Validation Report

Arizona, SPS-1
Task Order 15, CLIN 2
May 2 to 3, 2007

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1 Executive Summary

A visit was made to the Arizona 0100 on May 2 to 3, 2007 for the purposes of conducting a validation of the WIM system located on U.S. 93 at milepost 52.6. The SPS-1 is located in the righthand, northbound lane of a four-lane divided facility. 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 a relocation of a site that was assessed on March 3, 2004. The original site was 110 feet upstream of the current site. This is the first validation visit to this location. The site was installed before November 30, 2006 by International Road Dynamics (IRD).

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

The site is instrumented with bending plate and iSinc electronics. It is installed in portland cement concrete, 400 feet long.

The validation used the following trucks:

1) 5-axle tractor-trailer with a tractor having an air suspension and trailer with a standard rear tandem and air suspension loaded to 75,370 lbs., the "golden" truck.
2) 5-axle tractor semi-trailer with a tractor having an air suspension and a trailer with a standard rear tandem and an air suspension loaded to 63,250 lbs., the "partial" truck.

The validation speeds ranged from 43 to 65 miles per hour. The pavement temperatures ranged from 80 to 111 degrees Fahrenheit. The desired speed range was achieved during this validation. The desired 30 degree Fahrenheit temperature range was achieved.

Table 1-1 Post-Validation results – 040100 – 03-May-2007

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	-0.6 ± 8.5%	Pass
Tandem axles	±15 percent	0.5 ± 11.5%	Pass
Axle Groups	±15 percent	0.5 ± 11.5%	Pass
GVW	±10 percent	0.3 ± 5.9%	Pass
Speed	±1 mph [2 km/hr]	**-0.1 ± 1 mph**	**Fail**
Axle spacing	± 0.5 ft [150mm]	-0.1 ± 0.1 ft	Pass

The pavement condition appeared 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.

There has been no collection of profile data since after the last installation activities were completed at this site. Profile data collection is tentatively scheduled for mid- to late-summer 2007. An amended report incorporating the profile information will be prepared after it is received.

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%	98.8%	Pass
GVW	± 10%	100%	Pass

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

2 Corrective Actions Recommended

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

3 Post Calibration Analysis

This final analysis is based on test runs conducted May 3, 2007 from mid-morning to early afternoon at test site 040100 on U.S. 93. This SPS-1 site is at milepost 52.6 on the northbound, 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 a trailer with a standard rear tandem and an air suspension loaded to 75,370 lbs., the "golden" truck.
2. 5-axle tractor semi-trailer with a tractor having an air suspension and a trailer with a standard rear tandem and an air suspension loaded to 63,250 lbs., the "partial" truck.

Each truck made a total of 20 passes over the WIM scale at speeds ranging from approximately 43 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 80 to 111 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 the site met the conditions for research quality loading data. It did not meet the criteria for speed, but this is not sufficient to keep the site from providing research quality data.

Table 3-1 Post-Validation Results – 040100 – 03-May-2007

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	-0.6 ± 8.5%	Pass
Tandem axles	±15 percent	0.5 ± 11.5%	Pass
GVW	±10 percent	0.3 ± 5.9%	Pass
Speed	±1 mph [2 km/hr]	**-0.1 ± 1.0 mph**	**Fail**
Axle spacing	±0.5 ft [150mm]	-0.1 ± 0.1 ft	Pass

The test runs were conducted primarily during the late morning and afternoon hours under sunny conditions. The runs were also conducted at various speeds to determine the effects of these variables on the performance of the WIM scale. To investigate these effects, the dataset was split into three speed groups and three temperature groups. The distribution of runs 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 – 40 to 47 mph, Medium speed – 48 to 61 mph and High speed – 62 + mph. The three temperature groups were

created by splitting the runs between those at 75 to 90 degrees Fahrenheit for Low temperature, 91 to 99 degrees Fahrenheit for Medium temperature and 100 to 115 degrees Fahrenheit for High temperature.

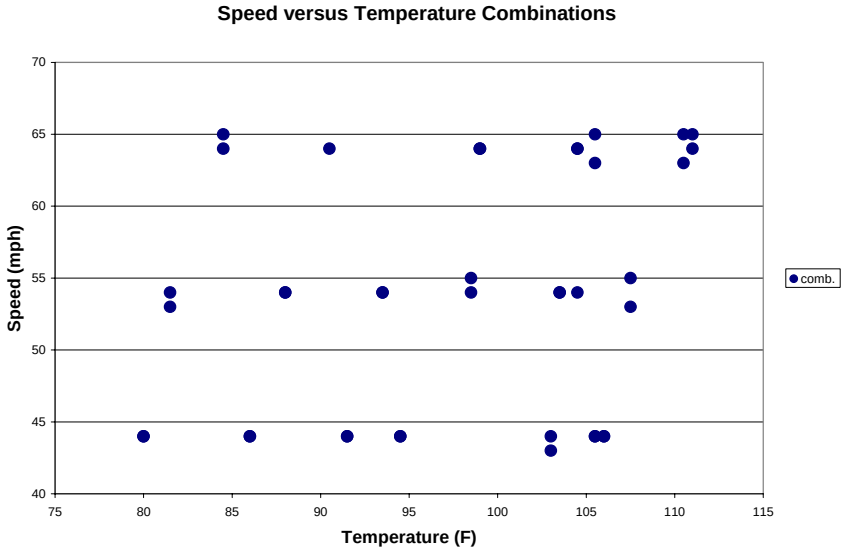


Figure 3-1 Post-Validation Speed-Temperature Distribution – 040100 – 03-May-2007

A series of graphs was developed to investigate visually any sign of a relationship between speed or temperature and the scale performance. Figure 3-2 shows the GVW Percent Error vs. Speed graph for the population as a whole.

The figure shows no particular trend in bias of the estimates. There is however slightly larger variation in error observed at the low and high speed ranges.

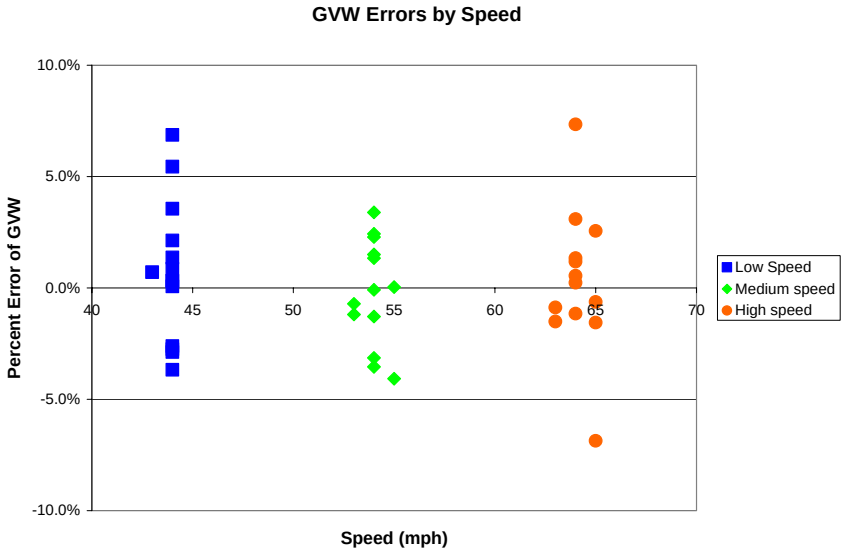


Figure 3-2 Post-validation GVW Percent Error vs. Speed – 040100 – 03-May-2007

Figure 3-3 shows the relationship between temperature and GVW percentage error. There is no indication of a trend in GVW error with temperature in the observed range.

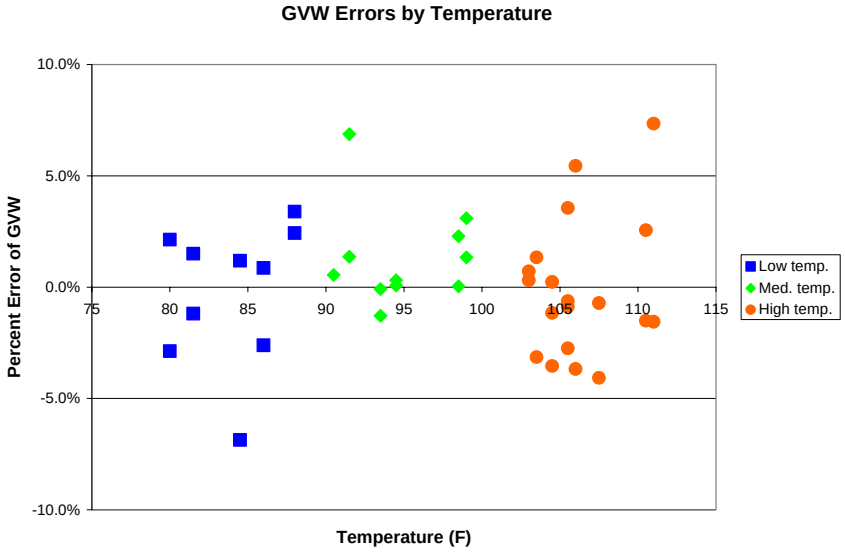


Figure 3-3 Post-Validation GVW Percent Error vs. Temperature – 040100 – 03-May-2007

Figure 3-4 shows the relationship between the drive tandem spacing errors in feet and speeds. This graph is used as a potential indicator of classification errors due to failure to correctly identify spacings on a vehicle. Since the most common reference value is the drive tandem on a Class 9 vehicle, this is the spacing evaluated and plotted for validations. The equipment has a tendency to underestimate drive tandem spacings. The tendency is slightly greater at the high speed range than the low and medium ranges.

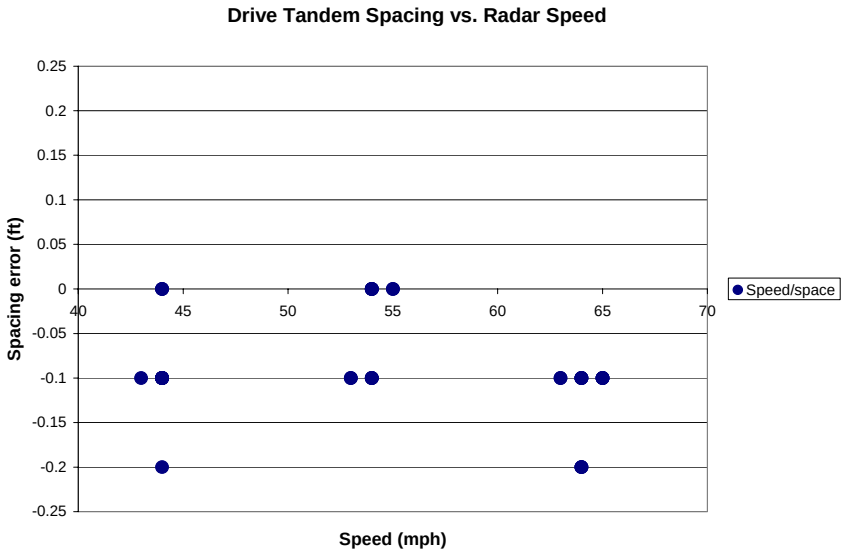


Figure 3-4 Post-Validation Spacing vs. Speed – 040100 – 03-May-2007

3.1 Temperature-based Analysis

The three temperature groups were created by splitting the runs between those at 75 to 90 degrees Fahrenheit for Low temperature, 91 to 99 degrees Fahrenheit for Medium temperature and 100 to 115 degrees Fahrenheit for High temperature.

Table 3-2 Post-Validation Results by Temperature Bin – 040100 – 03-May-2007

Element	95% Limit	Low Temperature 75 to 90 °F	Medium Temperature 91 to 99 °F	High Temperature 100 to 115 °F
Steering axles	±20 %	1.5 ± 5.5%	-0.8 ± 10.3%	-1.7 ± 9.3%
Tandem axles	±15 %	-0.5 ± 13.7%	1.8 ± 11.7%	0.2 ± 11.1%
GVW	±10 %	-0.2 ± 7.1%	1.3 ± 4.9%	-0.1 ± 6.5%
Speed	±1 mph	0.0 ± 1.1 mph	-0.3 ± 1 mph	0.1 ± 1.1 mph
Axle spacing	± 0.5 ft	-0.1 ± 0.1 ft	-0.1 ± 0.2 ft	-0.1 ± 0.1 ft

Table 3-2 shows the variation in results by temperature. The steering axle weights go from overestimated to underestimated as temperatures increase. There is overestimation rather than underestimation of GVW in the medium temperature group for the observed range but the variability is essentially the same. The tandem axle errors show the same tendencies as the GVW errors.

Figure 3-5 is the distribution of GVW Errors versus Temperature by Truck graph. There is little if any impact on the errors by truck from temperature variation. The unequal distribution of temperature observations over the range makes it unreasonable to discuss variability of errors by truck due to temperature.

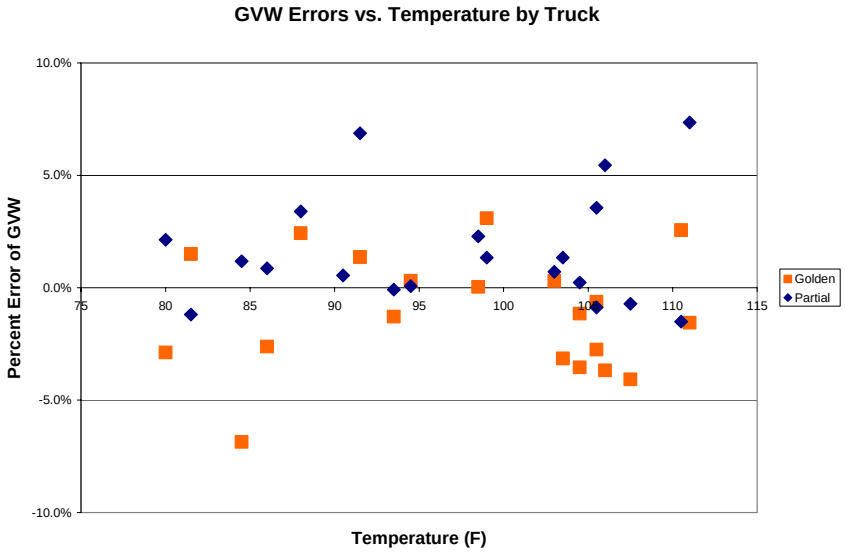


Figure 3-5 Post-Validation GVW Percent Error vs. Temperature by Truck – 040100 – 03-May-2007

Figure 3-6 shows the relation between steering axle errors and temperature. This graph is included due to the frequent use of steering axle weights of Class 9 vehicles for calibration. This site does not use auto-calibration. The steering axles in this graph are associated only with Class 9 vehicles. Steering axles appear to tend toward underestimation as temperatures get higher in the observed range.

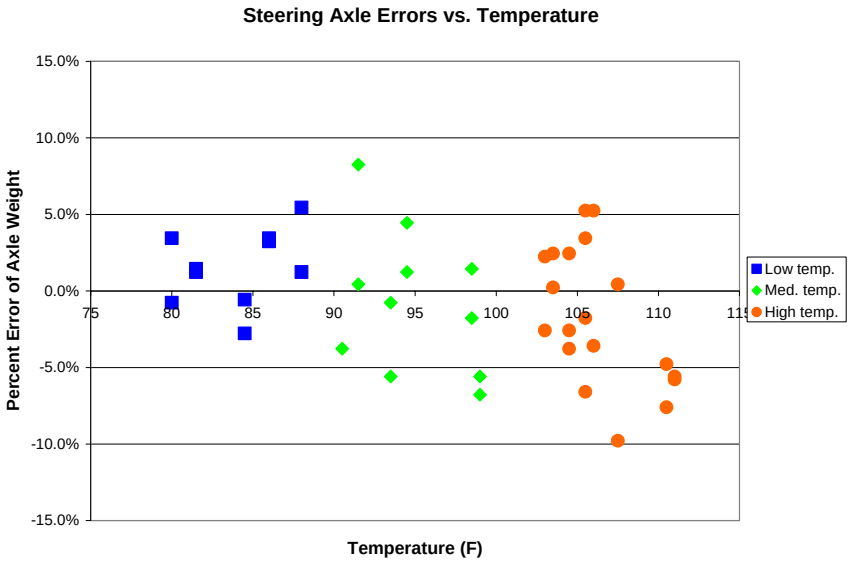


Figure 3-6 Post-Validation Steering Axle Error vs. Temperature by Group – 040100 – 03-May-2007

3.2 Speed-based Analysis

The three speed groups were divided using 40 to 47 mph for Low speed, 48 to 61 mph for Medium speed and 62+ mph for High speed.

Table 3-3 Post-Validation Results by Speed Bin – 040100 – 03-May-2007

Element	95% Limit	Low Speed 40 to 47 mph	Medium Speed 48 to 61 mph	High Speed 62+ mph
Steering axles	±20 %	2.4 ± 6.9%	-0.1 ± 8.4%	-4.5 ± 4.6%
Tandem axles	±15 %	0.3 ± 9.8%	-0.3 ± 8.7%	1.4 ± 16.2%
GVW	±10 %	0.7 ± 6.7%	-0.2 ± 5.2%	0.3 ± 7.1%
Speed	±1 mph	-0.2 ± 0.9 mph	0.2 ± 1.2 mph	-0.1 ± 1.1 mph
Axle spacing	± 0.5 ft	-0.1 ± 0.1 ft	0.0 ± 0.1 ft	-0.1 ± 0.1 ft

Table 3-3 indicates little difference in the reported values as a function of speed except at high speeds. In going from the medium to the high speed group the variability of the tandem axle weights nearly doubles. The GVW error variability increases by nearly fifty percent.

Figure 3-7 shows that the trends with speed are influenced by the individual trucks and a couple of outliers. The Golden truck (squares) GVW errors tend to go from underestimated to overestimated as speeds increase. The partial truck (diamonds) GVE errors tend to be overestimated by smaller and smaller amounts. Except for the two outliers, the variability by truck tends to decrease with increasing speed.

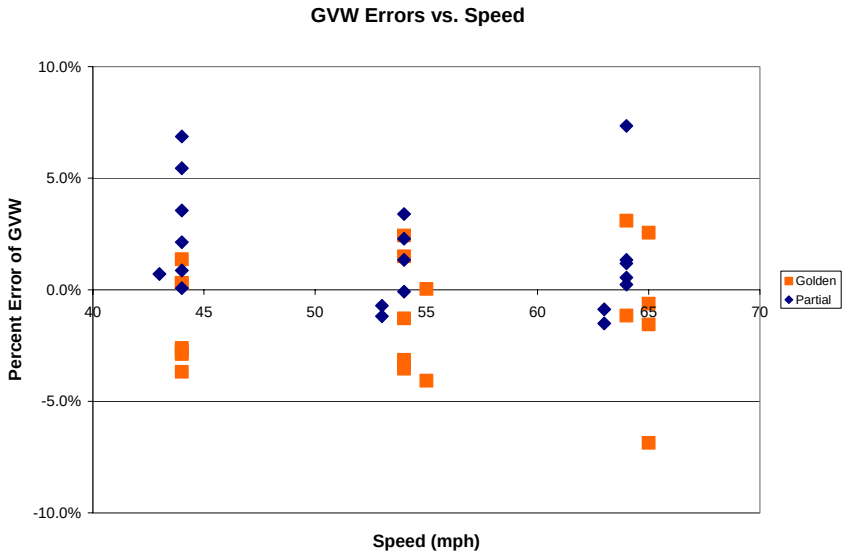


Figure 3-7 Post-Validation GVW Percent Error vs. Speed by Truck – 040100 – 03-May-2007

Figure 3-8 shows the relation between steering axle errors and speed. This graph is included due to the frequent use of steering axle weights of Class 9 vehicles for auto-calibration. This site does not use auto-calibration. The steering axles in this graph are associated only with Class 9 vehicles. Steering axle weights go from overestimated and somewhat variable to underestimated and less variable as speed increases.

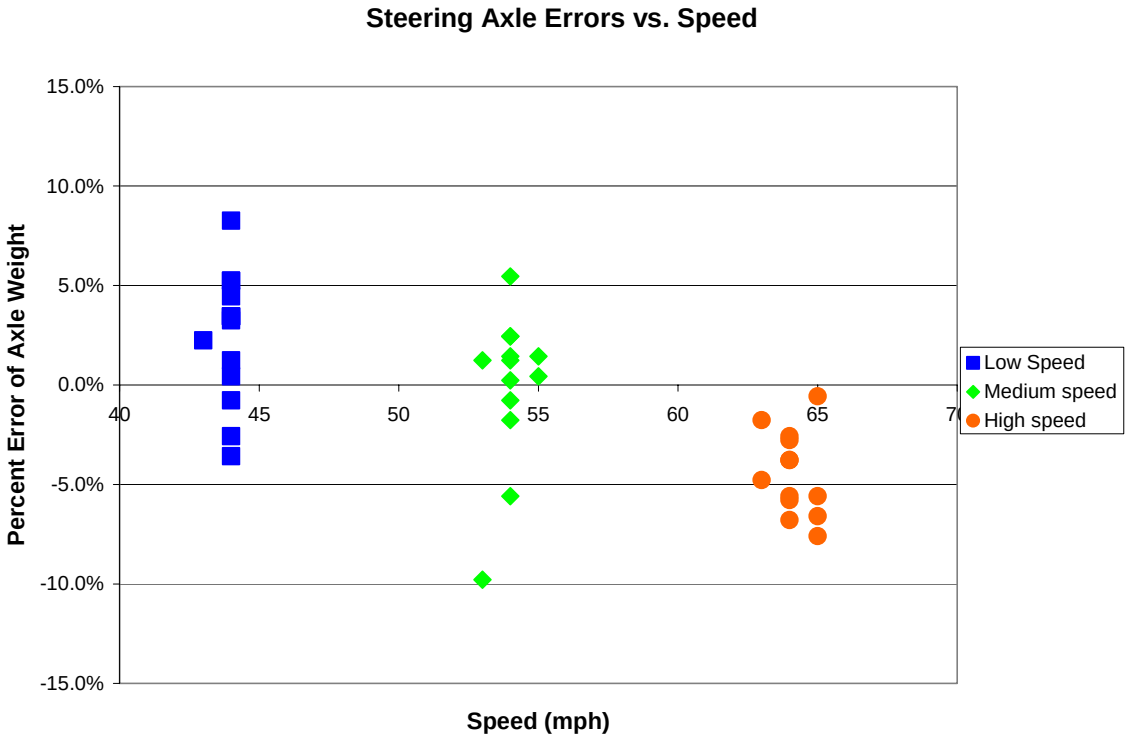


Figure 3-8 Post-Validation Steering Axle Percent Error vs. Speed by Group – 040100 – 03-May-2007

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 3 hours of data 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 0.0 percent unknown vehicles and 0.0 percent unclassified vehicles.

