Validation Report

Arizona, SPS-1
Task Order 23, CLIN 2
February 13 to 14, 2008

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1 Executive Summary

A visit was made to the Arizona 0100 on February 13 to 14, 2008 for the purposes of conducting a validation of the WIM system located on US 93 near the Chloride, AZ turn-off.. The SPS-1 is located in the righthand, northbound lane of a four-lane divided facility. The posted speed limit at this location is 65 mph. The LTPP lane is the only lane that is instrumented at this site. The validation procedures were in accordance with LTPP's SPS WIM Data Collection Guide dated August 21, 2001.

This 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 second validation visit to this location. The site was installed prior to November 30, 2006 by International Road Dynamics Inc..

This site demonstrates the ability to produce research quality loading data under the observed conditions. The classification algorithm is not currently providing research quality classification information.

The site is instrumented with bending plate and iSync electronics. It is installed in portland cement concrete, 400 feet long. Beyond this PCC, the pavement surface is asphalt concrete.

The validation used the following trucks:

1) 5-axle tractor-trailer with a tractor having an air suspension and a trailer with a standard rear tandem and an air suspension loaded to 77,150 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 64,470 lbs., the "partial" truck.

The validation speeds ranged from 44 to 63 miles per hour. The pavement temperatures ranged from 29 to 80 degrees Fahrenheit. The desired speed range was achieved during this validation. The desired 30 degree Fahrenheit temperature range was also achieved.

Table 1-1 Post-Validation results – 040100 – 14-Feb-2008

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	-2.6 ± 7.2%	Pass
Tandem axles	±15 percent	-2.0 ± 6.7%	Pass
GVW	±10 percent	-2.1 ± 4.6%	Pass
Axle spacing	± 0.5 ft [150mm]	0.0 ± 0.0 ft	Pass

Prepared: rwp Checked: bko

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

Based on profile data collected at this site on December 11, 2007 WIMIndex values have been computed. All of the values fall between the lower threshold and upper threshold limits. Given the current condition of the scale at this review, the roughness does not appear to be a factor in the performance of the scale.

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

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

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

Prepared: rwp *Checked: bko*

Upon our arrival at the site, we found the system parameters were not the same as we left them at the conclusion of our last validation on May 3, 2007. Apparently the site has had equipment maintenance work that was performed between our last Validation visit and this one.

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

2 Corrective Actions Recommended

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

3 Post Calibration Analysis

This final analysis is based on test runs conducted during the afternoon of February 13, 2008 and during the morning and early afternoon of February 14, 2008 at test site 040100 on US 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 trailer with a standard rear tandem and air suspension loaded to 77,150 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 64,470 lbs., the “partial” truck.

Each truck made a total of 20 passes over the WIM scale at speeds ranging from approximately 44 to 63 miles per hour. The desired speed range was achieved during this validation. Pavement surface temperatures were recorded during the test runs ranging from about 29 to 80 degrees Fahrenheit. The desired 30 degree Fahrenheit temperature range was also achieved. The computed values of 95% confidence limits of each statistic for the total population are in Table 3-1.

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

Table 3-1 Post-Validation Results – 040100 – 14-Feb-2008

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	-2.6 ± 7.2%	Pass
Tandem axles	±15 percent	-2.0 ± 6.7%	Pass
GVW	±10 percent	-2.1 ± 4.6%	Pass
Axle spacing	± 0.5 ft [150mm]	0.0 ± 0.0 ft	Pass

Prepared: rwp Checked: bko

Test runs conducted during the afternoon of February 13 had recorded pavement temperatures much higher than the runs performed during the morning of February 14. Together, these runs achieved the desired range of temperatures.

The runs were also conducted at various speeds to determine the effects of these variables on the performance of the WIM scale. To investigate these effects, the data set was split into three speed groups and two temperature groups. The distribution of runs by speed and temperature is illustrated in Figure 3-1. The figure indicates that the desired distribution of speed and temperature combinations was achieved for this set of validation runs.

The three speed groups were divided as follows: Low speed – 44 to 50 mph, Medium speed – 51 to 60 mph and High speed – 61 + mph. The two temperature groups were created by splitting the runs between those at 29 to 55 degrees Fahrenheit for Low temperature and 56 to 80 degrees Fahrenheit for High temperature.

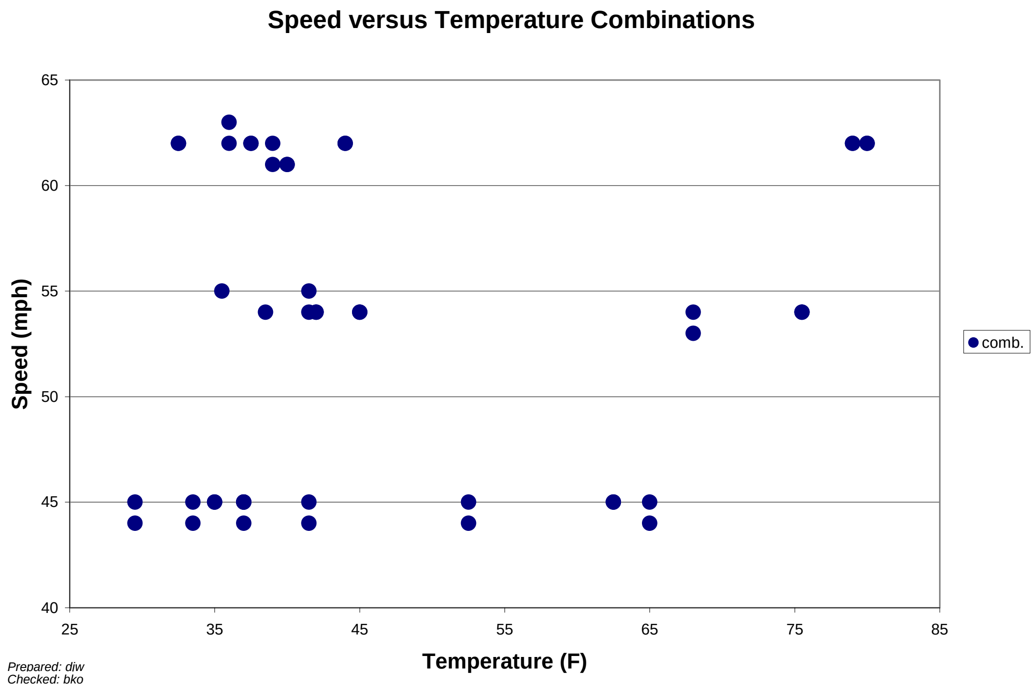


Figure 3-1 Post-Validation Speed-Temperature Distribution – 040100 – 14-Feb-2008

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

Figure 3-2 shows the GVW Percent Error vs. Speed graph for the population as a whole. Bias of the GVW errors was slightly negative over the entire range of these speeds. There does not appear to be any effect of speed on the variability or bias of the measurement errors.

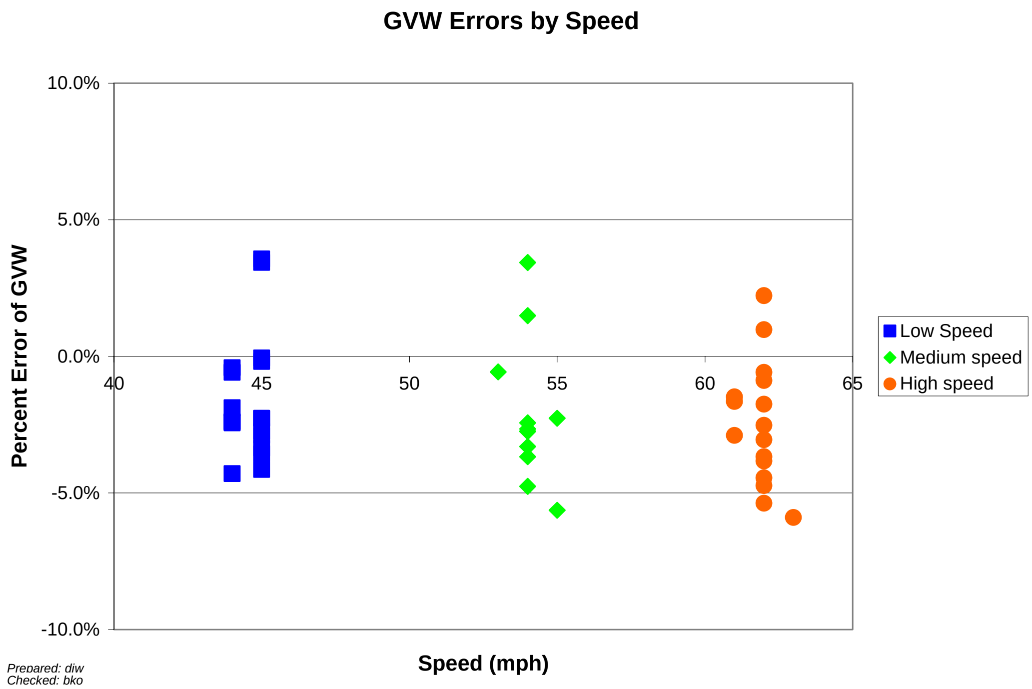


Figure 3-2 Post-validation GVW Percent Error vs. Speed – 040100 – 14-Feb-2008

Figure 3-3 shows the relationship between temperature and GVW percentage error. This graph clearly shows the higher temperature runs that were conducted on February 13 and the lower temperatures that were encountered on February 14. The twelve post-calibration runs from the afternoon of the 13th have little or no measurement bias. The runs from the 14th when temperatures were cooler indicate that cooler temperatures do have an effect on GVW measurements errors.

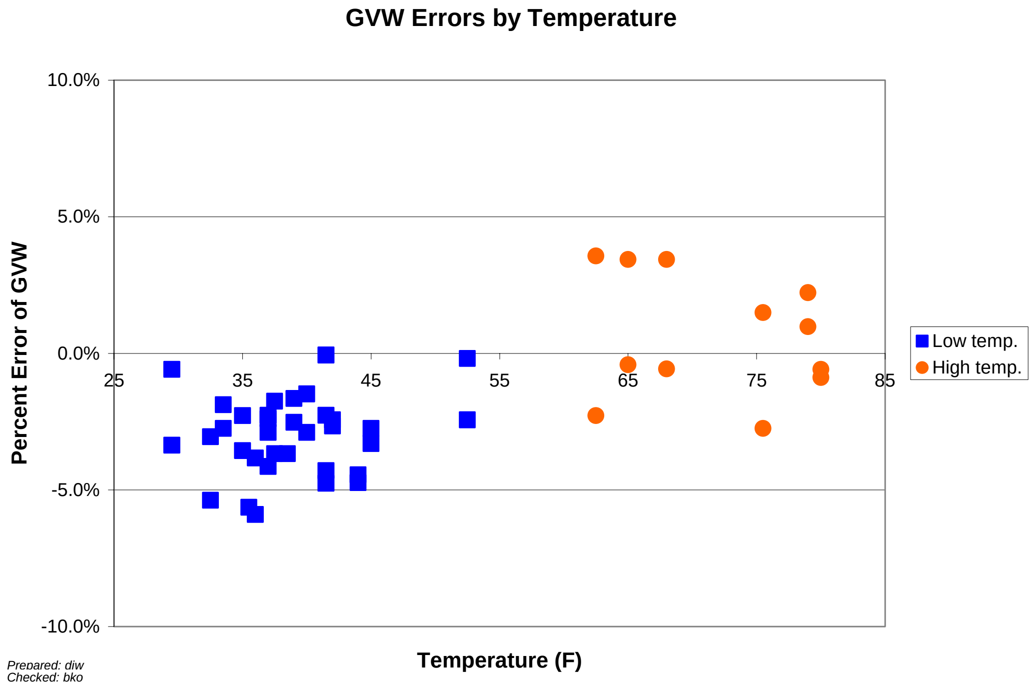


Figure 3-3 Post-Validation GVW Percent Error vs. Temperature – 040100 – 14-Feb-2008

Figure 3-4 shows the relationship between the drive tandem spacing errors in feet and speeds. This graph is used as a potential indicator of classification errors due to failure to correctly identify spacings on a vehicle. Since the most common reference value is the drive tandem on a Class 9 vehicle, this is the spacing evaluated and plotted for validations. Drive tandem spacing was measured with no error by the system during this round of tests. This was true for the entire range of truck speeds.

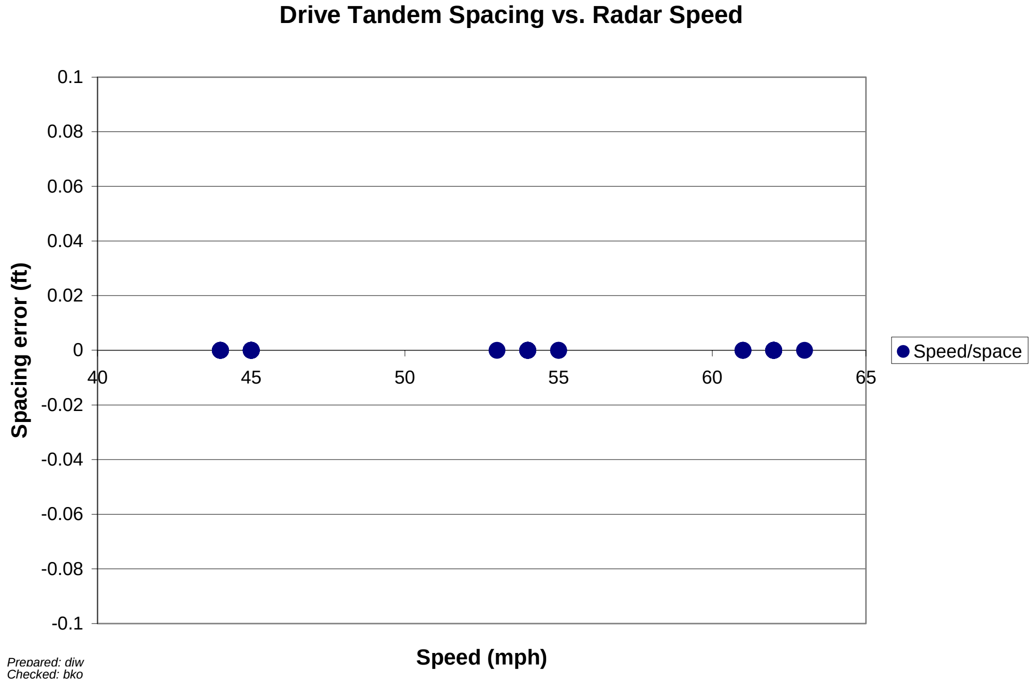


Figure 3-4 Post-Validation Spacing vs. Speed – 040100 – 14-Feb-2008

3.1 Temperature-based Analysis

The two temperature groups were created by splitting the runs between those at 29 to 55 degrees Fahrenheit for Low temperature and 56 to 80 degrees Fahrenheit for High temperature.

Table 3-2 Post-Validation Results by Temperature Bin – 040100 – 14-Feb-2008

Element	95% Limit	Low Temperature 29 to 55 °F	High Temperature 56 to 80 °F
Steering axles	±20 %	-3.4 ± 6.5%	-0.2 ± 7.6%
Tandem axles	±15 %	-3.0 ± 5.8%	0.9 ± 6.2%
GVW	±10 %	-3.0 ± 2.9%	0.6 ± 4.9%
Axle spacing	± 0.5 ft	0.0 ± 0.0 ft	0.0 ± 0.0 ft

Prepared: rwp *Checked: bko*

Table 3-2 shows the differences in weight estimation bias between the higher temperature runs that were conducted on February 13 and the lower temperatures that were encountered on February 14. The single calibration was performed based on the 40 runs from the morning of the 13^{th} when temperatures were warmer. There is an indication that cooler temperatures do have an effect on GVW measurements errors.

Figure 3-5 is the distribution of GVW Errors versus Temperature by Truck graph. The errors are similar at lower pavement temperatures and tend to diverge slightly at higher temperatures. Both trucks however, show the same qualitative response to temperature variation over this range.

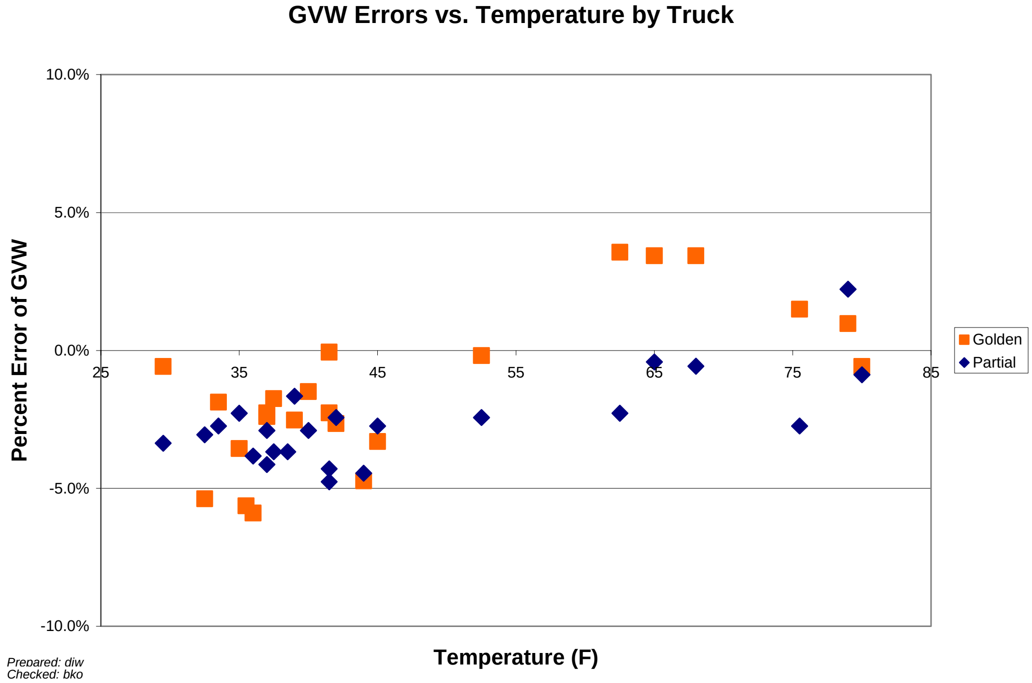


Figure 3-5 Post-Validation GVW Percent Error vs. Temperature by Truck – 040100 – 14-Feb-2008

Figure 3-6 shows the relation between steering axle errors and temperature. This graph is included due to the frequent use of steering axle weights of Class 9 vehicles for calibration. This site does not use auto-calibration. The steering axles in this graph are associated only with Class 9 vehicles.

