Validation Report

Arizona, SPS-2
Task Order 23, CLIN 2
February 11 to 12, 2008

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1 Executive Summary

A visit was made to the Arizona 0200 on February 11 to 12, 2008 for the purposes of conducting a validation of the WIM system located on I-10 at between Tonopah, Arizona and AZ 85. The SPS-2 is located in the righthand, eastbound lane of a four-lane divided facility. The posted speed limit at this location is 75 mph. The LTPP lane is the only lane that is instrumented at this site. The validation procedures were in accordance with LTPP's SPS WIM Data Collection Guide dated August 21, 2001.

This site was installed as part of a relocation of the abandoned site located approximately 330 feet west of this site. This is the second validation visit to this location. The site was installed as part of Phase 2 of the Pooled Fund Study prior to November 28, 2006 by International Road Dynamics/PAT.

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

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

The validation used the following trucks:

1) 5-axle tractor-trailer with a tractor having an air suspension and a trailer with a standard rear tandem and an air suspension loaded to 77,130 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 64,210 lbs., the "partial" truck.

The validation speeds ranged from 52 to 73 miles per hour. The pavement temperatures ranged from 65 to 86 degrees Fahrenheit. The desired speed range was achieved during this validation. The desired 30 degree Fahrenheit temperature range was not achieved.

Table 1-1 Post-Validation results – 040200 – 12-Feb-2008

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	3.8 ± 5.8%	Pass
Tandem axles	±15 percent	2.2 ± 8.2%	Pass
GVW	±10 percent	2.4 ± 5.8%	Pass
Axle spacing	± 0.5 ft [150mm]	0.1 ± 0.1 ft	Pass

Prepared: rwp *Checked: bko*

The pavement condition appeared satisfactory for conducting a performance evaluation. Other then the old bending plate location approximately 300 feet upstream of the site there were no distresses observed that would influence truck motions.

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 1, 2007. Apparently the site was calibrated by the Phase 2 contractor in January 2008 after equipment maintenance work was performed at the site.

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

2 Corrective Actions Recommended

The patching at the old bending plate location should be repaired to eliminate the truck bouncing prior to reaching the relocated site.

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

3 Post Calibration Analysis

This final analysis is based on test runs conducted February 12, 2008 during the late morning and afternoon hours at test site 040200 on I-10. This SPS-2 site is at milepost 108.6 on the eastbound, 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 77,130 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 64,210 lbs., the "partial" truck.

Each truck made a total of 20 passes over the WIM scale at speeds ranging from approximately 52 to 73 miles per hour. The desired speed range was achieved during this validation. Pavement surface temperatures were recorded during the test runs ranging from about 65 to 86 degrees Fahrenheit. The desired 30 degree Fahrenheit temperature range was not achieved. The computed values of 95% confidence limits of each statistic for the total population are in Table 3-1.

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

Table 3-1 Post-Validation Results – 040200 – 12-Feb-2008

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	3.8 ± 5.8%	Pass
Tandem axles	±15 percent	2.2 ± 8.2%	Pass
GVW	±10 percent	2.4 ± 5.8%	Pass
Axle spacing	± 0.5 ft [150mm]	0.1 ± 0.1 ft	Pass

Prepared: rwp *Checked: bko*

The pavement condition appeared satisfactory for conducting a performance evaluation. There were no distresses observed that would influence truck motions significantly. An old bending plate location approximately 300 feet upstream of the site was observed to cause discernable bouncing by trucks that was barely dampened when they reached the sensor area.

The runs were conducted at various speeds and pavement temperatures 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 not achieved for this set of validation runs due to cool and cloudy conditions that precluded higher pavement temperatures.

The three speed groups were divided as follows: Low speed – 52 to 59 mph, Medium speed – 60 to 67 mph and High speed – 68 + mph. The two temperature groups were created by splitting the runs between those at 65 to 75 degrees Fahrenheit for Low temperature and 76 to 86 degrees Fahrenheit for High temperature.

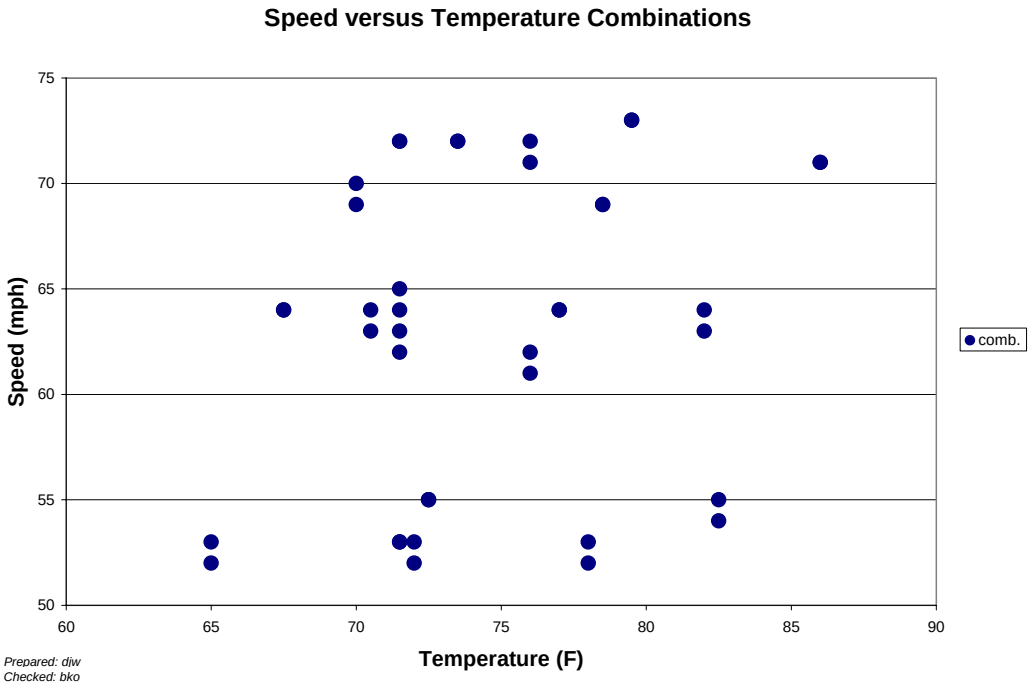

Figure 3-1 Post-Validation Speed-Temperature Distribution – 040200 – 12-Feb-2008

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. From the figure, it appears that the equipment estimates GVW reasonably well at all speeds. GVW estimates were slightly high throughout the speed range and variability in error increased slightly as the speed increased.

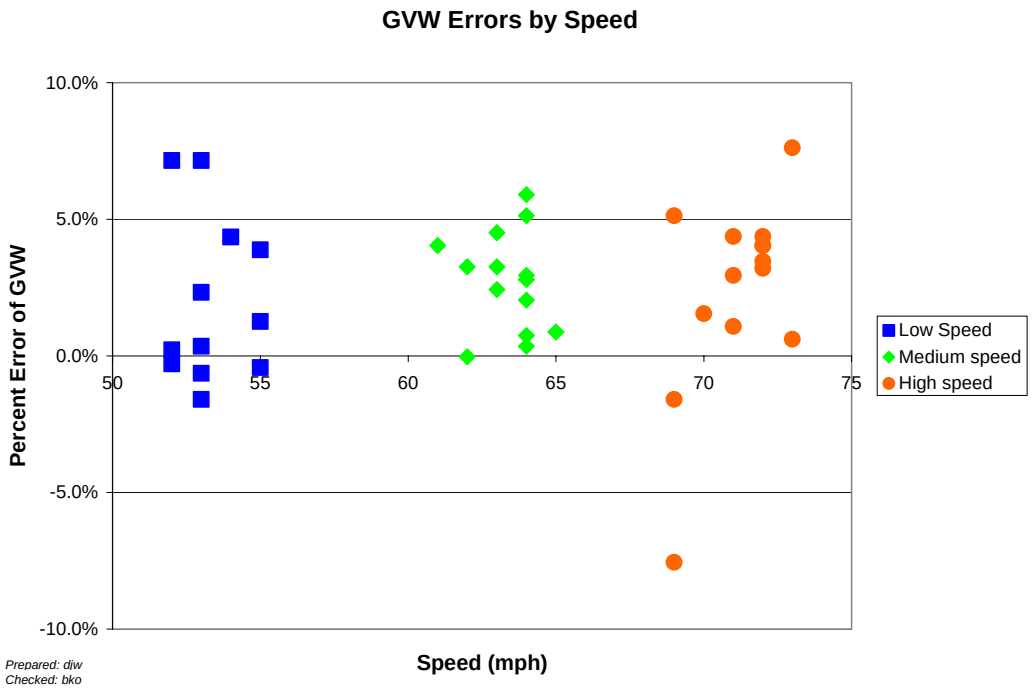

Figure 3-2 Post-validation GVW Percent Error vs. Speed – 040200 – 12-Feb-2008

Figure 3-3 shows the shows how the system appears to slightly overestimate GVW over the entire range of measured pavement temperatures.

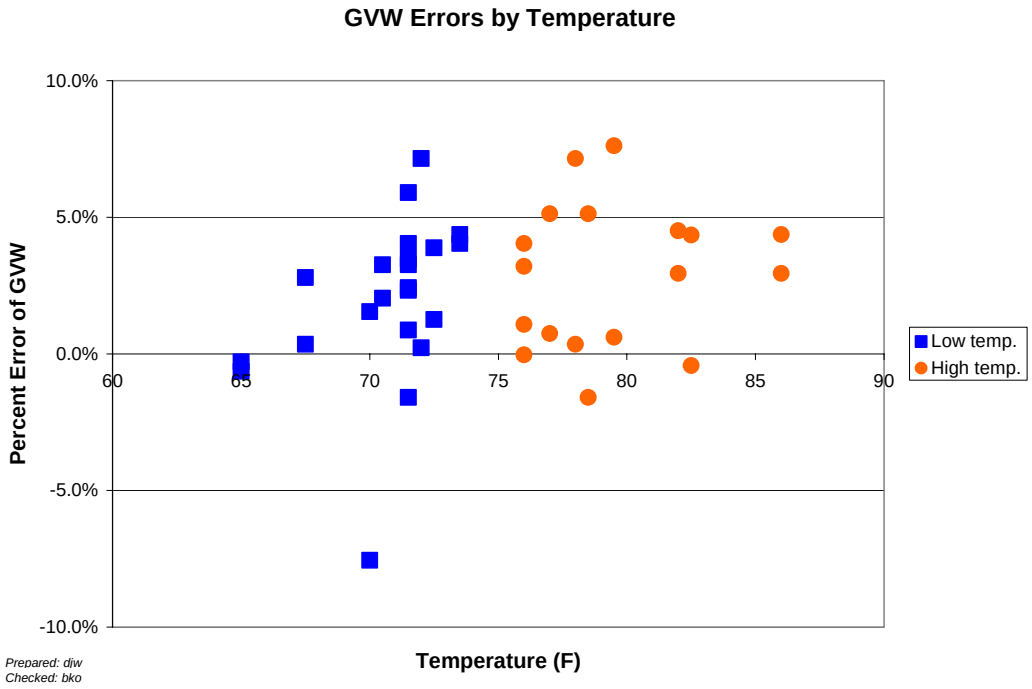

Figure 3-3 Post-Validation GVW Percent Error vs. Temperature – 040200 – 12-Feb-2008

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. The graph indicates that the errors in measurement of tandem spacings for the test trucks were not affected by changes in speed. The system consistently measured tandem axle spacing 0.1 feet greater than the measured static values.