The second check is the ability of the algorithm to correctly distinguish between truck classes with no more than 2% errors in such classifications. Table 3-4 has the classification error rates by class. The overall misclassification rate is 0.0 percent.

Table 3-4 Truck Misclassification Percentages for 040100 – 03-May-2007

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

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 040100 – 03-May-2007

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

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

3.4 Evaluation by ASTM E-1318 Criteria

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

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

Characteristic	Limits for Allowable Error	Percent within Allowable Error	Pass/Fail
Single Axles	± 20%	100%	Pass
Axle Groups	± 15%	98.8%	Pass
GVW	± 10%	100%	Pass

4 Pavement Discussion

There has been no collection of profile data since after the last installation activities were completed at this site. Profile data collection is tentatively scheduled for mid- to late-summer 2007. An amended report incorporating the profile information will be prepared after it is received.

4.1 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.

4.2 Vehicle-pavement Interaction Discussion

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

The prior installation is located approximately 110 feet following the present site and does not affect the truck motions as they cross the WIM scale area.

5 Equipment Discussion

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

Since the site assessment the equipment has been replaced under the SPS Pooled Fund Study Phase II contact.

5.1 Pre-Evaluation Diagnostics

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

5.2 Calibration Process

The equipment required four iterations of the calibration process between the initial 40 runs and the final 40 runs. The third iteration was performed to test the proper operation of a new SSM board that was installed by the task leader as directed by an IRD representative. The board was replaced due to the results of the pre-validation and the first two calibration iterations.

For this equipment, there are 5 speed designated weight compensation factors for each sensor 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, and if the weights are underestimated, these factors are increased by the same percentage as the mean error.

The original calibration factors for this site that were in place prior to the Pre-validation were as follows:

Speed bin	Sensor 1	Sensor 2
1	3700	3700
2	3700	3700
3	3700	3700
4	3700	3700
5	3700	3700

5.2.1 Calibration Iteration 1

Based on the results from the Pre-Validation, which produced a mean GVW error range of -15.0% to -50.0%, the compensation factors were adjusted to compensate for underestimations of all weights.

Computations for the changes and equipment factor changes were made by the Validation Task Leader. The adjustments to the system calibration factors are shown below:

Speed bin	Sensor 1	Sensor 2
1	4684	4684
2	4805	4805
3	5000	5000
4	5285	5285
5	5523	5523

The results of the first iteration are shown in Table 5-1 and Figure 5-1.

Table 5-1 Calibration Iteration 1 Results – 040100 – 02-May-2007 (1:35:00 PM)

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	2.4 ± 17.2%	Pass
Axle Groups	±15 percent	**-1.0 ± 31%**	**Fail**
GVW	±10 percent	**-0.8 ± 13.9%**	**Fail**
Speed	±1 mph	**0.2 ± 1.4 mph**	**Fail**
Axle spacing	± 0.5 ft	-0.1 ± 0 ft	Pass

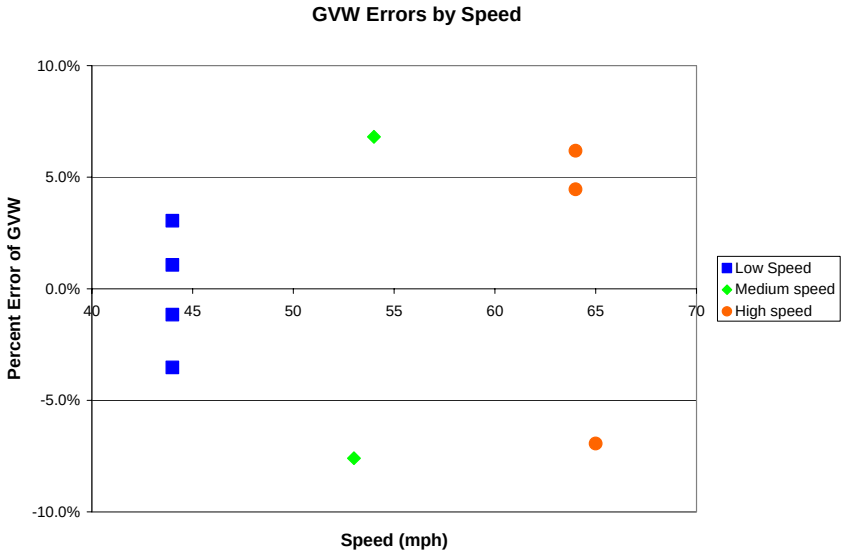


Figure 5-1 Calibration Iteration 1 GVW Percent Error vs. Speed Group – 040100 – 02-May-2007 (1:35:00 PM)

5.2.2 Calibration Iteration 2

Based on the results from the calibration iteration 1, which produced a mean GVW error range of -8.0% to +8.0%, the compensation factors were adjusted to compensate for over- and underestimations of weights.

Computations for the changes and equipment factor changes were made by the Validation Task Leader. The adjustments to the system calibration factors are shown below:

Speed bin	Sensor 1	Sensor 2
1	4628	4628
2	4755	4755
3	4955	4955
4	5271	5271
5	5545	5545

The results of the second iteration are shown in Table 5-2 and Figure 5-2.

Table 5-2 Calibration Iteration 2 Results – 040100 – 03-May-2007 (7:28:00 AM)

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	1.3 ± 16.8%	Pass
Tandem axles	±15 percent	**-5.6 ± 23.9%**	**Fail**
GVW	±10 percent	**-4.8 ± 20.7%**	**Fail**
Speed	±1 mph [2 km/hr]	**-0.1 ± 1.1 mph**	**Fail**
Axle spacing	± 0.5 ft [150mm]	-0.1 ± 0.1 ft	Pass

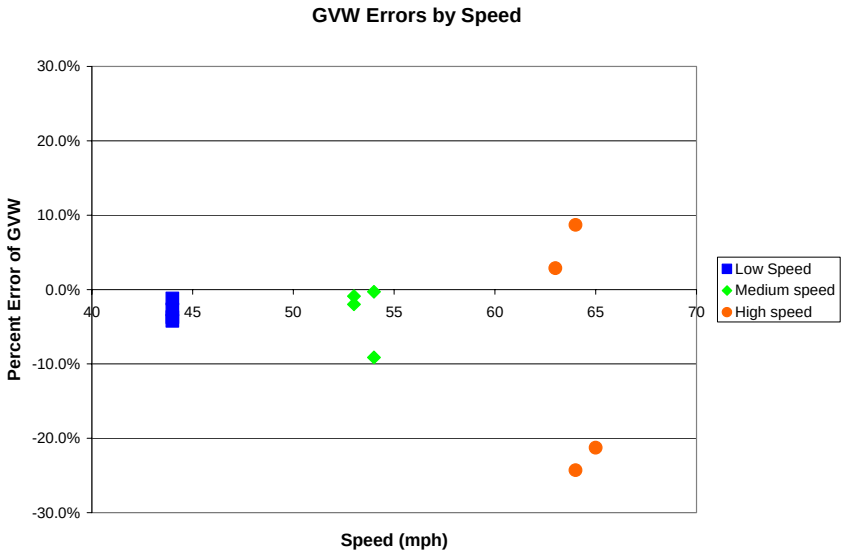


Figure 5-2 Calibration Iteration 2 GVW Percent Error vs. Speed Group – 040100 – 03-May-2007 (7:28:00 AM)

5.2.3 Calibration Iteration 3

Following the second iteration, which produced a mean GVW error range of -25.0% to +10.0%, IRD was contacted for consultation. The recommendation was made by the IRD representative to replace the SSM board, which processes the signals from the weighpads. The board that was installed had previously been utilized at the site and remained in the cabinet in an unused slot. The board was replaced by the Validation Task Leader and a set of test runs was performed to verify the proper operation of the system. New compensation factors were provided by IRD, which are shown below:

Speed bin	Sensor 1	Sensor 2
1	2800	2800
2	2905	2905
3	3015	3015
4	3080	3080
5	3150	3150

The results of the third iteration are shown in Table 5-3 and Figure 5-3.

Table 5-3 Calibration Iteration 3 Results – 040100 – 03-May-2007 (8:53:00 AM)

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	**-24.6 ± 10.2%**	**Fail**
Tandem axles	±15 percent	**-22.6 ± 7.7%**	**Fail**
GVW	±10 percent	**-22.9 ± 5.7%**	**Fail**
Speed	±1 mph [2 km/hr]	**0.1 ± 1.1 mph**	**Fail**
Axle spacing	± 0.5 ft [150mm]	-0.1 ± 0.1 ft	Pass

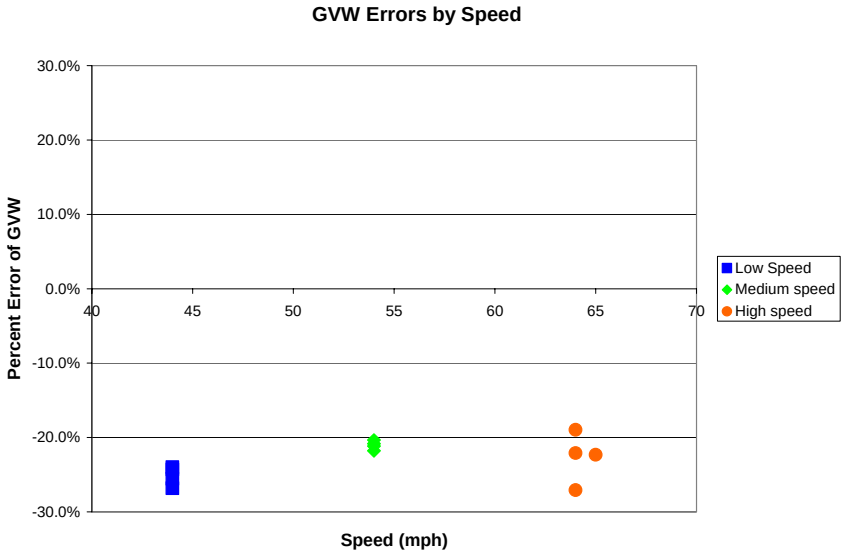


Figure 5-3 Calibration Iteration 3 GVW Percent Error vs. Speed Group – 040100 – 03-May-2007 (8:53:00 AM)

5.2.4 Calibration Iteration 4

Based on the results from the third iteration, which produced a mean GVW error range of -28.0% to -19.0%, the compensation factors were adjusted to compensate for underestimations of all weights.

Computations for the changes and equipment factor changes were made by the Validation Task Leader. The adjustments to the system calibration factors are shown below:

Speed bin	Sensor 1	Sensor 2
1	3743	3743
2	3773	3773
3	3817	3817
4	4024	4024
5	4283	4283

The results of the fourth iteration are shown in Table 5-4 and Figure 5-4.

Table 5-4 Calibration Iteration 4 Results – 040100 – 03-May-2007 (9:52:00 AM)

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	-0.8 ± 6.1%	Pass
Tandem axles	±15 percent	0.1 ± 11.8%	Pass
GVW	±10 percent	0.1 ± 4.5%	Pass
Speed	±1 mph [2 km/hr]	0.1 ± 0.7 mph	Pass
Axle spacing	± 0.5 ft [150mm]	-0.1 ± 0.1 ft	Pass

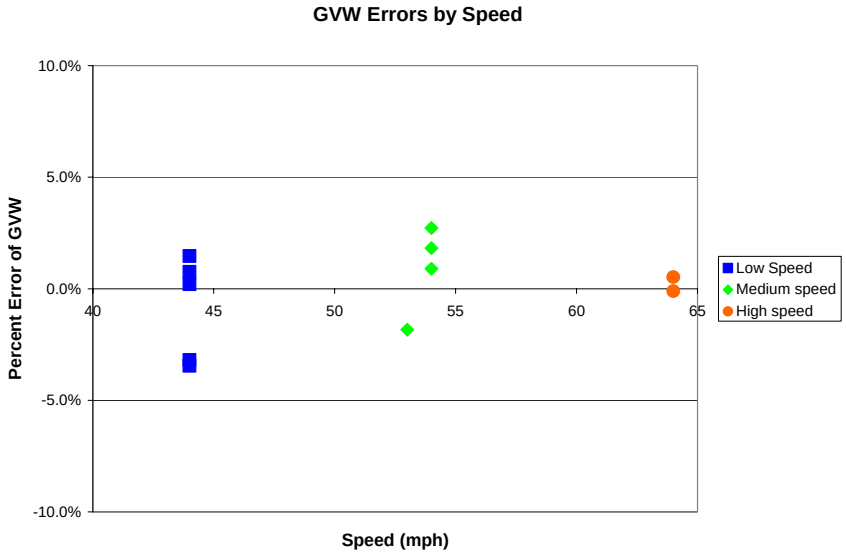


Figure 5-4 Calibration Iteration 4 GVW Percent Error vs. Speed Group – 040100 – 03-May-2007 (9:52:00 AM)

Mean errors for all weights were deemed acceptable for research quality data. Thirty more runs were performed to complete the required 40 post-validation runs.

5.3 Summary of Traffic Sheet 16s

This site has validation information from previous visits as well as the current one in the tables below. Table 5-5 has the information found in TRF_CALIBRATION_AVC for Sheet 16s submitted prior to this validation as well as the information for the current visit

Table 5-5 Classification Validation History – 040100 – 03-May-2007

Date	Method	Mean Difference				Percent Unclassified
		Class 9	Class 8	Other 1	Other 2	
5/3/2007	Manual	0	0			0
5/2/2007	Manual	0				0
6/13/2005	Manual					
6/1/2004	Manual					
3/3/2004	Manual	0	1800			22
6/2/2003	Manual					

Table 5-6 has the information found in TRF_CALIBRATION_WIM for Sheet 16s submitted prior to this validation as well as the information for the current visit.

Table 5-6 Weight Validation History – 040100 – 03-May-2007

Date	Method	Mean Error and (SD)		
		GVW	Single Axles	Tandem Axles
5/3/2007	Test Trucks	0.3 (2.9)	-0.6 (4.2)	0.5 (5.8)
5/2/2007	Test Trucks	-26.1 (7.3)	-22.4 (8.5)	-26.5 (9.1)
6/13/2005	Test Trucks	1.8 (1.0)	-8.4 (2.7)	3.3 (2.9)
6/1/2004	Test Trucks	0.8 (0.8)	4.6 (0.5)	2.0 (0.2)
6/2/2003	Test Trucks	1.4 (1.2)	1.3 (2.9)	0.7 (2.7)

There was new equipment installed at this site in mid- to late 2006. The data from the installation date to the validation date is clearly not of research quality. There will be not quite 210 days of data from 2007 after the validation even without equipment problems.

5.4 Projected Maintenance/Replacement Requirements

This site is scheduled to have semi-annual maintenance visits as a part of the LTPP SPS WIM Pooled Fund Phase II contract.

6 Pre-Validation Analysis

This pre-validation analysis is based on test runs conducted May 2, 2007 from mid-morning to noon at 040100. This SPS-1 site is at milepost 52.6 on U.S. 93 in the northbound, righthand of a four-lane divided facility. No auto-calibration was used during test runs. The two trucks used for initial validation and for the subsequent calibration 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 76,190 lbs.
2. 5-axle tractor semi-trailer with a tractor having an air suspension and a trailer with a standard rear tandem and an air suspension loaded to 63,850 lbs. , the partial truck.

For the initial validation each truck made a total of 20 passes over the WIM scale at speeds ranging from approximately 44 to 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 80 to 100 degrees Fahrenheit. The desired 30 degree Fahrenheit temperature range was not achieved. The computed values of 95% confidence limits of each statistic for the total population are in Table 6-1.

The site catastrophically failed all of the requirements for research quality loading data on initial validation. The weights were underestimated by nearly twenty-five percent and

variability for all elements exceeded the allowable ranges. Due to the level of failure additional investigation of the data on the basis of reported left and right wheel weights was undertaken. The discussion is included in the appendix to the report. Since the actual static wheel weights were not available no conclusion can be drawn from the observed conditions.

Table 6-1 Pre-Validation Results – 040100 – 02-May-2007

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	**-22.4 ± 17.2%**	**Fail**
Tandem axles	±15 percent	**-26.5 ± 18.2%**	**Fail**
GVW	±10 percent	**-26.1 ± 14.8%**	**Fail**
Speed	±1 mph [2 km/hr]	**-0.2 ± 1 mph**	**Fail**
Axle spacing	± 0.5 ft [150mm]	-0.1 ± 0.1 ft	Pass

The test runs were conducted primarily during the morning and early afternoon hours under partially cloudy skies, resulting in a narrow range of pavement temperatures. The runs were also conducted at various speeds to determine the effects of these variables on the performance of the WIM scale. To investigate these effects, the dataset was split into three speed groups and two temperature groups. The distribution of runs 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. Prolonging the initial validation period for a range a temperatures was considered unimportant given the magnitude of the observed errors and the insensitivity of those errors to temperature.

The three speed groups were divided into 40 to 47 mph for Low speed, 48 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 80 to 92 degrees Fahrenheit for Low temperature and 93 to 101 degrees Fahrenheit for High temperature.

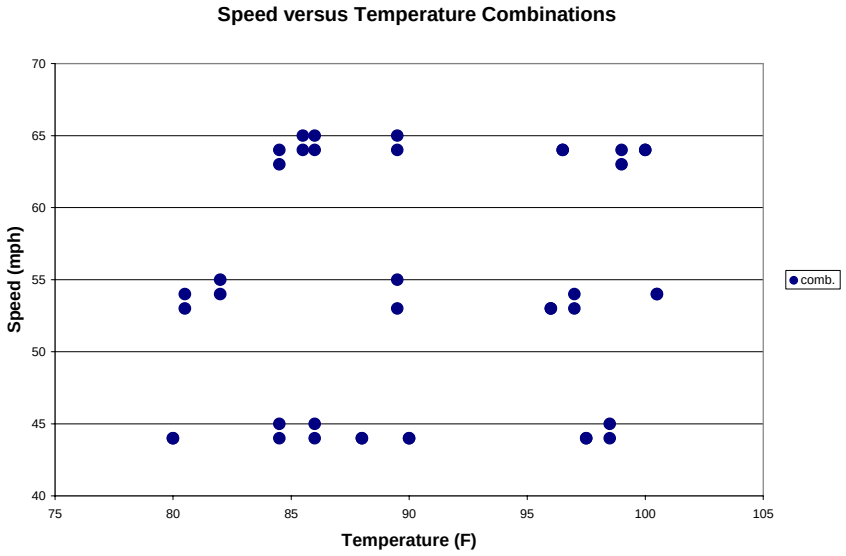


Figure 6-1 Pre-Validation Speed-Temperature Distribution – 040100 – 02-May-2007

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

Figure 6-2 shows the GVW Percent Error vs. Speed graph for the population as a whole. Figure 6-2 shows not only the underestimation of weights but the increase in underestimation as the speed increased as well as increasing variability.

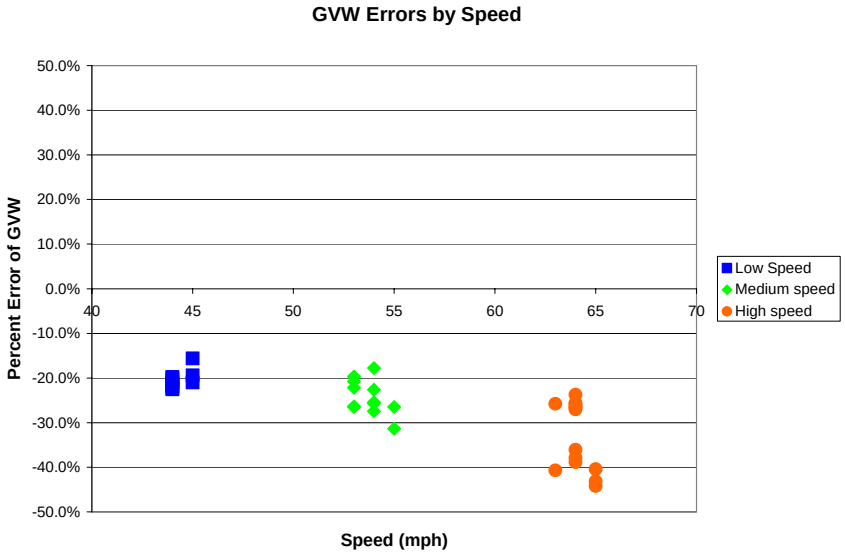


Figure 6-2 Pre-validation GVW Percent Error vs. Speed – 040100 – 02-May-2007

Figure 6-3 shows the relationship between temperature and GVW percentage error. The figure shows that the observed errors have no relationship to the temperature variation.