The steering axles behave exactly as the GVW did over this temperature range. A slight underestimation of weights at low temperatures and an absence of any bias at higher temperatures can be observed.

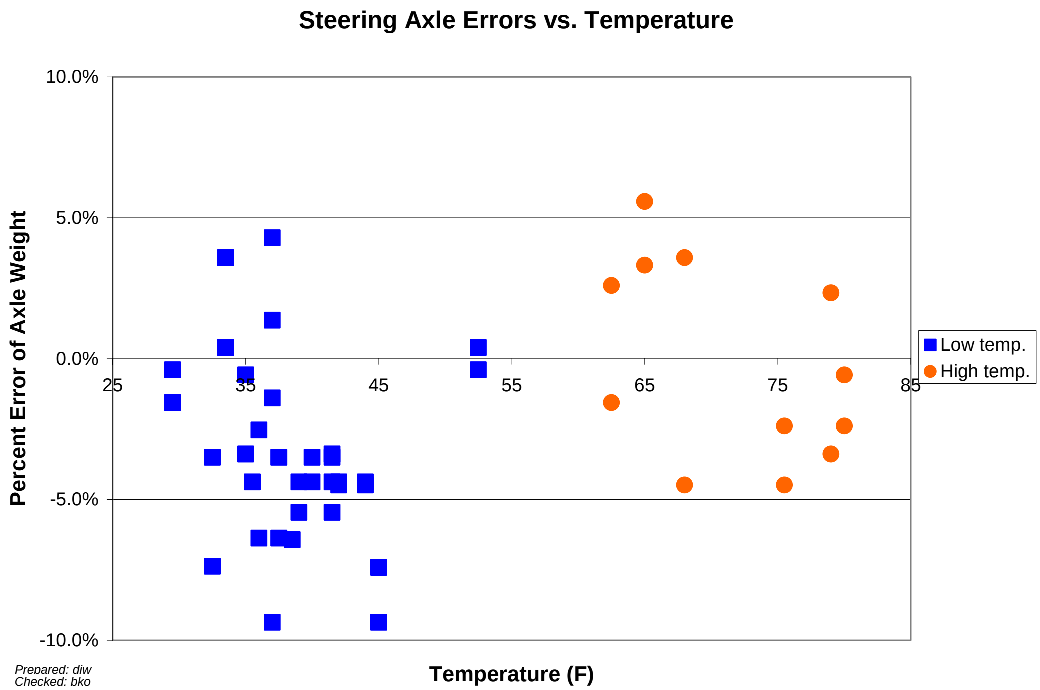


Figure 3-6 Post-Validation Steering Axle Error vs. Temperature by Group – 040100 – 14-Feb-2008

3.2 Speed-based Analysis

The three speed groups were divided using 44 to 50 mph for Low speed, 51 to 60 mph for Medium speed and 61+ mph for High speed.

Table 3-3 Post-Validation Results by Speed Bin – 040100 – 14-Feb-2008

Element	95% Limit	Low Speed 44 to 50 mph	Medium Speed 51 to 60 mph	High Speed 61+ mph
Steering axles	±20 %	-0.2 ± 7.4%	-4.5 ± 6.9%	-3.8 ± 5.0%
Tandem axles	±15 %	-1.9 ± 5.7%	-1.7 ± 7.6%	-2.2 ± 7.6%
GVW	±10 %	-1.6 ± 4.7%	-2.2 ± 5.6%	-2.5 ± 4.8%
Axle spacing	± 0.5 ft	0.0 ± 0.0 ft	0.0 ± 0.0 ft	0.0 ± 0.0 ft

Prepared: rwp Checked: bko

Bias of steering axle weight estimates changed somewhat with speed but for axle groups and for GVW there was little observed change. Figure 3-7 shows the relatively little change in error bias in GVW over the range of speeds. The ‘Golden’ truck displays a slightly greater variability in measurement errors than the ‘Partial’ truck.

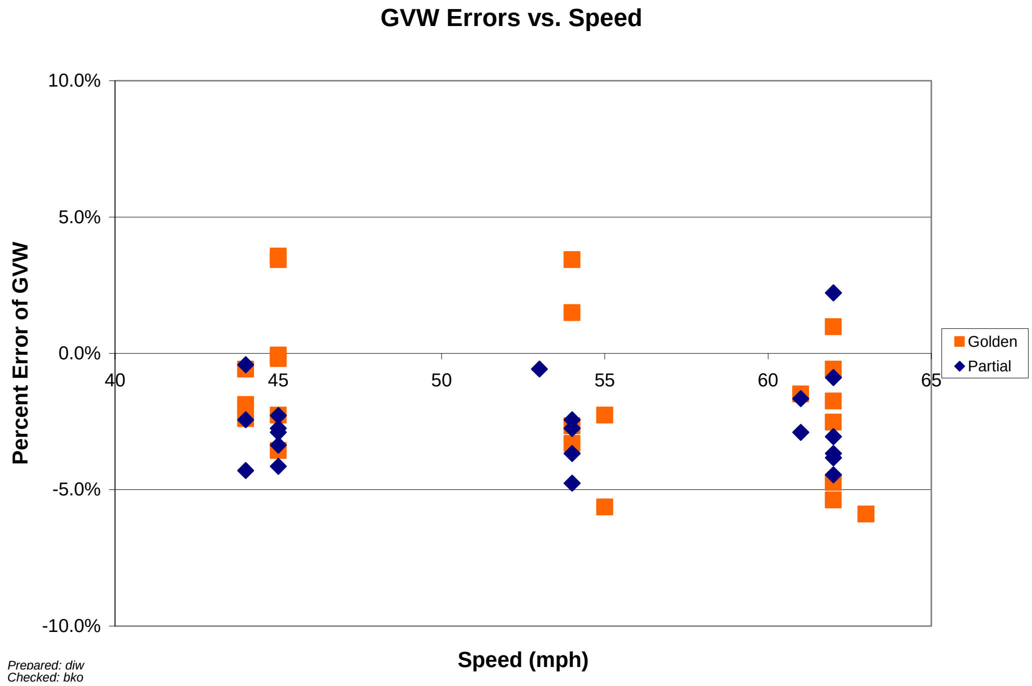


Figure 3-7 Post-Validation GVW Percent Error vs. Speed by Truck – 040100 – 14-Feb-2008

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

The graph shows the changes in measurement bias of steering axles with speed. The greatest bias occurs at intermediate speeds and the least at low speeds.

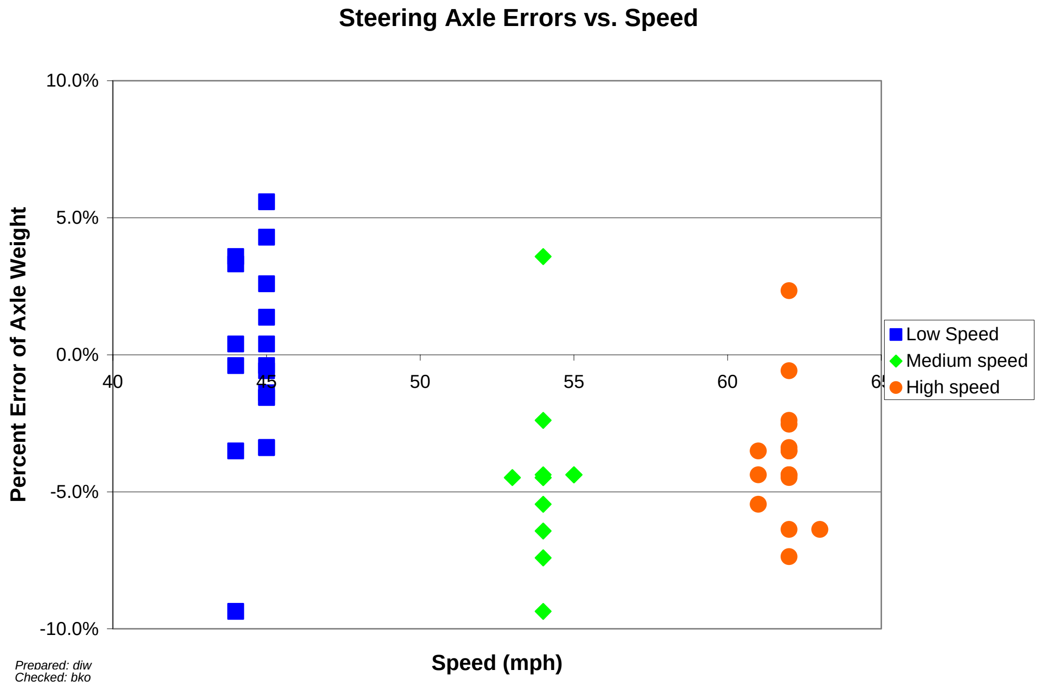


Figure 3-8 Post-Validation Steering Axle Percent Error vs. Speed by Group – 040100 – 14-Feb-2008

3.3 Classification Validation

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

The classification validation is intended to find gross errors in vehicle classification, not to validate the installed algorithm. A sample of three hours (27 trucks) was collected at the site. Video was taken at the site to provide ground truth for the evaluation. Based on a 100 percent sample it was determined that there are 0 percent unknown vehicles and 0 percent unclassified vehicles.

The second check is the ability of the algorithm to correctly distinguish between truck classes with no more than 2% errors in such classifications. Table 3-4 has the classification error rates by class. The overall misclassification rate is 20 percent. Due to the small sample size, this percentage could be misleading.

Table 3-4 Truck Misclassification Percentages for 040100 – 14-Feb-2008

Class	Percent Error	Class	Percent Error	Class	Percent Error
4	N/A	5	27	6	0
7	N/A				
8	38	9	0	10	N/A
11	N/A	12	N/A	13	N/A

Prepared: rwp Checked: bko

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

Table 3-5 Truck Classification Mean Differences for 040100 – 14-Feb-2008

Class	Mean Difference	Class	Mean Difference	Class	Mean Difference
4	N/A	5	38	6	0
7	N/A				
8	- 38	9	0	10	N/A
11	N/A	12	N/A	13	N/A

Prepared: rwp Checked: bko

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

The site consistently recorded straight trucks with trailers and erroneously classified them as Class 5 rather than the correct Class 8. .

3.4 Evaluation by ASTM E-1318 Criteria

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

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

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

Prepared: rwp Checked: bko

4 Pavement Discussion

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

4.1 Profile Analysis

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

Profile data collected at the SPS WIM location by Nichols Consulting Engineers on December 11, 2007 were processed through the LTPP SPS WIM Index Software, version 1.1. This WIM scale is installed on a rigid pavement.

A total of 8 profiler passes were conducted over the WIM Site. Since the issuance of the LTPP directive on collection of longitudinal profile data for SPS WIM sections, the requirements have been a minimum of 3 passes in the center of the lane and one shifted to each side. For this the RSC has completed 4 passes at the center of the lane, 2 passes shifted to the left side of the lane, and 2 passes shifted to the right side of the lane. Shifts to the sides of the lanes were collected as close to the lane edges as was safely possibly. For each profiler pass, profilers were recorded under the left wheel path (LWP) and the right wheel path (RWP).

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

Table 4-1 Thresholds for WIM Index Values

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

Prepared: als Checked: jrn
Prepared: rwp Checked: bko

Table 4-2 shows the computed index values for all 8 profiler passes for this WIM site. The average values over the passes in each path were also calculated when three or more passes were completed. These are shown in the right most column of the table. Values above the upper index limits are presented in bold while values below the lower index limits are presented in italics.

Table 4-2 WIM Index Values – 040100 – 11-Dec-2007

Profiler Passes			Pass 1	Pass 2	Pass 3	Pass 4	Ave.
Center	LWP	LRI (m/km)	0.645	0.605	0.690	0.703	0.661
		SRI (m/km)	0.742	0.739	0.754	0.741	0.744
		Peak LRI (m/km)	0.862	1.040	0.928	1.153	0.996
		Peak SRI (m/km)	0.769	0.899	0.903	0.925	0.874
	RWP	LRI (m/km)	1.153	1.099	1.051	1.020	1.081
		SRI (m/km)	1.402	1.203	0.767	0.856	1.057
		Peak LRI (m/km)	1.161	1.099	1.051	1.036	1.087
		Peak SRI (m/km)	1.415	1.219	1.127	1.209	1.242
Left Shift	LWP	LRI (m/km)	0.870	0.810			
		SRI (m/km)	0.695	0.646			
		Peak LRI (m/km)	1.116	1.139			
		Peak SRI (m/km)	0.728	1.105			
	RWP	LRI (m/km)	1.007	1.026			
		SRI (m/km)	1.541	1.733			
		Peak LRI (m/km)	1.045	1.044			
		Peak SRI (m/km)	1.571	1.941			
Right Shift	LWP	LRI (m/km)	0.864	0.755			
		SRI (m/km)	1.168	1.054			
		Peak LRI (m/km)	0.892	0.914			
		Peak SRI (m/km)	1.172	1.145			
	RWP	LRI (m/km)	1.054	0.879			
		SRI (m/km)	0.769	0.770			
		Peak LRI (m/km)	1.144	0.987			
		Peak SRI (m/km)	0.949	1.119			

Prepared: als Checked: jrn
Prepared: rwp Checked: bko

From the table, it can be seen that all of the values fall between the index limits indicating that the pavement roughness may or may not interfere with the validation outcome. Since the site was validated successfully, it is concluded that the pavement roughness was not a factor in the proper operation of the equipment.

4.2 Distress Survey and Any Applicable Photos

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

4.3 Vehicle-pavement Interaction Discussion

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

5 Equipment Discussion

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

5.1 Pre-Evaluation Diagnostics

No problems were found with the equipment prior to the evaluations. However, during the morning of February 14, 2008 the system signaled an error in recording axle weights very soon after logging onto the system. After consultation with IRD, reseating the system board appeared to solve the problem.

5.2 Calibration Process

Upon our arrival at the site, we found the system parameters were not the same as we left them at the conclusion of our last validation on May 3, 2007. Apparently the site has had equipment maintenance work that was performed between our last Validation visit and this one.

The equipment was given one-iteration of the calibration process between the initial 40 runs and the final 40 runs. The system already met the validation requirements but a single calibration was performed to eliminate a small negative bias in weight estimates.

For this equipment, there are 5 speed designated 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 percentages 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 the site that were in place prior to the Pre-Validation were as follows:

Speed Bin	Sensor 1	Sensor 2
1	3571	3571
2	3550	3550
3	3626	3626
4	3700	3700
5	3450	3450

Additionally, an adjustment for spacing measurement error can be made by altering a single compensation factor to directly effect the distances reported by the equipment. The original factor was 341.

5.2.1 Calibration Iteration 1

Based on the results from the Pre-Validation, the compensation factors were adjusted slightly to compensate for underestimation 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	3619	3619
2	3642	3642
3	3766	3766
4	3822	3822
5	3545	3545

The spacing compensation factor was not adjusted.

Results of this calibration are tabulated in Table 5-1 and illustrated in Figure 5-1. Measurement bias was reduced to near zero.

Table 5-1 Calibration Iteration 1 Results – 040100 – 13-Feb-2008 (01:36 PM)

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	-0.8 ± 7.4%	Pass
Tandem axles	±15 percent	0.4 ± 6.1%	Pass
GVW	±10 percent	0.2 ± 4.7%	Pass
Axle spacing	± 0.5 ft	0.0 ± 0.0 ft	Pass

Prepared: rwp *Checked: bko*

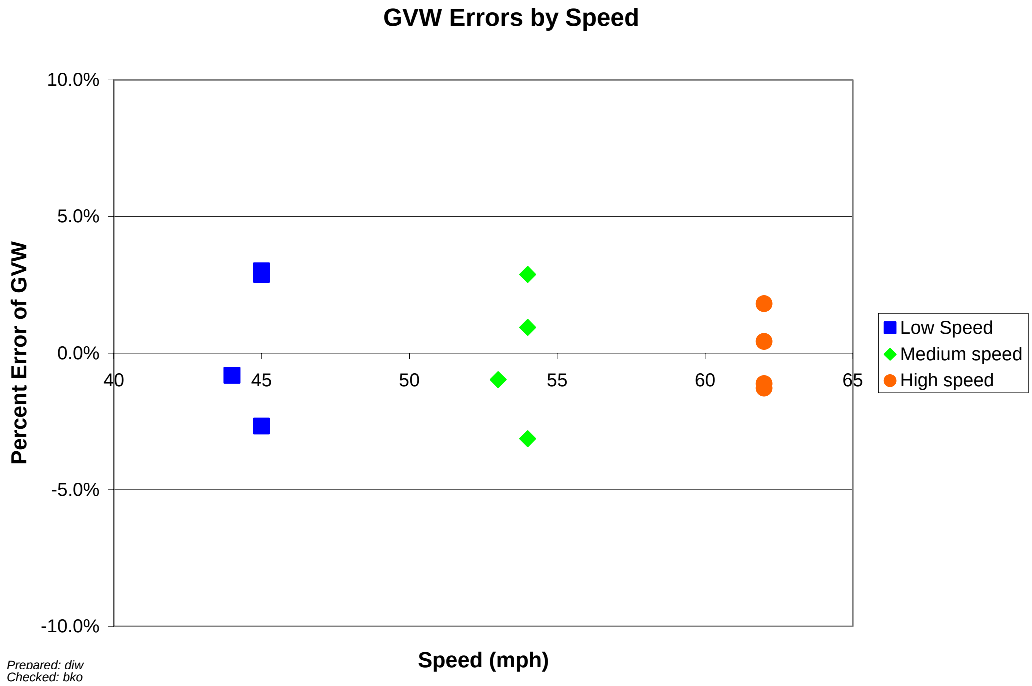


Figure 5-1 Calibration Iteration 1 GVW Percent Error vs. Speed Group – 040100 – 13-Feb-2008 (01:36 PM)

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

The equipment persistently classified straight trucks with trailers as Class 5 vehicles rather than Class 8 trucks. The error was in the algorithm rather than the capability to recognize and record all vehicle axles.