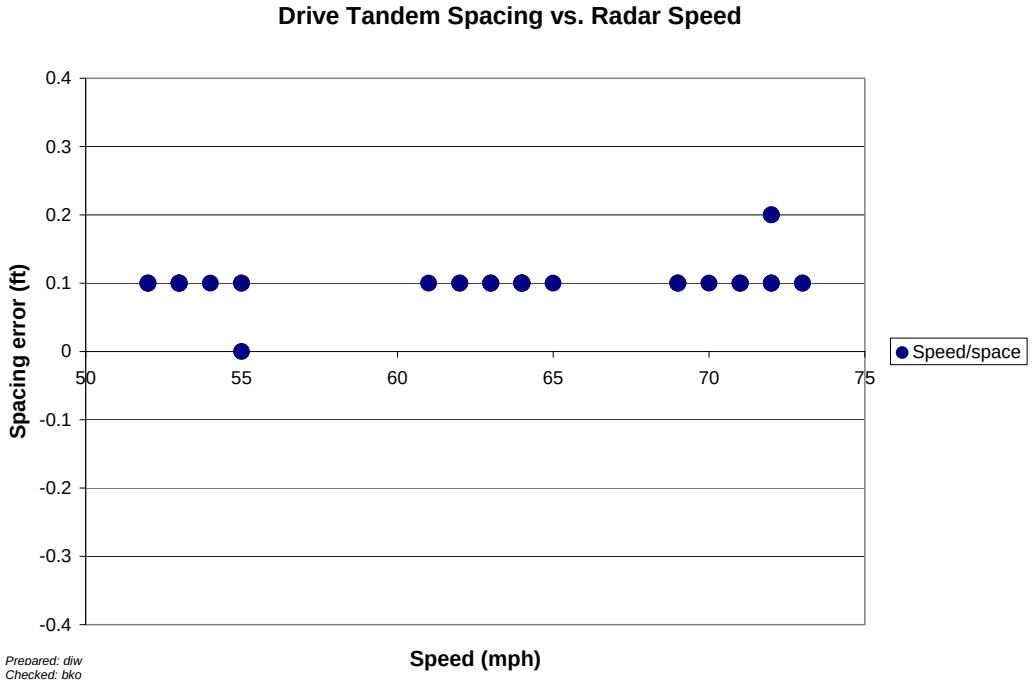

Figure 3-4 Post-Validation Spacing vs. Speed – 040200 – 12-Feb-2008

3.1 Temperature-based Analysis

The two temperature groups were created by splitting the runs between those at 65 to 75 degrees Fahrenheit for Low temperature and 76 to 86 degrees Fahrenheit for High temperature.

Table 3-2 Post-Validation Results by Temperature Bin – 040200 – 12-Feb-2008

Element	95% Limit	Low Temperature 65 to 75 °F	High Temperature 76 to 86 °F
Steering axles	±20 %	3.3 ± 5.9%	4.4 ± 6.0%
Tandem axles	±15 %	1.7 ± 7.9%	2.7 ± 8.7%
GVW	±10 %	2.0 ± 6.3%	2.9 ± 5.6%
Axle spacing	± 0.5 ft	0.1 ± 0.1 ft	0.1 ± 0.0 ft

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From Table 3-2, it appears that the equipment consistently overestimates GVW, steering and tandem weights at all temperatures. The error is slightly more so at higher pavement temperatures. Individually, variability in error for each weight group appears to be consistent throughout the entire temperature range.

Figure 3-5 is the distribution of GVW Errors versus Temperature by Truck graph. From the figure it would appear that the overestimation of GVW is mostly a function of the error in measurement of the lighter 'partial' truck. It appears from this temperature graph that a small temperature influence exists between 65 and 86 degrees, primarily for the lighter truck. It cannot be determined if this effect exists beyond the limited temperature range of this test.

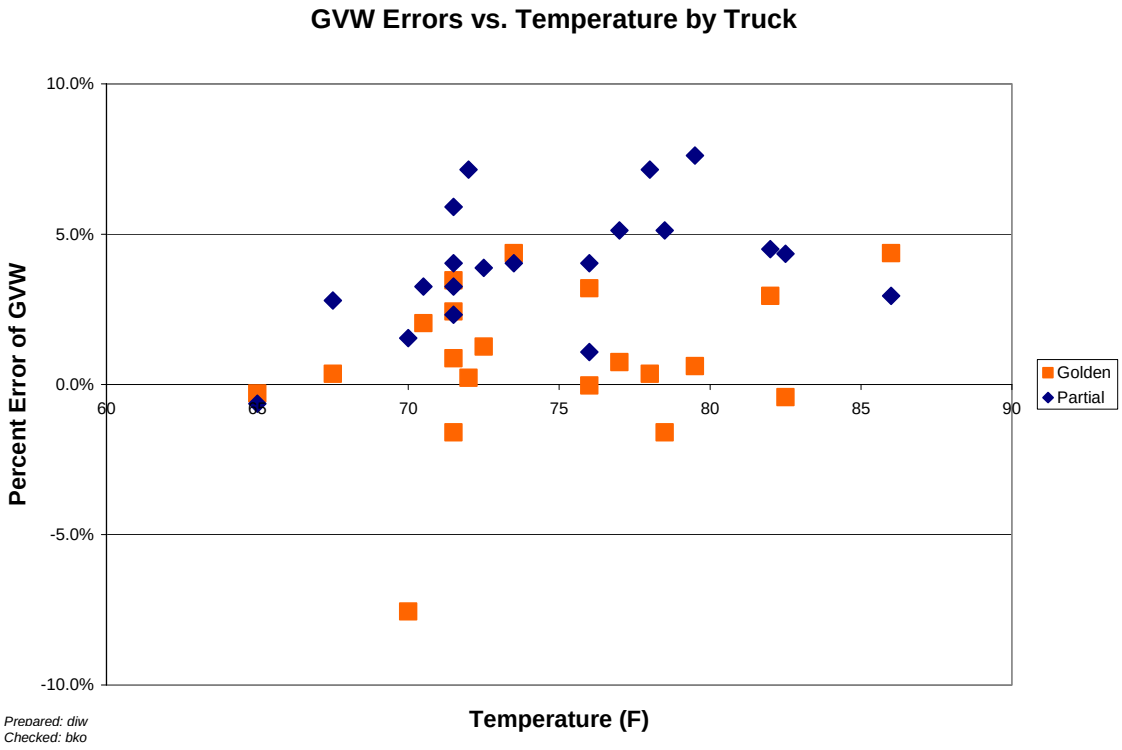


Figure 3-5 Post-Validation GVW Percent Error vs. Temperature by Truck – 040200 – 12-Feb-2008

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.

From the figure, it can be seen that the equipment estimates steering axle weights with reasonable accuracy with a consistent overestimation of weights throughout the temperature range. Variability in steering axle error appears to also be consistent at all measured temperatures.

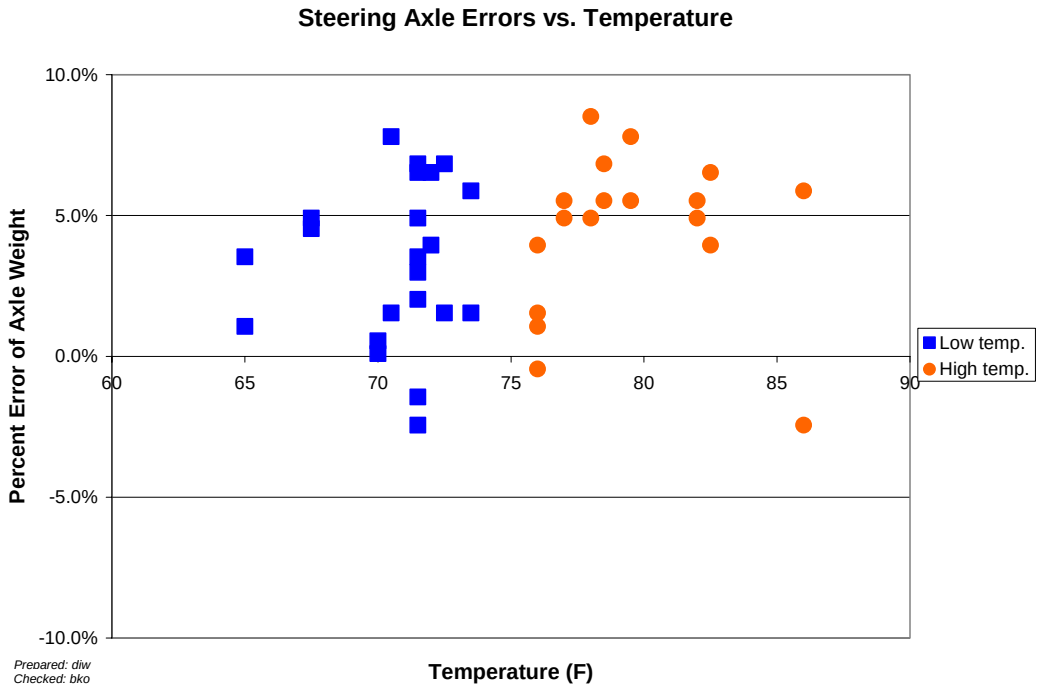


Figure 3-6 Post-Validation Steering Axle Error vs. Temperature by Group – 040200 – 12-Feb-2008

3.2 Speed-based Analysis

The three speed groups were divided using 52 to 59 mph for Low speed, 60 to 67 mph for Medium speed and 68+ mph for High speed.

Table 3-3 Post-Validation Results by Speed Bin – 040200 – 12-Feb-2008

Element	95% Limit	Low Speed 52 to 59 mph	Medium Speed 60 to 67 mph	High Speed 68+ mph
Steering axles	±20 %	4.0 ± 6.6%	3.9 ± 5.5%	3.6 ± 7.0%
Tandem axles	±15 %	1.7 ± 7.3%	2.6 ± 6.8%	2.2 ± 10.7%
GVW	±10 %	2.0 ± 6.6%	2.7 ± 3.9%	2.4 ± 7.8%
Axle spacing	± 0.5 ft	0.1 ± 0.1 ft	0.1 ± 0.0 ft	0.1 ± 0.1 ft

Prepared: rwp *Checked: bko*

From Table 3-3, it can be seen that the equipment tends to slightly overestimate steering and tandem axle weights as well as GVW at all speeds and the overestimation is most pronounced for steering axles. Variability of these estimated are generally consistent over the range of speeds. At all speeds, steering axle weights were overestimated by greater degrees than either tandem axle or GVW weight levels.

Figure 3-7 illustrates the ability of the equipment to generally overestimate GVW for both trucks with the greatest error found in measurements of the Partial truck. As speed increases, it appears that GVW error for the Golden truck becomes increasingly greater

and more variable, although the effect is small. Speed appears to have little or no effect on the error in measurement of GVW for the Partial truck. The outlier was verified using the capture files collected on site.

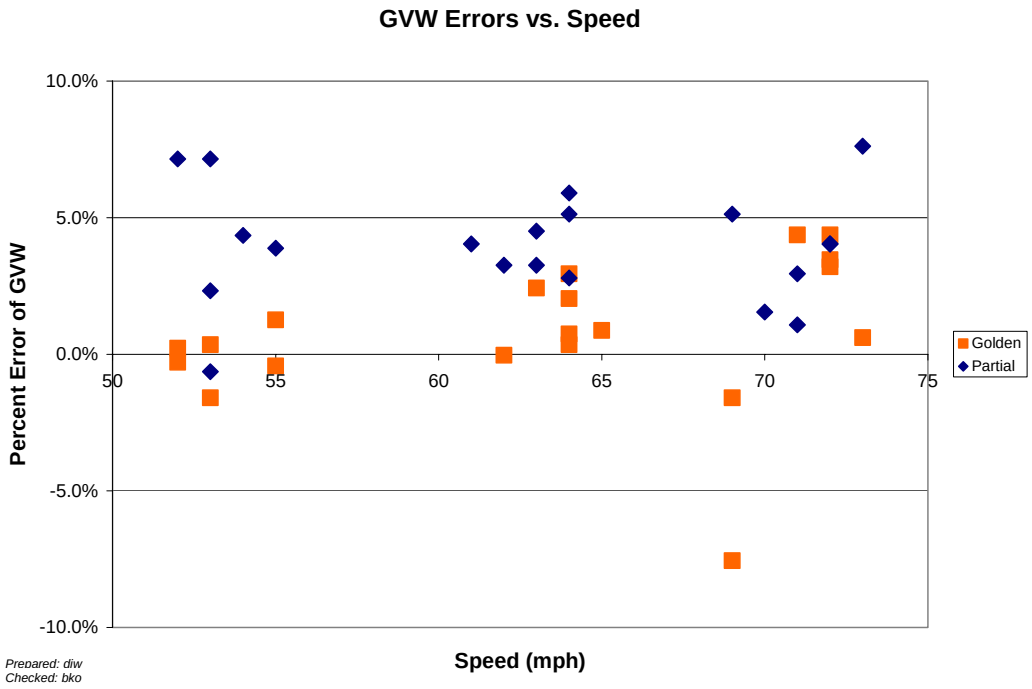


Figure 3-7 Post-Validation GVW Percent Error vs. Speed by Truck – 040200 – 12-Feb-2008

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.