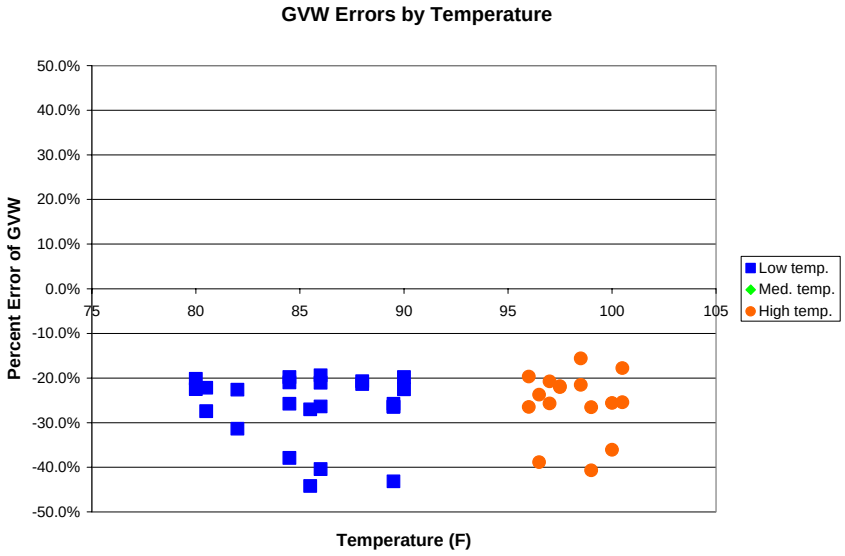


Figure 6-3 Pre-Validation GVW Percent Error vs. Temperature – 040100 – 02-May-2007

Figure 6-4 shows the relationship between the drive tandem spacing errors in feet and speeds. This graph is used as a potential indicator of classification errors due to failure to correctly identify spacings on a vehicle. Since the most common reference value is the drive tandem on a Class 9 vehicle, this is the spacing evaluated and plotted for validations. The spacing errors observed in Figure 6-4 appear only at the high speed range.

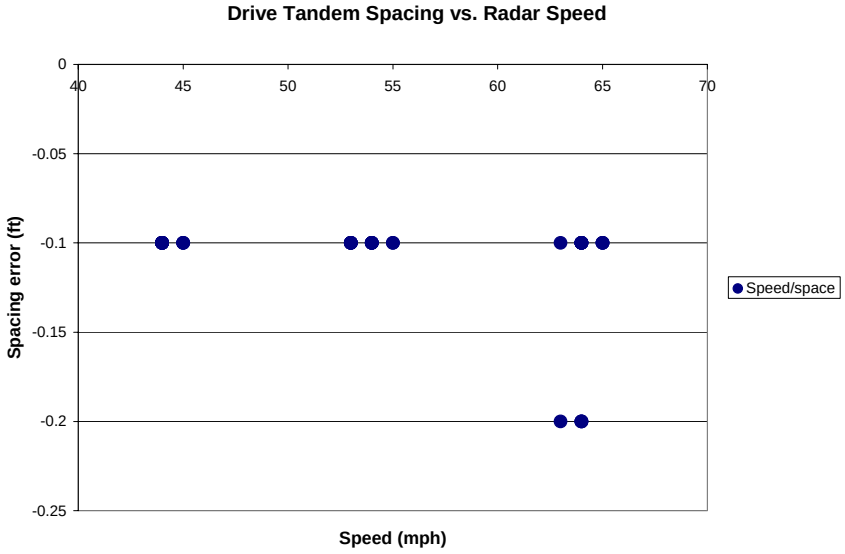


Figure 6-4 Pre-Validation Spacing vs. Speed - 040100 – 02-May-2007

6.1 Temperature-based Analysis

The two temperature groups were created by splitting the runs between those at 80 to 92 degrees Fahrenheit for Low temperature and 93 to 101 degrees Fahrenheit for High temperature.

Table 6-2 Pre-Validation Results by Temperature Bin – 040100 – 02-May-2007

Element	95% Limit	Low Temperature 80 to 92 °F	High Temperature 93 to 101 °F
Steering axles	±20 %	-22.2 ± 17.6%	-22.7 ± 18.8%
Tandem axles	±15 %	-27.0 ± 18.8%	-25.8 ± 18.1%
GVW	±10 %	-26.5 ± 15.6%	-25.5 ± 15.4%
Speed	±1 mph	-0.3 ± 0.9 mph	0.0 ± 1.1 mph
Axle spacing	± 0.5 ft	-0.1 ± 0.1 ft	-0.1 ± 0.1 ft

Table 6-2 shows no particular influence of temperature on the observed errors.

Figure 6-5 shows the distribution of GVW Errors versus Temperature by Truck. Figure 6-5 shows different variability in errors by truck but no trend in the error by truck with temperature.

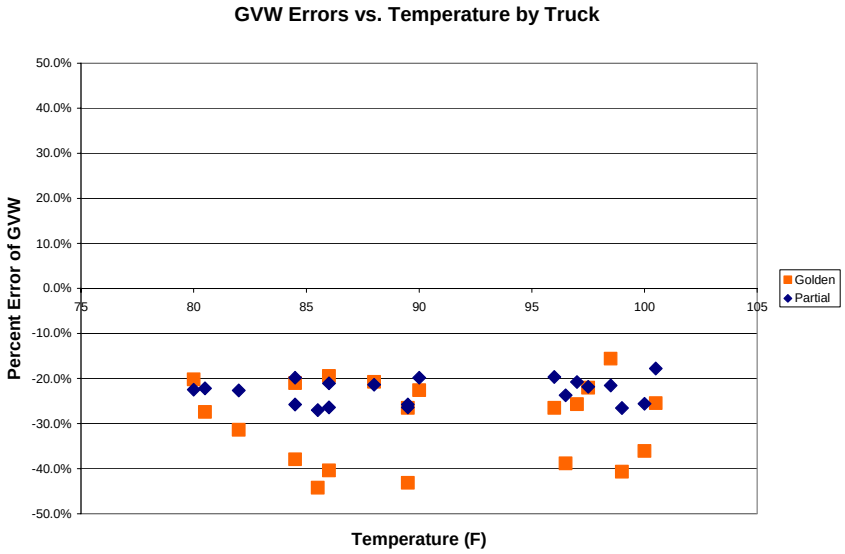


Figure 6-5 Pre-Validation GVW Percent Error vs. Temperature by Truck – 040100 – 02-May-2007

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

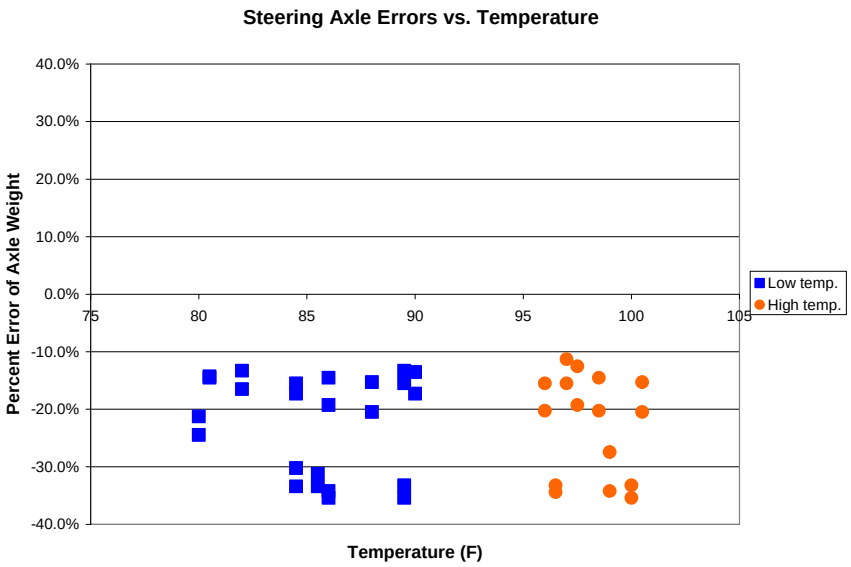


Figure 6-6 Pre-Validation Steering Axle Error vs. Temperature by Group – 040100 – 02-May-2007

6.2 Speed-based Analysis

The speed groups were divided as follows: Low speed – 40 to 47 mph, Medium speed – 48 to 61 mph and High speed – 62+ mph.

Table 6-3 Pre-Validation Results by Speed Bin – 040100 – 02-May-2007

Element	95% Limit	Low Speed 40 to 47 mph	Medium Speed 48 to 61 mph	High Speed 62+ mph
Steering axles	±20 %	-17.5 ± 7.4%	-15.5 ± 5.9%	-33.2 ± 4.8%
Tandem axles	±15 %	-21.2 ± 6.2%	-25.7 ± 12.2%	-32.6 ± 24%
GVW	±10 %	-20.7 ± 3.8%	-24.4 ± 8.4%	-33.0 ± 16.7%
Speed	±1 mph	-0.3 ± 1 mph	0.0 ± 1.3 mph	-0.1 ± 0.8 mph
Axle spacing	± 0.5 ft	-0.1 ± 0.0 ft	-0.1 ± 0 ft	-0.1 ± 0.1 ft

Table 6-3 shows how the errors vary by speed group. For the GVW errors the amount of error increases as speed increases. Additionally, the variability of the error approximately doubles when going from the low to the medium group and then again from the medium to the high group. The same pattern shows for tandem axles. For steering axles the error increases as speed increases but the variability decreases.

Figure 6-7 shows that both trucks follow the same trend. The golden truck (squares) has larger underestimates than the partial truck (diamonds) with increasing speed. At the low speed both trucks have approximately the same level of underestimation. Both trucks also appear to have the same degree of variability at any given speed group.

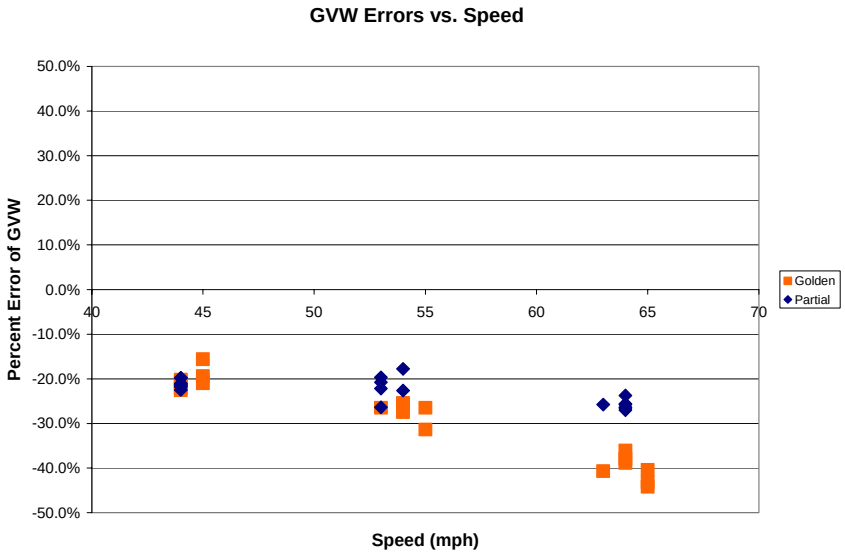


Figure 6-7 Pre-Validation GVW Percent Error vs. Speed Group - 040100 –02-May-2007

Figure 6-8 shows the relation between steering axle errors and speed. This graph is included due to the frequent use of steering axle weights of Class 9 vehicles for calibration. This site does not use auto-calibration. The steering axles in this graph are associated only with Class 9 vehicles. Figure 6-8 shows that for steering axles the high speed group is where a major change in the size of the under estimate occurs.

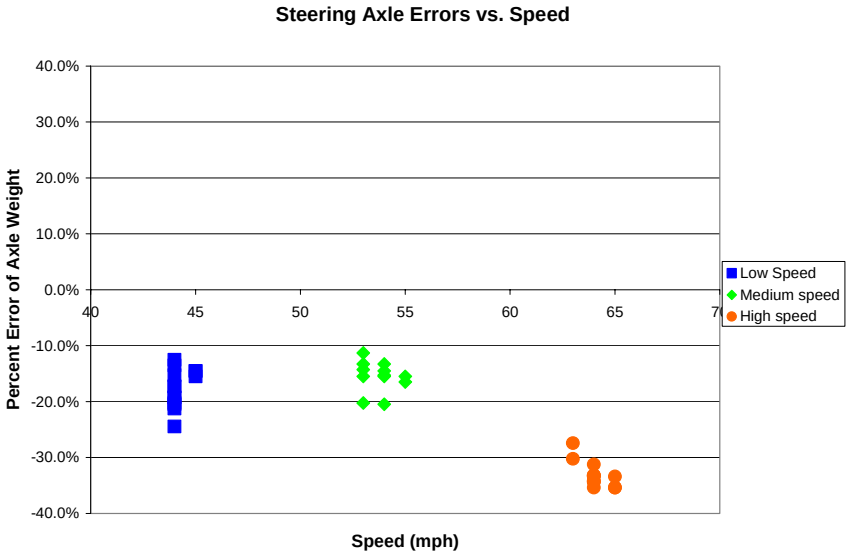


Figure 6-8 Pre-Validation Steering Axle Percent Error vs. Speed Group - 040100 – 02-May-2007

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 three hours of data 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 6-4 has the classification error rates by class. The overall misclassification rate is .0 percent.

Table 6-4 Truck Misclassification Percentages for 040100 – 02-May-2007

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

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

Table 6-5 Truck Classification Mean Differences for 040100 – 02-May-2007

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

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

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

6.4 Evaluation by ASTM E-1318 Criteria

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

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

Characteristic	Limits for Allowable Error	Percent within Allowable Error	Pass/Fail
Single Axles	± 20%	50%	Fail
Axle Groups	± 15%	2.5%	Fail
GVW	± 10%	0%	Fail

7 Data Availability and Quality

As of May 2, 2007 this site does not have at least 5 years of research quality data. Research quality data is defined to be at least 210 days in a year of data of known calibration meeting LTPP's precision requirements.

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

The amount and coverage for the site is shown in Table 7-1. The value for months is a measure of the seasonal variation in the data. The indicator of coverage indicates whether day of week variation has been accounted for on an annual basis. As can be seen from the table only 1994-1996, 1998-2000 and 2005 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 four additional years of research quality data are needed to meet the goal of a minimum of 5 years of research weight data. The date for 2005 is both sufficient in quantity and has the necessary validation information to be considered research quality data.

Table 7-1 Amount of Traffic Data Available 040100 – 02-May-2007

Year	Classification Days	Months	Coverage	Weight Days	Months	Coverage
1994	352	12	Full week	354	12	Full week
1995	340	12	Full week	344	12	Full week
1996	345	12	Full week	346	12	Full week
1997	183	6	Full week	184	6	Full week
1998	331	11	Full week	294	12	Full week
1999				313	12	Full week
2000	258	11	Full week	261	11	Full week
2001	144	5	Full week	150	7	Full week
2003	56	2	Full week	178	7	Full week
2004	164	7	Full week	165	7	Full week
2005	357	12	Full week	364	12	Full week

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. The data was not available for download and preparation of the relevant graphs and statistics as of May 15, 2007.

8 Data Sheets

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

Sheet 19 – Truck 1 – 3S2 loaded air suspension (4 pages)
Sheet 19 – Truck 2 – 3S2 partially loaded (4 pages)

Sheet 20 – Speed and Class verification Pre-Validation (1 page)
Sheet 20 – Speed and Classification verification – Post-Validation (1 page)

Sheet 21 – Pre-validation (3 pages)
Sheet 21 – Calibration Iteration 1 (1 page)
Sheet 21 – Calibration Iteration 2 (1 page)
Sheet 21 – Calibration Iteration 3 (1 page)
Sheet 21 – Calibration Iteration 4 (1 page)
Sheet 21 – Post-validation (3 pages)

Calibration Iteration 1 Worksheets (2 pages)
Calibration Iteration 2 Worksheets (2 pages)
Calibration Iteration 3 Worksheets (2 pages)
Calibration Iteration 4 Worksheets (2 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 this page. It includes a current Sheet 17 with all applicable maps and photographs. There are no significant changes in the information provided in 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: Arizona

SHRP ID: 0100

Figures

1. General Information

SITE ID: *040100*

LOCATION: *U.S. 93 North at M.P. 52.62*

VISIT DATE: *May 3, 2007 (or immediately following the SPS-2 Validation)*

VISIT TYPE: *Validation*

2. Contact Information

POINTS OF CONTACT:

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

Highway Agency: *Dr. Estomih Kombe, 602-712-3135, ekombe@azdot.gov*

Murari Pradhan, 602-712-6574, mpradhan@azdot.gov

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

FHWA Division Office Liaison: *Karen King, 602-379-3645 x 125, karen.king@fhwa.dot.gov*

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

3. Agenda

BRIEFING DATE: *Briefing not requested for this visit.*

ON SITE PERIOD: *May 3rd and 4th, 2007 (or immediately following the SPS-2 Validation)*

TRUCK ROUTE CHECK: *Completed. See truck route.*

4. Site Location/ Directions

NEAREST AIRPORT: *McCarran International Airport, Las Vegas, Nevada*

DIRECTIONS TO THE SITE: *0.25 miles North of County Route 125*

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

WIM SITE LOCATION: *U.S. 93 North at M.P. 52.62 (Latitude: 35^0 24.004' and Longitude: -114^0 15.671')*

WIM SITE LOCATION MAP: *See Figure 4.1*

Figure 4-1 - Site 040100 in Arizona

5. Truck Route Information

ROUTE RESTRICTIONS: *None.*

SCALE LOCATION: *TA Kingman, Kingman, AZ, I-40, exit 48,Latitude: 35.19088, Longitude: -114.0705,Tim Curry - proprietor, Phone No: 928-753-7600, 24 hrs, $8.00 per run.*

TRUCK ROUTE:

- *Northbound to crossover (1.17 miles)*
- *Southbound to crossover (1.945 miles)*
- *Total turnaround length is 6.230 miles*

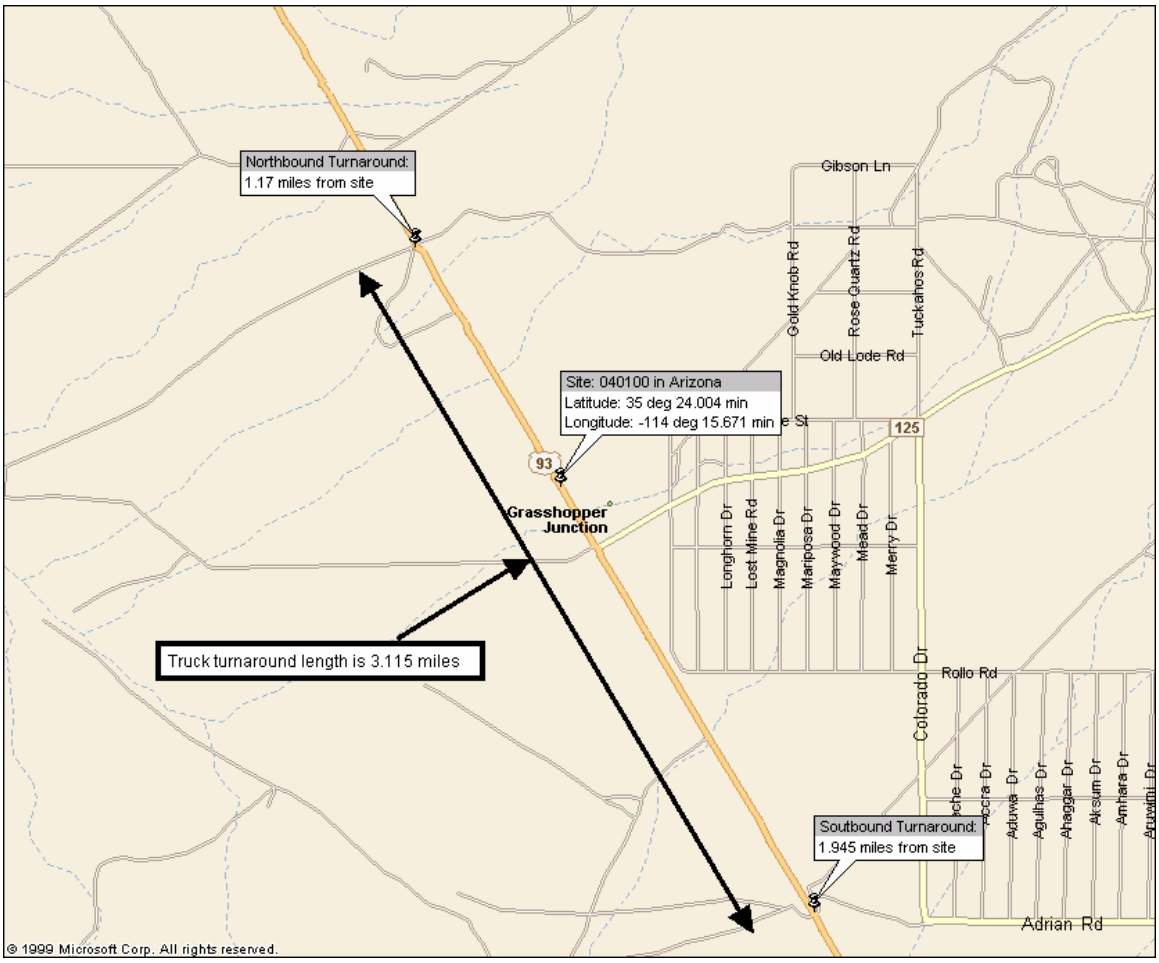


Figure 5-1 - Truck Route at 040100 in Arizona

6. Sheet 17 – Arizona (040100)

1.* ROUTE ___US 93_____MILEPOST ___52.62__LTPP DIRECTION - N S E W

2.* WIM SITE DESCRIPTION - Grade ___<_1____ % Sag vertical Y / N
Nearest SPS section upstream of the site _0_4_0 1_6_0_ ___ ___
Distance from sensor to nearest upstream SPS Section ___ ___ 153 .75___ ___ 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 ___ _8__ ft

4.* PAVEMENT TYPE _____Portland Cement Concrete_____

5.* PAVEMENT SURFACE CONDITION – Distress Survey
Date: 5/2/2007 Photo: 6420040020_SPSWIM_TO_15_04_2.67_0100_Upstream.JPG
Date: 5/2/2007 Photo: 6420040020_SPSWIM_TO_15_04_2.67_0100_Downstream.JPG
Date: _____ Photo Filename: _____

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 _66_ __ ft

Distance from system __ _72_ __ ft

TYPE ____3R_____

CABINET ACCESS controlled by LTPP / (STATE) / JOINT?