Table 5-2 Classification Validation History – 040100 – 14-Feb-2008

Date	Method	Mean Difference				Percent Unclassified
		Class 9	Class 8	Other 1	Other 2	
2/14/2008	Manual	0	-38			0
2/13/2008	Manual	0	-22			0
5/3/2007	Manual	0	0			0
5/2/2007	Manual	0	0			0

Prepared: rwp *Checked: bko*

Table 5-3 has the information for TRF_CALIBRATION_WIM for Sheet 16s submitted prior to this validation as well as the information for the current visit.

Table 5-3 Weight Validation History – 040100 – 14-Feb-2008

Date	Method	Mean Error and (SD)		
		GVW	Single Axles	Tandem Axles
2/14/208	Test Trucks	-2.1 (2.3)	-2.6 (3.6)	-2 (3.4)
2/13/2008	Test Trucks	-2.6 (2.0)	-3.4 (3.4)	-2.4 (3.0)
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)

Prepared: rwp Checked: bko

5.4 Projected Maintenance/Replacement Requirements

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

6 Pre-Validation Analysis

This pre-validation analysis is based on test runs conducted February 13, 2008 in the morning and early afternoon at test site 040100 on US 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 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 77,570 lbs.
2. 5-axle tractor semi-trailer with a tractor having an air suspension and a trailer with a standard rear tandem and an air suspension loaded to 64,730 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 43 to 63 miles per hour. The desired speed range was achieved during this validation. Pavement surface temperatures were recorded during the test runs ranging from about 45 to 68 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.

Although a Pass result was obtained for each condition with the exception of speed, an attempt to calibrate was made in order to eliminate the slight negative bias found in each weight measurement category.

Table 6-1 Pre-Validation Results – 040100 – 13-Feb-2008

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	-3.4 ± 7.0%	Pass
Tandem axles	±15 percent	-2.4 ± 5.9%	Pass
GVW	±10 percent	-2.6 ± 3.9%	Pass
Axle spacing	± 0.5 ft [150mm]	0.0 ± 0.0 ft	Pass

Prepared: rwp *Checked: bko*

Test runs were conducted during the late morning and early afternoon hours. Temperatures were relatively low and the range was narrow due to cloudy and windy conditions that precluded the pavement surface from warming.

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 due to the narrow range of temperatures.

The three speed groups were divided into 43 to 50 mph for Low speed, 51 to 59 mph for Medium speed and 60+ mph for High speed. The two temperature groups were created by splitting the runs between those at 45 to 54 degrees Fahrenheit for Low temperature and 55 to 68 degrees Fahrenheit for High temperature.

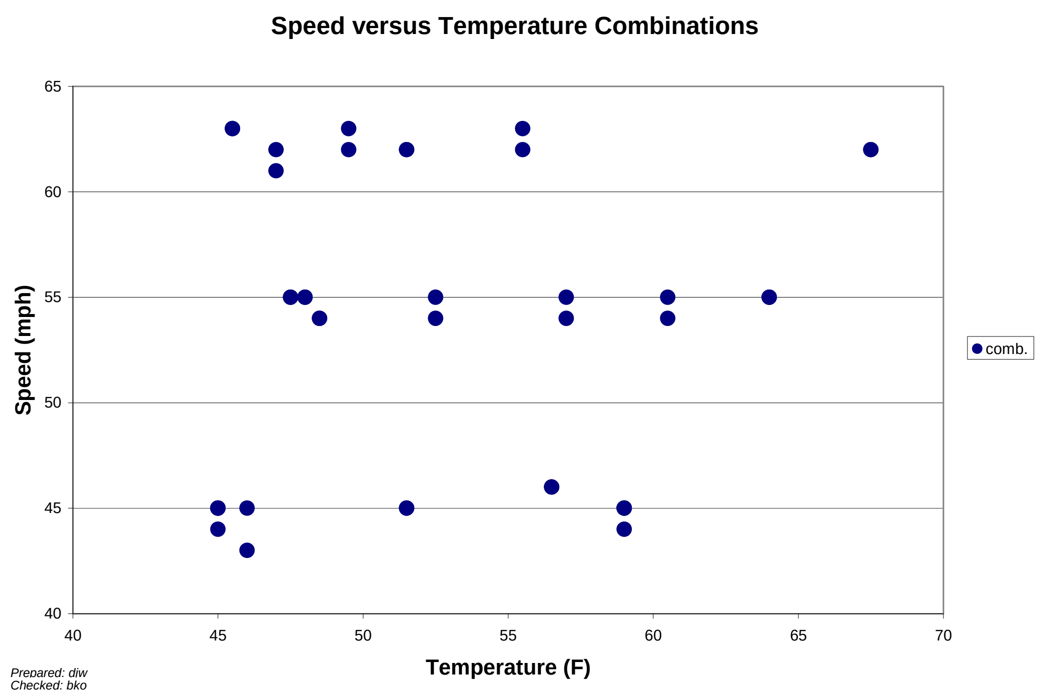


Figure 6-1 Pre-Validation Speed-Temperature Distribution – 040100 – 13-Feb-2008

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

Figure 6-2 shows the GVW Percent Error vs. Speed graph for the population as a whole. Here can be seen the slight negative bias in GVW estimation that appear to be independent of temperature, although the variability is somewhat greater at lower speeds.

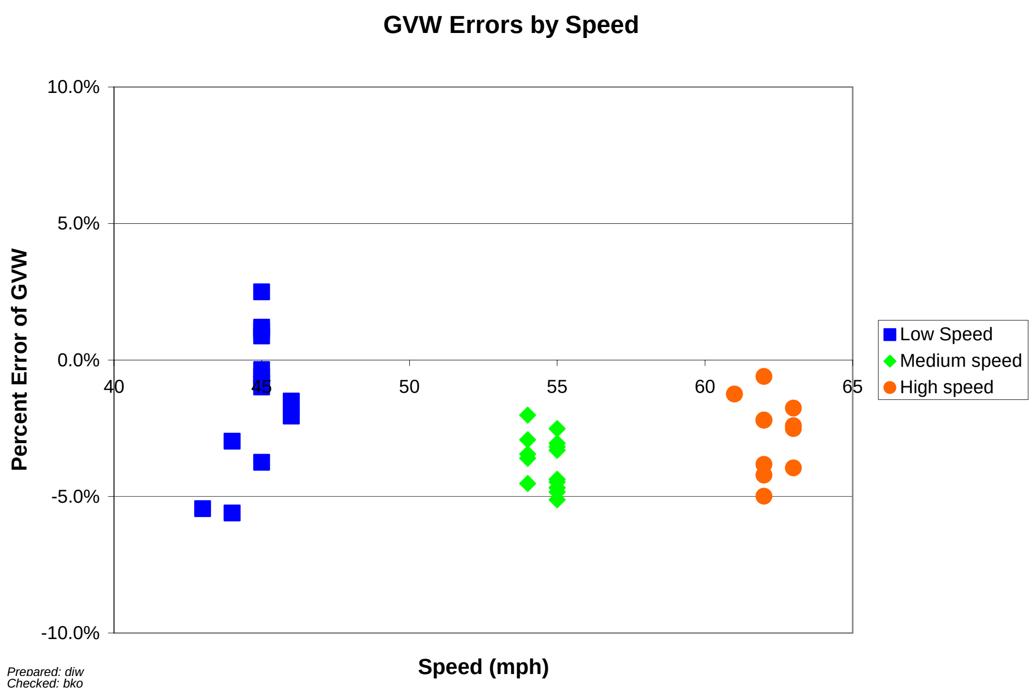


Figure 6-2 Pre-validation GVW Percent Error vs. Speed – 040100 – 13-Feb-2008

Figure 6-3 shows the relationship between temperature and GVW percentage error. There doesn't appear to be any effect of temperature on the GVW measurements over the range illustrated here. The following day's tests included some at very low temperatures that indicated some effects.

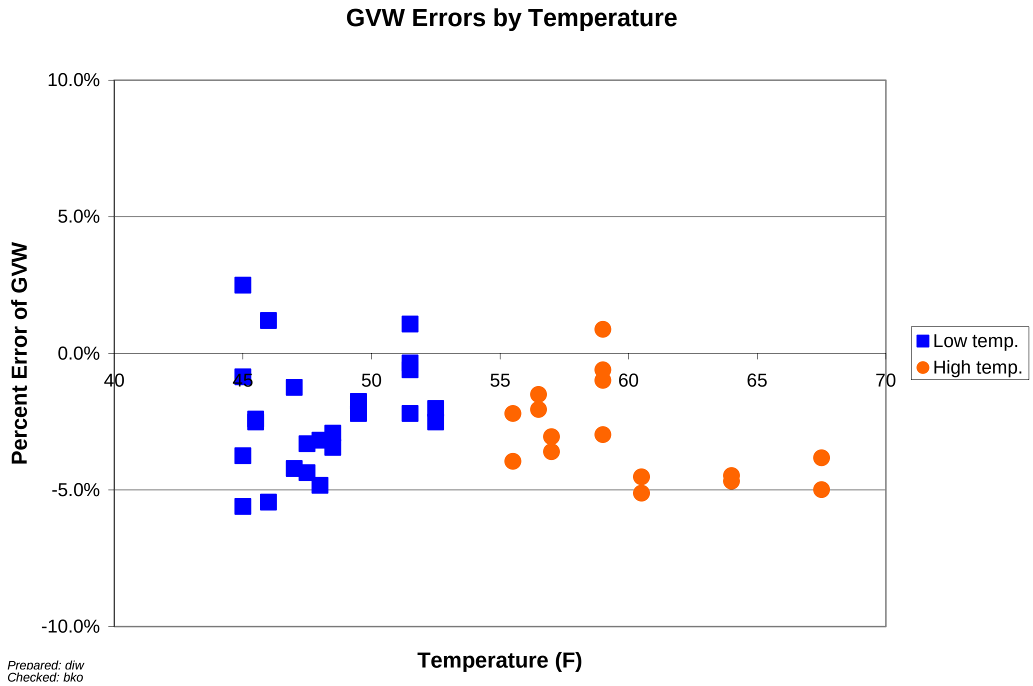


Figure 6-3 Pre-Validation GVW Percent Error vs. Temperature – 040100 – 13-Feb-2008

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

The WIM equipment measured spacing with near perfect accuracy independent of pavement temperature and speed.

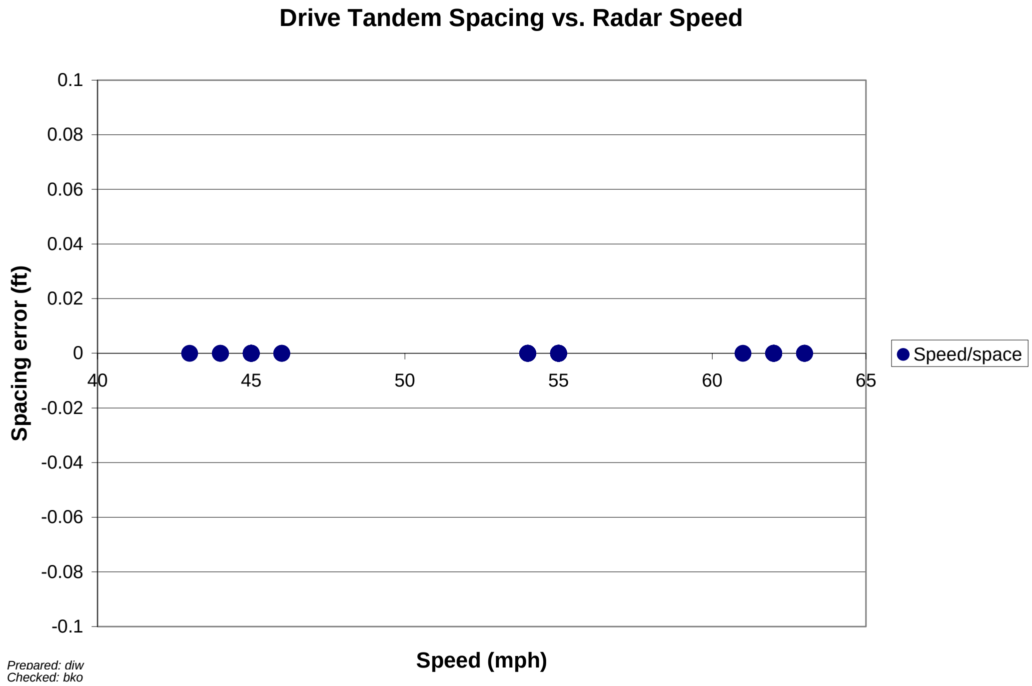


Figure 6-4 Pre-Validation Spacing vs. Speed - 040100 – 13-Feb-2008

6.1 Temperature-based Analysis

The two temperature groups were created by splitting the runs between those at 45 to 54 degrees Fahrenheit for Low temperature and 55 to 68 degrees Fahrenheit for High temperature.

Table 6-2 Pre-Validation Results by Temperature Bin – 040100 – 13-Feb-2008

Element	95% Limit	Low Temperature 45 to 54 °F	High Temperature 55 to 68 °F
Steering axles	±20 %	-3.3 ± 7.3%	-3.5 ± 7.2%
Tandem axles	±15 %	-2.1 ± 6.2%	-2.9 ± 5.5%
GVW	±10 %	-2.3 ± 4.3%	-3.0 ± 3.7%
Axle spacing	± 0.5 ft	0.0 ± 0.0 ft	0.0 ± 0.0 ft

Prepared: rwp *Checked: bko*

Table 6-2 shows little or no effect of pavement temperature on the ability of this equipment to measure weight values. Minor underestimation of weights occurred at both low and high observed temperature levels.

Figure 6-5 shows the distribution of GVW Errors versus Temperature by Truck. It shows that weight estimates of both trucks behaved similarly except at the very low end of the graph where some divergence is noted.

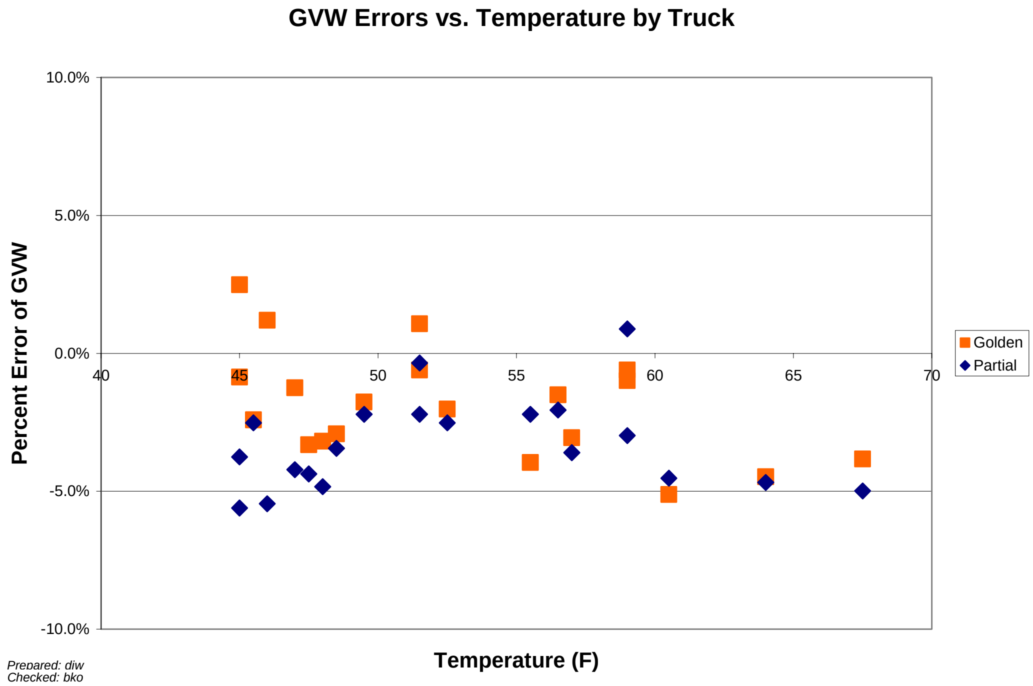


Figure 6-5 Pre-Validation GVW Percent Error vs. Temperature by Truck – 040100 – 13-Feb-2008

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

Weight estimates for steering axles for both trucks appear to be negatively biased and slightly more so at temperatures above 60F.