From the figure, it appears that the WIM equipment estimates steering axle weights with reasonable accuracy throughout the entire speed range. Variability is consistent throughout the entire speed range. Estimates are typically high throughout the speed range.

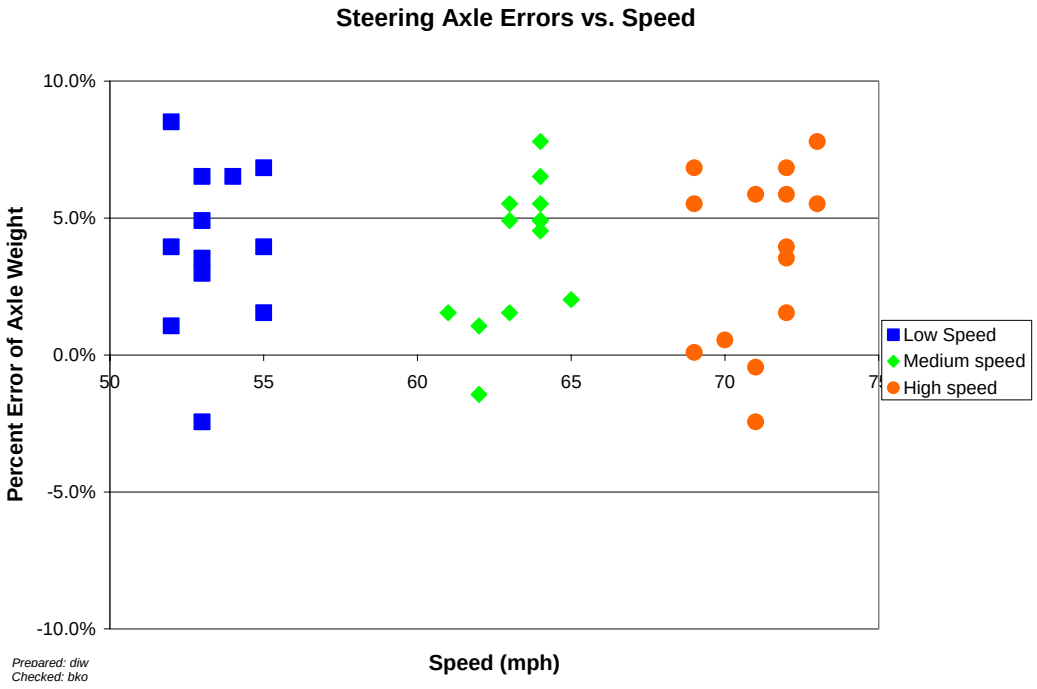


Figure 3-8 Post-Validation Steering Axle Percent Error vs. Speed by Group – 040200 – 12-Feb-2008

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 100 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 4.9 percent. The site consistently recorded straight trucks with trailers and erroneously classified them as vehicle Class 5 rather than the correct Class 8. With the exception of a single misclassified bus, these were the only errors.

Table 3-4 Truck Misclassification Percentages for 040200 – 12-Feb-2008

Class	Percent Error	Class	Percent Error	Class	Percent Error
4	100	5	43	6	0
7					
8	20	9		10	
11	0	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 040200 – 12-Feb-2008

Class	Mean Difference	Class	Mean Difference	Class	Mean Difference
4	N/A	5	- 17	6	0
7	0				
8	- 20	9	0	10	0
11	0	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.

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

Approximately 330 feet in advance of the WIM sensors, an older bending plate location, now patched with asphalt caused a noticeable movement of heavy trucks as they passed over. This movement was typically dampened prior to the trucks reaching the existing

bending plates but it could not be determined if there was any detrimental effect. Otherwise 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 13, 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 site 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 by: jrn

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 – 040200 – 13-Dec-2007

Profiler Passes			**Pass 1**	**Pass 2**	**Pass 3**	**Pass 4**	**Ave.**
Center	LWP	LRI (m/km)	0.900	0.921	0.857	0.942	0.905
		SRI (m/km)	0.773	0.627	0.610	0.795	0.701
		Peak LRI (m/km)	0.900	0.921	0.857	0.944	0.906
		Peak SRI (m/km)	0.908	0.941	0.885	0.873	0.902
	RWP	LRI (m/km)	1.195	1.227	1.164	1.151	1.184
		SRI (m/km)	1.184	1.238	1.312	0.990	1.181
		Peak LRI (m/km)	1.198	1.227	1.164	1.151	1.185
		Peak SRI (m/km)	1.356	1.613	1.754	1.372	1.524
Left Shift	LWP	LRI (m/km)	1.130	1.211			
		SRI (m/km)	0.751	0.742			
		Peak LRI (m/km)	1.312	1.322			
		Peak SRI (m/km)	1.248	0.851			
	RWP	LRI (m/km)	1.102	0.863			
		SRI (m/km)	0.845	0.661			
		Peak LRI (m/km)	1.102	0.863			
		Peak SRI (m/km)	1.169	0.871			
Right Shift	LWP	LRI (m/km)	1.001	0.994			
		SRI (m/km)	1.115	0.971			
		Peak LRI (m/km)	1.005	0.997			
		Peak SRI (m/km)	1.277	1.324			
	RWP	LRI (m/km)	1.039	1.102			
		SRI (m/km)	1.566	1.594			
		Peak LRI (m/km)	1.039	1.102			
		Peak SRI (m/km)	1.779	1.731			

Prepared: als Checked: jrn

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 with the exception of the previously mentioned old bending plate location. Figure 4-1 illustrates the location of the patched older bending plate location.

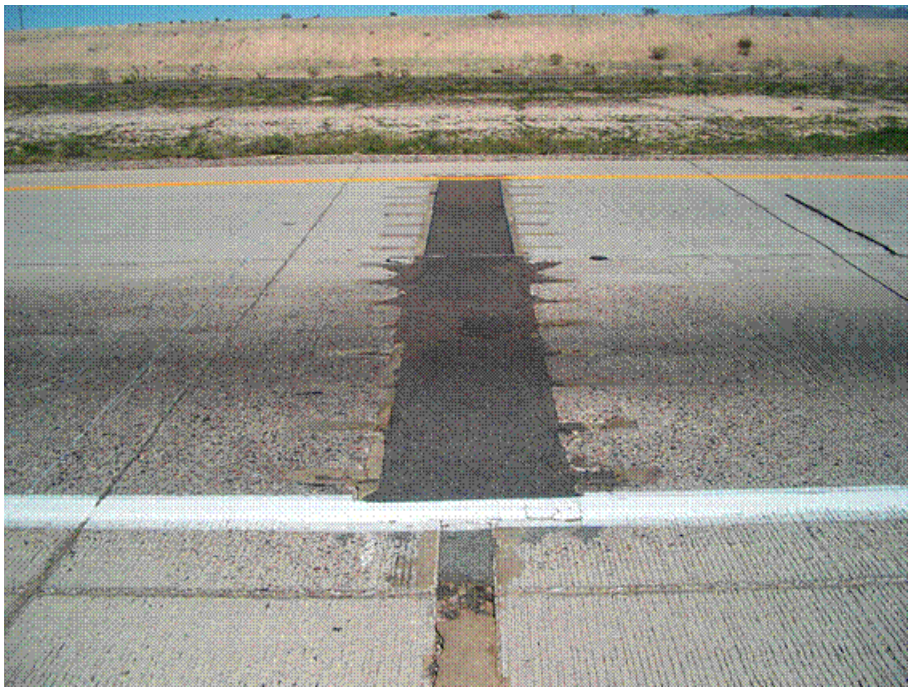


Figure 4-1 Patched Old Bending Plate Location – 040200 – 12-Feb-2008

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 as they pass over the scale. Trucks appear to track down the wheel path and daylight cannot be seen between the tires and any of the sensors for the equipment. Trucks did bounce as they passed over the location of the old bending plate but this motion was dampened by the time they reached the present installation. It is not known whether this motion had any effect on WIM scale performance.

5 Equipment Discussion

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

After the assessment on March 4, 2004, new equipment was installed at a location 330 feet further east than the original site. The older location was patched and has some effect on vehicle movement prior to reaching the existing site location.

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

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 1, 2007. Apparently the site was calibrated by the Phase 2 contractor in January 2008 after equipment maintenance work was performed at the site.

The equipment required two iterations of the calibration process between the initial 40 runs and the final 40 runs.

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

Speed Bin	Sensor 1	Sensor 2
1	3222	3644
2	3112	3520
3	3195	3613
4	3055	3456
5	3306	3739

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 factor at the start of the validation was 341.

5.2.1 Calibration Iteration 1

Based on the results from the Pre-Validation, which produced a slightly positive mean GVW error range, the compensation factors were adjusted slightly downward to compensate for overestimation of all weights except for the low speed category.

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

Speed bin	Sensor 1	Sensor 2
1	3178	3594
2	3056	3456
3	3123	3532
4	2975	3366
5	3207	3627

The spacing compensation factor was adjusted from 341 to 347 to compensate for the high recorded values of axle C to D spacing.

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

Table 5-1 Calibration Iteration 1 Results – 040200 – 12-Feb-2008 (08:26 AM)

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	-2.2 ± 6.8%	Pass
Tandem axles	±15 percent	-3.4 ± 10.1%	Pass
GVW	**±10 percent**	**-3.3 ± 9.2%**	**Fail**
Axle spacing	± 0.5 ft	0.1 ± 0.0 ft	Pass

Prepared: rwp *Checked: bko*

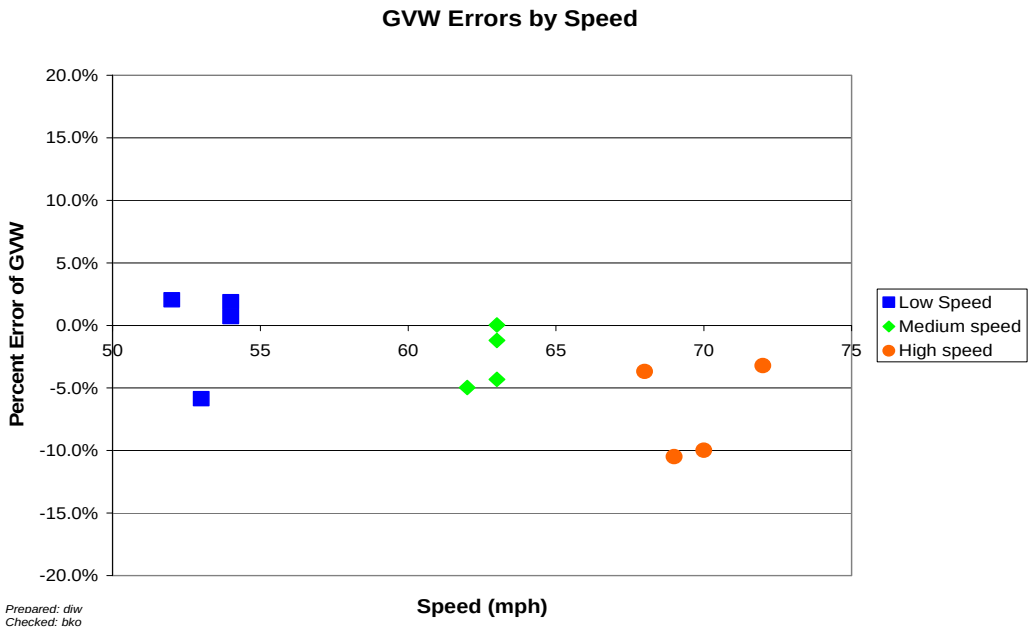


Figure 5-1 Calibration Iteration 1 GVW Percent Error vs. Speed Group – 040200 – 12-Feb-2008 (08:26 AM)

5.2.2 Calibration Iteration 2

Based on the results from the calibration iteration 1, which produced a mean GVW error range from -1.0% to -4.6%, the compensation factors were again computed to compensate for underestimations of weights.

