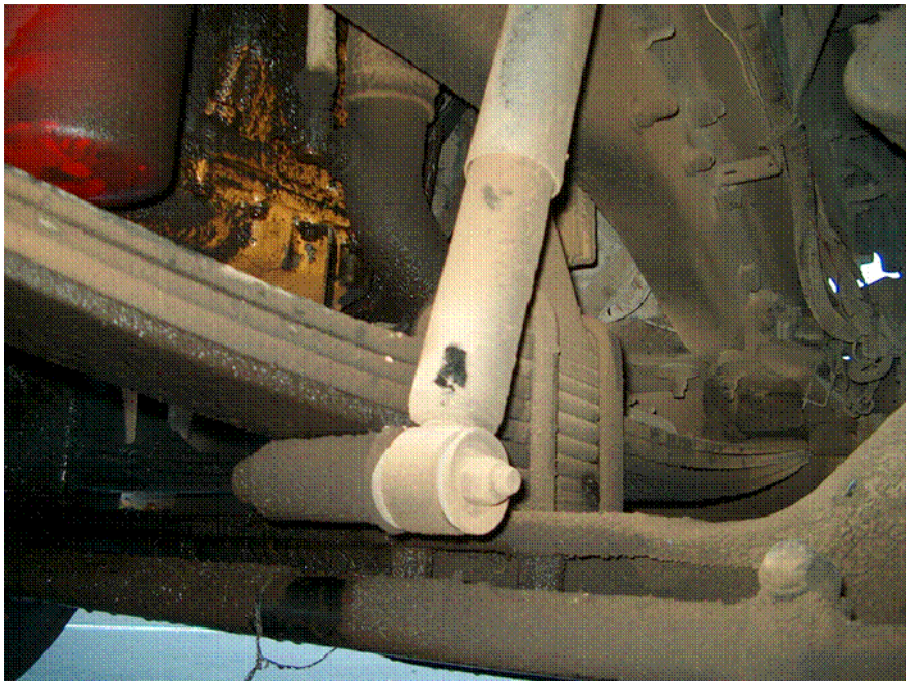

Photo 3 - 05_0200_Truck_1_Suspension_1_10_28_08.jpg

Photo 4 - 05_0200_Truck_1_Suspension_2_10_28_08.jpg

Photo 5 - 05_0200_Truck_1_Suspension_3_10_28_08.jpg

Photo 6 - 05_0200_Truck_2_Tractor_10_28_08.jpg

Photo 7 - 05_0200_Truck_2_Trailer_10_28_08.jpg

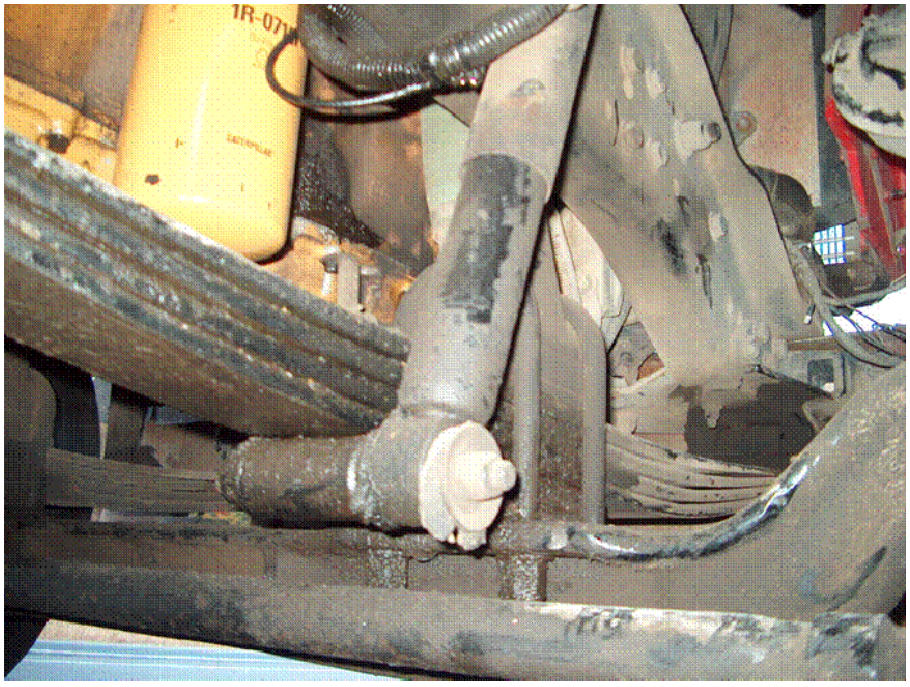

Photo 8 - 05_0200_Truck_2_Suspension_1_10_28_08.jpg

Photo 9 - 05_0200_Truck_2_Suspension_2_10_28_08.jpg

Photo 10 - 05_0200_Truck_2_Suspension_3_10_28_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

Arkansas SPS-2 (Lane 1)

Validation Visit – 29 October, 2008

Calibration factors for sensor #1:

	29 October 2008	28 October 2008	15 May 2007
Dynamic compensation	100	100	
Axle sensor distance	372	372	
80 kph	3475	3475	3133
88 kph	3576	3576	3224
96 kph	3582	3582	3229
104 kph	3420	3420	3063
112 kph	3413	3413	3077

Calibration factors for sensor #2:

	29 October 2008	28 October 2008	28 May 2008
Dynamic compensation			
Axle sensor distance			
80 kph	3475	3475	3295
88 kph	3576	3576	3391
96 kph	3582	3582	3396
105 kph	3420	3420	3243
112 kph	3413	3413	3236