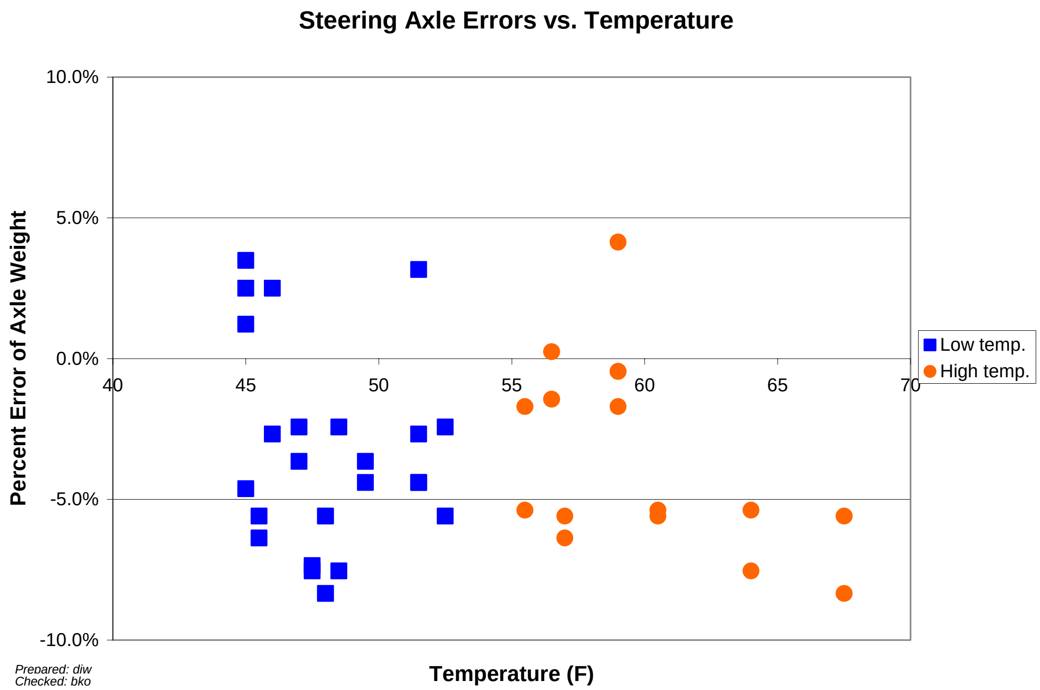


Figure 6-6 Pre-Validation Steering Axle Error vs. Temperature by Group – 040100 – 13-Feb-2008

6.2 Speed-based Analysis

The speed groups were divided as follows: Low speed – 43 to 50 mph, Medium speed – 51 to 59 mph and High speed – 60+ mph.

Table 6-3 Pre-Validation Results by Speed Bin – 040100 – 13-Feb-2008

Element	**95% Limit**	**Low Speed 43 to 50 mph**	**Medium Speed 51 to 59 mph**	**High Speed 60+ mph**
Steering axles	±20 %	0.1 ± 6.2%	-5.9 ± 3.9%	-4.5 ± 4.1%
Tandem axles	±15 %	-1.6 ± 5.6%	-3.3 ± 5.6%	-2.4 ± 6.8%
GVW	±10 %	-1.3 ± 5.3%	-3.7 ± 2%	-2.7 ± 2.9%
Axle spacing	± 0.5 ft	0.0 ± 0.0 ft	0.0 ± 0.0 ft	0.0 ± 0.0 ft

Prepared: rwp *Checked: bko*

Negative measurement bias was observed for the Medium and High speed ranges but was absent or less pronounced within the Low speed range. This is particularly true for steering axle weights.

Figure 6-7 shows that for GVW, the different behavior at low speeds is connected to the 'Golden' truck (squares) only. The weight estimation bias for the 'Partial' truck (diamonds) is nearly constant over the entire range of test speeds.

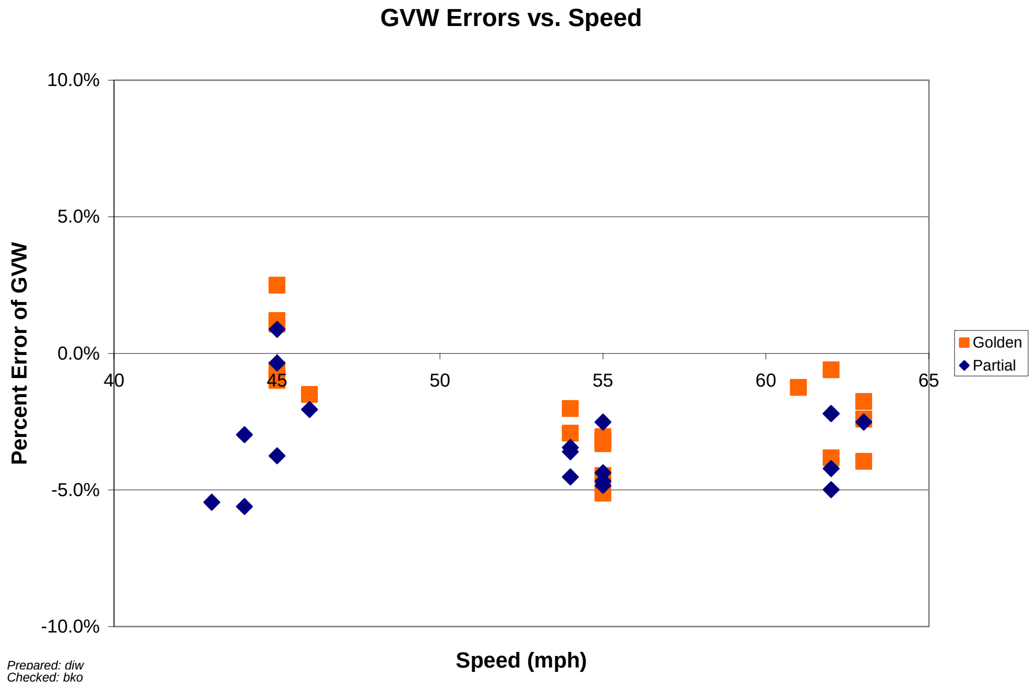


Figure 6-7 Pre-Validation GVW Percent Error vs. Speed Group - 040100 –13-Feb-2008

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

The general negative bias in steering axle weight measurements is mostly absent at low speeds. Graphing these steering axle weight errors by truck shows that this is true for both the 'Golden' and 'Partial' trucks. Unlike the GVW graph, figure 6-9 shows the different behavior at low speeds in this steering axle weight graph is connected to both trucks.

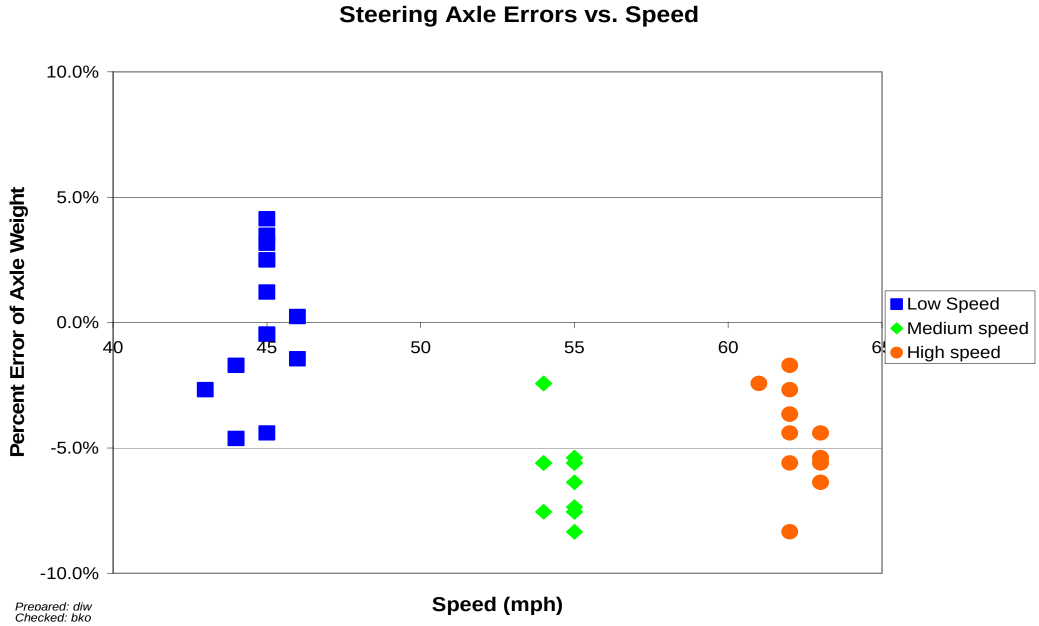


Figure 6-8 Pre-Validation Steering Axle Percent Error vs. Speed Group - 040100 – 13-Feb-2008

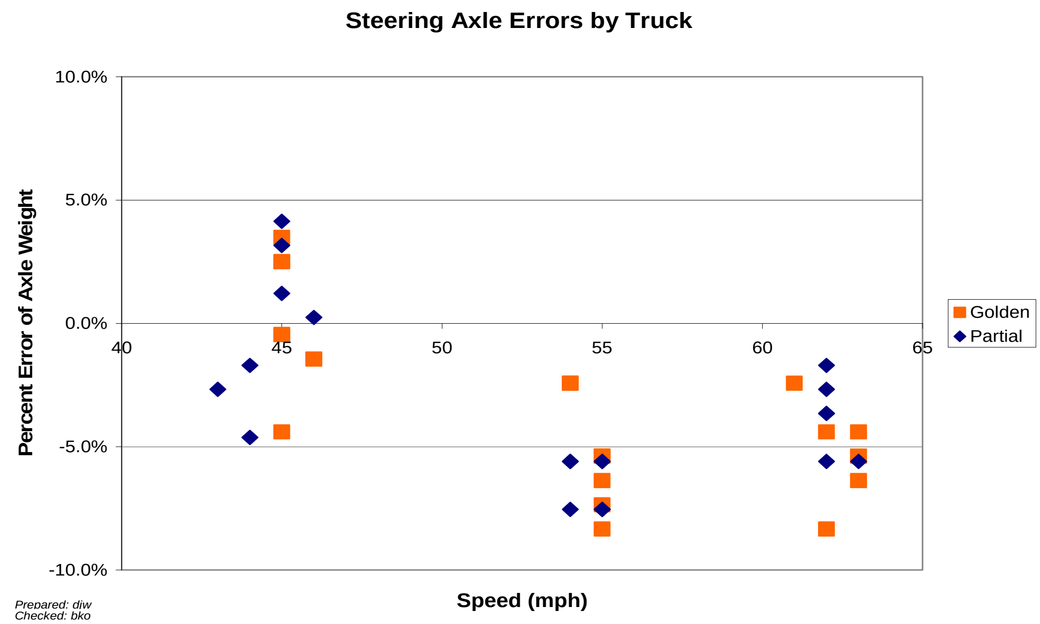


Figure 6-9 Pre-Validation Steering Axle Percent Error vs. Speed Group by Truck - 040100 –13-Feb-2008

6.3 Classification Validation

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

The classification validation is intended to find gross errors in vehicle classification, not to validate the installed algorithm. A sample of three hours (38 trucks) was collected at the site. The classification identification is to identify gross errors in classification, not validate the classification algorithm. Video was taken at the site to provide ground truth for the evaluation. Based on a 100 percent sample it was determined that there are 0 percent unknown vehicles and 0 percent unclassified vehicles.

The second check is the ability of the algorithm to correctly distinguish between truck classes with no more than 2% errors in such classifications. Table 6-4 has the classification error rates by class. The overall misclassification rate is 10. percent. Due to the small sample size, this percentage could be misleading.

Table 6-4 Truck Misclassification Percentages for 040100 – 13-Feb-2008

Class	Percent Error	Class	Percent Error	Class	Percent Error
4	N/A	5	13	6	0
7	N/A				
8	22	9	0	10	N/A
11	N/A	12	N/A	13	N/A

Prepared: rwp Checked: bko

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

Table 6-5 Truck Classification Mean Differences for 040100 – 13-Feb-2008

Class	Mean Difference	Class	Mean Difference	Class	Mean Difference
4	N/A	5	15	6	0
7	N/A				
8	- 22	9	0	10	N/A
11	N/A	12	N/A	13	N/A

Prepared: rwp Checked: bko

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

The equipment consistently classifies straight trucks with trailers as vehicle Class 5 trucks.

6.4 Evaluation by ASTM E-1318 Criteria

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

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

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

Prepared: rwp Checked: bko

6.5 Prior Validations

The last validation for this site was done 03-May-2007. It was the first validation of the site. The site was producing research quality data. Figure 6-10 shows the GVW Percent Error vs. Speed for the post validation runs. The site was validated with two trucks. The “Golden” truck was loaded to 75,370 lbs. The “partial” truck which had an air suspension on both tandems was loaded to 63,250 lbs.

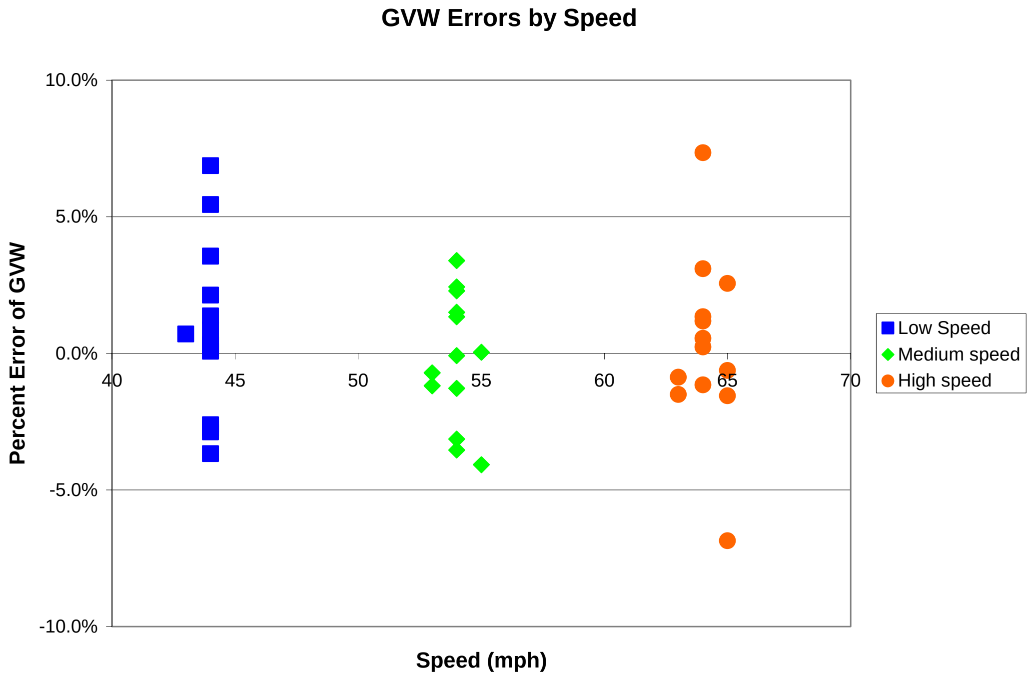


Figure 6-10 Last Validation GVW Percent Error vs. Speed – 040100 – 03-May-2007

Table 6-7 shows the overall results from the last validation. A Pass condition was achieved for all weight and dimension measurement categories. However, speed measurement failed.

Table 6-7 Last Validation Final 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
Gross vehicle weights	±10 percent	0.3 ± 5.9%	Pass
Axle spacing	± 0.5 ft [150 mm]	-0.1 ± 0.1 ft	Pass

Prepared: rwp *Checked: bko*

Table 6-8 has the results at the end of the last validation by temperature. Observed temperatures during that validation were higher and did not overlap the temperatures of the present validation at all. Through this validation the equipment has been observed at temperature from 25 to 111 degrees Fahrenheit.

Table 6-8 Last Validation Results by Temperature Bin – 040100 – 03-May-2007

Element	95% Limit	Low Temperature 80 to 90 °F	Medium Temperature 90 to 100 °F	High Temperature 100 to 111 °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%
Axle spacing	± 0.5 ft	-0.1 ± 0.1 ft	-0.1 ± 0.2 ft	-0.1 ± 0.1 ft

Prepared: rwp *Checked: bko*

Table 6-9 has the results of the prior post validation by speed groups.

Table 6-9 Last Validation Results by Speed Bin – 040100 – 03-May-2007

Element	95% Limit	Low Speed 43-47 mph	Medium Speed 48-61 mph	High Speed 62-65 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%
Axle spacing	± 0.5 ft	-0.1 ± 0.1 ft	0.0 ± 0.1 ft	-0.1 ± 0.1 ft

Prepared: rwp *Checked: bko*

7 Data Availability and Quality

As of February 13, 2008 this site does not have at least 5 years of research quality data. Research quality data is defined to be at least 210 days in a year of data of known calibration meeting LTPP's precision requirements.

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

The amount and coverage for the site is shown in Table 7-1. The value for months is a measure of the seasonal variation in the data. The indicator of coverage indicates whether day of week variation has been accounted for on an annual basis. Validation information to ensure research quality data was not available for any of the data prior to 2005. As can be seen from the table only 2005 since that time has a sufficient quantity to be considered a complete year of data. It can be seen that at least 4 additional years of research quality data are needed to meet the goal of a minimum of 5 years of research weight data.