As shown in Figure 5-1, using the computed new factors from the spreadsheet did not provide the expected results, so the second calibration was actually just inputting the original factors back in. The system calibration factors for the second iteration are shown below:

Speed bin	Sensor 1	Sensor 2
1	3222	3644
2	3112	3520
3	3195	3613
4	3055	3456
5	3306	3739

Table 5-2 Calibration Iteration 2 Results – 040200 – 12-Feb-2008 (10:13 AM)

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	1.0 ± 5.9%	Pass
Tandem axles	±15 percent	0.0 ± 8.9%	Pass
GVW	±10 percent	0.2 ± 7.5%	Pass
Axle spacing	± 0.5 ft [150mm]	0.1 ± 0.1 ft	Pass

Prepared: rwp *Checked: bko*

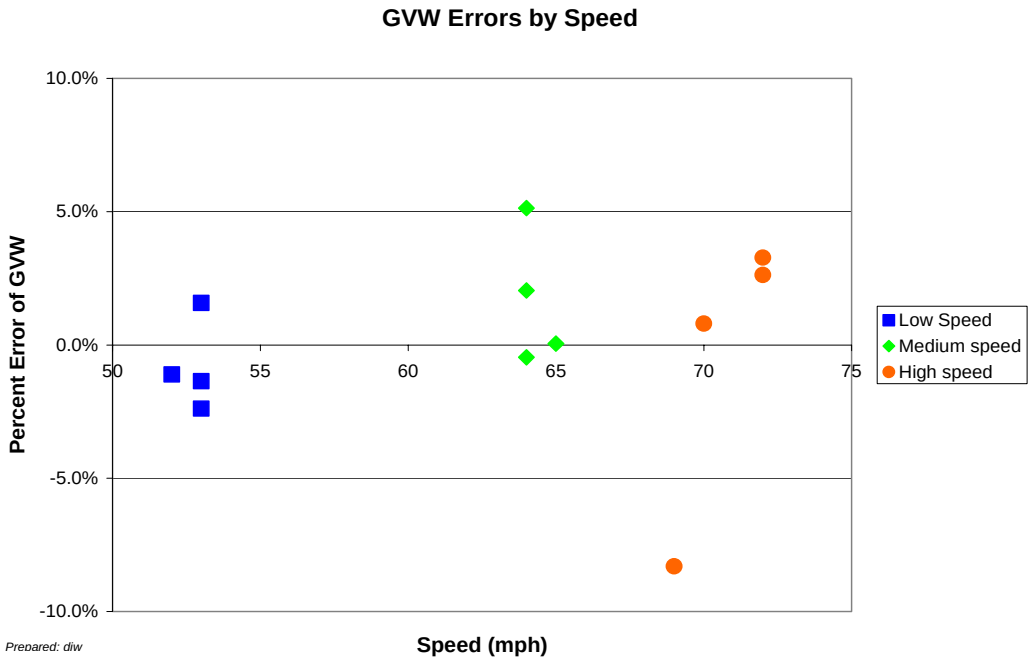


Figure 5-2 Calibration Iteration 2 GVW Percent Error vs. Speed Group – 040200 – 12-Feb-2008 (10:13 AM)

The change to the spacing factor appeared to have no effect so it was changed back to its original value.

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

Table 5-3 Classification Validation History – 040200 – 12-Feb-2008

Date	Method	Mean Difference				Percent Unclassified
		Class 9	Class 8	Other 1	Other 2	
02/12/08	Manual	0	-20			0
02/11/08	Manual	0	-27			0
05/01/07	Manual	0	0			0
04/30/07	Manual	0	0			0

Prepared: rwp *Checked: bko*

Table 5-4 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 5-4 Weight Validation History – 040200 – 12-Feb-2008

Date	Method	Mean Error and (SD)		
		GVW	Single Axles	Tandem Axles
02/12/08	Test Trucks	2.4 (2.9)	3.8 (2.9)	2.2 (4.1)
02/11/08	Test Trucks	2.2 (3.2)	5.0 (3.1)	1.7 (4.0)
05/01/07	Test Trucks	-0.2 (3.6)	1.1 (4.9)	-0.3 (5.4)
04/30/07	Test Trucks	1.5 (3.0)	1.4 (4.3)	1.6 (4.0)

Prepared: rwp *Checked: bko*

5.4 Projected Maintenance/Replacement Requirements

The equipment repeatedly erred in measuring some Class 8 vehicles and assigning them to vehicle Class 5. All axles and axle spacing measurements appeared to be recorded correctly but the vehicle class assignments were made incorrectly. This indicates that the problem is in the software rather than in the hardware of the site.

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

Under a separate LTPP contract, this site is to be visited semi-annually for routine preventive equipment diagnostics and inspection. Annual validations are also anticipated.

6 Pre-Validation Analysis

This pre-validation analysis is based on test runs conducted February 11, 2008 during the morning and afternoon hours at test site 040200 on I-10. This SPS-2 site is at milepost 108.6 on the eastbound, 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 77,550 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 64,560 lbs., the "partial" truck.

For the initial validation each truck made a total of 20 passes over the WIM scale at speeds ranging from approximately 46 to 72 miles per hour. The desired speed range was achieved during this validation. Pavement surface temperatures were recorded during the test runs ranging from about 61 to 83degrees Fahrenheit. The desired 30 degree Fahrenheit temperature range was not achieved. The computed values of 95% confidence limits of each statistic for the total population are in Table 6-1

As shown in Table 6-1, the site met all of the requirements for research quality data during the pre-validation. It was determined that, although no adjustments to weight measurements were necessary, the spacing measurements were long. Both weight and spacing factors were be modified to bring the results as close to static measured values as possible.

Table 6-1 Pre-Validation Results – 040200 – 11-Feb-2008

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	5.0 ± 6.1%	Pass
Tandem axles	±15 percent	1.7 ± 8.0%	Pass
GVW	±10 percent	2.2 ± 6.4%	Pass
Axle spacing	± 0.5 ft [150mm]	0.1 ± 0.1 ft	Pass

Prepared: rwp *Checked: bko*

The test runs were conducted primarily during the late morning and early afternoon hours. Cool temperatures and low clouds resulted 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.

The three speed groups were divided into 46 to 59 mph for Low speed, 60 to 69 mph for Medium speed and 70+ mph for High speed. The two temperature groups were created by splitting the runs between those at 61 to 72 degrees Fahrenheit for Low temperature and 73 to 83 degrees Fahrenheit for High temperature.

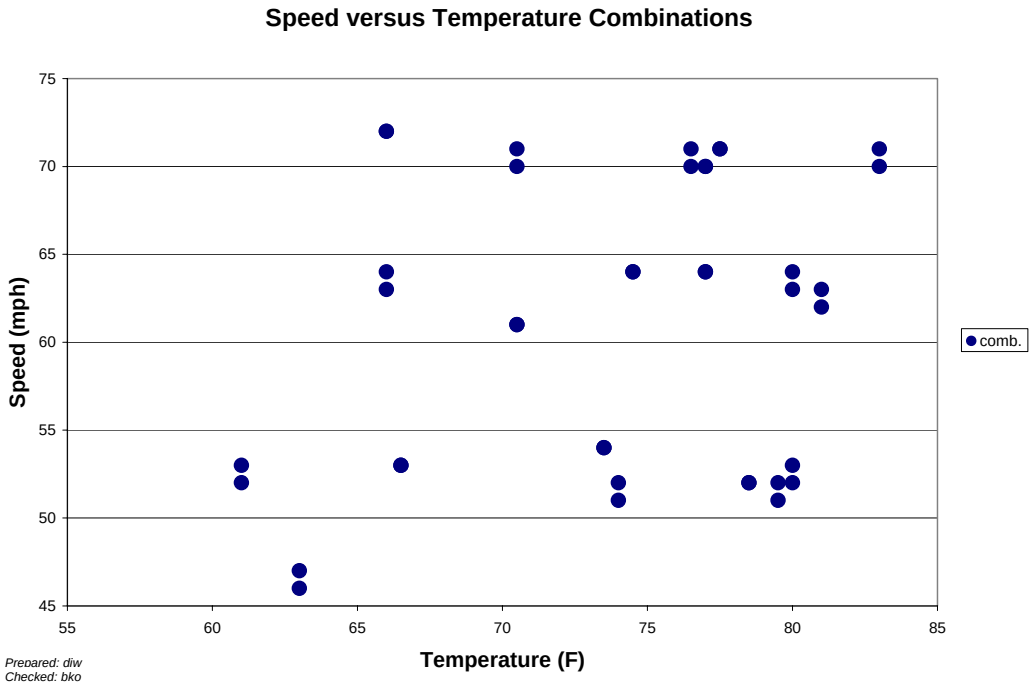


Figure 6-1 Pre-Validation Speed-Temperature Distribution – 040200 – 11-Feb-2008

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. The figure illustrates the tendency for the equipment to overestimate GVW very slightly at both the low and high ends of the speed range. Variability appears to remain constant over the range of speeds.

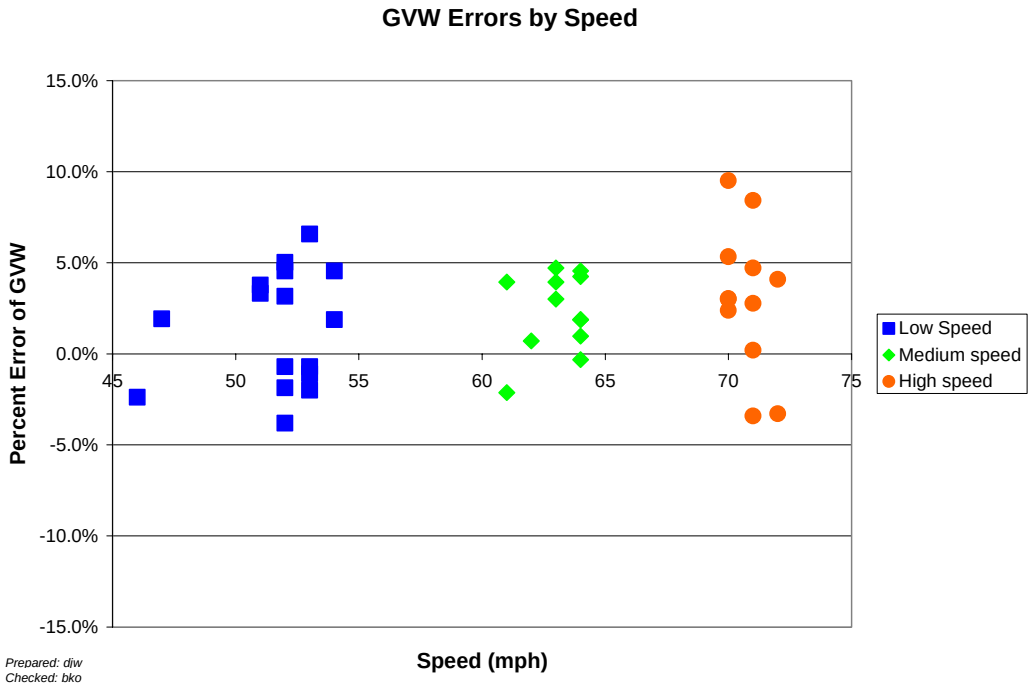


Figure 6-2 Pre-validation GVW Percent Error vs. Speed – 040200 – 11-Feb-2008

Figure 6-3 shows the lack of relationship between temperature and GVW percentage error.