Contact - name and phone number __Estomih Kombe (602) 712-3135 __

Alternate - name and phone number_ Nate Woolfenden – (602) 954-0257

11. * POWER

Distance to cabinet from drop ___ _3__ ___ ft Overhead / underground / solar / AC in cabinet?

Service provider _____ Phone number _____

12. * TELEPHONE

Distance to cabinet from drop ___ ___ __1_ ft Overhead / under ground / cell?

Service provider _____ Phone Number_928-565-2017__

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

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

14. * TEST TRUCK TURNAROUND time __10__ minutes DISTANCE __6.2_ mi.

15. PHOTOS FILENAME

Power source 6420040020_SPSWIM_TO_15_04_2.67_0100_Solar_Panel.JPG

6420040020_SPSWIM_TO_15_04_2.67_0100_Service_Mast.JPG

Phone source 6420040020_SPSWIM_TO_15_04_2.67_0100_Cell_Modem.JPG

6420040020_SPSWIM_TO_15_04_2.67_0100_Telephone_Drop.JPG

Cabinet exterior 6420040020_SPSWIM_TO_15_04_2.67_0100_Cabinet_Exterior.JPG

Cabinet interior

6420040020_SPSWIM_TO_15_04_2.67_0100_Cabinet_Interior_Front.JPG

6420040020_SPSWIM_TO_15_04_2.67_0100_Cabinet_Interior_Rear.JPG

Weight sensors

6420040020_SPSWIM_TO_15_04_2.67_0100_Leading_Weighpad.JPG

6420040020_SPSWIM_TO_15_04_2.67_0100_Trailing_Weighpad.JPG

Classification sensors _____

Other sensors Loops, Temperature

Description

6420040020_SPSWIM_TO_15_04_2.67_0100_Leading_Loop.JPG

6420040020_SPSWIM_TO_15_04_2.67_0100_Trailing_Loop.JPG

6420040020_SPSWIM_TO_15_04_2.67_0100_Temp_Sensor.JPG

Downstream direction at sensors on LTPP lane _

6420040020_SPSWIM_TO_15_04_2.67_0100_Downstream.JPG

Upstream direction at sensors on LTPP lane

6420040020_SPSWIM_TO_15_04_2.67_0100_Upstream.JPG

COMMENTS

GPS Coordinates: Latitude: 35^0 24.004’ and Longitude: -114^0 15.671’

Closest Amenities: Kingman – 18 miles south of site
Various restaurants, hotels, gas etc.
Telephone service is available but is being used by the weather station installed near the WIM cabinet

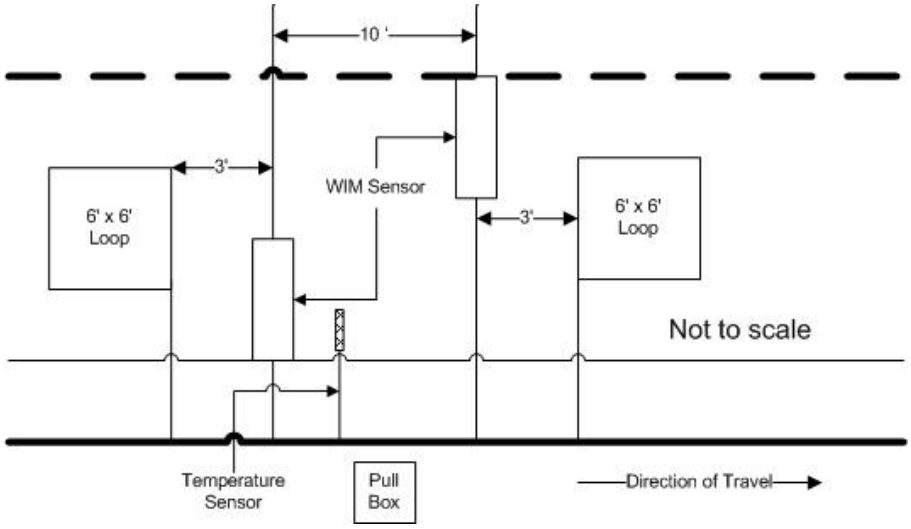
Test Truck Recommendations:
Types of Trucks: Two Class 9s
Truck 1: Class 9, 72,000 to 80,000 lb legal limit on gross and axles, air suspension;
Truck 2: Class 9, Partially loaded to 65,000 lb

Expected Speeds: 55, 60 and 65 mph

COMPLETED BY ________Dean J. Wolf________________________

PHONE __301-210-5105___ DATE COMPLETED _0_5_ /_0_3_ / _2_0_0_7_

Sketch of equipment layout



Site Map

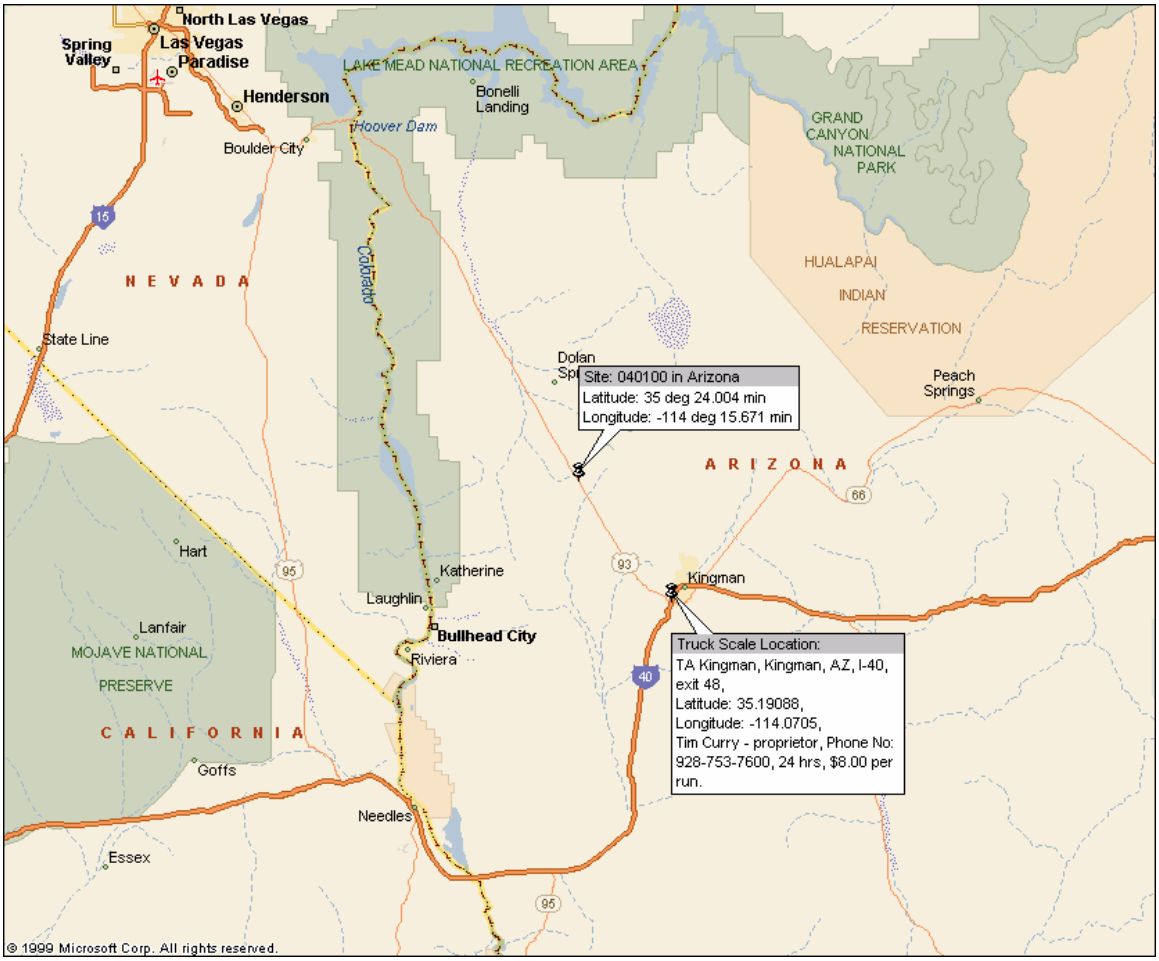


Figure 6-1 - Site Map at 040100 in Arizona

Figure 6-2 - 6420040020_SPSWIM_TO_15_04_2.67_0100_Upstream.JPG – 5-2-2007

Figure 6-3 - 6420040020_SPSWIM_TO_15_04_2.67_0100_Upstream.JPG – 5-2-2007

Figure 6-4 - 6420040020_SPSWIM_TO_15_04_2.67_0100_Solar_Panel.JPG - 5/2/2007

Figure 6-5 - 6420040020_SPSWIM_TO_15_04_2.67_0100_Service_Mast.JPG - 5/2/2007

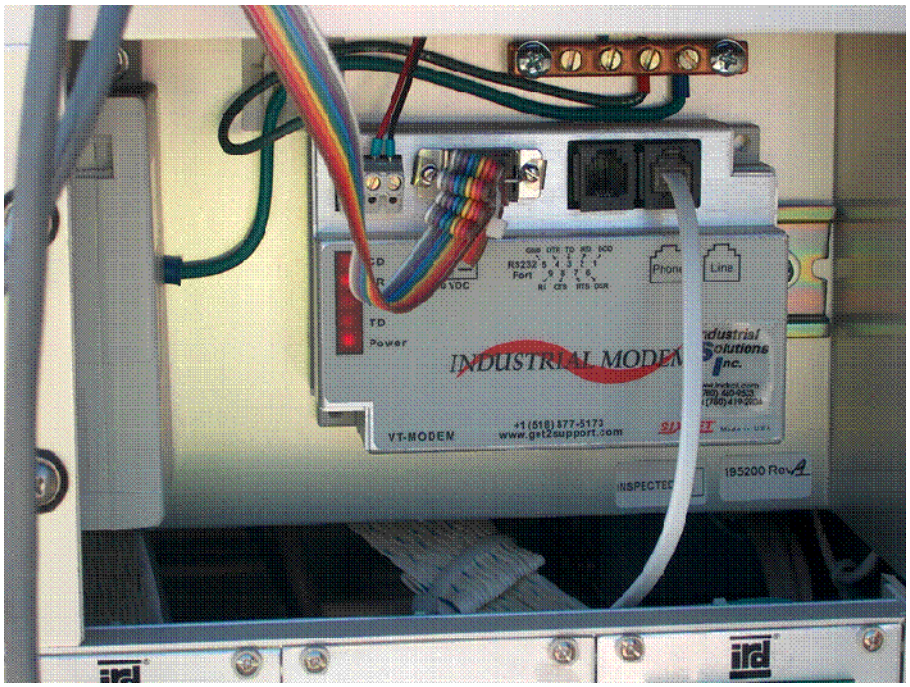


Figure 6-6 - 6420040020_SPSWIM_TO_15_04_2.67_0100_Cell_Modem.JPG – 5/2/2007

Figure 6-7 -6420040020_SPSWIM_TO_15_04_2.67_0100_Telephone_Drop.JPG - 5/2/2007

Figure 6-8 - 6420040020_SPSWIM_TO_15_04_2.67_0100_Cabinet_Exterior.JPG – 5/2/2007

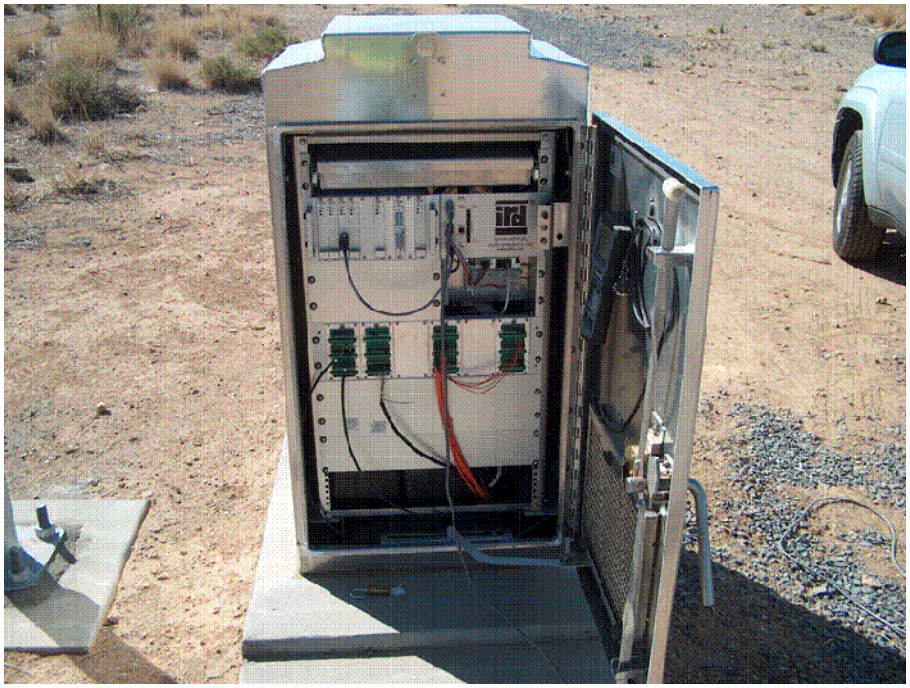


Figure 6-9 - 6420040020_SPSWIM_TO_15_04_2.67_0100_Cabinet_Interior_Front.JPG - 5/2/2007

Figure 6-10 - 6420040020_SPSWIM_TO_15_04_2.67_0100_Cabinet_Interior_Rear.JPG - 5/2/2007

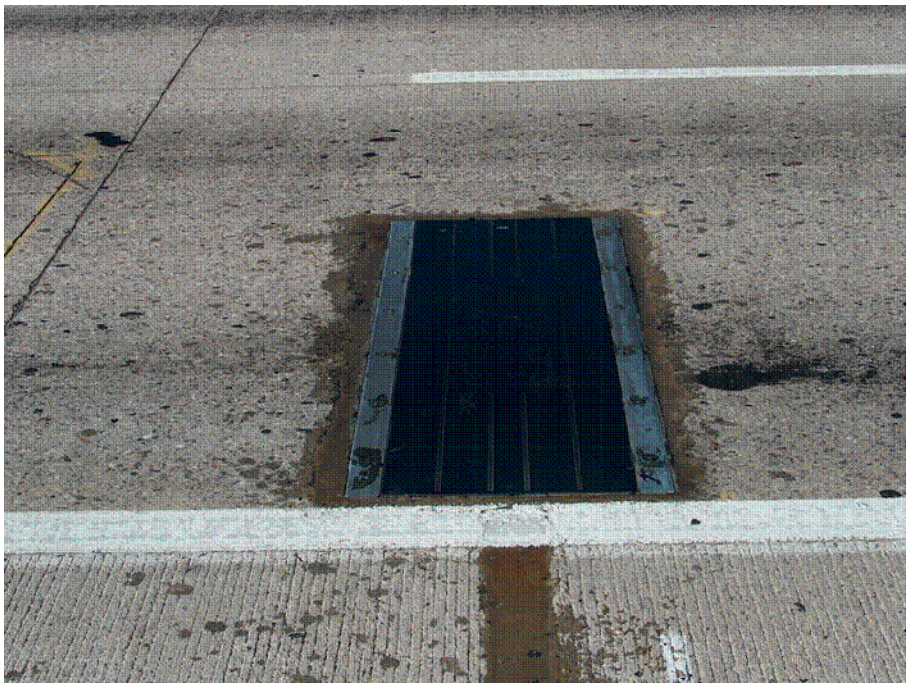


Figure 6-11 - 6420040020_SPSWIM_TO_15_04_2.67_0100_Leading_Weighpad.JPG – 5/2/2007

Figure 6-12- 6420040020_SPSWIM_TO_15_04_2.67_0100_Trailing_Weighpad.JPG – 5/2/2007

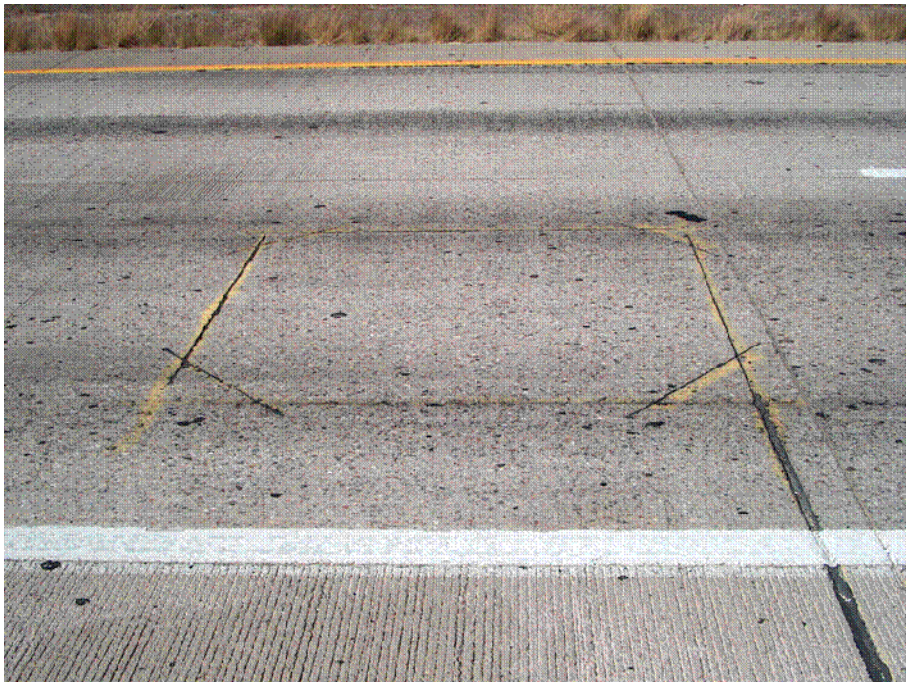


Figure 6-13 - 6420040020_SPSWIM_TO_15_04_2.67_0100_Leading_Loop.JPG – 5/2/2007

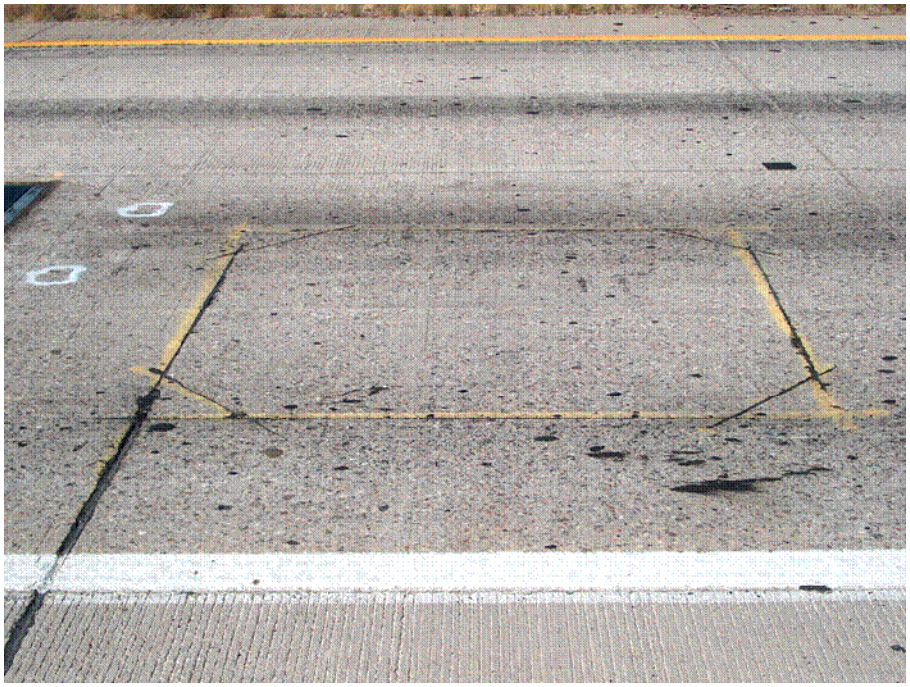


Figure 6-14 - 6420040020_SPSWIM_TO_15_04_2.67_0100_Trailing_Loop.JPG - 5/2/2007

Figure 6-15 - 6420040020_SPSWIM_TO_15_04_2.67_0100_Temp_Sensor.JPG - 5/2/2007

SHEET 18	STATE CODE [4]
LTPP MONITORED TRAFFIC DATA	SPS PROJECT ID [0100]
WIM SITE COORDINATION	DATE: (mm/dd/yyyy) 5/2/2007

Rev. 05/15/07

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

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

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

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

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

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

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

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

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

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

g. Communication –

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

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

3. PAVEMENT –

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

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

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

4. ON SITE ACTIVITIES –

a. WIM Validation Check - advance notice required _____ ☐ 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: Phoenix District Phone:(602) 712-6550

Agency: AZDOT

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

Name: Scott Sunderland Phone:(480) 641-3500

Agency: Otto Trucking

f. Traffic Control –

Name: Phoenix District Phone:(602) 712-6550

Agency: AZDOT

g. Enforcement Coordination –

Name: Phoenix District Phone:(602) 712-6550

Agency: AXDOT

h. Nearest Static Scale

Name: Love's Country Store Location:Buckeye, AZ

Phone: (623) 386-6926

SHEET 16 **LTPP MONITORED TRAFFIC DATA** **SITE CALIBRATION SUMMARY**	*STATE ASSIGNED ID [__ __ __ __] *STATE CODE [04] *SHRP SECTION ID [0100]

SITE CALIBRATION INFORMATION

1. * DATE OF CALIBRATION (MONTH/DAY/YEAR) [5/3/2007]

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

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

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

5. EQUIPMENT MANUFACTURER ___IRD/ PAT Traffic_____

WIM SYSTEM CALIBRATION SPECIFICS**

6.**CALIBRATION TECHNIQUE USED:

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

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

__ 20__ PASSES PER TRUCK

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

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

7. SUMMARY CALIBRATION RESULTS (EXPRESSED AS A PERCENT)
   MEAN DIFFERENCE BETWEEN ---
   - DYNAMIC AND STATIC GVW ___-26.1 STANDARD DEVIATION ___7.3
   - DYNAMIC AND STATIC SINGLE AXLES ___-22.4 STANDARD DEVIATION ___-8.5
   - DYNAMIC AND STATIC DOUBLE AXLES ___-26.5 STANDARD DEVIATION ___9.1

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

9. DEFINE THE SPEED RANGES USED (MPH) _____ _45_ __55__ __65_ _____ __ __ _____ _____
   _____ _____ _____ _____ _____ _____ _____ _____ _____ _____

10. CALIBRATION FACTOR (AT EXPECTED FREE FLOW SPEED) ___3700___

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 8 ____ 0.0
   - FHWA CLASS ____ ____ ____ ____
   - 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 [04] *SHRP SECTION ID [0100]

SITE CALIBRATION INFORMATION

1. * DATE OF CALIBRATION (MONTH/DAY/YEAR) [5/3/2007]

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

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

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

5. EQUIPMENT MANUFACTURER ___IRD/ PAT Traffic_____

WIM SYSTEM CALIBRATION SPECIFICS**

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

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

   __ 20__ PASSES PER TRUCK

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

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

7. SUMMARY CALIBRATION RESULTS (EXPRESSED AS A PERCENT)
   MEAN DIFFERENCE BETWEEN ---
   DYNAMIC AND STATIC GVW ___0.3 STANDARD DEVIATION ___-2.9
   DYNAMIC AND STATIC SINGLE AXLES ___-0.6 STANDARD DEVIATION ___-4.2
   DYNAMIC AND STATIC DOUBLE AXLES ___0.5 STANDARD DEVIATION ___5.8

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

9. DEFINE THE SPEED RANGES USED (MPH) _____ _45_ __55__ __65_ __ __ __ __ _____ _____
   _____ _____ _____ _____ _____ _____ _____ _____ _____ _____

10. CALIBRATION FACTOR (AT EXPECTED FREE FLOW SPEED) ___4283___

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

CLASSIFIER TEST SPECIFICS***

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

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

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

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

APPENDIX A

Sheet 19	* STATE_CODE
LTPP Traffic Data	* SPS PROJECT ID 0100
*CALIBRATION TEST TRUCK #1	* DATE 05-02-07

Rev. 08/31/01

PART I.

truck 7072 trailer W0836 — truck-2

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

truck - 7141
trailer - W0584

AXLES - units - lbs / 100s lbs / kg

	3. Empty Truck Axle Weight	4.* Pre-Test Average Loaded Axle Weight	5.* Post-Test Average Loaded Axle Weight	6.* Measured D)irectly or C)alculated?
A				D / C
B				D / C
C				D / C
D				D / C
E				D / C
F				D / C

GVW (same units as axles)

7. a) Empty GVW _____ *b) Average Pre-Test Loaded weight _____
*c) Post Test Loaded Weight _____
*d) Difference Post Test – Pre-test _____

GEOMETRY

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

9. a) * Make: _____ b) * Model: Kenworth T-800B

10.* Trailer Load Distribution Description:

TRASH LOADED EVENLY ALONG TRAILER

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

10_15_2_67_0100_TRUCK_1

Sheet 19	* STATE CODE
LTPP Traffic Data	* SPS PROJECT ID
*CALIBRATION TEST TRUCK # 1	* DATE 05-02-2007

Rev. 08/31/01

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

A to B 14.0 B to C 4.3 C to D 34.1

D to E 4.1 E to F _____

Wheelbased (measured A to last) _____ Computed _____

13. *Kingpin Offset From Axle B (units) 1.7 (_____)
(+ is to the rear)

SUSPENSION

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

16. Cold Tire Pressures (psi) – from right to left

Steering Axle	Axle B	Axle C	Axle D	Axle E

TO-15-2.67-04-0100-TRUCK-1

Sheet 19	* STATE_CODE
LTPP Traffic Data	* SPS PROJECT ID 0100
*CALIBRATION TEST TRUCK # 1	* DATE 05-02-07

Rev. 08/31/01

PART II

Table 1. Axle and GVW computations - pre-test

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

Table 2. Raw Axle and GVW measurements

Axles	Meas.	Pre-test Weight			Post-test Weight
A	I				
A + B	II				
A + B + C	III				
A + B + C + D	IV				
A + B + C + D + E (1)	V				
B + C + D + E	VI				
C + D + E	VII				
D + E	VIII				
E	IX				
A + B + C + D + E (2)	X				
A + B + C + D + E (3)	XI				

Table 3. Axle and GVW computations - post -test

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

TO_15_04_2.67_0100_TRUCK_1

Sheet 19	* STATE_CODE
LTPP Traffic Data	* SPS PROJECT ID 0100
*CALIBRATION TEST TRUCK # 1	* DATE 05-02-2007

Rev. 08/31/01

Table 4 . Axle and GVW computations -

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

Table 5. Raw data – Axle scales – pre-test - day 1 pre

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10060	17360	17360	15710	15710		76200
2	10080	17330	17330	15730	15730		76200
3	10040	17360	17360	15700	15700		76160
Average	10060	17350	17350	15710	15710		76190
day 1 post	9720	17170	17170	14490	14490 UNUSABLE		73040 (-3147)

Table 6. Raw data – Axle scales – day 2 pre

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10160	17220	17220	15640	15640		75820
2	10140	17210	17210	15630	15630		75820
3	10160	17210	17210	15620	15620		75820
Average	10150	17210	17210	15620	15620		75820
day 2 post	9760	17040	17040	15540	15540		74920 (-900)

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

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

Measured By Ambie Verified By

TO-15_04-2-67_0100_TRUCK_1

Sheet 19	* STATE_CODE
LTPP Traffic Data	* SPS PROJECT ID 0100
*CALIBRATION TEST TRUCK # 2	* DATE 05-02-2007

Rev. 08/31/01

truck 7141
trailer W0584
#1

truck - 7092
trailer - W08360

PART I.

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

AXLES - units - lbs / 100s lbs / kg

	3. Empty Truck Axle Weight	4.* Pre-Test Average Loaded Axle Weight	5.* Post-Test Average Loaded Axle Weight	6.* Measured D)irectly or C)alculated?
A				D / C
B				D / C
C				D / C
D				D / C
E				D / C
F				D / C

VW (same units as axles)

7. a) Empty GVW _____

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

GEOMETRY

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

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

10.* Trailer Load Distribution Description:

TRUCK LOADED EVENLY ALONG TRAILER

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

b). Trailer Tare Weight (units): _____

Sheet 19	* STATE_CODE
LTPP Traffic Data	* SPS PROJECT ID 0100
*CALIBRATION TEST TRUCK # 2	* DATE 05-02-07

Rev. 08/31/01

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

A to B 14.6 B to C 4.3 C to D 34.1

D to E 4.1 E to F

Wheelbased (measured A to last) Computed

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

(+ is to the rear)

SUSPENSION

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

16. Cold Tire Pressures (psi) – from right to left

Steering Axle	Axle B	Axle C	Axle D	Axle E

TO-15_04_2.67_0100_TRUCK_2

Sheet 19	* STATE_CODE	04
LTPP Traffic Data	* SPS PROJECT ID	0100
*CALIBRATION TEST TRUCK #2	* DATE	05-2-07

Rev. 08/31/01

PART II

Table 1. Axle and GVW computations - pre-test

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

Table 2. Raw Axle and GVW measurements

Axles	Meas.	Pre-test Weight			Post-test Weight
A	I				
A + B	II				
A + B + C	III				
A + B + C + D	IV				
A + B + C + D + E (1)	V				
B + C + D + E	VI				
C + D + E	VII				
D + E	VIII				
E	IX				
A + B + C + D + E (2)	X				
A + B + C + D + E (3)	XI				

Table 3. Axle and GVW computations - post -test

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

TO-15-04-2.67-0100 - TRUCK-2

Sheet 19	* STATE_CODE	
LTPP Traffic Data	* SPS PROJECT ID	0100
*CALIBRATION TEST TRUCK # 2	* DATE	05-02-2007

Rev. 08/31/01

Table 4 . Axle and GVW computations -

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

Table 5. Raw data – Axle scales – pre-test - day 1 pm

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10020	13920	13920	13000	13000		63860
2	10040	13920	13980	12990	12990		63860
3	10040	13910	13910	12990	12990		63840
Average	10030	13920	13920	12990	12990		63850
day 1 post	9720	13770	13770	12900	12900		63060 (-790)

Table 6. Raw data – Axle scales – day 2 pm

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10160	17220	17220	15610	15610		75820
2	10140	17210	17210	15630	15630		75820
3	10160	17210	17210	15620	15620		75820
Average	10150	17210	17210	15620	15620		75820
day 2 post	9760	17040	17040	15540	15540		74920 (-900)

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

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

Measured By Amber Verified By

Sheet 20	* STATE_CODE
LTPP Traffic Data	*SPS PROJECT_ID 0100
Speed and Classification Checks * 1 of* 1	* DATE 05/02/2007

Rev. 08/31/2001....

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
44	9	21079	44	9	44	9	21300	44	9
44	9	21080	44	9	54	9	21323	55	9
55	9	21102	55	9	53	9	21324	53	9
53	9	21103	54	9	65	9	21358	65	9
70	9	21108	70	9	64	9	21359	64	9
70	9	21118	69	9	64	9	21385	64	9
64	9	21125	64	9	55	6	21416	55	6
63	9	21126	63	9	54	9	21430	53	9
41	9	21137	41	9	53	9	21431	53	9
70	6	21176	70	6	50	5	21458	50	5
62	5	21179	62	5	64	9	21465	64	9
54	9	21184	54	9	64	9	21466	64	9
53	9	21185	53	9	44	9	21494	44	9
54	5	21187	55	5	44	9	21495	44	9
77	9	21195	76	9	54	9	21532	54	9
64	9	21213	65	9	54	9	21533	53	9
64	9	21214	64	9	64	9	21576	64	9
44	9	21236	45	9	64	9	21576	64	9
44	9	21237	44	9	39	9	21598	39	9
33	9	21259	33	9	65	5	21603	64	5
29 65	9	21271	65	9	44	9	21606	45	9
64	9	21272	64		44	9	21607	44	9
29	9	21283	29	9	54	9	21644	54	9
51	5	21293	51	5	54	9	21645	54	9
43	9	21299	44	9	68	9	21673	68	9

Recorded by Ambie Direction W Lane 1 Time from 9:00 to 12:00

Sheet 20	* STATE_CODE 04
LTPP Traffic Data	*SPS PROJECT_ID 0180
Speed and Classification Checks * 1 of*	* DATE 05/03/2007

Rev. 08/31/2001....

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
54	9	24212	54	9	43	9	24763	44	9
54	9	24213	53	9	43	9	24764	43	9
64	9	24242	65	9	69	8	24775	69	8
64	9	24243	64	9	72	10	24789	71	10
44	9	24264	44	9	60	5	24790	60	5
44	9	24265	44	9	~~55~~	9	24795 24824	~~57~~ ~~58~~	9
49	5	24278	49	5	54	9	24796	54	9
56	6	24281	55	6	57	5	24824	56	5
54	9	24293	54	9	65	9	24836	65	9
54	9	24294	54	9	63	9	24837	63	9
44	9	24360	44	9	66	8	24861	65	8
44	9	24361	44	9	43	9	24813	44	9
57	5	24385	57	5	44	9	24874	44	9
54	9	24389	54	9	64	8	24912	64	8
54	9	24390	54	9	54	9	24913	54	9
37	9	24408	37	9					
43	9	24463	44	9					
44	9	24464	44	9					
55	9	24506	55	9					
53	9	24507	54	9					
64	9	24533	64	9					
63	9	24534	64	9					
64	9	24746	63	9					
69	6	24751	69	6					
67	9	24752	66	9					

Recorded by _____ Direction W Lane 1 Time from 10:03 to 1:03

Sheet 21

LTPP Traffic Data

WIM System Test Truck Records 1 of 3

Rev. 08/31/2001

* STATE_CODE	
*SPS PROJECT_ID	0100
* DATE	05/02/2007

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
80	44	1	1	9:00:04	21079	40	4.2 / 3.4	9.2 / 5.1	8.7 / 5.0	8.1 / 4.9	7.4 / 4.8		60.8	14.4	4.3	34.1	4.1	
80	44	2	1	9:00:07	21080	40	4.7 / 3.2	6.4 / 4.2	5.6 / 4.9	6.0 / 4.2	5.8 / 4.6		49.8	14.5	4.3	34.3	4.1	
82	55	1	2	9:10:05	21102	55	4.9 / 3.5	5.6 / 5.1	5.1 / 4.1	7.5 / 4.6	6.6 / 5.3		52.3	14.5	4.3	34.2	4.1	
82	54	2	2	9:10:08	21103	53	4.8 / 3.9	5.1 / 3.6	6.4 / 4.7	6.4 / 3.3	6.2 / 4.9		49.4	14.5	4.3	34.3	4.1	
84.5	64	1	3	9:19:31	21125	64	4.2 / 2.5	4.1 / 4.2	3.7 / 4.3	7.9 / 3.6	7.6 / 5.1		47.3	14.4	4.3	34.1	4.0	
84.5	63	2	3	9:19:34	21126	63	4.4 / 2.6	6.3 / 3.4	6.1 / 4.1	5.5 / 4.4	6.4 / 4.2		47.4	14.4	4.2	34.2	4.0	
84.5	45	1	4	9:29:41	21153	44	4.6 / 3.9	9.6 / 5.1	8.4 / 5.1	7.3 / 4.2	7.1 / 4.9		60.2	14.5	4.3	34.1	4.1	
84.5	44	2	4	9:29:44	21154	44	4.5 / 3.8	6.7 / 5.1	5.5 / 4.7	6.4 / 4.0	6.1 / 4.5		51.2	14.5	4.3	34.2	4.1	
80.5	54	1	5	9:39:26	21184	54	4.9 / 3.7	7.6 / 5.3	6.9 / 4.4	6.7 / 4.7	6.3 / 5.0		55.3	14.4	4.3	34.2	4.1	
80.5	53	2	5	9:39:30	21185	53	4.6 / 4.0	5.6 / 5.1	4.7 / 4.8	6.9 / 4.7	4.8 / 4.6		49.7	14.5	4.3	34.4	4.1	
85.5	65	1	6	9:49:01	21213	64	3.9 / 2.8	4.1 / 4.2	5.0 / 4.7	4.7 / 5.1	3.1 / 4.8		42.5	14.4	4.3	34.2	4.1	
85.5	64	2	6	9:49:05	21214	64	4.3 / 2.6	6.6 / 3.6	6.1 / 4.1	5.3 / 4.3	6.0 / 3.7		46.6	14.4	4.2	34.2	4.0	
86.0	45	1	7	9:58:48	21236	44	4.7 / 3.9	9.5 / 5.7	8.5 / 4.6	7.5 / 4.6	7.5 / 4.9		61.4	14.4	4.3	34.0	4.1	
86.0	44	2	7	9:58:51	21237	44	4.2 / 3.9	6.4 / 4.7	5.6 / 5.0	5.8 / 4.8	5.5 / 4.8		50.4	14.5	4.3	34.3	4.1	
86.0	65	1	8	10:08:16	21271	65	4.0 / 2.5	3.9 / 4.1	3.8 / 4.3	7.6 / 6.1	4.3 / 4.7		45.4	14.4	4.3	34.3	4.1	
86.0	64	2	8	10:08:19	21272	64	4.0 / 2.6	6.2 / 3.9	5.7 / 4.2	5.6 / 4.6	6.2 / 4.0		47.0	14.5	4.3	34.3	4.1	

Recorded by Debbie

Checked by

pre

6420040020_SPSWIM_Sheet_21.doc

TO_15-04_2.67-0100

-72-48
-80-50
-88-55
-96-60
-105-65

Sheet 21

LTPP Traffic Data

WIM System Test Truck Records 2 of 3

Rev. 08/31/2001

* STATE_CODE	
*SPS PROJECT_ID	0100
* DATE	05/02/2007

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
88	44	1	9	10:18:31	21299	43	4.1 / 3.9	9.4 / 4.6	8.7 / 5.0	7.9 / 4.7	7.3 / 4.8		60.4	14.5	4.3	34.0	4.0	
88	44	2	9	10:18:33	21300	44	4.5 / 4.0	6.5 / 4.7	5.5 / 5.0	6.2 / 3.7	5.4 / 4.6		50.2	14.6	4.3	34.4	4.1	
89.5	55	1	10	10:28:22	21323	54	4.7 / 3.8	7.5 / 5.2	7.3 / 4.2	7.8 / 4.3	6.6 / 4.7		56.0	14.5	4.3	34.1	4.1	
89.5	53	2	10	10:28:25	21324	53	4.9 / 3.8	5.1 / 5.1	5.0 / 4.7	5.1 / 3.7	4.9 / 4.8		47.0	14.5	4.3	34.4	4.1	
89.5	65	1	11	10:38:35	21358	65	4.0 / 2.5	3.9 / 4.2	3.8 / 4.5	7.5 / 3.8	4.0 / 5.2		43.3	14.4	4.3	34.1	4.0	
89.5	64	2	11	10:38:37	21359	64	4.0 / 2.7	6.1 / 3.4	6.2 / 4.2	6.0 / 4.5	6.4 / 3.9		47.4	14.5	4.2	34.3	4.0	
90	44	1	12	10:48:50	21395	44	4.6 / 4.1	9.3 / 4.8	8.6 / 4.8	7.2 / 4.1	7.1 / 4.5		59.0	14.5	4.3	34.1	4.1	
90	44	2	12	10:48:53	21396	44	4.5 / 3.8	6.5 / 5.1	5.5 / 4.8	5.4 / 4.4	6.4 / 4.8		51.2	14.5	4.3	34.3	4.1	
96	53	1	13	10:58:41	21430	54	4.8 / 3.7	7.9 / 5.3	7.0 / 4.4	6.7 / 4.2	6.6 / 5.4		56.0	14.4	4.3	34.1	4.0	
96	53	2	13	10:58:44	21431	53	4.1 / 3.9	6.7 / 4.5	5.8 / 5.6	5.8 / 4.6	5.4 / 4.8		51.3	14.5	4.3	34.4	4.1	
96.5	64	1	14	11:08:16	21465	64	4.1 / 2.5	4.1 / 4.1	5.2 / 4.4	6.9 / 5.2	7.5 / 3.7		46.6	14.4	4.3	34.1	4.1	
96.5	64	2	14	11:08:19	21466	64	4.1 / 2.6	6.8 / 3.7	6.2 / 4.0	6.4 / 4.4	6.6 / 3.9		48.7	14.5	4.2	34.2	4.0	
97.5	44	1	15	11:18:05	21494	44	4.7 / 4.1	9.4 / 4.7	8.8 / 4.8	7.3 / 3.5	7.2 / 4.8		59.4	14.5	4.3	34.2	4.1	
97.5	44	2	15	11:18:09	21495	44	4.1 / 4.0	6.3 / 5.2	5.8 / 4.7	6.0 / 3.8	5.5 / 4.7		49.9	14.5	4.3	34.3	4.1	
97.0	54	1	16	11:28:44	21532	54	4.8 / 3.7	7.7 / 5.0	6.9 / 4.0	8.2 / 4.7	6.5 / 5.0		56.6	14.5	4.3	34.0	4.1	
97.0	53	2	16	11:28:47	21533	54	4.9 / 4.0	5.4 / 4.7	6.6 / 4.2	7.2 / 3.7	6.6 / 3.3		50.6	14.5	4.3	34.3	4.1	

Recorded by Ambie

Checked by

Sheet 21

LTPP Traffic Data

WIM System Test Truck Records 3 of 5

Rev. 08/31/2001

* STATE_CODE	
*SPS PROJECT_ID	0100
* DATE	05/02/2007

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
100.	64	1	17	11:39:12	21576	64	4.9 / 2.5	4.3 / 4.1	5.3 / 4.6	8.0 / 3.0	7.6 / 5.4		48.7	14.4	4.3	34.2	4.0	
100	64	2	17	11:39:15	21577	64	4.9 / 2.7	6.1 / 3.5	5.8 / 4.5	6.4 / 4.4	6.1 / 4.0		47.5	14.6	4.3	34.4	4.1	
98.5	45	1	18	11:49:35	21606	44	4.7 / 3.9	9.0 / 5.0	8.7 / 5.0	8.5 / 7.4	7.0 / 4.9		64.3	14.5	4.3	34.1	4.1	
98.5	44	2	18	11:49:38	21607	44	4.1 / 3.9	7.0 / 5.1	5.8 / 4.6	5.6 / 4.3	5.3 / 4.5		50.1	14.5	4.3	34.1	4.0	
100.5	54	1	19	11:59:41	21644	54	4.5 / 3.5	7.8 / 5.1	7.0 / 4.2	8.4 / 4.5	6.4 / 5.3		56.8	14.4	4.3	34.1	4.0	
100.5	54	2	19	11:59:43	21645	54	4.6 / 3.9	5.7 / 4.9	6.5 / 4.5	6.6 / 4.7	6.6 / 4.5		52.5	14.5	4.3	34.3	4.1	
99	63	1	20	12:09:18	21691	62	4.3 / 3.0	4.2 / 4.3	5.4 / 4.8	6.9 / 4.1	3.5 / 4.7		45.2	14.5	4.3	34.2	4.1	
99	64	2	20	12:09:21	21692	64	4.0 / 2.6	6.3 / 3.6	5.8 / 4.1	6.0 / 4.2	6.3 / 4.0		46.9	14.5	4.3	34.4	4.0	