Table 7-1 Amount of Traffic Data Available 040100 – 13-Feb-2008

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
2006				121	4	Full Week
2007	169	2	Full Week	39	2	Full Week

Prepared: rwp *Checked: bko*

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

Class 9 and Class 5 constitute more than 10 percent of the truck population. Based on the data collected from the end of the last calibration iteration the following are the expected values for these populations. The precise values to be used in data review will need to be determined by the Regional Support Contractor on receipt of the first 14 days of data after the successful validation. For sites that do not meet LTPP precision requirements, this period may still be used as a starting point from which to track scale changes.

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

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

- Class 9 loaded peak is the bin 60,000 pounds or larger with the greatest percentage of trucks.
- For all other trucks the typical axle configuration is used to determine the maximum allowable weight based on 18,000 pounds for single axles and 34,000 pounds for tandem axles. A ten percent cushion above that maximum is used to set the overweight threshold.
- For all other trucks in the absence of site specific information the computation of under weights assumes the power unit weighs 10,000 pounds and each axle on a trailer 5,000 pounds. Ninety percent of the total for the unloaded configuration is the value below which a truck is considered under weight.
- For all trucks other than class 9s that have a bi-modal distribution the unloaded peak is defined to be in a bin less than or equal to half of the allowable maximum weight.
- For all trucks other than class 9s that have a bi-modal distribution the loaded peak is defined to be in a bin greater than or equal to half of the allowable maximum weight.

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

Table 7-2 GVW Characteristics of Major sub-groups of Trucks – 040100 – 14-Feb-2008

Characteristic	Class 9	Class 5
Percentage Overweights	0.0%	0.0%
Percentage Underweights	0.0%	27.6%
Unloaded Peak	34,000	-
Loaded Peak	74,000	-
Peak	74,000	10,000

Prepared: rwp Checked: bko

The expected percentage of unclassified vehicles is 0.1%. This is based on the percentage of unclassified vehicles in the post-validation data download.

The graphical screening comparison figures are found in Figure 7-1 through Figure 7-4. These are based on data collected immediately after the validation and may not be wholly representative of the population at the site. They should however provide a sense of the statistics expected when SPS comparison data is computed for the post-validation Sheet 16.

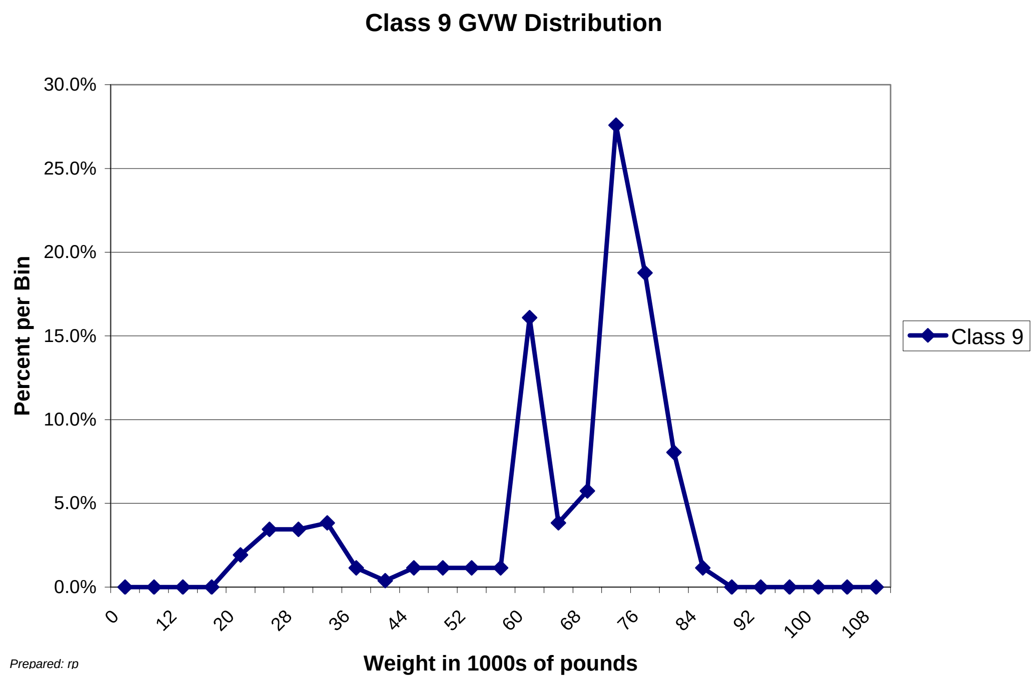


Figure 7-1 Expected GVW Distribution Class 9 – 040100 – 14-Feb-2008

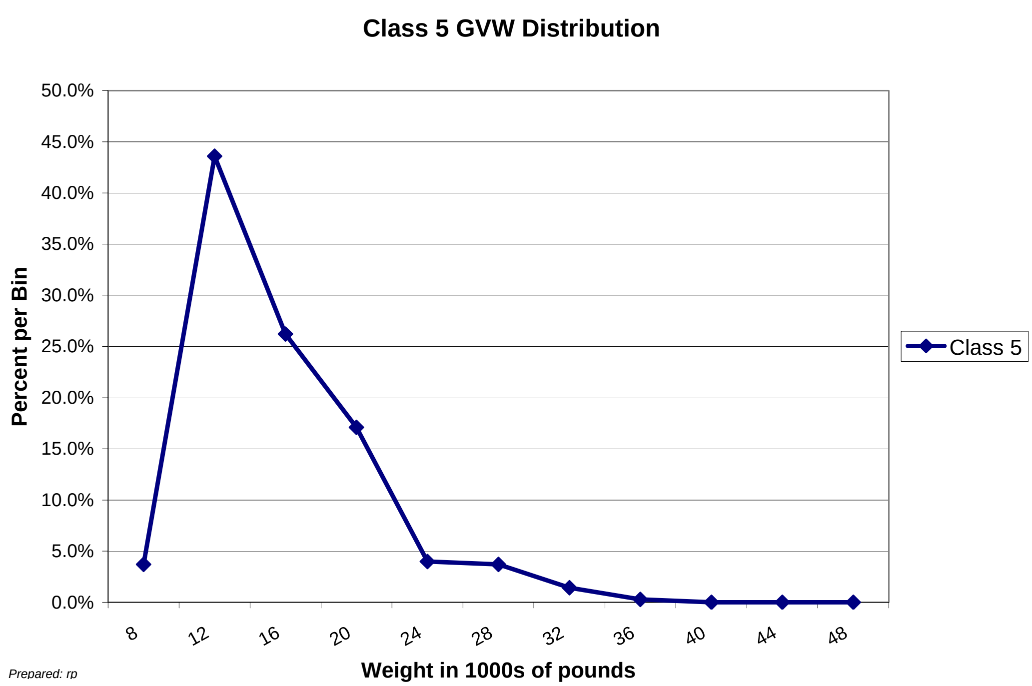


Figure 7-2 Expected GVW Distribution Class 5 – 040100 – 14-Feb-2008

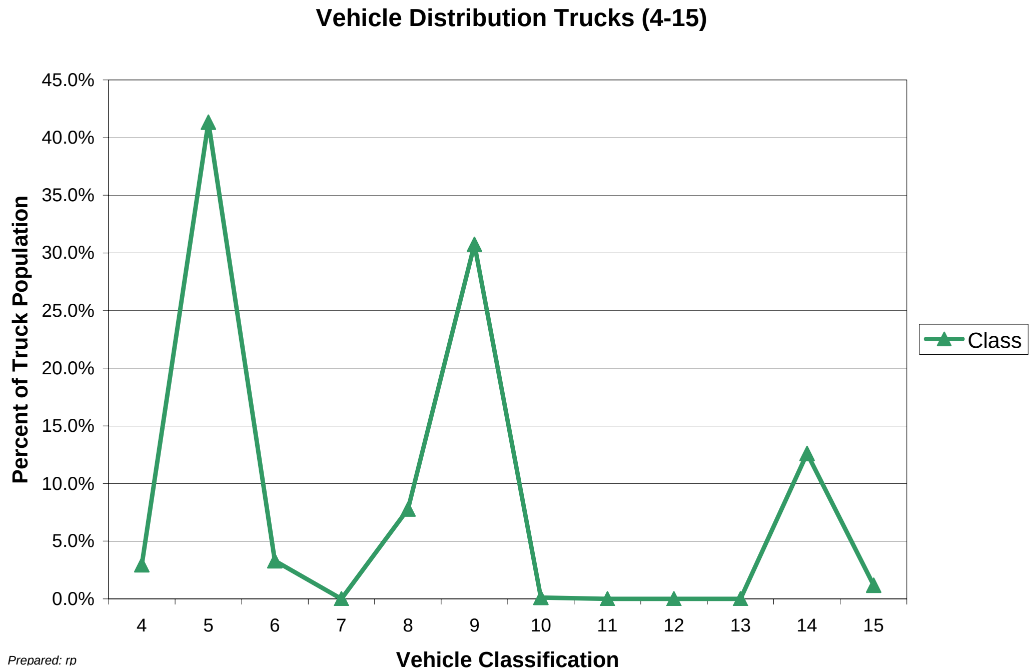


Figure 7-3 Expected Vehicle Distribution – 040100 – 14-Feb-2008

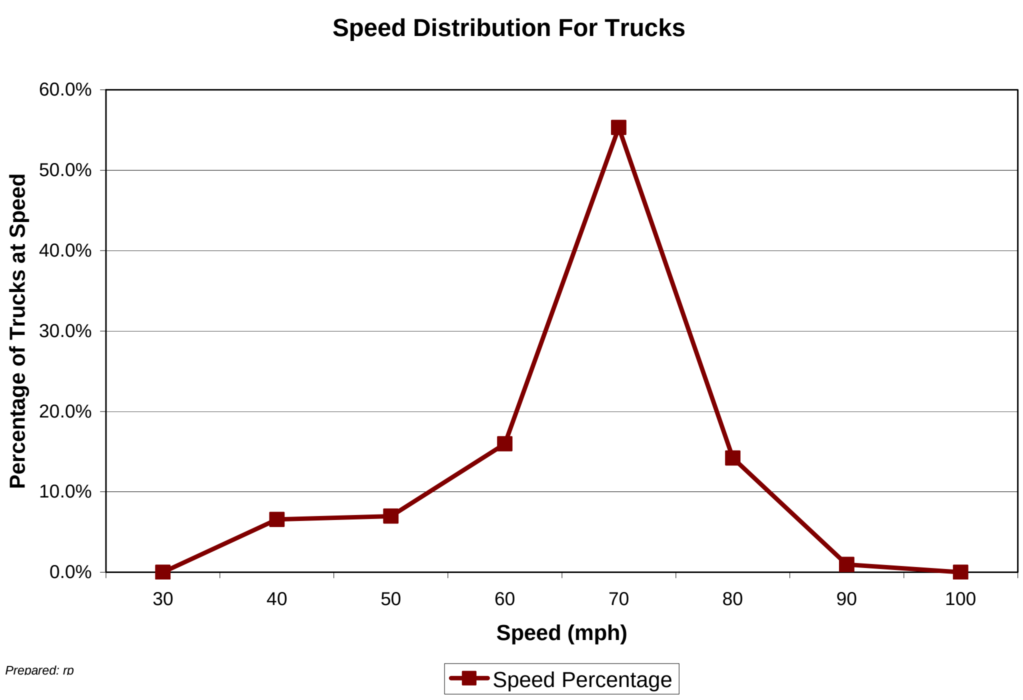


Figure 7-4 Expected Speed Distribution – 040100 – 14-Feb-2008

8 Data Sheets

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

Sheet 19 – Truck 1 – 3S2 loaded air suspension (3 pages)
Sheet 19 – Truck 2 – 3S2 partially loaded, air suspension tractor and leaf suspension trailer (4 pages)

Sheet 20 – Classification Verification – Pre-Validation (1 page)
Sheet 20 – Classification Verification – Post-Validation (1 page)

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

Calibration Iteration 1 Worksheet – (1 page)

Test Truck Photographs (6 pages)

LTPP Mod 3 Classification Scheme (1 page)

Final System Parameters (1 page)

9 Updated Handout Guide and Sheet 17

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

10 Updated Sheet 18

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

11 Traffic Sheet 16(s)

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

POST-VISIT HANDOUT GUIDE FOR SPS WIM FIELD VALIDATION

STATE: Arizona

SHRP ID: 0100

Figures

Photos

1. General Information

SITE ID: *040100*

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

VISIT DATE: *February 13 & 14, 2008*

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: *February 13 and 14, 2008 (or the two days 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*

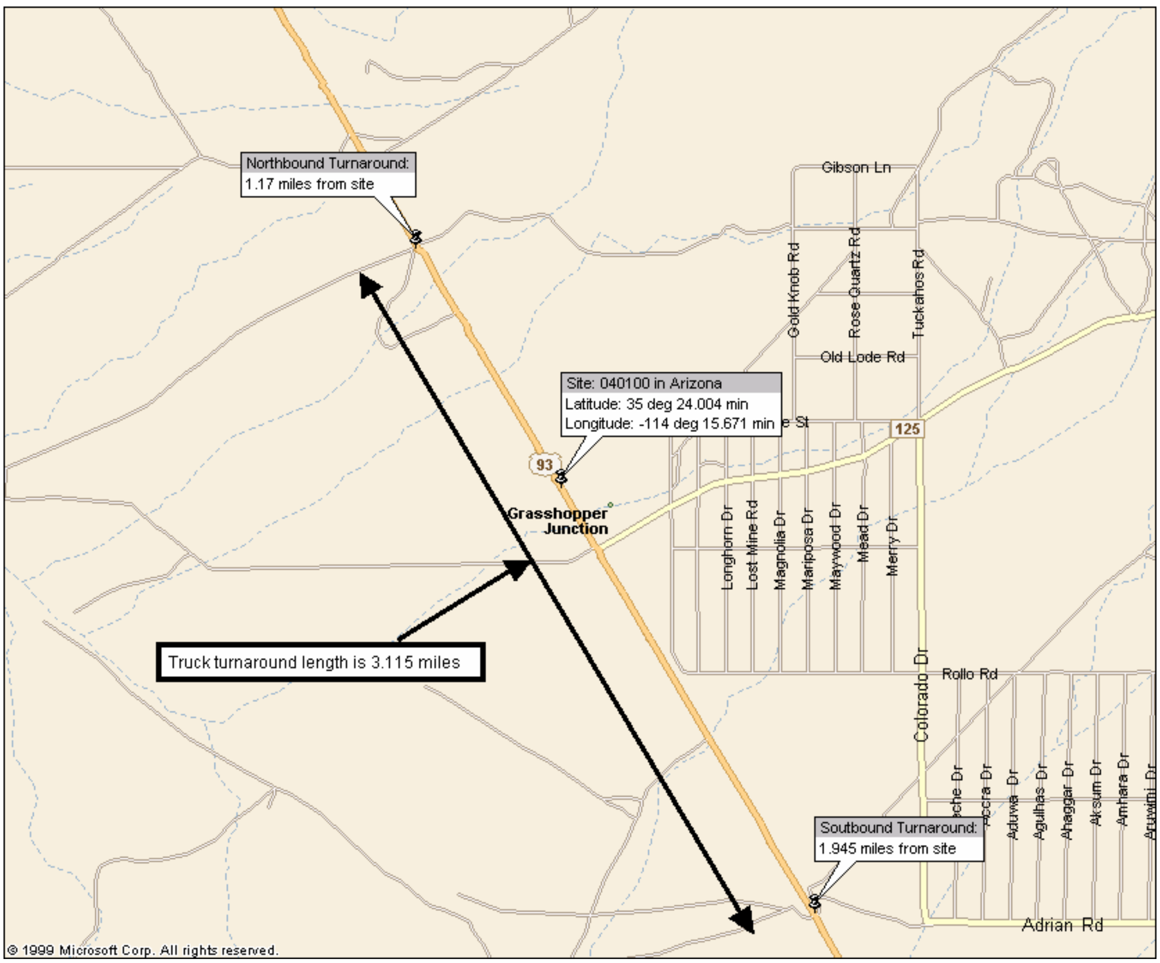


Figure 5-1 - Truck Route at 040100 in Arizona

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: _2/13/2008__ Photo: _04_0100_Upstream_02_13_08.jpg ____________________
Date: _2/13/2008__ Photo: _04_0100_Downstream_02_13_08.jpg __________________
Date: ______ Photo: ____

6. * SENSOR SEQUENCE _______Loop – Bending Plate– Bending Plate – Loop ___

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

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

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

Clearance under plate ___ __4 . _0__ in
Clearance/access to flush fines from under system Y / N

10. * CABINET LOCATION

Same side of road as LTPP lane Y / N Median Y/ N Behind barrier Y / N

Distance from edge of traveled lane _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	04_0100_Solar_Panels_02_13_08.jpg
	04_0100_Service_Mast_02_13_08.jpg
Phone source	----
Cabinet exterior	04_0100_Cabinet_Exterior_02_13_08.jpg
Cabinet interior	04_0100_Cabinet_Interior_Front_02_13_08.jpg
	04_0100_Cabinet_Interior_Rear_02_13_08.jpg
Weight sensors	04_0100_Leading_Weighpad_02_13_08.jpg
	04_0100_Trailing_Weighpad_02_13_08.jpg
Classification sensors	
Other sensors	04_0100_Leading_Loop_02_13_08.jpg
	04_0100_Trailing_Loop_02_13_08.jpg
Description	Loops