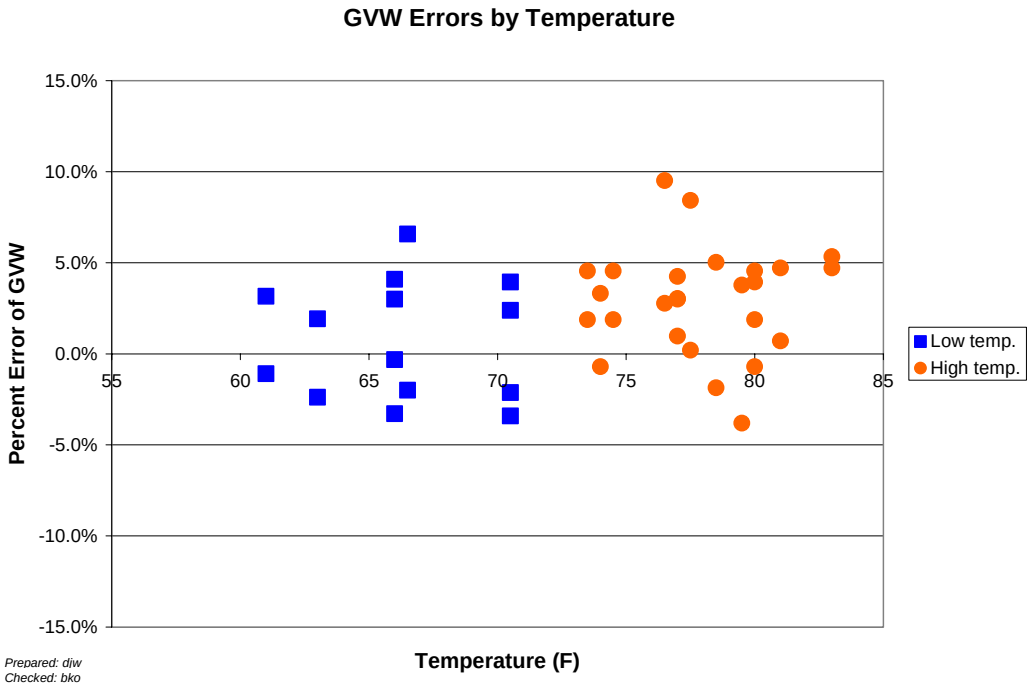


Figure 6-3 Pre-Validation GVW Percent Error vs. Temperature – 040200 – 11-Feb-2008

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 graph indicates that the errors in tandem spacings for the test trucks did not differ at different speeds. At both lower and higher speeds the equipment consistently overestimated the spacing by 0.1 feet.

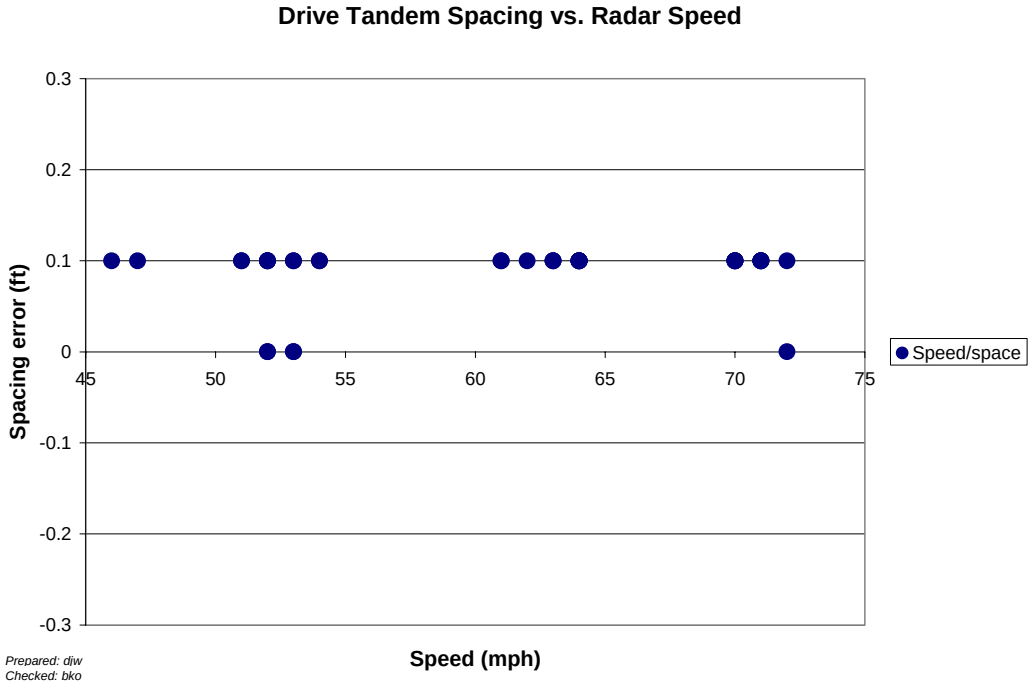


Figure 6-4 Pre-Validation Spacing vs. Speed - 040200 – 11-Feb-2008

6.1 Temperature-based Analysis

The two temperature groups were created by splitting the runs between those at 61 to 72 degrees Fahrenheit for Low temperature and 73 to 83 degrees Fahrenheit for High temperature.

Table 6-2 Pre-Validation Results by Temperature Bin – 040200 – 11-Feb-2008

Element	95% Limit	Low Temperature 61 to 72 °F	High Temperature 73 to 83 °F
Steering axles	±20 %	3.8 ± 6.1%	5.7 ± 6.1%
Tandem axles	±15 %	0.2 ± 8.1%	2.5 ± 7.8%
GVW	±10 %	0.7 ± 6.9%	2.9 ± 6.1%
Axle spacing	± 0.5 ft	0.1 ± 0.1 ft	0.1 ± 0.1 ft

Prepared: rwp *Checked: bko*

From Table 6-2, it can be seen that all weights are overestimated with reasonable consistency throughout the entire temperature range. Higher temperatures appeared to correlate to slightly greater overestimation of weight.

Figure 6-5 shows the distribution of GVW Errors versus Temperature by Truck. The equipment appears to produce an overestimation of GVW for the partial truck (diamonds) over the observed temperature range. For the golden truck (squares), the equipment appears to measure accurately.

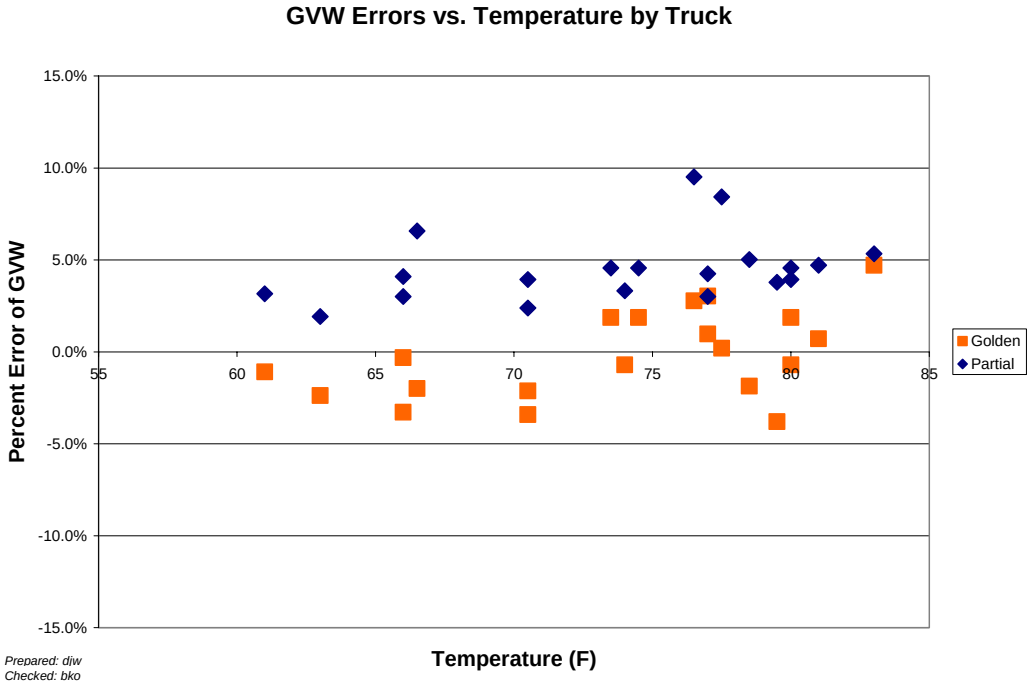


Figure 6-5 Pre-Validation GVW Percent Error vs. Temperature by Truck – 040200 – 11-Feb-2008

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. The figure shows that steering axle weights are overestimated by the equipment at the lower and upper ends of the temperature range. Variability in error appears to fairly consistent over the entire temperature range but the bias is slightly greater at higher temperatures.

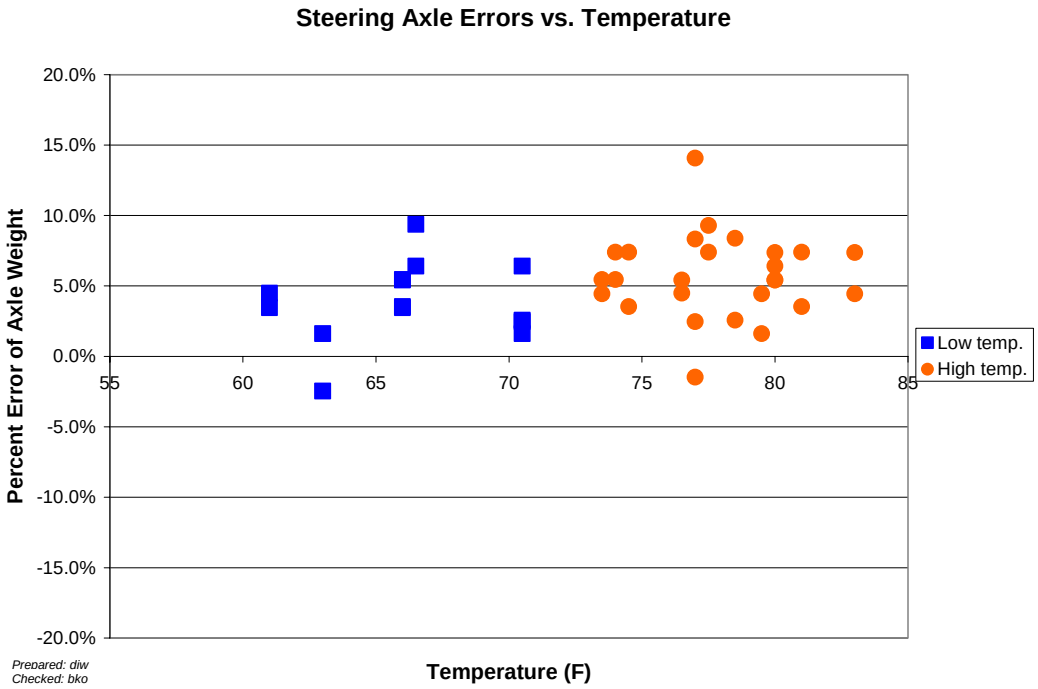


Figure 6-6 Pre-Validation Steering Axle Error vs. Temperature by Group – 040200 – 11-Feb-2008

6.2 Speed-based Analysis

The speed groups were divided as follows: Low speed – 46 to 59 mph, Medium speed – 60 to 69 mph and High speed – 70+ mph.