Recorded by _____ Checked by _____

Sheet 21

LTPP Traffic Data

WIM System Test Truck Records 1 of

Rev. 08/31/2001

* STATE_CODE	
*SPS PROJECT_ID	0100
* DATE	05/02/2007

	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	
✓	108	44	1	1	13:35:06	28005	44	5.8/4.7	12.9/6.1	10.9/6.1	8.1/7.7	9.6/6.0		77.0	14.4	4.3	34.1	4.1		
✓	109	44	2	1	13:35:08	22006	45	5.4/5.0	8.3/6.4	7.0/6.0	8.4/5.9	7.7/5.7		65.8	14.5	4.3	34.4	4.1		
✓	104.5	53	1	2	13:45:15	22045	54	6.1/5.3	8.7/7.2	7.3/5.8	7.7/6.1	9.2/7.0		70.4	14.4	4.3	34.2	4.0		*
✓	104.5	54	2	2	13:45:18	22046	54	6.0/5.2	7.6/6.9	6.6/6.1	9.1/6.4	8.4/5.8		68.2	14.5	4.3	34.4	4.1		
✓	106	64	1	3	13:56:43	22089	65	5.7/3.4	6.1/5.9	5.9/6.5	9.9/5.8	11.8/7.1		68.1	14.4	4.3	34.3	4.1		*
✓	106	64	2	3	13:56:45	22090	64	5.9/4.1	6.0/4.8	9.0/5.7	9.9/6.3	9.2/5.9		66.7	14.5	4.3	34.2	4.1		
X	103	43	2	4	14:01:57	22141	42	5.2/4.4	8.9/5.2	7.4/6.1	8.2/5.2	7.3/5.4		68.3	14.5	4.3	34.2	4.1		
X	104	53	2	5	14:17:49	22178	54	6.0/5.0	8.9/6.4	6.8/5.9	9.4/6.2	9.1/6.1		69.0	14.5	4.3	34.3	4.1		
✓	104.5	64	2	6	14:27:46	22220	64	5.9/4.0	5.7/4.9	9.2/5.7	9.6/6.8	9.5/6.4		67.8	14.5	4.3	34.2	4.1		
✓	106	44	2	7	14:37:24	22250	44	5.7/5.1	7.7/5.5	7.0/6.4	7.2/5.3	6.8/4.9		61.6	14.5	4.3	34.4	4.1		
✓	106	44	1	4	14:54:39	22309	44	5.7/4.7	11.5/5.9	10.8/5.8	9.6/6.7	9.0/5.6		75.3	14.4	4.3	34.3	4.3		
X	102.5	54	1	5	15:04:38	22337	54	6.4/4.9	10.6/6.9	10.1/7.6	9.4/6.8	9.1/6.8		78.5	14.4	4.3	34.1	4.1		
✓	101.5	65	1	6	15:14:18	22364	64	5.8/3.4	6.2/5.8	5.6/6.1	11.6/7.6	11.7/7.1		70.9	14.4	4.3	34.1	4.3		*

Recorded by _____ Checked by _____

Sheet 21	* STATE_CODE 04
LTPP Traffic Data	*SPS PROJECT_ID 0100
WIM System Test Truck Records 1 of 1	* DATE 05/03/2007

Rev. 08/31/2001

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
58.5	44	1	1	7:28:44	23852	44	5.9/4.6	11.6/5.6	10.3/5.8	9.4/6.4	8.5/5.7		←	13.8	14.4	4.3	34.0	4.1
58.5	44	2	1	7:28:47	23853	44	5.1/4.8	7.4/6.4	7.0/5.8	7.5/5.7	6.4/4.8		61.0	14.6	4.3	34.3	4.1	
56.5	54	1	2	7:38:54	23851	54	6.6/4.6	10.1/6.9	9.0/7.7	9.4/6.6	8.2/6.4		75.6	14.4	4.3	34.1	4.1	
56.5	53	2	2	7:38:57	23852	53	6.3/5.0	7.8/6.4	6.3/5.8	6.9/5.9	6.4/6.3		63.1	14.5	4.3	34.2	4.1	
56.0	44	1	3	7:48:54	23871	44	6.0/4.5	11.0/5.5	10.2/5.8	10.0/5.9	8.3/5.6		73.0	14.4	4.3	34.0	4.1	
56.0	44	2	3	7:48:56	23872	44	4.9/4.8	8.2/6.6	7.0/6.1	7.5/5.3	6.4/6.0		62.9	14.5	4.3	34.3	4.1	
56.0	65	1	4	7:58:23	23890	64	6.2/3.4	6.4/5.7	5.8/6.0	7.3/6.0	6.6/6.4		59.7	14.4	4.3	34.0	4.0	
56.0	64	2	4	7:58:27	23891	64	6.2/3.6	9.1/4.9	9.0/6.0	8.8/5.8	10.0/5.7		69.2	14.5	4.2	34.2	4.0	
56.0	54	1	5	8:07:57	23905	54	6.4/4.7	8.2/4.6	7.8/5.9	9.8/6.6	8.3/6.5		68.9	14.4	4.3	34.1	4.1	
56.0	53	2	5	8:07:59	23906	52	6.2/5.1	7.5/6.3	6.4/5.8	6.8/5.8	6.4/6.2		62.4	14.5	4.3	34.2	4.1	
57.5	64	1	6	8:17:19	23924	64	6.0/3.4	6.3/5.5	5.7/6.3	4.9/7.3	5.0/7.1		57.4	14.4	4.3	34.0	4.1	
57.5	63	2	6	8:17:21	23925	64	5.8/3.5	8.9/4.6	8.5/5.5	8.1/5.7	9.4/5.6		65.5	14.5	4.2	34.2	4.0	

Recorded by _____ Checked by _____

CAL 2

Sheet 21	* STATE_CODE	04
LTPP Traffic Data	*SPS PROJECT_ID	0100
WIM System Test Truck Records 1 of ___	* DATE	05/03/2007

Rev. 08/31/2001

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
57	54	1	1	8:53:41	(54) 24017	54	4.7/3.7	9.1/5.4	7.4/5.0	8.5/4.1	7.2/5.2	→	60.4	14.5	4.4	34.3	4.1	
57	54	2	1	8:53:43	(54) 24018	54	4.8/3.4	6.8/4.4	5.8/5.2	6.4/4.1	4.9/4.3		50.2	14.6	4.3	34.5	4.2	
70.5	54	1	2	9:04:11	24042	54	4.6/3.6	9.0/5.3	7.2/5.2	8.4/4.6	6.5/4.8		59.3	14.6	4.4	34.3	4.1	
70.5	54	2	2	9:04:14	24043	54	4.7/3.6	6.8/5.0	5.7/5.2	6.3/4.2	4.9/4.2		50.4	14.6	4.3	34.5	4.1	
79.5	64	1	3	9:13:36	24068	64	4.4/2.9	7.6/4.6	6.6/4.9	6.3/5.9	6.7/5.3		55.3	14.5	4.3	34.3	4.1	
79.5	64	2	3	9:13:40	24069	65	4.4/2.8	6.5/4.2	5.6/5.2	5.3/5.1	6.1/4.3		49.6	14.6	4.3	34.5	4.2	
79.5	65	1	4	9:22:58	24095	64	4.1/3.2	6.9/5.4	7.7/5.7	6.4/5.4	8.0/6.0		58.9	14.6	4.3	34.2	4.0	
79.5	64	2	4	9:23:02	24096	64	3.5/3.9	5.0/4.9	6.7/5.0	5.4/5.8	6.6/5.1		51.6	14.6	4.2	34.2	4.0	
75.0	44	1	5	9:32:57	24115	44	3.9/3.5	8.4/4.8	7.9/4.9	7.6/4.0	7.8/4.8		57.4	14.6	4.3	34.4	4.1	
75.0	44	2	5	9:33:00	24116	44	4.2/3.2	6.6/4.3	5.7/4.6	6.2/3.7	5.9/3.9		48.4	14.6	4.2	34.3	4.0	
75.0	44	1	6	9:42:51	24139	44	4.1/3.1	8.2/5.2	7.2/5.0	7.2/4.7	6.2/4.8		55.5	14.6	4.3	34.9	4.0	
75.0	44	2	6	9:42:53	24140	45	4.3/3.3	6.7/4.7	5.8/4.5	5.0/3.7	6.0/3.8		47.4	14.6	4.3	34.4	4.1	

Recorded by _____ Checked by _____

10_15_04_267_0100 cal-3 | New cal. factors | cal 3

Sheet 21

LTPP Traffic Data

WIM System Test Truck Records 1 of

Rev. 08/31/2001

* STATE_CODE	04
*SPS PROJECT_ID	0100
* DATE	05/03/2007

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
80	44	1	1	9:52:50	24173	44	5.8 / 4.5	10.8 / 6.8	10.9 / 6.8	7.3 / 5.3	8.5 / 6.5		73.2	14.5	4.3	34.0	4.1	
80	44	2	1	9:52:52	24174	44	5.8 / 4.1	9.1 / 6.3	7.4 / 6.6	7.9 / 5.3	6.6 / 5.5		64.6	14.6	4.3	34.2	4.1	
81.5	54	1	2	10:03:48	24292	54	5.5 / 4.6	11.2 / 6.3	9.4 / 6.9	10.0 / 6.1	10.3 / 6.4		76.5	14.6	4.4	34.3	4.1	
81.5	53	2	2	10:03:51	24213	54	5.6 / 4.5	7.9 / 6.0	7.7 / 7.0	6.9 / 5.3	6.1 / 5.5		62.5	14.6	4.3	34.5	4.2	
84.5	65	1	3	10:14:39	24242	64	6.0 / 3.9	9.4 / 5.8	7.9 / 6.1	8.0 / 6.7	9.6 / 6.7		70.2	14.5	4.3	34.4	4.1	
84.5	64	2	3	10:14:42	24243	64	5.3 / 4.4	6.4 / 6.0	6.7 / 6.7	6.1 / 7.5	8.8 / 6.3		64.0	14.6	4.2	34.4	4.0	
86	44	1	4	10:24:21	24264	44	5.8 / 4.5	10.6 / 6.6	9.7 / 6.6	8.7 / 6.2	8.2 / 6.4		73.4	14.5	4.3	34.0	4.1	
86	44	2	4	10:24:23	24265	44	5.5 / 4.8	8.9 / 6.0	7.5 / 6.7	6.6 / 5.6	6.6 / 5.5		63.8	14.5	4.3	34.1	4.0	
88.0	54	1	5	10:34:13	24293	54	5.8 / 4.7	11.9 / 6.7	10.1 / 6.2	11.2 / 5.0	9.9 / 6.1		77.2	14.5	4.4	34.1	4.1	
88.0	54	2	5	10:34:35	24294	54	5.8 / 4.3	8.6 / 6.3	7.9 / 6.6	8.1 / 5.6	6.6 / 5.4		65.4	14.6	4.3	34.5	4.1	
90.5	65	1	6	10:44:44	24322	65	5.3 / 3.5	8.3 / 6.3	7.2 / 7.0	6.6 / 5.8	8.7 / 6.8		65.6	14.6	4.3	34.4	4.1	
90.5	64	2	6	10:44:47	24323	64	5.3 / 4.3	7.0 / 6.5	6.4 / 6.4	5.6 / 6.9	8.6 / 6.6		63.6	14.5	4.3	34.4	4.0	
91.5	44	1	7	10:54:25	24360	44	5.7 / 4.3	10.7 / 6.5	10.7 / 6.7	9.8 / 5.9	9.5 / 6.5		76.4	14.6	4.3	34.3	4.1	
91.5	44	2	7	10:54:28	24361	44	5.7 / 5.1	8.4 / 5.8	7.4 / 6.7	8.5 / 5.8	8.1 / 6.1		67.6	14.5	4.3	34.1	4.1	
93.5	54	1	8	11:04:02	24389	54	5.6 / 3.8	11.2 / 6.1	9.6 / 7.0	10.2 / 5.6	9.4 / 5.9		74.4	14.5	4.4	34.4	4.1	
93.5	54	2	8	11:04:03	24390	54	5.7 / 4.2	8.5 / 5.9	7.6 / 6.9	7.6 / 5.2	6.5 / 5.2		63.2	14.6	4.3	34.5	4.2	

CAL 4

POST

Recorded by _____ Checked by _____

6420040020_SPSWIM_Sheet_21.doc

TO-15_04_2.67_0100

CAL 4/post

Sheet 21

LTPP Traffic Data

WIM System Test Truck Records 1 of

Rev. 08/31/2001

* STATE_CODE	04
*SPS PROJECT_ID	0100
* DATE	05/03/2007

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
80	44	1	1	9:52:50	24173	44	5.8 / 4.5	10.8 / 6.8	10.9 / 6.8	7.3 / 5.3	8.5 / 6.5		73.2	14.5	4.3	34.0	4.1	
80	44	2	1	9:52:52	24174	44	5.8 / 4.1	9.1 / 6.3	7.4 / 6.6	7.9 / 5.3	6.6 / 5.5		64.6	14.6	4.3	34.2	4.1	
81.5	54	1	2	10:03:48	24212	54	5.5 / 4.6	11.2 / 6.3	9.4 / 6.9	10.0 / 6.1	10.3 / 6.4		76.5	14.6	4.4	34.3	4.1	
81.5	53	2	2	10:03:51	24213	54	5.6 / 4.5	7.9 / 6.0	7.7 / 7.0	6.9 / 5.3	6.1 / 5.5		62.5	14.6	4.3	34.5	4.2	
84.5	65	1	3	10:14:39	24242	64	6.0 / 3.9	9.4 / 5.8	7.9 / 6.1	8.0 / 6.7	9.6 / 6.7		70.2	14.5	4.3	34.4	4.1	
84.5	64	2	3	10:14:42	24243	64	5.3 / 4.4	6.4 / 6.0	6.7 / 6.7	6.1 / 7.5	8.8 / 6.3		64.0	14.6	4.2	34.4	4.0	
86	44	1	4	10:24:21	24264	44	5.8 / 4.5	10.6 / 6.6	9.7 / 6.6	8.7 / 6.2	8.2 / 6.4		73.4	14.5	4.3	34.0	4.1	
86	44	2	4	10:24:23	24265	44	5.5 / 4.8	8.9 / 6.0	7.5 / 6.7	6.6 / 5.6	6.6 / 5.5		63.8	14.5	4.3	34.1	4.0	
88.0	54	1	5	10:34:33	24293	54	5.8 / 4.7	11.4 / 6.7	10.1 / 6.2	11.2 / 5.0	9.9 / 6.1		77.2	14.5	4.4	34.1	4.1	
88.0	54	2	5	10:34:35	24294	54	5.8 / 4.3	8.6 / 6.3	7.9 / 6.6	8.1 / 5.6	6.6 / 5.4		65.4	14.6	4.3	34.5	4.1	
90.5	65	1	6	10:44:44	24322	65	5.3 / 3.5	8.3 / 6.3	7.2 / 7.0	6.6 / 5.8	8.7 / 6.8		65.6	14.6	4.3	34.4	4.1	
90.5	64	2	6	10:44:47	24323	64	5.3 / 4.3	7.0 / 6.5	6.4 / 6.4	5.6 / 6.9	8.6 / 6.6		63.6	14.5	4.3	34.4	4.0	
91.5	44	1	7	10:54:25	24360	44	5.7 / 4.3	10.7 / 6.5	10.7 / 6.7	9.8 / 5.9	9.5 / 6.5		76.4	14.6	4.3	34.3	4.1	
91.5	44	2	7	10:54:28	24361	44	5.7 / 5.1	8.4 / 5.8	7.4 / 6.7	8.5 / 5.8	8.1 / 6.1		67.6	14.5	4.3	34.1	4.1	
93.5	54	1	8	11:04:00	24389	54	5.6 / 3.8	11.2 / 6.1	9.6 / 7.0	10.2 / 5.6	9.4 / 5.9		74.4	14.5	4.4	34.4	4.1	
93.5	54	2	8	11:04:03	24390	54	5.7 / 4.2	8.5 / 5.9	7.6 / 6.9	7.6 / 5.2	6.5 / 5.2		63.2	14.6	4.3	34.5	4.2	

Recorded by _____ Checked by _____

6420040020_SPSWIM_Sheet_21.doc

TO-15_04_2.67_0100

CA 4 post

Sheet 21

LTPP Traffic Data

WIM System Test Truck Records 2 of 3

Rev. 08/31/2001

* STATE_CODE	04
*SPS PROJECT_ID	0100
* DATE	05 / 03 / 2007

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
94.5	44	1	9	11:23:38	24463	43	5.6/4.8	10.8/6.3	10.8/6.8	10.0/5.5	8.1/7.0		75.6	14.6	4.4	34.0	4.1	
94.5	44	2	9	11:23:41	24464	44	10.8/6.3 5.4/4.5	9.0/5.9	7.5/6.5	6.1/5.2	7.5/5.5		63.3	14.6	4.2	34.5	4.1	
98.6	55	1	10	11:34:10	24506	55	5.7/4.4	11.8/6.3	9.6/6.4	10.7/5.9	8.6/6.0		75.4	14.5	4.4	34.2	4.1	
98.5	54	2	10	11:34:14	24507	53	5.4/4.4	8.6/6.1	7.9/7.3	7.2/5.4	6.8/5.6		64.7	14.6	4.3	34.6	4.2	
99	64	1	11	11:43:52	24533	64	5.1/4.3	9.7/7.1	9.9/7.4	9.4/7.2	9.8/8.6		77.7	14.5	4.3	34.1	4.0	
99	64	2	11	11:43:55	24534	63	4.9/4.4	6.6/6.1	6.6/6.7	6.6/6.9	8.5/6.8		64.1	14.6	4.2	34.4	4.0	
103	44	1	12	12:41:23	24763	43	5.3/4.4	10.7/6.7	9.7/6.9	8.1/7.2	9.7/6.7		75.6	14.5	4.3	33.7	4.0	
103	43	2	12	12:41:26	24764	43	5.4/4.8	8.4/5.9	6.6/6.6	7.0/5.9	7.7/5.4		63.7	14.6	4.3	34.3	4.1	
103.5	54	1	13	12:51:26	24795	55	5.8/4.4	11.2/5.9	9.7/6.7	11.5/5.6	6.4/5.9		73.0	14.5	4.4	34.2	4.2	
103.5	54	2	13	12:51:29	24796	54	5.7/4.3	8.1/5.7	7.8/7.0	8.5/5.5	5.8/5.5		64.1	14.6	4.3	34.4	4.2	
105.5	65	1	14	13:00:45	24836	65	5.7/3.9	9.3/6.3	8.4/6.9	10.6/7.5	9.6/7.1		74.9	14.5	4.3	34.3	4.0	
105.5	63	2	14	13:00:49	24837	63	5.7/4.1	8.7/5.1	7.2/6.0	6.8/6.2	7.0/5.8		62.7	14.6	4.3	34.4	4.1	
105.5	44	1	15	13:10:14	24873	43	5.9/4.4	10.4/6.1	10.9/6.7	8.1/6.3	7.9/6.7		73.3	14.5	4.4	34.1	4.1	
105.5	44	2	15	13:10:16	24874	44	5.8/4.7	8.7/5.9	7.5/6.6	7.6/5.1	7.6/6.1		65.5	14.6	4.3	34.1	4.1	
104.5	54	1	16	13:21:50	24913	54	5.8/4.4	11.2/6.0	9.2/6.7	10.0/5.6	7.7/6.1		72.7	14.5	4.4	34.3	4.2	
104.5	64	1	17	13:31:27	24951	64	5.0/4.7	9.3/7.4	8.9/7.3	5.1/8.4	9.8/8.6		74.5	14.5	4.3	34.3	4.0	

Recorded by Ambie

Checked by

(*) 24914.

6420040020_SPSWIM_Sheet_21.doc

Cal-4 / post

TD-15_04_2.67_0100

Sheet 21	* STATE_CODE	04
LTPP Traffic Data	*SPS PROJECT_ID	0100
WIM System Test Truck Records 3 of 3	* DATE	05/03/2007

Rev. 08/31/2001

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
104.5	64	2	16	13:31:38	24952	64	5.4 / 4.2	8.7 / 5.7	7.0 / 6.7	5.6 / 6.8	7.1 / 6.4		63.4	14.6	4.3	34.5	4.0	
106.	44	1	18	13:41:51	24991	44	5.6 / 4.0	10.6 / 6.0	9.7 / 6.7	9.5 / 5.9	8.0 / 6.7		72.6	14.5	4.4	34.0	4.1	
106	44	2	17	13:41:54	24992	44	5.7 / 4.8	9.0 / 6.0	7.7 / 6.2	8.5 / 5.8	7.2 / 5.7		66.7	14.5	4.3	34.5	4.1	
107.5	55	1	19	13:52:14	25039	55	5.7 / 4.3	10.8 / 6.3	10.0 / 7.1	10.1 / 5.4	6.1 / 6.7		72.3	14.5	4.4	34.3	4.2	
107.5	53	2	18	13:52:17	25040	54	5.1 / 3.9	8.2 / 5.6	7.6 / 6.7	7.8 / 5.5	7.4 / 5.0		62.8	14.6	4.3	34.5	4.1	
110.5	65	1	20	14:02:19	25070	65	5.1 / 4.1	9.6 / 7.0	9.4 / 7.5	9.0 / 7.7	9.6 / 8.2		77.3	14.5	4.3	34.1	4.0	
110.5	63	2	19	14:02:22	25071	64	5.1 / 4.4	7.4 / 5.9	6.4 / 6.5	6.6 / 6.9	6.7 / 6.4		62.3	14.6	4.3	34.4	4.1	
111.0	65	1	21	14:11:24	25102	65	4.5 / 4.9	9.5 / 7.0	8.4 / 7.1	6.2 / 7.6	10.2 / 8.7		74.2	14.5	4.3	34.2	4.0	
111.0	64	2	20	14:11:27	25103	64	4.9 / 4.5	6.6 / 6.4	8.9 / 6.6	8.1 / 7.2	7.7 / 6.9		67.9	14.6	4.2	34.3	4.0	

Recorded by _____ Checked by _____

Cal-B/Post.