Downstream direction at sensors on LTPP lane

04_0100_Downstream_02_13_08.jpg

Upstream direction at sensors on LTPP lane

04_0100_Upstream_02_13_08.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

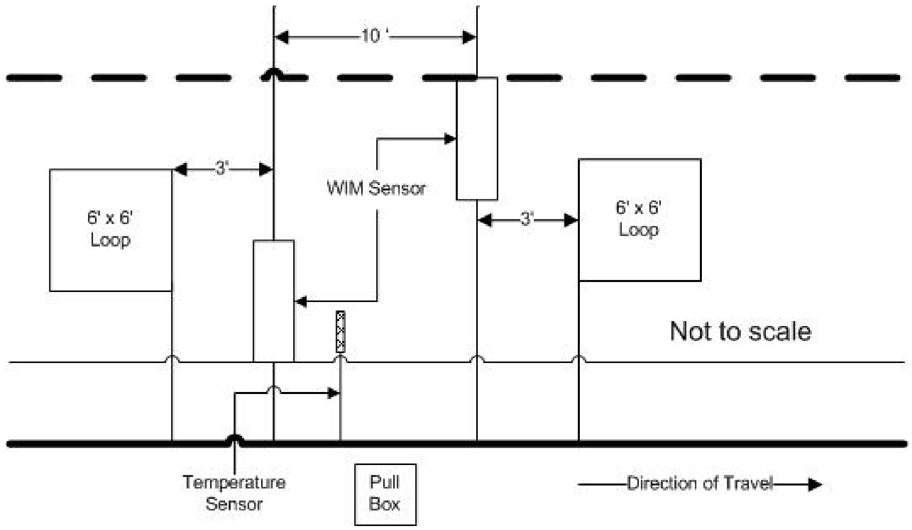
Test Truck Recommendations:
Types of Trucks: Two Class 9s
Truck 1: Class 9, 72,000 to 80,000 lb legal limit on gross and axles, air suspension;
Truck 2: Class 9, Partially loaded to 65,000 lb

Expected Speeds: 45, 55 and 65 mph

COMPLETED BY Dean J. Wolf

PHONE 301-210-5105 DATE COMPLETED 0 2 / 1 3 / 2 0 0 8

Figure 6-1 Sketch of equipment layout



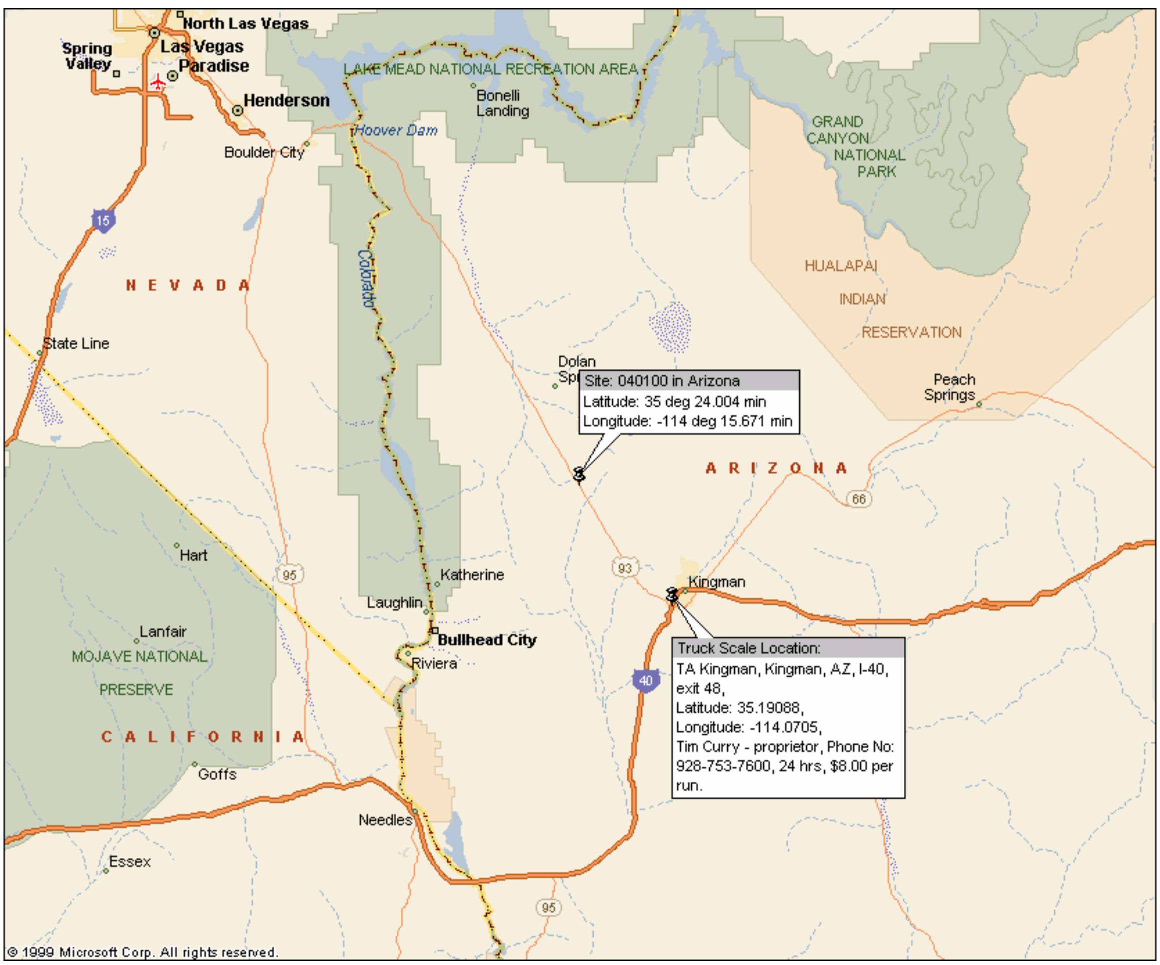


Figure 6-2 - Site Map at 040100 in Arizona

Photo 6-1 04_0100_Upstream_02_13_08.jpg

Photo 6-2 04_0100_Downstream_02_13_08.jpg

Photo 6-3 04_0100_Solar_Panels_02_13_08.jpg

Photo 6-4 04_0100_Service_Mast_02_13_08.jpg

Photo 6-5 04_0100_Cabinet_Exterior_02_13_08.jpg

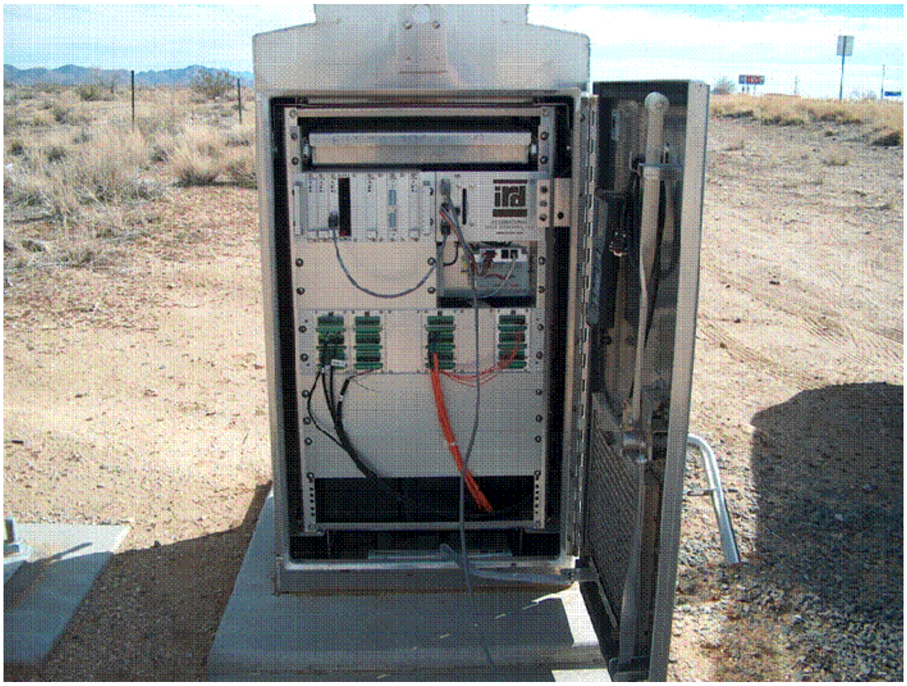


Photo 6-6 04_0100_Cabinet_Interior_Front_02_13_08.jpg

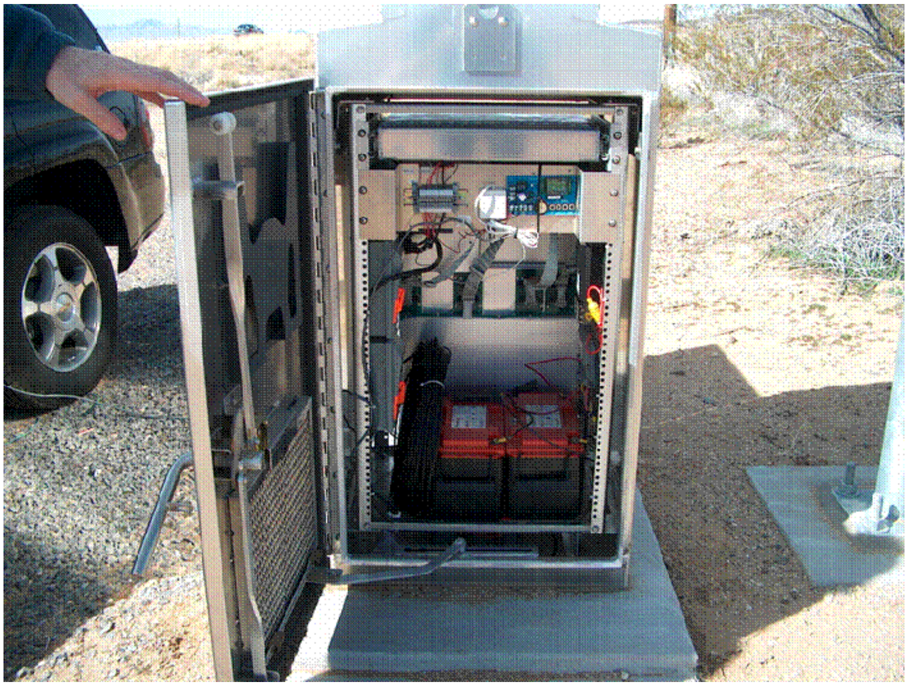


Photo 6-7 04_0100_Cabinet_Interior_Rear_02_13_08.jpg

Photo 6-8 04_0100_Leading_Weighpad_02_13_08.jpg

Photo 6-9 04_0100_Trailing_Weighpad_02_13_08.jpg

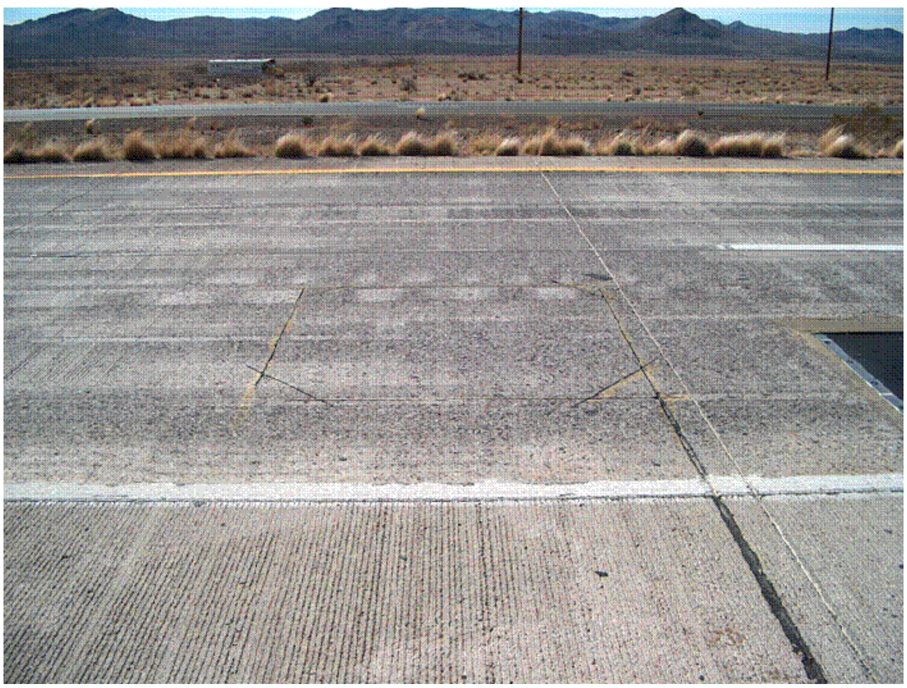


Photo 6-10 04_0100_Leading_Loop_02_13_08.jpg

Photo 6-11 04_0100_Trailing_Loop_02_13_08.jpg

SHEET 18	STATE CODE [4]
LTPP MONITORED TRAFFIC DATA	SPS PROJECT ID [0100]
WIM SITE COORDINATION	DATE: (mm/dd/yyyy) 2/13/2008

Rev. 05/15/07

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

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

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

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

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

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

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

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

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

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

g. Communication –

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

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

3. PAVEMENT –

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

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

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

4. ON SITE ACTIVITIES –

a. WIM Validation Check - advance notice required _2__ ☐ days ☒ weeks

b. Notice for straightedge and grinding check - __2_ ☐ 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 – ______________________

SHEET 18	STATE CODE [4]
LTPP MONITORED TRAFFIC DATA	SPS PROJECT ID [0100]
WIM SITE COORDINATION	DATE: (mm/dd/yyyy) 2/13/2008

Rev. 05/15/07

e. Test Vehicles
   i. Trucks –
      1st – Air suspension 3S2 ☐ State ☒ LTPP
      2nd – _3S2 different weight/suspension__ ☐ State ☒ LTPP
      3rd – ________________ ☐ State ☐ LTPP
      4th – ________________ ☐ State ☐ LTPP
   ii. Loads – ☐ State ☐ LTPP
   iii. Drivers – ☐ State ☐ LTPP

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

   IRD

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

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

i. Traffic Control Required – ☐Yes ☒No

j. Enforcement Coordination Required – ☐Yes ☒No

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

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: AZ DOT

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: AZ DOT

g. Enforcement Coordination –

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

Agency: AZ DOT

h. Nearest Static Scale

Name: TA Truck Stop Location:Kingman, AZ

Phone: (928) 753-7600

SHEET 16 LTPP MONITORED TRAFFIC DATA SITE CALIBRATION SUMMARY	*STATE ASSIGNED ID [__ __ __ __] *STATE CODE [4] *SHRP SECTION ID [0100]

SITE CALIBRATION INFORMATION

1. * DATE OF CALIBRATION (MONTH/DAY/YEAR) [2/13/2008]

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

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

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

5. EQUIPMENT MANUFACTURER ___IRD/ PAT Traffic___

WIM SYSTEM CALIBRATION SPECIFICS**

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

___ NUMBER OF TRUCKS COMPARED __2__ NUMBER OF TEST TRUCKS USED

__20__ PASSES PER TRUCK

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

TRUCK	TYPE	SUSPENSION
1	9	1
2	9	1
3		

7. SUMMARY CALIBRATION RESULTS (EXPRESSED AS A PERCENT)
MEAN DIFFERENCE BETWEEN ---
DYNAMIC AND STATIC GVW ___-2.6 STANDARD DEVIATION ___2.0
DYNAMIC AND STATIC SINGLE AXLES ___-3.4 STANDARD DEVIATION ___3.4
DYNAMIC AND STATIC DOUBLE AXLES ___-2.4 STANDARD DEVIATION ___3.0

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) ___3450.00___

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

CLASSIFIER TEST SPECIFICS***

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

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

14. MEAN DIFFERENCE IN VOLUMES BY VEHICLES CLASSIFICATION:
*** FHWA CLASS 9 ____ 0.0 FHWA CLASS ____ ____ ____ _____
*** FHWA CLASS 8 ____ -22.0 FHWA CLASS ____ ____ ____ _____
FHWA CLASS ____ ____ ____ _____
FHWA CLASS ____ ____ ____ _____
*** PERCENT "UNCLASSIFIED" VEHICLES: ____ 0.0

PERSON LEADING CALIBRATION EFFORT: __Dean J. Wolf, MACTEC__________
CONTACT INFORMATION: ______301-210-5105______________ rev. November 9, 1999

SHEET 16 LTPP MONITORED TRAFFIC DATA SITE CALIBRATION SUMMARY	*STATE ASSIGNED ID [__ __ __ __] *STATE CODE [4] *SHRP SECTION ID [0100]

SITE CALIBRATION INFORMATION

1. * DATE OF CALIBRATION (MONTH/DAY/YEAR) [2/14/2008]

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

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

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

5. EQUIPMENT MANUFACTURER ___IRD/ PAT Traffic___

WIM SYSTEM CALIBRATION SPECIFICS**

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

 ___ NUMBER OF TRUCKS COMPARED __2__ NUMBER OF TEST TRUCKS USED

 __20__ PASSES PER TRUCK

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

7. SUMMARY CALIBRATION RESULTS (EXPRESSED AS A PERCENT)
 MEAN DIFFERENCE BETWEEN ---
 DYNAMIC AND STATIC GVW ___-2.1 STANDARD DEVIATION ___2.3
 DYNAMIC AND STATIC SINGLE AXLES ___-2.6 STANDARD DEVIATION ___3.6
 DYNAMIC AND STATIC DOUBLE AXLES ___-2.0 STANDARD DEVIATION ___3.4

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) ___3545.00___

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

CLASSIFIER TEST SPECIFICS***

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

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

14. MEAN DIFFERENCE IN VOLUMES BY VEHICLES CLASSIFICATION:
 *** FHWA CLASS 9 ____ 0.0 FHWA CLASS ____ ____ ____ ____
 *** FHWA CLASS 8 ____ - 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 64
LTPP Traffic Data	* SPS PROJECT ID 0100
*CALIBRATION TEST TRUCK # 1	* DATE 02/13/08

Rev. 08/31/01

PART I.