Table 6-3 Pre-Validation Results by Speed Bin – 040200 – 11-Feb-2008

Element	95% Limit	Low Speed 46 to 59 mph	Medium Speed 60 to 69 mph	High Speed 70+ mph
Steering axles	±20 %	4.7 ± 6.2%	5.2 ± 4.9%	5.4 ± 8.6%
Tandem axles	±15 %	1.8 ± 6.5%	2.7 ± 10.7%	1.8 ± 6.5%
GVW	±10 %	1.4 ± 6.8%	2.3 ± 4.8%	3.1 ± 8.7%
Axle spacing	± 0.5 ft	0.1 ± 0.1 ft	0.1 ± 0.0 ft	0.1 ± 0.1 ft

Prepared: rwp *Checked: bko*

From Table 6-3, it can be seen that the system estimates all weights with reasonable accuracy at all speeds, with a slightly greater overestimation for steering axle weights and for all weights at the higher speeds. Variability in error for all weights generally increases as speed increases.

Figure 6-7 illustrates the tendency of the equipment to overestimate GVW for the partial truck at all speeds. For the golden truck, the system is more accurate at all speeds. For

both trucks there is a slight tendency for measurement bias to increase slightly at higher temperatures.

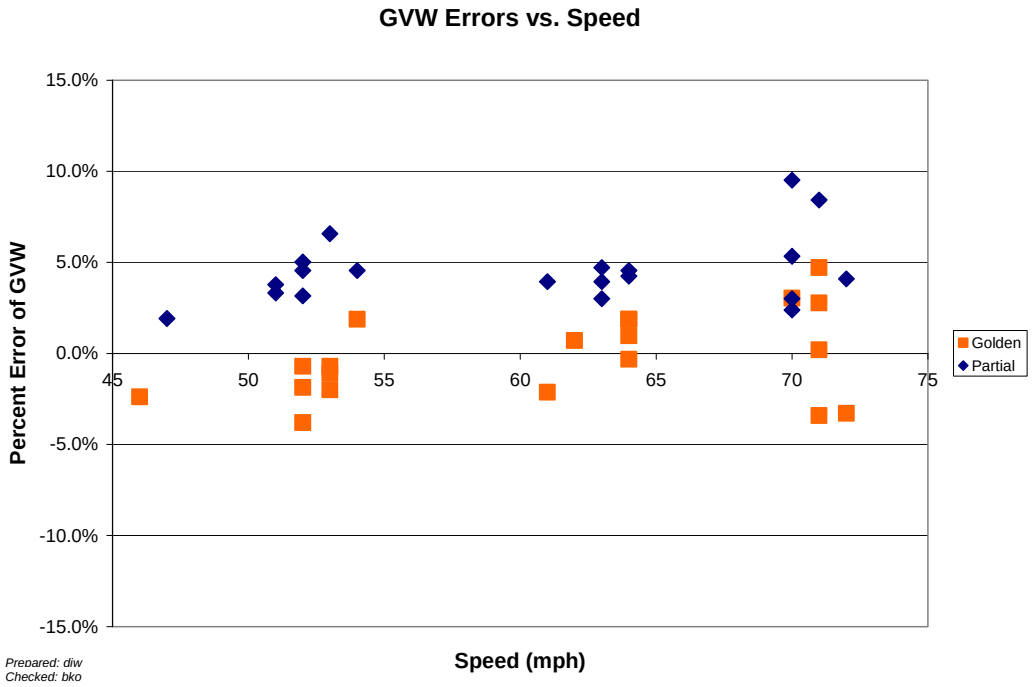


Figure 6-7 Pre-Validation GVW Percent Error vs. Speed Group - 040200 –11-Feb-2008

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.

From the figure, it appears that the equipment overestimates steering axle weights at all speeds. Variability in the steering axle error appears to be reasonably consistent throughout the entire speed range.

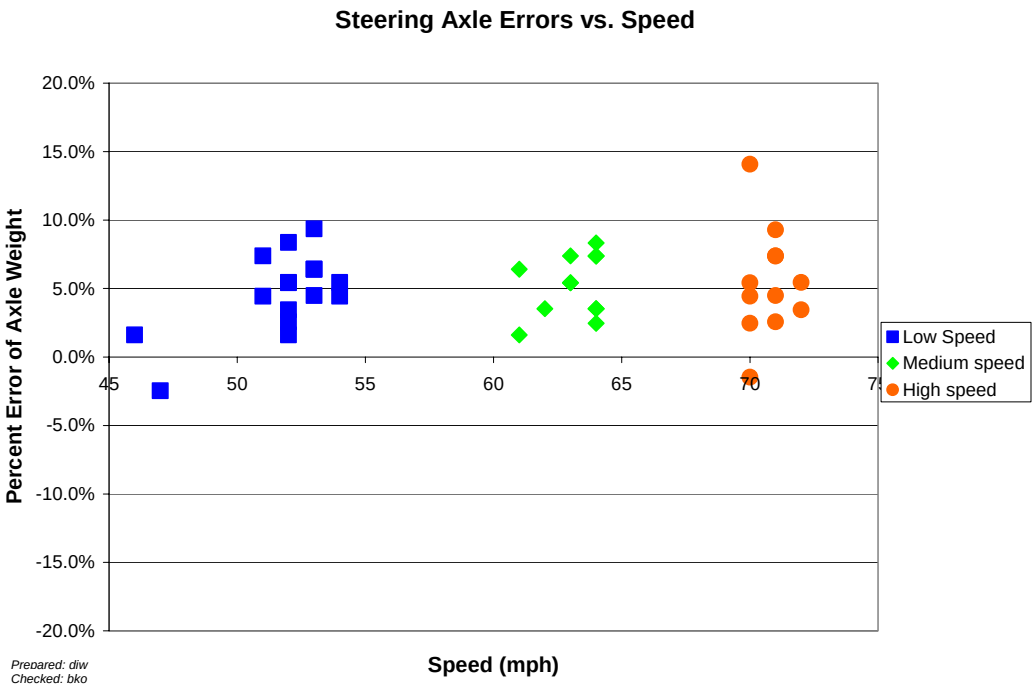


Figure 6-8 Pre-Validation Steering Axle Percent Error vs. Speed Group - 040200 – 11-Feb-2008

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 100 trucks was collected at the site. The classification identification is to identify gross errors in classification, not validate the classification algorithm. Video was taken at the site to provide ground truth for the evaluation. Based on 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 7.7 percent.

Table 6-4 Truck Misclassification Percentages for 040200 – 11-Feb-2008

Class	Percent Error	Class	Percent Error	Class	Percent Error
4	100	5	27	6	0
7	N/A				
8	27	9	0	10	N/A
11	0	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 040200 – 11-Feb-2008

Class	Mean Difference	Class	Mean Difference	Class	Mean Difference
4	N/A	5	17	6	0
7	N/A				
8	- 27	9	0	10	N/A
11	0	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 misclassified lighter Class 8 vehicles as Class 5 trucks, resulting in poor Mean Difference figures for both of these classes.

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 May 1, 2007. It was the first validation of the site. The site was producing research quality data. Figure 6-9 shows the GVW Percent Error vs. Speed for the post validation runs. The site was validated with two trucks. The "Golden" truck was loaded to 77,870 lbs. The "partial" truck which had air suspension on both tandems was loaded to 64,870 lbs.

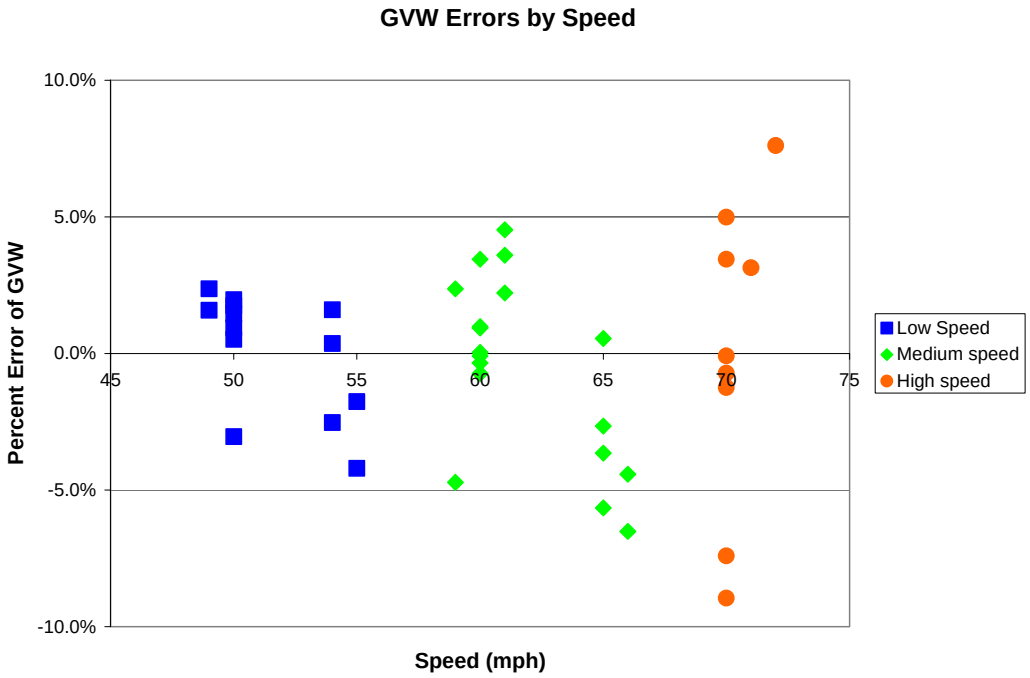


Figure 6-9 Last Validation GVW Percent Error vs. Speed – 040200 – 01-May-2007

Table 6-7 shows the overall results from the last validation.

Table 6-7 Last Validation Final Results – 040200 – 01-May-2007

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	1.1 ± 10.0%	Pass
Tandem axles	±15 percent	-0.3 ± 10.8%	Pass
Gross vehicle weights	±10 percent	-0.2 ± 7.2%	Pass
Axle spacing	± 0.5 ft [150 mm]	0.0 ± 0.2 ft	Pass

Prepared: rwp *Checked: bko*

Table 6-8 has the results at the end of the last validation by temperature. Temperatures of the pavement were much higher during this prior validation than for the subsequent 2008 validation. Through this prior validation the equipment has been observed at temperatures from 61 to 121 degrees Fahrenheit.

Table 6-8 Last Validation Results by Temperature Bin – 040200 – 01-May-2007

Element	95% Limit	Low Temperature 85 to 99 °F	High Temperature 100 to 115 °F
Steering axles	±20 %	0.8 ± 10.9%	1.8 ± 8.5%
Tandem axles	±15 %	-1.3 ± 10.1%	2.4 ± 11.7%
GVW	±10 %	-1.0 ± 7.0%	1.8 ± 7.3%
Speed	±1 mph	0.0 ± 0.5 mph	0.0 ± 1.0 mph
Axle spacing	± 0.5 ft	0.0 ± 0.2 ft	-0.1 ± 0.2 ft

Prepared: rwp *Checked: bko*

Table 6-9 has the results of the prior post validation by speed groups. Variability of errors increased markedly at higher speeds. This trend was not observed during the current 2008 validation.

Table 6-9 Last Validation Results by Speed Bin – 040200 – 01-May-2007

Element	95% Limit	Low Speed 45 to 56 mph	Medium Speed 57 to 66 mph	High Speed 67 to 75 mph
Steering axles	±20 %	-1.1 ± 6.6%	2.2 ± 6.5%	2 ± 19.7%
Tandem axles	±15 %	0.2 ± 6.2%	-1.1 ± 9.8%	0.6 ± 18%
GVW	±10 %	0.1 ± 4.8%	-0.6 ± 7.0%	0.1 ± 12.7%
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft	0.0 ± 0.3 ft

Prepared: rwp *Checked: bko*

7 Data Availability and Quality

As of February 11, 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 tells whether day of week variation has been accounted for on an annual basis. As can be seen from the table no year has a sufficient quantity to be considered complete. Together with the previously gathered calibration information it can be seen that at least 5 additional years

of research quality data are needed to meet the goal of a minimum of 5 years of research weight data.