3.11.2. Iteration 1 Worksheet

Date 9/2/07

Beginning factors:

Speed Point (mph)	Name	Value
Overall		3 / 2
Front Axle		
1 – (45)	speed bin 1	3700 / 3700
2 – (50)	2	3700 / 3700
3 – (55)	3	3700 / 3700
4 – (60)	4	3700 / 3700
5 – (65)	5	3700 / 3700

Errors (Pre-Validation):

	Speed Point 1 (45)	Speed Point 2 (50)	Speed Point 3 (55)	Speed Point 4 (60)	Speed Point 5 (65)
F/A	-16.2	-15	-14.1	-26	-32.1
Tandem	-20.1	-22	-24.7	-27	-31.7
GVW	-29.6	-23	-26.8	-30.1	-32.1

Adjustments:

	Raise	Lower	Percentage
Overall	☐	☐	
Front Axle	☐	☐	
Speed Point 1	☑	☐	26.6 %
Speed Point 2	☑	☐	29.9 %
Speed Point 3	☑	☐	35.1 %
Speed Point 4	☑	☐	42.8 %
Speed Point 5	☑	☐	49.3 %

End factors:

Speed Point (mph)	Name	Value
Overall		1 / 2
Front Axle		4684 / 4684
1 – (45)	speed bin 1	4805 / 4805
2 – (50)	2	5000 / 5000
3 – (55)	3	5285 / 5285
4 – (60)	4	5523 / 5523
5 – (65)	5	

Task Leader Initials: DJF

- ☑ Open WIM Controller Log File – filename _____
- ☑ 10 runs (equal distribution)
  - ☑ Varying speeds
  - ☑ Separate Sheet 21s (pages = 1)
  - ☑ Recorded on Spreadsheet
- ☑ Errors from 1st Iteration –

	Mean	1SD	2SD	P/F
○ GVW	-0.8 %	6.1 %	13.9 %	P
○ Tandem	-6.0 %	14.8 %	31.0 %	F
○ Axle	2.4 %	37.6 %	17.2 %	F
○ Spacing	0.1 ft		0.0 ft	P

- ☑ Data meets performance requirements?
  - ☑ No – go to 3.11.3.
  - ○ Yes – go to 3.12

Task Leader Initials: _____

3.11.3. Iteration 2 Worksheet

Date 5/3/07

Beginning factors:

Speed Point (mph)	Name	Value
Overall		1 /2
Front Axle		
1 – (45)	speed bin 1	4684 /4684
2 – (50)	2	4805 /4805
3 – (55)	3	5000 /5000
4 – (60)	4	5285 /5285
5 – (65)	5	5523 /5523

Errors (Iteration 1):

	Speed Point 1 (45)	Speed Point 2 (50)	Speed Point 3 (55)	Speed Point 4 (60)	Speed Point 5 (65)
F/A	+ 6.5	+10.2	+ 14.3	+ 6.0	-3.4
Tandem	+ 0.4	- 0.2	- 0.9	0	1.2
GVW	+ 1.2	+ 1.1	+ 0.9	0	- 0.4

Adjustments:

	Raise	Lower	Percentage	
Overall	☐	☐		
Front Axle	☐	☐		
Speed Point 1	☐	☑	~~+1 %~~	.1 %
Speed Point 2	☐	☑	~~+0 %~~	.1 %
Speed Point 3	☐	☑	~~.0 %~~	.09 %
Speed Point 4	☐	☑	~~.0 %~~	.03 %
Speed Point 5	☑	☐	~~.0 %~~	.04 %

End factors:

Speed Point (mph)	Name	Value
Overall		1 /2
Front Axle		
1 – (45)	speed bin 1	4628 /4628
2 – (50)	2	4755 /4755
3 – (55)	3	4955 /4955
4 – (60)	4	5271 /5271
5 – (65)	5	5545 /5545

Task Leader Initials: MM

☑ Open WIM Controller Log File – filename _____

☐ 10 runs (equal distribution)

- ☑ Varying speeds
- ☑ Separate Sheet 21s (pages = 1)
- ☑ Recorded on Spreadsheet

☑ Errors from 2nd Iteration –

	Mean	1SD	2SD	P/F
☑ GVW	-4.8 %	9.4 %	20.7 %	F
☑ Tandem	-5.6 %	11.6 %	23.9 %	F
☑ Axle	1.3 %	7.6 %	16.8 %	F
☑ Spacing	-0.1 %	X %	0.1 %	P

☑ Data meets performance requirements?

- ☑ No – go to 3.11.4.
- ○ Yes – go to 3.11.5.

Task Leader Initials: 

3.11.4. Iteration 3 Worksheet

Date 5/3/07

Beginning factors:

Speed Point (mph)	Name	Value
Overall		1 / 2
Front Axle		
1 – (45)		4628 / 4628
2 – (50)		4755 / 4755
3 – (55)		4955 / 4955
4 – (60)		5271 / 5271
5 – (65)		5545 / 5545

Errors (Iteration 2):

	Speed Point 1 (45)	Speed Point 2 (50)	Speed Point 3 (55)	Speed Point 4 (60)	Speed Point 5 (65)
F/A	0.0	+5.0	+10.0	0.0	-6.0
Tandem	-3.0	-3.0	-4.0	-5.0	-10.0
GVW	-1.0	-1.5	-4.0	-8.0	-10.0

Adjustments: NO ADJUSTMENTS MADE. NEW FACTORS PROVIDED BY IRD.

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

End factors:

Speed Point (mph)	Name	Value
Overall		1 / 2
Front Axle		
1 – (45)		2800 / 2800
2 – (50)		2905 / 2905
3 – (55)		3015 / 3015
4 – (60)		3080 / 3080
5 – (65)		3150 / 3150

3.11.4. Iteration 3 Worksheet

Date 5/3/07

Beginning factors:

Speed Point (mph)	Name	Value
Overall		1/2
Front Axle		
1 – (45)	speed bin 1	2800/2800
2 – (50)	2	2905/2905
3 – (55)	3	3015/3015
4 – (60)	4	3080/3080
5 – (65)	5	3150/3150

Errors (Iteration 2):

	Speed Point 1 (45)	Speed Point 2 (50)	Speed Point 3 (55)	Speed Point 4 (60)	Speed Point 5 (65)
F/A	-27.2	-31.5	-18.6	-23	-28.2
Tandem	-24.8	-22.9	-21.5	-21.6	-21.6
GVW	-25.2	-23	-21.0	-21.7	-22.6

Adjustments:

	Raise	Lower	Percentage
Overall	☐	☐	
Front Axle	☐	☐	
Speed Point 1	☑	☐	33.7 %
Speed Point 2	☑	☐	29.9 %
Speed Point 3	☑	☐	26.6 %
Speed Point 4	☑	☐	30.6 %
Speed Point 5	☑	☐	36.0 %

End factors:

Speed Point (mph)	Name	Value
Overall		1/2
Front Axle		
1 – (45)	speed bin 1	3743/3743
2 – (50)	2	3773/3773
3 – (55)	3	3817/3817
4 – (60)	4	4024/4024
5 – (65)	5	4283/4283

Task Leader Initials: _____

- ☑ WIM Controller Log File on (filename _____)
- ☑ 10 runs (equal distribution)
  - ☑ Varying speeds
  - ☑ Separate Sheet 21s (pages = 1)
  - ☑ Recorded on Spreadsheet
- ☑ Errors (from 3rd Iteration) –

	Mean	1SD	2SD	P/F
☑ GVW	0.0 %	2.0 %	4.5 %	P
☑ Tandem	0.1 %	5.7 %	11.8 %	P
☑ Axle	-0.8 %	2.7 %	6.1 %	P
☑ Spacing	-0.1 ft		0.1 ft	P

- ☑ Data meets performance requirements?
  - ☑ Yes – go to 3.11.5
  - ○ No – Contact COTR, go to 3.11.5.

3.11.5. Calibration Post Truck Measurement (Sheet 19) (if required)

- ☐ One measurement of GVW (<1K) Truck 1___ Truck 2___ Truck 3___
- ☐ Three measurements Truck 1___ Truck 2___ Truck 3___
- ☐ All information entered on Sheet 19 Truck 1___ Truck 2___ Truck 3___
- ☐ Weight tickets annotated

3.12. Post-Validation Pre Truck Measurement (Sheet 19)

- ☑ Three measurements Truck 1 ✓ Truck 2 ✓ Truck 3___
- ☑ All information entered on Sheet 19 Truck 1 ✓ Truck 2 ✓ Truck 3___
- ☑ Weight tickets annotated

3.13. Validation

- ☑ WIM Controller Log File – filename _____
- ☑ 30 runs (even distribution)
  - ☑ Test truck 1 15
  - ☑ Test truck 2 15
  - ○ Test truck 3 ____
- ☑ Speed distribution –
  - ☑ 43 to 47 mph
  - ☑ 48 to 61 mph
  - ☑ 62 to 65 mph
- ☑ Temperature ranges –
  - ☑ 80 to 90
  - ☑ 91 to 99
  - ☑ 100 to 111

Task Leader Initials: QQV

TEST VEHICLE PHOTOGRAPHS FOR SPS WIM VALIDATION

May 2 and 3, 2007

STATE: Arizona

SHRP ID: 0100

Photo 1 - 6420040020_SPSWIM_TO_15_04_2.67_0100_Truck_1_Tractor.JPG-5/3/2007

Photo 2 - 6420040020_SPSWIM_TO_15_04_2.67_0100_Truck_1_Trailer.JPG-5/3/2007

Photo 3 - 6420040020_SPSWIM_TO_15_04_2.67_0100_Truck_1_Suspension_1.JPG – 5/3/2007

Photo 4 - 6420040020_SPSWIM_TO_15_04_2.67_0100_Truck_1_Suspension_2.JPG - 5/3/2007

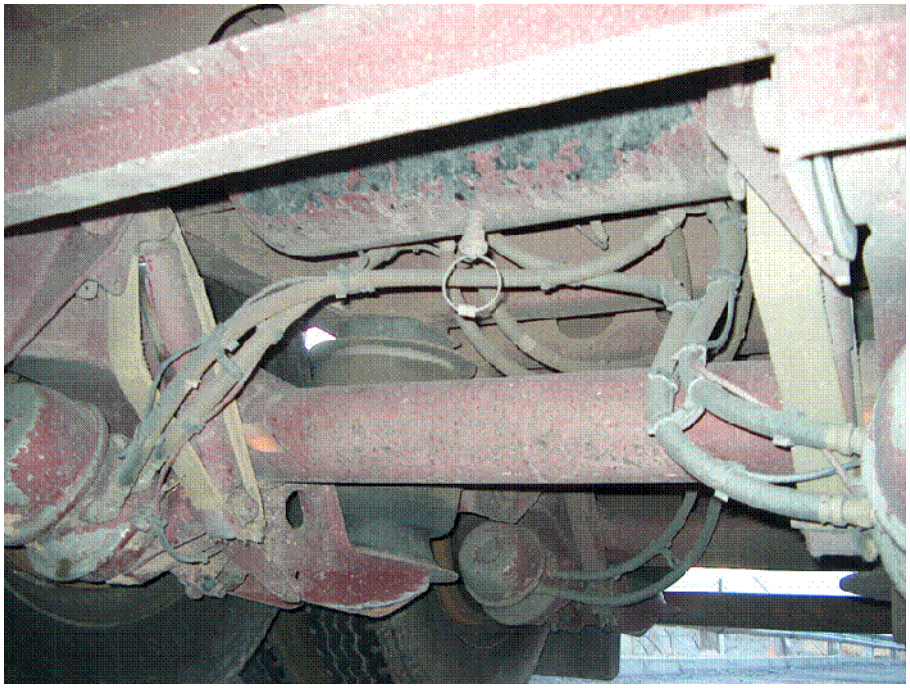


Photo 5 - 6420040020_SPSWIM_TO_15_04_2.67_0100_Truck_1_Suspension_3.JPG – 5/3/2007

Photo 6 - 6420040020_SPSWIM_TO_15_04_2.67_0100_Truck_2_Tractor.JPG – 4/30/2007

Photo 7 - 6420040020_SPSWIM_TO_15_04_2.67_0100_Truck_2_Trailer.JPG – 4/30/2007

Photo 8 - 6420040020_SPSWIM_TO_15_04_2.67_0100_Truck_2_Suspension_1.JPG – 4/30/2007

Photo 9 - 6420040020_SPSWIM_TO_15_04_2.67_0100_Truck_2_Suspension_2.JPG – 4/30/2007

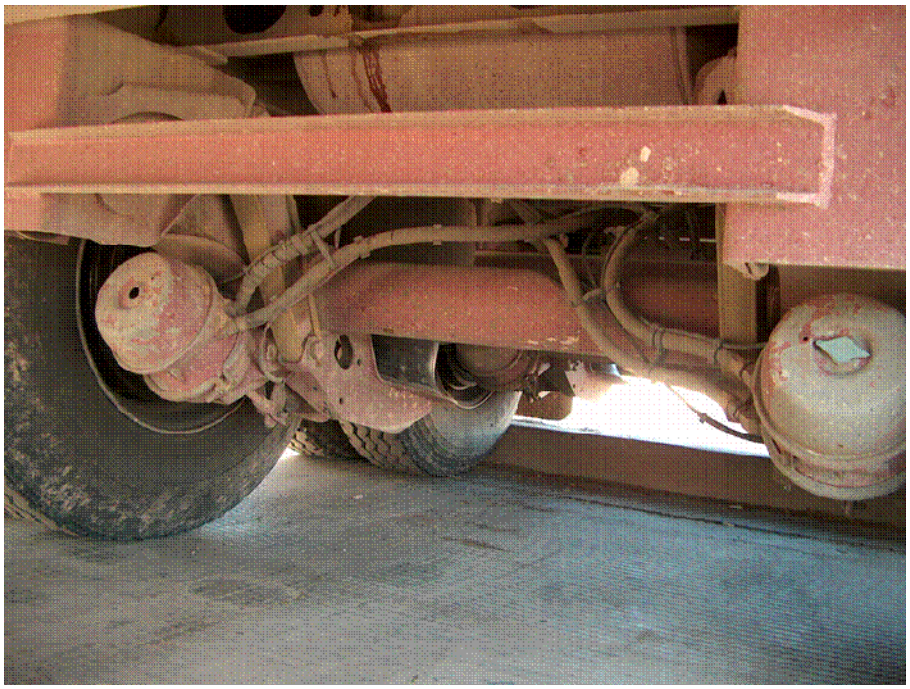


Photo 10 - 6420040020_SPSWIM_TO_15_04_2.67_0100_Truck_2_Suspension_3.JPG – 4/30/2007

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

Final System Operating Parameters

Arizona SPS-1 (Lane 1)

Validation Visit – 3 May, 2007

Calibration factor for sensor #1:

72 kph:	3743
80 kph:	3773
88 kph :	3817
96 kph:	4024
104 kph:	4283

Calibration factor for sensor #2:

72 kph:	3743
80 kph:	3773
88 kph :	3817
96 kph:	4024
104 kph:	4283

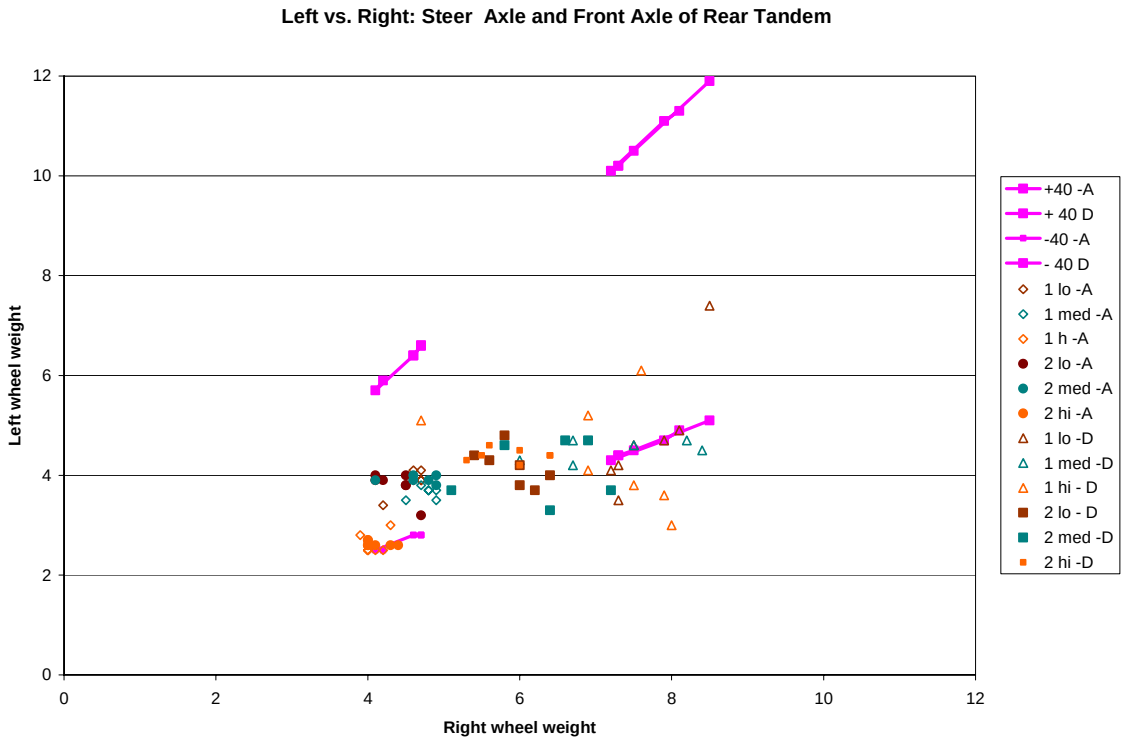


Figure 1 Pre-Calibration Left-Right Wheel Load Investigation - 040100 - 02-May-2007

The problems with attempting to calibrate the site led to investigation of the wheel load variations. Since static weights were not collected by wheel, the following are observations.

In Figure 1 contains the left versus right wheel load plot for the steering axle and the front axle of the rear tandem by truck. The weight of the left wheel is on the vertical axis. The weight of the right wheel is on the horizontal axis. The golden truck is number 1. The partial truck is number 2. The data points are further differentiated by speed group: lo, med and hi and axle. The steering axle is –A. The front axle of the drive tandem is –D.

The open diamonds and the solid dots represent the steering axle. On both vehicles that axle is approximately 10,000 pounds. this implies a wheel weight of 5,000 pounds. At the low and medium speeds the left wheel is between 3,000 and 4,000 pounds and the right wheel varies between 4,000 and 5,000 pounds. Both front axles are reported as lighter than their static weight. The left wheel weights have less variation than the right wheel weights. At high speeds (close to the speed limit) the left wheel weights are concentrated just below 3,000 pounds and the right ones around 4,000 pounds.

The open triangles and the solid squares represent the D-axle. For the golden truck (1-triangles) this axle is approximately 15,700 lbs with an expected wheel load of around 7,850 pounds. The actual range of wheel weights for the left wheel are 3,000 to 5,000 lbs with two measurements over 6,000 pounds. The range of wheel weights for the right

wheel is 4,000 to 8,000 pounds. For the partial truck (2 – squares) the axle is approximately 13,000 pounds. The expected wheel weights would be about 6,500 pounds. The left wheel weights are found between 3,000 and 4,000 pounds. The right wheel weights range from 4,000 to 7,000 pounds.

From this data all left wheels weigh between 3,000 and 5,000 pounds.

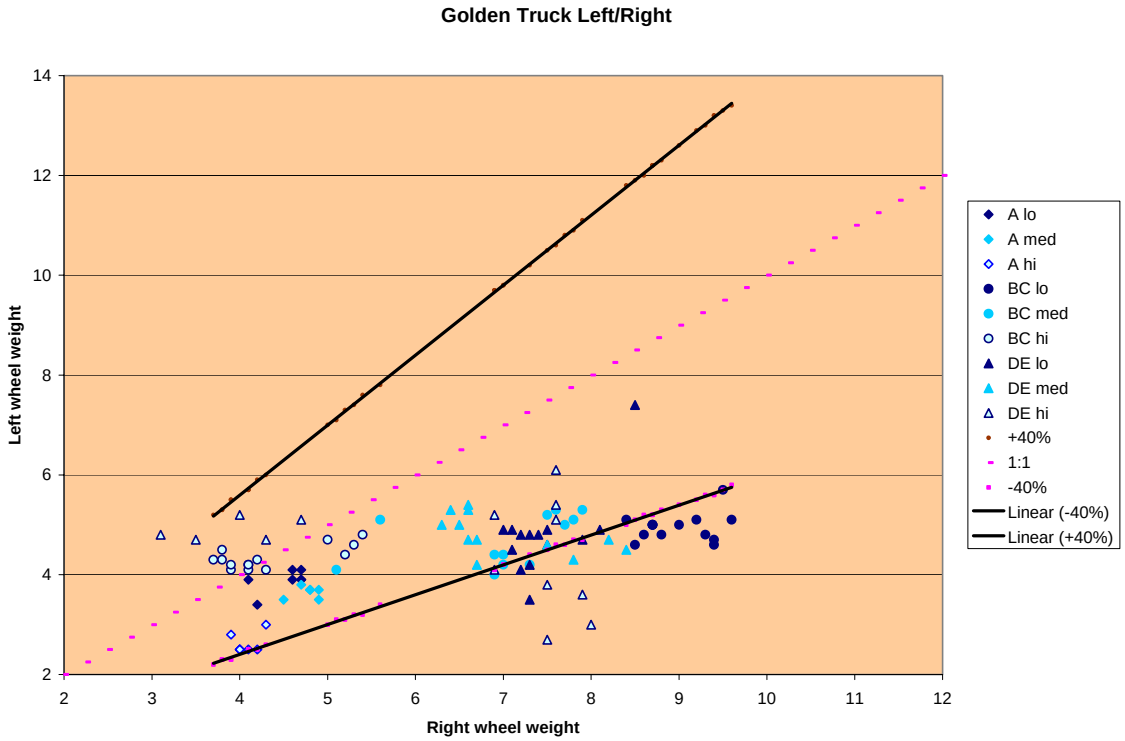


Figure 2 Golden Truck Pre-Calibration Left-Right Wheel Load Investigation - 040100 - 02-May-2007

Figure 2 shows a graph similar to Figure 1 for the golden truck alone. In this graph all of the wheel loads for all of the axles are included. The diamonds are the steering axle. The circles are the drive tandem (B-C axle). The triangles are the trailer tandem (D-E axle). Low speed is dark blue. Medium speed is turquoise. High speed is light blue with a dark outline. The plus or minus 40 percent limits for a site to be operating rationally are identified by the solid black trend lines. The 45 degree diagonal around which all points should cluster is marked by the dotted pink line. Low (lo) speed is up to 47 mph. Medium (med) speed is 48 to 61 mph. High (hi) speed is 62 to 70 mph.