TRUCK 7141
TRAILER W0584
FERNANDO

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

AXLES - units - lbs / 100s lbs / kg

GEOMETRY

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

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

10.* Trailer Load Distribution Description:

GARBAGE

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

b). Trailer Tare Weight (units): ______

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

A to B 14.5'   B to C 4.3'   C to D 34.3'

D to E 4.1'   E to F ______

Wheelbase (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 FULL LEAF
B	11R22.5	AIR
C	11R22.5	AIR
D	11R22.5	AIR
E	11R22.5	AIR
F		

Sheet 19	* STATE CODE 04
LTPP Traffic Data	* SPS PROJECT ID 0100
*CALIBRATION TEST TRUCK # 1	* DATE 02/13/08

Rev. 08/31/01

PART II

Day 1

*b) Average Pre-Test Loaded weight 77920
*c) Post Test Loaded Weight 77220
*d) Difference Post Test – Pre-test -700

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10380	17300	17300	16470	16470		77920
2	10260	17390	17390	16440	16440		77920
3	10300	17350	17350	16460	16460		77920
Average	10310	17350	17350	16460	16460		77920

Table 6. Raw data – Axle scales –

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

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	9980	17220	17220	16400	16400		77220
2							
3							
Average	9980	17220	17220	16400	16400		77220

Measured By DJW Verified By RP Weight date 02/13/08

Sheet 19	* STATE CODE 04
LTPP Traffic Data	* SPS PROJECT ID 0100
*CALIBRATION TEST TRUCK # 1	* DATE 02/14/08

Rev. 08/31/01

Day 2

7.2 *b) Average Pre-Test Loaded weight 77680
*c) Post Test Loaded Weight 77080
*d) Difference Post Test – Pre-test -600

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10380	16760	16760	16890	16890		77680
2	10380	16760	16760	16890	16890		77680
3	10340	16790	16790	16880	16880		77680
Average	10370	16770	16770	16890	16890		77680

Table 6.2. Raw data – Axle scales –

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

Table 7.2 Raw data – Axle scales – post-test

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10100	16670	16670	16820	16820		77080
2							
3							
Average	10100	16670	16670	16820	16820		77080

Measured By DJW Verified By ______ Weight date 02-14-08

Sheet 19	* STATE_CODE 04
LTPP Traffic Data	* SPS PROJECT ID 0100
*CALIBRATION TEST TRUCK # 2	* DATE 02/13/08

Rev. 08/31/01

TRUCK 7115 JERRY
TRAILER W0836

PART I.

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

AXLES - units - lbs / 100s lbs / kg

GEOMETRY

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

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

10.* Trailer Load Distribution Description:

GARBAGE

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

b). Trailer Tare Weight (units): ______

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

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

D to E 4.1' E to F ______

Wheelbase (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 FULL LEAF
B	11R22.5	AIR
C	11R22.5	AIR
D	11R22.5	AIR
E	11R22.5	AIR
F		

Sheet 19	* STATE_CODE	04
LTPP Traffic Data	* SPS PROJECT ID	0100
*CALIBRATION TEST TRUCK # 2	* DATE	02/13/08

Rev. 08/31/01

PART II

Day 1

*b) Average Pre-Test Loaded weight 65040
*c) Post Test Loaded Weight 64420
*d) Difference Post Test – Pre-test -620

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10420	13840	13840	13470	13470		65040
2	10420	13840	13840	13470	13470		65040
3	10400	13860	13860	13460	13460		65040
Average	10410	13850	13850	13470	13470		65040

Table 6. Raw data – Axle scales –

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

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10140	13720	13720	13420	13420		64420
2							
3							
Average	10140	13720	13720	13420	13420		64420

Measured By DJW Verified By RP Weight date 02/13/08

Sheet 19	* STATE_CODE 04
LTPP Traffic Data	* SPS PROJECT ID 0100
*CALIBRATION TEST TRUCK # 2	* DATE 02/14/08

Rev. 08/31/01

Day 2

7.2 *b) Average Pre-Test Loaded weight 64970
*c) Post Test Loaded Weight 64520
*d) Difference Post Test – Pre-test -450

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10600	13800	13800	13380	13380		64960
2	10620	13780	13780	13390	13390		64960
3	10620	13790	13790	13390	13390		64980
Average	10610	13790	13790	13390	13390		64970

Table 6.2. Raw data – Axle scales –

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

Table 7.2 Raw data – Axle scales – post-test

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10380	13720	13720	13350	13350		64520
2							
3							
Average	10380	13720	13720	13350	13350		64520

Measured By DSW Verified By ____________ Weight date 02-14-08

Sheet 20	* STATE_CODE 04
LTPP Traffic Data	*SPS PROJECT_ID 0100
Speed and Classification Checks * 1 of* 1	* DATE 02/13/2008

Rev. 08/31/2001....

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
69	5	30971	69	5	60	5	31265	60	5
68	5	30972	68	5	62	5	31266	61	5
58	6	30973	58	6	55	5	31312	55	5
67	9	30985	68	9	68	9	31315	68	9
65	5	30987	63	5	37	9	31318	36	9
62	5	30991	62	5	64	9	31338	65	9
63	8	30995	63	8	72	9	31356	73	9
66	5	31008	65	8	55	6	31376	55	6
64	9	31023	64	9	69	5	31387	68	5
68	5	31078	68	5	65	8	31390	63	8
60	8	31119	60	8	67	9	31394	67	9
38	9	31123	36	9	59	8	31408	58	8
34	9	31124	33	9	62	8	31409	62	8
36	9	31128	35	9					
67	5	31139	66	5					
39	9	31147	38	9					
70	5	31155	71	8					
65	8	31158	65	8					
71	9	31170	71	9					
67	8	31177	67	8					
69	9	31180	68	9					
68	5	31199	67	5					
65	9	31220	65	9					
60	5	31251	60	5					
61	5	31264	61	5					

Some 3s called 5s
trucks w/ trailers called 5 (8s)

Recorded by DJW RP Direction N Lane 1 Time from 8:50 to 11:50

8.5_6420070022_SPSWIM_TO_23_04_2.99_0100_Pre-Validation_Sheet_20.doc

VIDEO 9:05

Sheet 20	* STATE_CODE 04
LTPP Traffic Data	*SPS PROJECT_ID 0100
Speed and Classification Checks * 1 of* 1	* DATE 02/14/2008

Rev. 08/31/2001….

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
67	9	101	67	9	67	9	521	67	9
59	5	104	59	8	67	9	522	66	9
67	8	41	68	8					
61	5	61	61	5					
57	5	69	57	8					
66	9	70	68	9					
64	5	100	65	8					
66	6	104	67	6					
47	8	107	48	8					
39	9	135	37	9					
65	9	149	65	9					
64	6	156	63	6					
58	5	184	58	5					
60	8	186	60	8					
48	5	189	48	5					
67	5	224	67	5					
73	5	226	71	5					
65	9	244	66	9					
72	5	249	72	5					
65	9	305	65	9					
62	6	337	62	6					
65	5	365	65	5					
64	8	458	64	8					
69	8	501	69	8					
54	5	509	54	5					

Recorded by DJW Direction N Lane 1 Time from 10:10 to 1:10

Sheet 21	* STATE_CODE 04
LTPP Traffic Data	*SPS PROJECT_ID 0100
WIM System Test Truck Records 1 of 3	* DATE 02/13/2008

Rev. 08/31/2001

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
45	44	2	1	9:28	31039	43	5.1/4.7	6.7/6.2	7.1/6.0	6.6/6.1	6.4/6.1		61.1	14.5	4.3	34.2	4.1	
45	45	1	1	9:28	31040	45	5.5/4.9	10.2/7.5	9.8/8.1	9.5/7.2	9.5/7.4		79.5	14.4	4.3	34.1	4.1	
47.5	55	2	2	9:38	31063	54	5.0/4.5	7.0/6.5	7.6/5.7	7.0/6.2	6.4/6.1		61.9	14.5	4.3	34.1	4.1	
47.5	55	1	2	9:38	31064	55	4.9/4.5	9.7/6.7	9.3/6.8	9.9/6.8	9.7/6.7		75.0	14.5	4.3	34.1	4.1	
45.5	63	2	3	9:47	31083	62	5.2/4.5	7.0/6.0	7.1/5.6	7.4/6.5	7.3/6.4		63.1	14.5	4.3	34.1	4.1	
45.5	63	1	3	9:47	31084	62	4.9/4.6	10.0/7.0	8.9/7.3	8.9/7.3	9.2/7.5		75.7	14.4	4.3	34.1	4.1	
45	45	2	4	9:57	31105	44	5.3/5.1	6.9/6.0	7.5/5.8	6.9/6.1	6.4/6.2		62.3	14.5	4.3	34.0	4.1	
45	45	1	4	9:57	31106	44	5.7/4.8	9.8/7.1	9.7/7.4	9.0/6.9	9.1/7.4		76.9	14.4	4.3	34.0	4.1	
48.5	54	2	5	10:07	31132	55	4.9/4.6	6.8/6.5	7.5/5.9	7.2/6.0	6.9/6.2		62.5	14.5	4.3	34.1	4.1	
48.5	54	1	5	10:07	31133	54	5.3/4.6	9.8/6.7	9.2/6.8	10.1/6.8	9.6/6.3		75.3	14.4	4.3	34.0	4.0	
47	62	2	6	10:17	31167	62	5.2/4.7	7.0/6.0	7.1/5.8	7.1/6.4	6.9/5.9		62.0	14.5	4.3	34.1	4.1	
47	61	1	6	10:17	31168	62	5.3/4.6	10.0/6.8	9.1/7.2	9.7/7.5	9.3/7.1		76.6	14.4	4.3	34.1	4.1	
46	43	2	7	10:27	31196	44	5.2/4.8	7.1/5.7	7.4/5.6	7.1/5.8	6.5/6.1		61.2	14.5	4.3	34.0	4.1	
46	45	1	7	10:27	31197	45	5.5/4.9	10.1/7.1	9.9/7.6	9.6/7.1	9.1/7.6		78.5	14.4	4.3	34.2	4.1	
48	55	2	8	10:37	31222	54	5.0/4.7	7.2/6.5	7.6/5.7	6.9/5.9	6.4/5.8		61.6	14.5	4.3	34.1	4.1	
48	55	1	8	10:37	31223	55	4.9/4.4	9.8/6.8	9.1/7.0	9.9/6.9	9.6/6.0		75.1	14.4	4.3	34.1	4.1	

Recorded by DJW

Checked by RR

Sheet 21	* STATE_CODE	04
LTPP Traffic Data	*SPS PROJECT_ID	0100
WIM System Test Truck Records 2 of 3	* DATE	02/13/2008

Rev. 08/31/2001

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
49.5	62	2	9	10:46	31262	62	5.3/4.6	6.9/6.3	7.4/5.7	7.5/6.2	7.1/6.2		63.3	14.5	4.3	34.1	4.1	
49.5	63	1	9	10:46	31263	62	5.2/4.5	10.1/6.7	9.6/7.1	9.1/7.2	9.3/7.4		76.2	14.4	4.3	34.1	4.1	
51.5	45	2	10	10:56	31290	45	5.4/5.2	7.4/6.1	7.9/5.7	7.3/6.1	6.8/6.6		64.5	14.5	4.3	34.1	4.1	
51.5	45	1	10	10:56	31291	45	5.0/4.7	10.0/7.4	9.8/7.6	9.8/7.1	9.6/7.5		78.4	14.4	4.3	34.1	4.1	
57	54	2	11	11:06	31321	54	5.1/4.6	7.2/6.3	7.7/5.6	6.9/6.0	6.8/6.2		62.4	14.6	4.3	34.1	4.1	
57	55	1	11	11:06	31322	55	5.0/4.5	9.9/6.6	9.3/6.8	10.0/7.0	9.4/6.7		75.2	14.5	4.3	34.1	4.0	
55.5	62	2	12	11:15	31343	62	5.4/4.7	7.2/5.8	7.3/5.7	7.3/6.1	7.3/6.5		63.3	14.6	4.3	34.1	4.1	
55.5	63	1	12	11:15	31344	62	5.2/4.4	9.8/6.6	9.3/6.9	9.2/7.0	9.3/6.9		74.5	14.4	4.3	34.0	4.0	
59	45	2	13	11:25	31381	44	5.5/5.2	7.7/6.4	7.9/5.6	7.2/6.3	7.0/6.3		65.3	13.0	4.3	34.2	4.1	
59	45	1	13	11:25	31382	45	5.1/5.0	10.2/7.4	9.8/7.5	9.2/7.0	8.9/7.1		77.1	14.4	4.3	34.1	4.0	
60.5	54	2	14	11:35	31412	54	5.0/4.7	7.1/5.9	7.6/5.7	7.0/6.0	6.7/6.2		61.8	14.5	4.3	35.1	4.1	
60.5	55	1	14	11:35	31413	55	5.0/4.6	9.6/6.6	8.8/6.5	9.8/6.4	9.8/6.6		73.6	14.4	4.3	34.1	4.0	
51.5	62	2	15	11:45	31442	62	5.2/4.8	7.2/6.0	7.6/5.6	7.3/6.4	7.3/5.9		63.3	14.5	4.3	34.1	4.1	
51.5	62	1	15	11:45	31444	62	5.1/4.6	10.3/6.7	9.6/6.9	10.0/7.4	9.6/7.0		77.1	14.4	4.3	34.0	4.1	
56.5	46	2	16	11:56	31483	44	5.3/5.0	7.7/5.9	7.9/5.6	7.6/5.7	6.7/6.1		63.4	14.5	4.3	34.1	4.0	
56.5	45	1	16	11:56	31484	45	5.1/4.9	9.8/7.0	9.7/7.5	9.6/6.6	9.2/7.0		76.4	14.5	4.3	34.1	4.0	

Recorded by DW

Checked by RP

Sheet 21	* STATE_CODE	04
LTPP Traffic Data	*SPS PROJECT_ID	0100
WIM System Test Truck Records 3 of 3	* DATE	02/13/2008

Rev. 08/31/2001

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
64	55	2	17	12:06	31517	54	4.8/4.7	6.9/6.3	7.7/5.6	6.9/6.0	6.3/6.4		61.7	14.5	4.3	34.1	4.1	
64	55	1	17	12:06	31518	55	4.8/4.8	9.6/6.6	9.1/6.7	9.9/6.7	9.5/6.5		74.1	14.5	4.3	33.9	4.0	
67.5	62	2	18	12:16	31546	62	5.0/4.7	7.1/5.7	7.2/5.4	6.9/6.4	7.1/6.0		61.5	14.5	4.3	34.1	4.1	
67.5	62	1	18	12:16	31547	62	5.0/4.3	9.8/6.6	9.0/7.0	9.0/7.5	9.2/7.2		74.6	14.3	4.3	34.0	4.1	
59	44	2	19	12:26	31569	45	5.2/4.9	7.6/6.0	7.7/5.7	7.0/5.7	6.8/6.1		62.8	14.5	4.3	34.1	4.1	
59	45	1	19	12:26	31570	45	5.2/4.9	10.0/7.0	9.4/7.7	9.6/7.2	8.8/7.0		76.8	14.5	4.3	34.2	4.1	
52.5	55	2	20	12:37	31594	55	4.9/4.8	7.1/6.6	7.4/5.8	7.0/6.2	7.0/6.3		63.1	14.5	4.3	34.1	4.1	
52.5	54	1	20	12:37	31595	54	5.0/4.9	10.0/6.5	9.5/6.8	10.0/7.0	9.7/6.6		76.0	14.4	4.3	33.9	4.1	

Recorded by DJW

Checked by [illegible]

77.9 65.