Table 7-1 Amount of Traffic Data Available 040200 – 11-Feb-2008

Year	Classification Days	Months	Coverage	Weight Days	Months	Coverage
1994	120	5	Full Week	147	6	Full Week
1995	44	2	Full Week	44	2	Full Week
1996	153	8	Full Week	180	8	Full Week
2007	178	6	Full Week	46	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 – 040200 – 12-Feb-2008

Characteristic	Class 9	Class 5
Percentage Overweights	0.1	0.0
Percentage Underweights	0.0	27.2
Unloaded Peak	42,000	-
Loaded Peak	74,000	-
Peak	74,000	10,000

Prepared: rwp *Checked: bko*

The expected percentage of unclassified vehicles is 0.4%. 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.

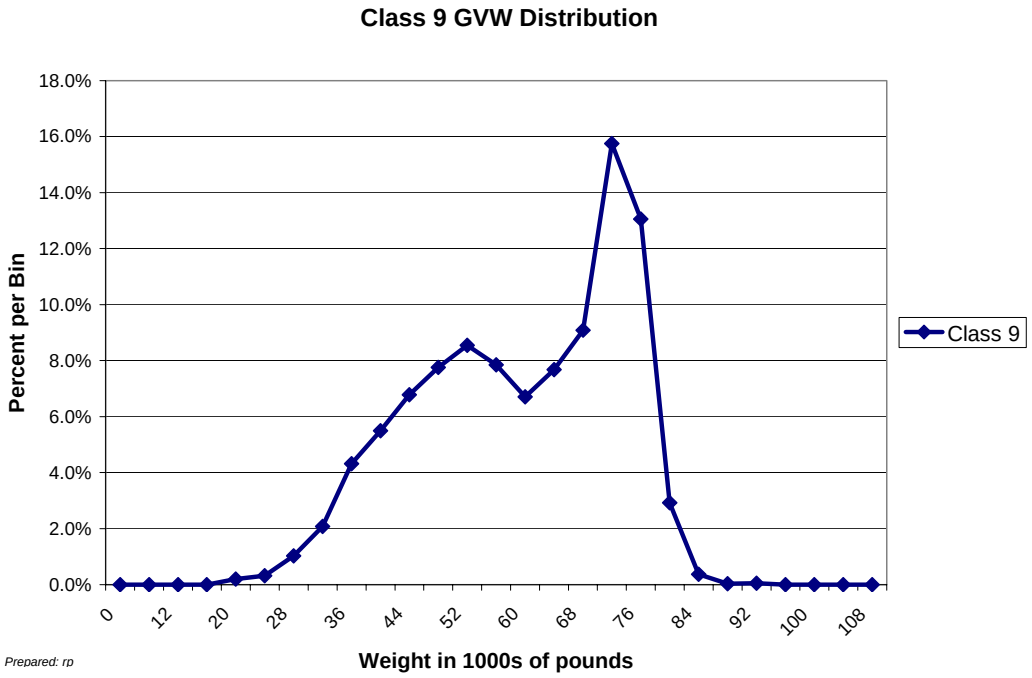


Figure 7-1 Expected GVW Distribution Class 9 – 040200 – 12-Feb-2008

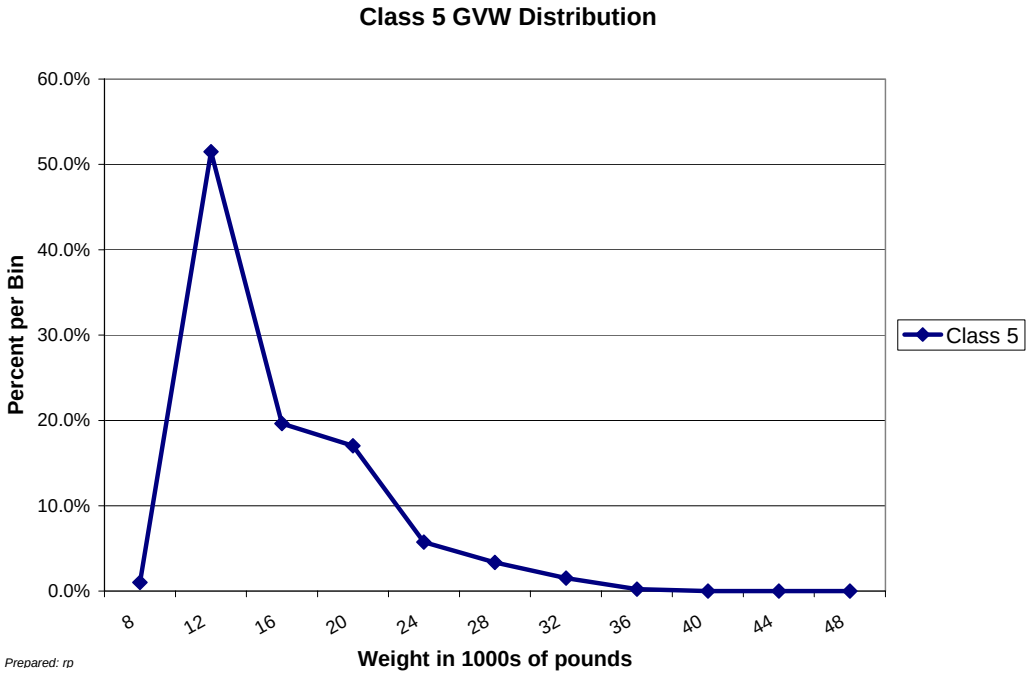


Figure 7-2 Expected GVW Distribution Class 5 – 040200 – 12-Feb-2008

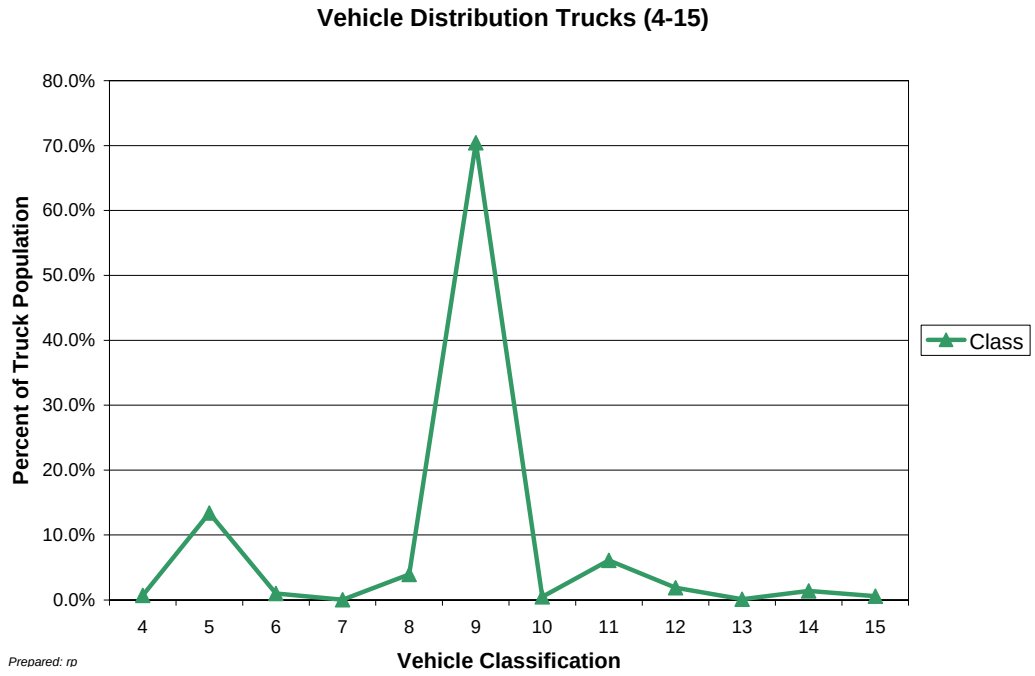


Figure 7-3 Expected Vehicle Distribution – 040200 – 12-Feb-2008

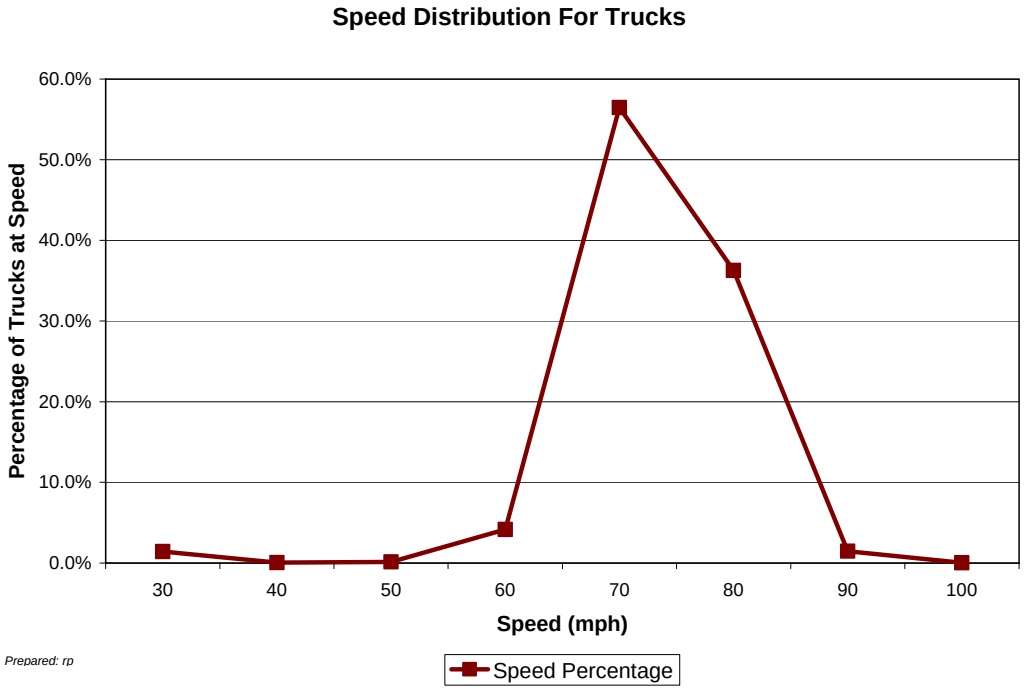


Figure 7-4 Expected Speed Distribution – 040200 – 12-Feb-2008

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 (3 pages)

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

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

Calibration Iteration 1 Worksheet – (1 page)
Calibration Iteration 2 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: 0200

Figures

Photos

1. General Information

SITE ID: *040200*

LOCATION: *Interstate 10 East at M.P. 108.55*

VISIT DATE: *February 11 & 12, 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 11 and 12, 2008*

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

4. Site Location/ Directions

NEAREST AIRPORT: *Phoenix Sky Harbor International Airport, Phoenix, AZ*

DIRECTIONS TO THE SITE: *Located on Interstate 10, Between Tonopah, AZ and AZ State Spur 85*

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

WIM SITE LOCATION: *Interstate 10 East at M.P. 108.6 (Latitude: 33^0 26.591' and Longitude: -112^0 41.774')*