In the tables that follow the weight ranges are approximated and additional symbols used to indicate whether they are just under (< - less than), just over (+ - plus) or close to (~ tilde).

Table 1 Range of Wheel Weights – Golden Truck Steering Axle – Pre-calibration by Speed – 040100 – 5/2/2007

Wheel	Left	Right
Low (blue diamond)	3,000+ – 4,000+	< 4,000 – 5,000
Medium (turquoise diamond)	3,000+ – 4,000+	< 4,000 – 5,000
High (light blue diamond with dark border)	2,500 – 3,000	< 4,000 – < 4,500

The front axle (A) is about 10,000 pounds. for an expected wheel weight of 5,000 pounds. With a +/-20% tolerance for single axles, the range should be 4,000 to 6,000 pounds.

The right side is consistently heavier than the left. Wheels get lighter at high speed.

Table 2 Range of Wheel Weights – Golden Truck Drive Tandem – Pre-calibration by Speed – 040100 – 5/2/2007

Wheel	Left	Right
Low (blue dot)	4,500 – 5,000+	8,000 – 10,000
Medium (turquoise dot)	4,000 – 5,500+	5,000 – ~8,000
High (light blue dot with dark border)	4,000 – 5,000	3,500 – 5,500

The drive tandem (B-C) is about 34,700 lbs with an expected wheel weight of about 8,700 pounds. With a +/-15 % tolerance for tandem axles, the range should be 7,400 to 10,000 pounds.

The right wheel is generally heavier than the left wheel. The left wheel gets a little lighter as speeds increase. The right wheel gets much lighter as speeds increase.

Table 3 Range of Wheel Weights – Golden Truck Tractor Tandem – Pre-calibration by Speed – 040100 – 5/2/2007

Wheel	Left	Right
Low (blue triangle)	3,000 – 5,000*	7,000 – 8,000
Medium (turquoise triangle)	4,000 – 5,500+	6,000 – 8,500
High (light triangle dot with dark border)	4,000 – 5,000	3,000 – 4,500+

* outlier at 7,500 pounds. left, 8,500 lbs right.

The tractor tandem (D-E) is about 31,400 lbs with an expected wheel weight of about 7,850 pounds. With a +/-15 % tolerance for tandem axles, the range should be 6,700 to 9,000 pounds.

The right wheel is heavier than the left wheel except at high speeds. The right wheel gets lighter the faster the truck goes. The left wheel is weighs pretty much the same at all speeds.

Overall left wheels weigh the same independent of actual static axle weight. Right wheels get lighter the faster the truck goes for the loaded truck.

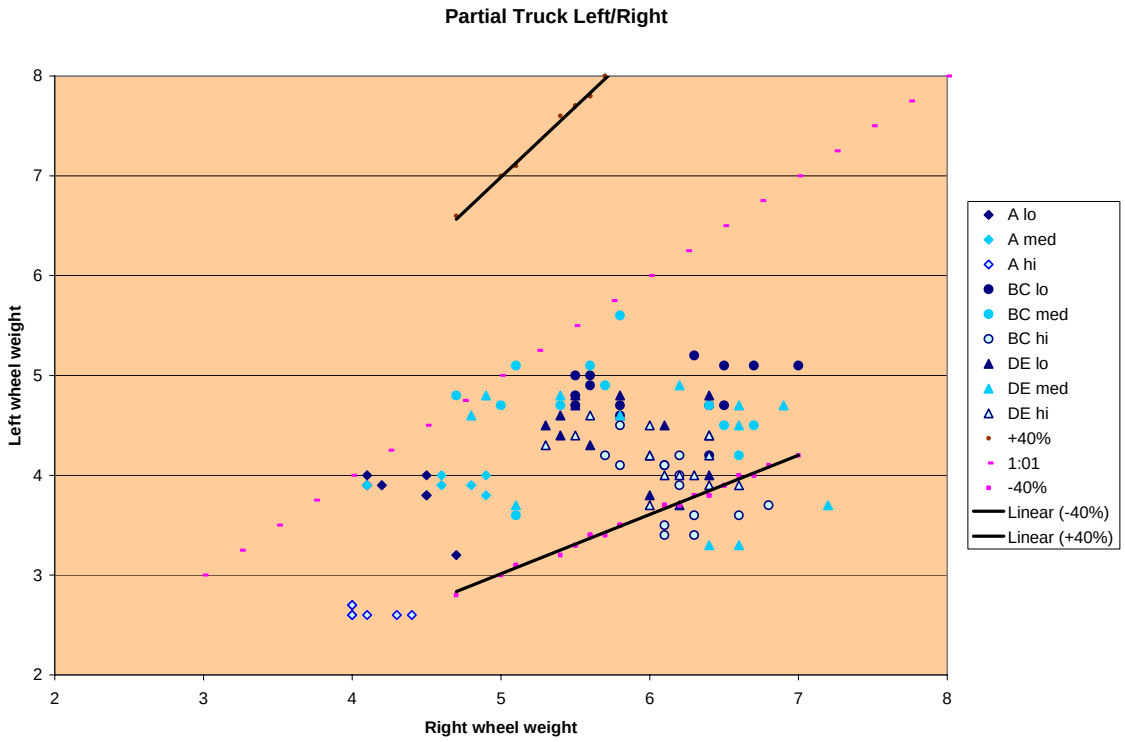


Figure 3 Partial Truck Pre-Validation Left-Right Wheel Load Investigation - 040100 - 02-May-2007

Figure 3 is set up exactly like Figure 2 for the partially loaded truck.

Table 4 Range of Wheel Weights – Partial Truck Steering Axle – Pre-calibration by Speed – 040100 – 5/2/2007

Wheel	Left	Right
Low (blue diamond)	3,000+ – 4,000	4,000 – < 5,000
Medium (turquoise diamond)	3,500+ – 4,000	4,000 – 5,000
High (light blue diamond with dark border)	~2,500	4,000 – 4,500

The front axle (A) is about 10,000 pounds. for an expected wheel weight of 5,000 pounds. With a +/-20% tolerance for single axles, the range should be 4,000 to 6,000 pounds.

The right side is consistently heavier than the left. The left wheel gets lighter at high speed.

Table 5 Range of Wheel Weights – Partial Truck Drive Tandem – Pre-calibration by Speed – 040100 – 5/2/2007

Wheel	Left	Right
Low (blue dot)	4,000 – 5,000+	5,000 – 7,000
Medium (turquoise dot)	3,500 – 5,500	4,500 – 6,500+
High (light blue dot with dark border)	3,500 – 4,500	5,500+ – < 7,000

The drive tandem (B-C) is about 27,800 lbs with an expected wheel weight of about 6, 950 pounds. With a +/-15 % tolerance for tandem axles, the range should be 5,900 to 8,000 pounds.

The right wheel is generally heavier than the left wheel. The left wheel gets a little lighter as speeds increase.

Table 6 Range of Wheel Weights – Partial Truck Tractor Tandem – Pre-calibration by Speed – 040100 – 5/2/2007

Wheel	Left	Right
Low (blue triangle)	3,500+ – <5,000	<5,500 – <6,500
Medium (turquoise triangle)	<3,500 – < 5,000	4,500+ – 7,500
High (light triangle dot with dark border)	3,500+ – 4,500	< 5,500 – 6,500+

The tractor tandem (D-E) is about 26,000 lbs with an expected wheel weight of about 6,500 pounds. With a +/-15 % tolerance for tandem axles, the range should be 5,500 to 7,500 pounds.

The right wheel is heavier than the left wheel.

All left wheels weigh the same independent of actual static axle weight except at high speed for the steering axle.

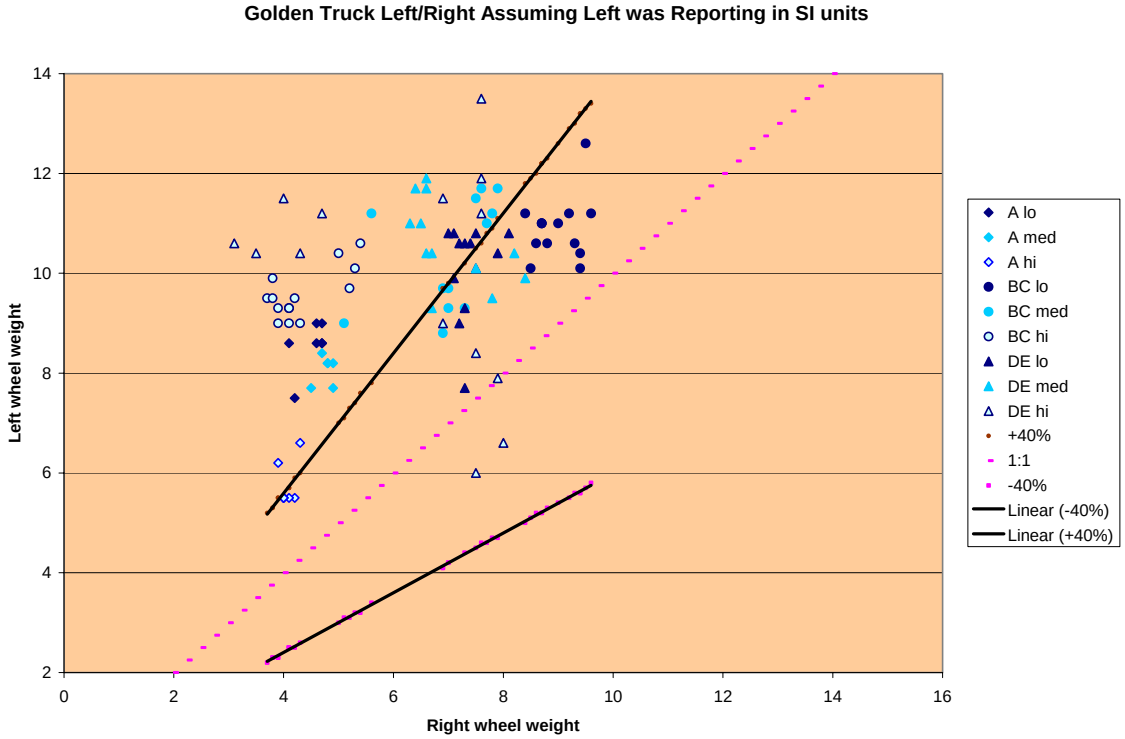


Figure 4 Golden Truck Left/Right Assuming Left Wheel Pad is in SI Units

Figure 4 was created to see what the outcome would be if the left wheel pad was reporting in S.I. units and the right wheel pad is U.S. customary units. While the tandems have closer weights to the expected, the left wheel of the steering axle is much higher than expected. This does not address the observation of lighter weights at higher speeds.

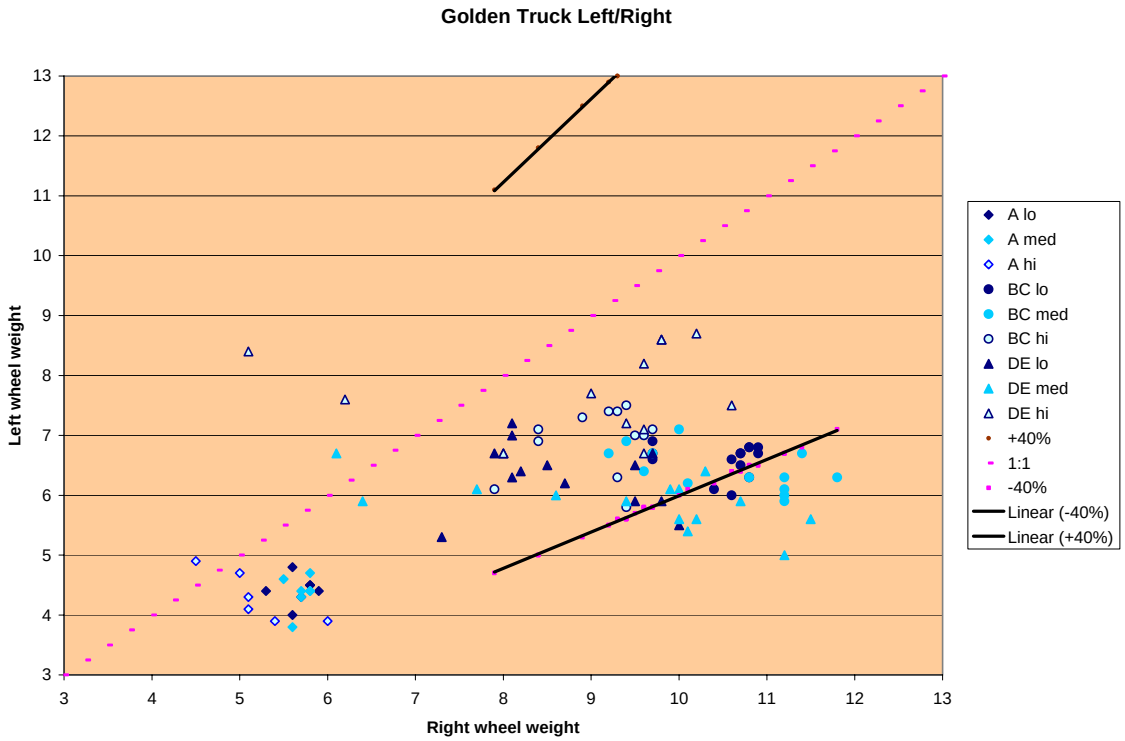


Figure 5 Golden Truck Post-Validation Left-Right Wheel Load Investigation - 040100 - 03-May-2007

Table 7 Range of Wheel Weights – Golden Truck Steering Axle – Post-validation by Speed – 040100 – 5/3/2007

Wheel	Left	Right
Low (blue diamond)	4,000 – 5,000	5,000 – 6,000
Medium (turquoise diamond)	< 4,000 – < 5,000	5,000 – 6,000
High (light blue diamond with dark border)	< 4,000 – 5,000	4,500 – 6,000

The front axle (A) is about 10,000 pounds. for an expected wheel weight of 5,000 pounds. With a +/-20% tolerance for single axles, the range should be 4,000 to 6,000 pounds.

The right wheel is generally heavier than the left. Wheels get slightly lighter at high speed. The right wheel weights fall in the upper end of the range. The left wheel weights fall in the lower end of the expected range.

Table 8 Range of Wheel Weights – Golden Truck Drive Tandem – Post-validation by Speed – 040100 – 5/3/2007

Wheel	Left	Right
Low (blue dot)	6,000 – 7,000	9,500 – < 11,000
Medium (turquoise dot)	< 6,000 – 7,000+	9,000+ – < 12,000
High (light blue dot with dark border)	< 6,000 – 7,500	~8,000 – < 10,000

The drive tandem (B-C) is about 34,300 lbs with an expected wheel weight of about 8,500 pounds. With a +/-15 % tolerance for tandem axles, the range should be 7,250 to 9,800 pounds.

The right wheel is heavier than the left wheel. The right wheel gets lighter as speeds increase. The right wheel is generally above the expected value. The left wheel gets a more variable as speeds increase. The left wheel weights are below the minimum of the expected range.

Table 9 Range of Wheel Weights – Golden Truck Tractor Tandem – Post-validation by Speed – 040100 – 5/3/2007

Wheel	Left	Right
Low (blue triangle)	< 5,500 – < 7,500	7,000+ – 10,000
Medium (turquoise triangle)	5,000 – < 7,000	6,000 – 11,500
High (light triangle dot with dark border)	6,500 – < 9,000	5,000 – 10,000

The tractor tandem (D-E) is about 31,000 lbs with an expected wheel weight of about 7,800 pounds. With a +/-15 % tolerance for tandem axles, the range should be 6,600 to 8,950 pounds.

The right wheel is generally heavier than the left wheel. The right wheel gets lighter the faster the truck goes. The right wheel weights have a range wider than the expected range for research quality axle data. They also have a wider range that the ASTM E-1318 Type I wheel load standard. The left wheel gets heavier at high speed. Except at high speed the range of wheel weights is below the expected value.

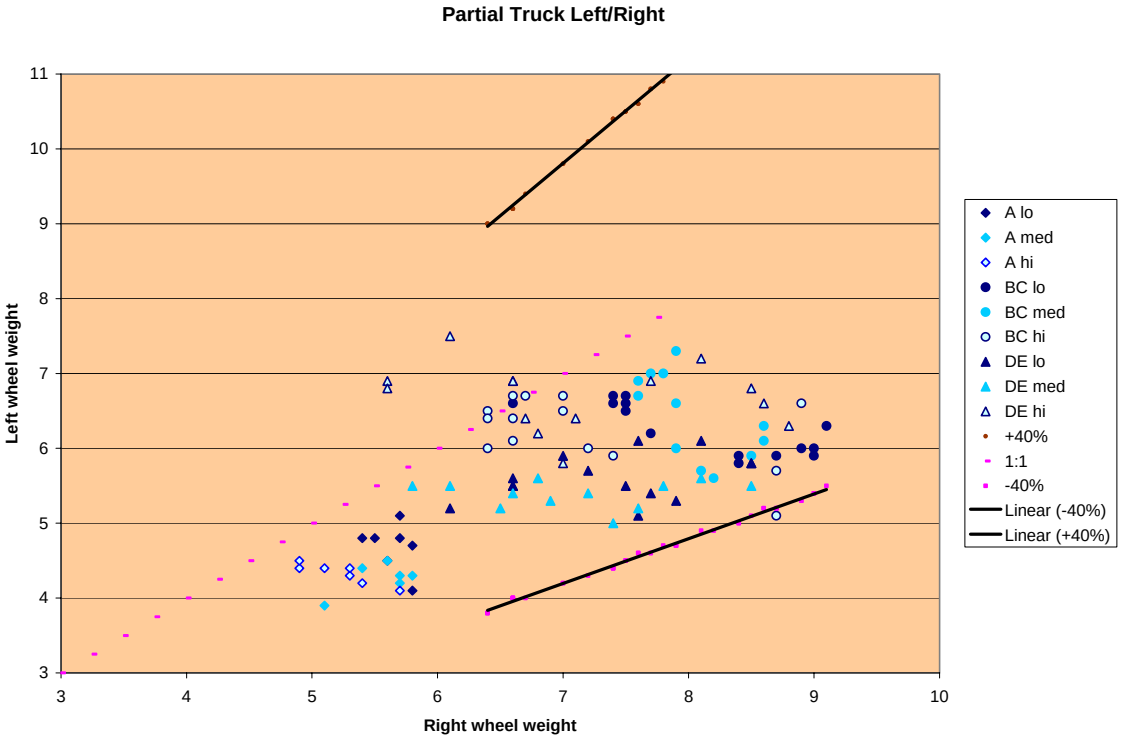


Figure 6 Partial Truck Post-Validation Left-Right Wheel Load Investigation - 040100 - 03-May-2007

Table 10 Range of Wheel Weights – Partial Truck Steering Axle – Post-validation by Speed – 040100 – 5/3/2007

Wheel	Left	Right
Low (blue diamond)	4,000 – 5,000+	< 5,500 – < 6,000
Medium (turquoise diamond)	< 4,000 – 4,500	5,000 – 6,000
High (light blue diamond with dark border)	4,000 – 4,500+	< 5,000 – 5,500+

The front axle (A) is about 10,000 pounds. for an expected wheel weight of 5,000 pounds. With a +/-20% tolerance for single axles, the range should be 4,000 to 6,000 pounds.

The right wheel is generally heavier than the left. Wheels get slightly lighter at high speed. Wheel weights are within the expected range.

Table 11 Range of Wheel Weights – Partial Truck Drive Tandem – Post-validation by Speed – 040100 – 5/3/2007

Wheel	Left	Right
Low (blue dot)	5,500+ – 6,500+	6,500 – 9,000
Medium (turquoise dot)	5,500 – 7,500	7,500 – 8,500
High (light blue dot with dark border)	5,000+ – 6,500+	<6,500 – 9,000

The drive tandem (B-C) is about 27,600 lbs with an expected wheel weight of about 6,900 pounds. With a +/-15 % tolerance for tandem axles, the range should be 5,800 to 7,900 pounds.

The right wheel is heavier than the left wheel. The right wheel weights are more variable as speeds increase. The right wheel weights tend to exceed the upper end of the expected range. The left wheel weights are generally below the expected value.

Table 12 Range of Wheel Weights – Partial Truck Tractor Tandem – Post-validation by Speed – 040100 – 5/3/2007

Wheel	Left	Right
Low (blue triangle)	5,000+ – 6,000+	6,000+ – 8,000
Medium (turquoise triangle)	5,000 – 5,500+	5,500+ – 8,500
High (light triangle dot with dark border)	5,500+ – 7,500+	5,500 – < 9,000

The tractor tandem (D-E) is about 25,600 lbs with an expected wheel weight of about 6,400 pounds. With a +/-15 % tolerance for tandem axles, the range should be 5,400 to 7,400 pounds.

The right wheel is generally heavier than the left wheel. The range of weights on the right wheel is greater than expected. It almost exceeds the ASTM E-1318 Type I wheel load criteria on both ends. The right wheel weights are more variable the faster the truck goes. The left wheel weights are move variables at high speed.