Sheet 21	* STATE_CODE 04
LTPP Traffic Data	*SPS PROJECT_ID 0100
WIM System Test Truck Records 1 of 1	* DATE 02/13/2008

Rev. 08/31/2001

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
65	44	2	1	13:36	31795	44	5.4/5.2	7.4/6.1	7.9/5.8	7.0/6.2	7.1/6.1		64.2	14.5	4.3	34.1	4.1	
65	45	1	1	13:36	31796	45	5.6/5.0	10.6/7.3	10.1/7.4	9.9/7.3	9.6/7.2		79.8	14.4	4.3	34.0	4.1	
68	53	2	2	13:46	31844	54	5.1/4.7	7.6/6.5	7.9/5.9	7.6/5.7	6.9/6.1		64.1	14.5	4.3	34.1	4.1	
68	54	1	2	13:46	31845	55	5.4/5.0	10.8/6.8	10.0/7.0	10.4/6.9	10.5/7.0		79.8	14.4	4.3	33.9	4.0	
79	62	2	3	13:57	31886	62	5.6/4.9	7.5/6.4	7.6/5.5	7.6/6.8	7.6/6.3		65.9	14.5	4.3	34.1	4.1	
79	62	1	3	13:57	31887	62	5.2/4.5	10.6/7.2	9.6/7.2	9.5/7.3	9.5/7.4		77.9	14.4	4.3	34.0	4.0	
62.5	45	2	4	14:07	31921	44	5.3/4.8	7.4/6.1	7.9/5.4	7.4/6.0	6.8/6.1		63.0	14.5	4.3	34.1	4.1	
62.5	45	1	4	14:07	31922	45	5.4/4.9	10.8/7.5	10.1/7.9	9.8/7.1	9.2/7.2		79.9	14.4	4.3	34.1	4.1	
75.5	54	2	5	14:17	31967	54	5.0/4.8	7.0/6.0	7.6/5.8	7.2/5.9	7.3/6.1		62.7	14.5	4.3	34.0	4.1	
75.5	54	1	5	14:17	31968	54	5.0/4.8	10.6/7.0	9.9/7.2	10.5/6.6	10.1/6.7		78.3	14.5	4.3	34.1	4.0	
80	62	2	6	14:27	32010	62	5.9/4.8	7.3/5.5	7.9/5.5	7.9/6.0	7.8/5.9		63.9	14.5	4.3	34.1	4.1	
80	62	1	6	14:27	32011	62	5.2/4.6	10.5/7.0	10.2/6.8	7.6/7.7	9.8/7.4		76.7	14.4	4.3	34.0	4.0	

Recorded by DJW Checked by

8.6b_6420070022_SPSWIM_TO_23_04_2.99_0100_Cal_1_sheet_21.doc

Sheet 21	* STATE_CODE	04
LTPP Traffic Data	*SPS PROJECT_ID	0100
WIM System Test Truck Records 1 of 3	* DATE	02/14/2008

Rev. 08/31/2001

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
29.5	45	2	7	10:15	106	44	5.3/4.8	6.3/6.2	7.4/5.7	7.1/6.1	6.8/6.2		62.3	14.5	4.3	34.1	4.1	
29.5	44	1	7	10:15	107	44	5.1/4.9	9.7/6.9	9.0/7.4	9.6/7.1	9.3/7.5		76.7	14.4	4.3	34.0	4.1	
32.5	62	2	8	10:35	49	62	5.3/4.6	6.8/6.1	7.0/6.0	7.3/6.3	6.9/6.1		62.5	14.5	4.3	34.1	4.1	
32.5	62	1	8	10:35	50	62	5.0/4.3	9.5/6.3	8.8/6.4	8.1/7.6	9.8/7.2		73.0	14.4	4.3	34.0	4.1	
35	45	2	9	10:45	78	45	5.2/5.0	7.3/6.4	7.3/6.0	6.8/6.0	6.9/6.5		63.0	14.5	4.3	34.1	4.1	
35	45	1	9	10:45	79	44	4.8/4.9	9.4/6.8	8.9/7.3	9.3/6.9	8.9/7.1		74.4	14.4	4.3	34.0	4.1	
~~35.5~~	~~54~~	~~2~~	~~10~~	~~10:54~~	~~112~~	~~53~~	~~4.9/4.1~~	~~6.6/5.5~~	~~6.9/5.1~~	~~6.8/5.9~~	~~6.7/5.4~~		~~57.8~~	~~14.4~~	~~4.3~~	~~34.0~~	~~4.1~~	
35.5	55	1	10	10:54	113	54	5.2/4.4	9.0/6.3	8.7/6.2	10.6/5.8	10.5/6.1		72.8	14.5	4.3	34.0	4.0	
36	62	2	10	11:04	140	62	5.5/4.5	6.8/6.2	7.0/5.9	7.3/6.0	7.1/5.9		62.0	14.5	4.3	34.1	4.1	
37	63	1	11	11:04	142	62	5.0/4.4	9.3/6.9	8.7/6.9	7.7/7.4	9.4/7.5		72.6	14.4	4.3	34.1	4.1	
33.5	45	2	12	11:14	169	44	5.3/5.0	7.1/6.1	7.5/5.5	6.7/6.2	6.6/6.2		62.7	14.5	4.3	34.1	4.1	
33.5	44	1	12	11:14	170	44	5.5/4.9	9.7/6.7	9.6/6.9	9.5/6.8	8.9/7.2		75.7	14.4	4.3	33.9	4.0	
42	54	2	13	11:24	200	54	5.2/4.6	7.4/6.2	7.8/5.7	6.8/6.3	6.6/6.3		62.9	14.5	4.3	34.1	4.1	
42	54	1	13	11:24	201	54	5.3/4.3	9.5/6.8	9.0/6.7	10.1/6.8	9.9/6.7		75.1	14.5	4.3	34.1	4.1	
44	62	2	14	11:33	229	62	5.3/4.5	6.5/6.1	6.9/5.9	7.1/6.5	6.8/5.9		61.6	14.6	4.3	34.1	4.1	
44	62	1	14	11:33	230	62	5.2/4.4	9.4/6.5	9.9/6.9	8.0/6.8	9.9/7.4		73.5	14.4	4.3	34.1	4.1	

Recorded by DJW Checked by RP

8.6c_6420070022_SPSWIM_TO_23_04_2.99_0100_Post-Validation_sheet_21.doc

Sheet 21	* STATE_CODE	04
LTPP Traffic Data	*SPS PROJECT_ID	0100
WIM System Test Truck Records 2 of 3	* DATE	02/14/2002

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
37	45	2	14	11:41	256	44	5.4/5.0	7.2/5.8	7.5/5.8	6.7/6.0	6.4/6.0		61.8	14.5	4.3	34.1	4.1	
37	44	1	15	11:41	257	45	5.0/4.1	9.5/6.8	9.3/7.2	9.8/7.0	9.3/7.3		75.3	14.5	4.3	34.1	4.1	
45	54	2	15	11:49	275	54	5.0/4.5	7.1/6.3	7.5/6.1	6.8/6.3	6.5/6.5		62.7	14.5	4.3	34.2	4.1	
45	54	1	16	11:49	276	55	4.9/4.2	9.6/6.5	9.2/6.8	10.2/6.7	9.8/6.8		74.6	14.4	4.3	34.0	4.0	
37.5	62	2	16	11:59	300	62	5.3/4.6	6.7/5.8	7.2/5.9	7.4/6.4	7.0/5.9		62.1	14.6	4.3	34.2	4.1	
37.5	62	1	17	11:59	301	62	5.1/4.3	9.7/6.5	9.1/6.8	9.9/7.5	9.6/7.4		75.8	14.4	4.3	34.0	4.1	
41.5	44	2	17	12:07	334	44	5.1/4.8	7.1/5.9	7.5/6.0	6.7/6.1	6.4/6.0		61.7	14.5	4.3	34.2	4.1	
41.5	45	1	18	12:07	335	45	5.2/4.5	10.0/6.9	9.5/7.1	9.4/7.1	9.7/7.6		77.1	14.4	4.3	34.1	4.0	
40	61	2	18	12:17	370	62	5.4/4.5	6.9/6.3	7.1/5.8	7.1/6.1	6.9/8.3		62.6	14.5	4.3	34.1	4.1	
40	61	1	19	12:17	371	61	5.3/4.3	10.4/6.5	9.5/6.6	8.7/7.3	10.4/7.2		76.0	14.4	4.3	34.0	4.0	
52.5	44	2	19	12:27	399	44	5.4/4.9	7.3/6.0	7.6/6.0	6.9/6.0	6.5/6.2		62.9	14.5	4.3	34.2	4.1	
52.5	45	1	20	12:27	400	45	5.6/4.4	10.2/6.6	9.6/7.4	9.8/6.9	9.5/7.1		77.0	14.4	4.3	34.0	4.0	
41.5	54	2	20	12:37	441	54	5.0/4.7	6.8/6.1	7.1/5.6	7.0/6.4	6.6/6.1		61.4	14.5	4.3	34.1	4.1	
41.5	55	1	21	12:37	442	55	5.1/4.5	9.4/6.4	9.1/6.7	10.1/7.2	10.1/6.9		75.4	14.5	4.3	34.0	4.0	
39	61	2	21	12:47	476	62	5.3/4.4	6.8/6.3	7.2/6.0	7.4/6.6	7.0/6.4		63.4	14.5	4.3	34.1	4.1	
39	62	1	22	12:47	477	62	5.1/4.5	9.5/6.4	9.0/6.8	9.5/7.3	9.6/7.4		75.2	14.4	4.3	34.0	4.1	

Recorded by DW Checked by RP

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Sheet 21	* STATE_CODE	04
LTPP Traffic Data	*SPS PROJECT_ID	0100
WIM System Test Truck Records 3 of 3	* DATE	02/14/2008

Rev. 08/31/2001

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
37	45	2	22	12:58	503	44	5.5/5.2	7.5/5.7	7.6/5.6	6.8/6.0	6.6/6.0		62.6	14.6	4.3	34.1	4.1	
37	45	1	23	12:58	504	44	5.1/4.8	9.8/6.9	9.2/7.4	9.4/7.4	8.4/7.0		75.4	14.4	4.3	34.0	4.0	
38.5	54	2	23	1:08	534	54	5.1/4.5	6.7/6.2	7.7/5.8	6.9/6.4	6.8/6.0		62.1	14.5	4.3	34.1	4.1	
~~38.5~~		~~1~~	~~24~~	~~1:08~~														

Recorded by DSW Checked by RP

Calibration Worksheet **Site:** 040100

Calibration Iteration 1 Date 02/13/08

Beginning factors:

Speed Point (mph)	**Name**	**Value**
Overall		
Front Axle		
1 – (45)	72 kph	3571
2 – (50)	80 kph	3550
3 – (55)	88 kph	3626
4 – (60)	96 kph	3700
5 – (65)	104 kph	3450

Errors:

	45 Speed Point 1	50 Speed Point 2	55 Speed Point 3	60 Speed Point 4	65 Speed Point 5
~~F/A~~ GVW	-1.3	-2.5	-3.7	-3.2	-2.7
Tandem					
~~GVW~~					

Adjustments:

	Raise	Lower	Percentage
Overall	☒	☐	
Front Axle	☐	☐	
Speed Point 1	☒	☐	1.3
Speed Point 2	☒	☐	2.6
Speed Point 3	☒	☐	3.9
Speed Point 4	☒	☐	3.3
Speed Point 5	☒	☐	2.8

End factors:

Speed Point (mph)	**Name**	**Value**
Overall		
Front Axle		
1 – (45)	72 kph	3619
2 – (50)	80 kph	3642
3 – (55)	88 kph	3766
4 – (60)	96 kph	3822
5 – (65)	104 kph	3595

TEST VEHICLE PHOTOGRAPHS FOR SPS WIM VALIDATION

February 13-14, 2008

STATE: Arizona

SHRP ID: 0100

Photo 1 - Truck_1_Tractor_ 04_0100_02_13_08.JPG

Photo 2 - Truck_1_Trailer_04_0100_02_13_08.JPG

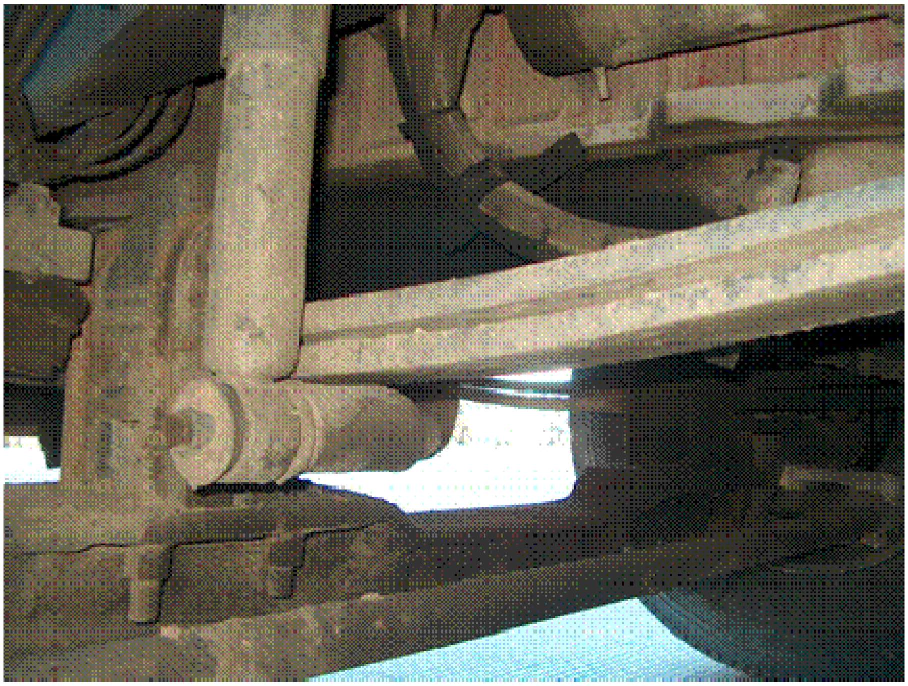

Photo 3 - Truck_1_Suspension_1_04_0100_02_13_08.JPG

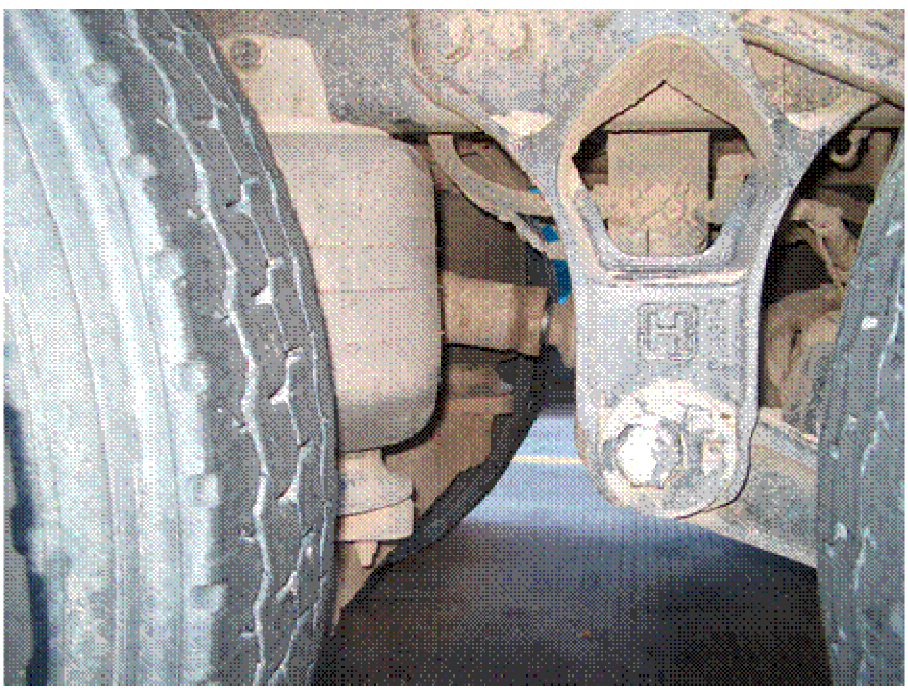

Photo 4 - Truck_1_Suspension_2_04_0100_02_13_08.JPG

Photo 5 - Truck_1_Suspension_3_04_0100_02_13_08.JPG

Photo 6 - Truck_2_Tractor_04_0100_02_13_08.JPG

Photo 7 - Truck_2_Trailer_04_0100_02_13_08.JPG

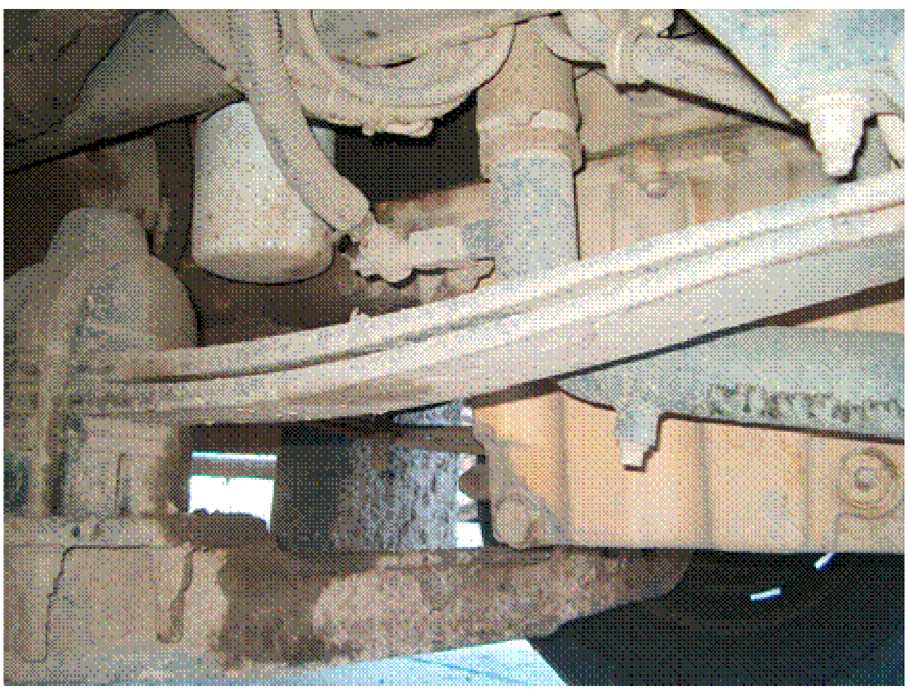

Photo 8 - Truck_2_Suspension_1_04_0100_02_13_08.JPG

Photo 9 - Truck_2_Suspension_2_04_0100_02_13_08.JPG

Photo 10 - Truck_2_Suspension_3_04_0100_02_13_08.JPG

ETG LTPP CLASS SCHEME, MOD 3

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

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

System Operating Parameters

Arizona SPS-1 (Lane 1)

Calibration Factors for Sensor #1

Validation Visit / Factor	February 14, 2008	February 13, 2008	May 3, 2007
Distance			
88 kph	3619	3571	3743
96 kph	3642	3550	3773
104 kph	3766	3626	3817
112 kph	3822	3700	4024
120 kph	3545	3450	4283

Calibration Factors for Sensor #2

Validation Visit / Factor	February 14, 2008	February 13, 2008	May 3, 2007
Distance			
88 kph	3619	3571	3743
96 kph	3642	3550	3773
104 kph	3766	3626	3817
112 kph	3822	3700	4024
120 kph	3545	3450	4283