WIM SITE LOCATION MAP:*See Figure 4.1*

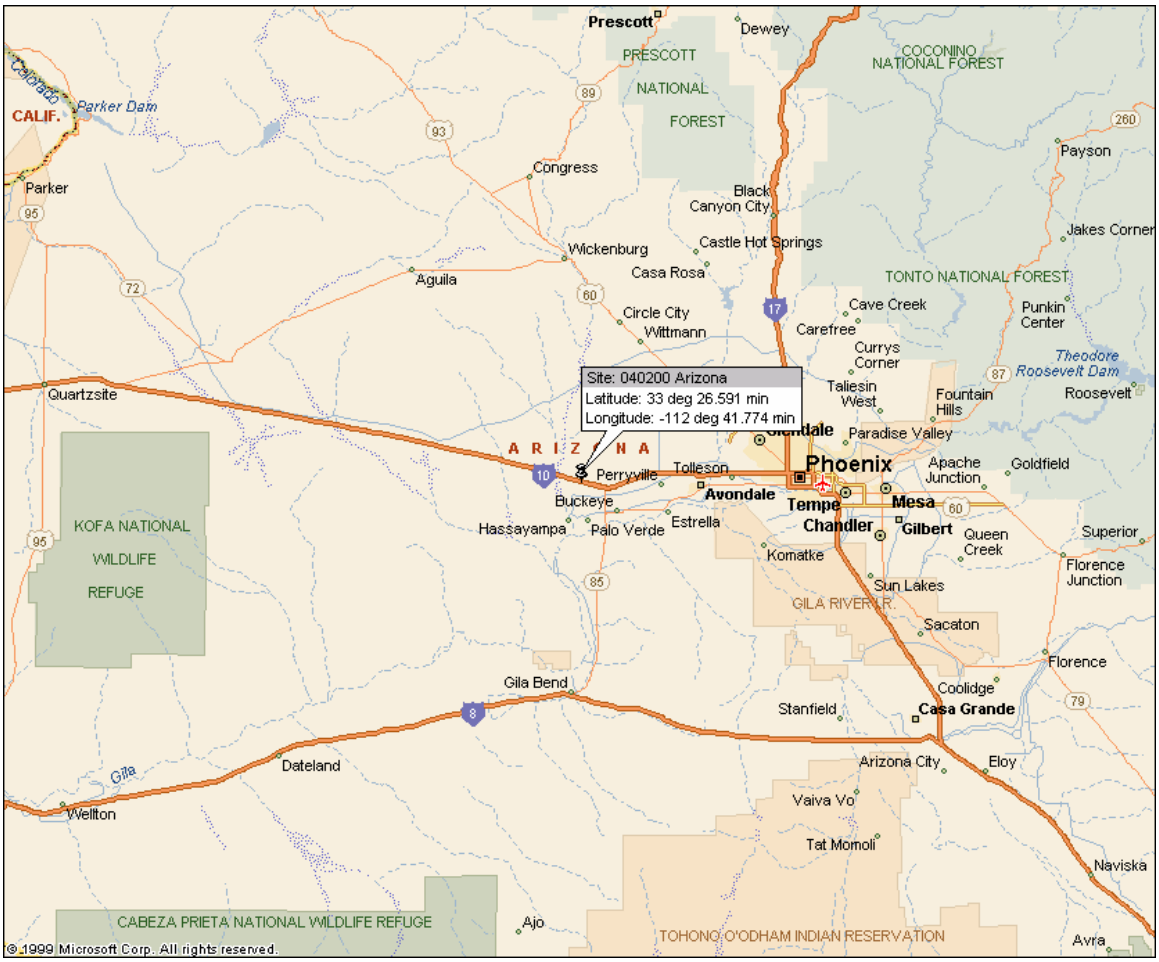


Figure 4-1 - Site 040200 in Arizona

5. Truck Route Information

ROUTE RESTRICTIONS: *None.*

SCALE LOCATION: *Love's Country Store, Buckeye, AZ, I-10, exit 114, Latitude: 33.43200, Longitude: -112.59110, Kevin Kobel – proprietor, Phone No: 623-386-6926, 24hrs, $8.00 per run.*

TRUCK ROUTE:

- *Eastbound*: *0.87 miles to Exit 109 (Sun Valley Parkway/N. Palo Verde Rd)*
- *Westbound: 4.4 miles to Exit 103 (339th Ave)*
- *Total Truck Turnaround is 10.54 miles*

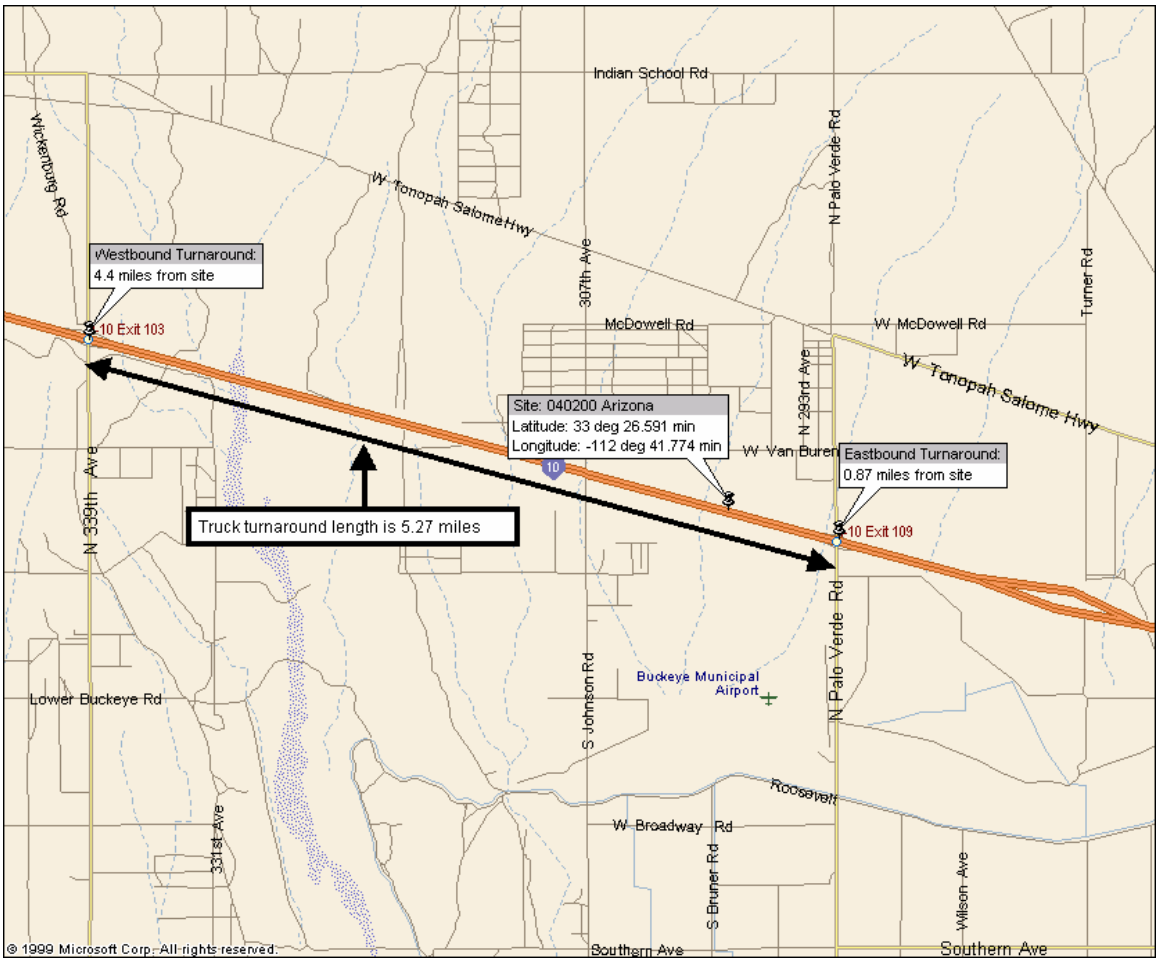


Figure 5-1 - Truck Route at 040200 in Arizona

6. Sheet 17 – Arizona (040200)

1.* ROUTE ___I-10_____MILEPOST ___108.6__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 2 6 6___
Distance from sensor to nearest upstream SPS Section _____3 8 2__ ft

3.* LANE CONFIGURATION
Lanes in LTPP direction __2__ Lane width _1_ _2_ ft

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

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

Shoulder width _1__ _0__ ft

4.* PAVEMENT TYPE _____Portland Cement Concrete_____

5.* PAVEMENT SURFACE CONDITION – Distress Survey
Date: _2/11/2008_ Photo: _04_0200_Upstream_02_11_08.jpg_____
Date: _2/11/2008_ Photo: _04_0200_Downstream_02_11_08.jpg _____
Date: _2/11/2008_ Photo: _04_0200_Old_WIM_Site_#1_02_11_08.jpg_____
Date: _2/11/2008_ Photo: _04_0200_Old_WIM_Site_#2_02_11_08.jpg_____

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 ___ __6_. _0__ in
Clearance/access to flush fines from under system Y / N

10. * CABINET LOCATION

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

Distance from edge of traveled lane _77.0_ __ ft

Distance from system __ _6_ _0_ 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 ___ ___ _4__ ft Overhead / underground / solar / AC in cabinet?

Service provider _____ Phone number _____

12. * TELEPHONE

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

Service provider _____ _____ Phone Number_____

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

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

14. * TEST TRUCK TURNAROUND time ___15__minutes, DISTANCE _10.54__ mi.

15. PHOTOS FILENAME

Power source 04_0200_Solar_Panels_02_11_08.jpg

Phone source 04_0200_Cell_Modem_02_11_08.jpg

Cabinet exterior 04_0200_Cabinet_Exterior_02_11_08.jpg

Cabinet interior 04_0200_Cabinet_Interior_Front_02_11_08.jpg

04_0200_Cabinet_Interior_Rear_02_11_08.jpg

Weight sensors 04_0200_Leading_Weighpad_02_11_08.jpg

04_0200_Trailing_Weighpad_02_11_08.jpg

Classification sensors _____

Other Sensors 04_0200_Leading_Loop_02_11_08.jpg

04_0200_Trailing_Loop_02_11_08.jpg

Description Loops

Downstream direction at sensors on LTPP lane

04_0200_Downstream_02_11_08.jpg

Upstream direction at sensors on LTPP lane

04_0200_Upstream_02_11_08.jpg

COMMENTS

GPS Coordinates: Latitude: 33^0 44.290' and Longitude: -112^0 69.463'

Amenities:
Exit 103 – Travel Plaza, Texaco, Subway, Country Fare Restaurant
Phoenix – 35 miles East of site – various amenities
Hotel – Days Inn, exit 114, next to CAT scales

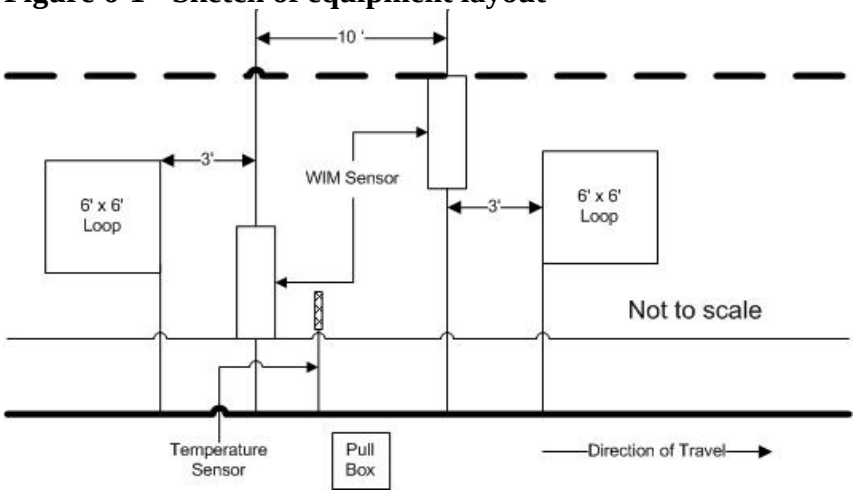
Test Truck Recommendations:
Types of Trucks: Two Class 9s
Truck 1: 72,000 to 80,000 legal limit on gross and axles, air suspension trailer;
Truck 2: approximately 66,000 on gross and axles

Expected Speeds: 55, 65 and 75 mph

COMPLETED BY Dean J. Wolf

PHONE 301-210-5105 DATE COMPLETED 02 / 11 / 2008

Figure 6-1 - Sketch of equipment layout



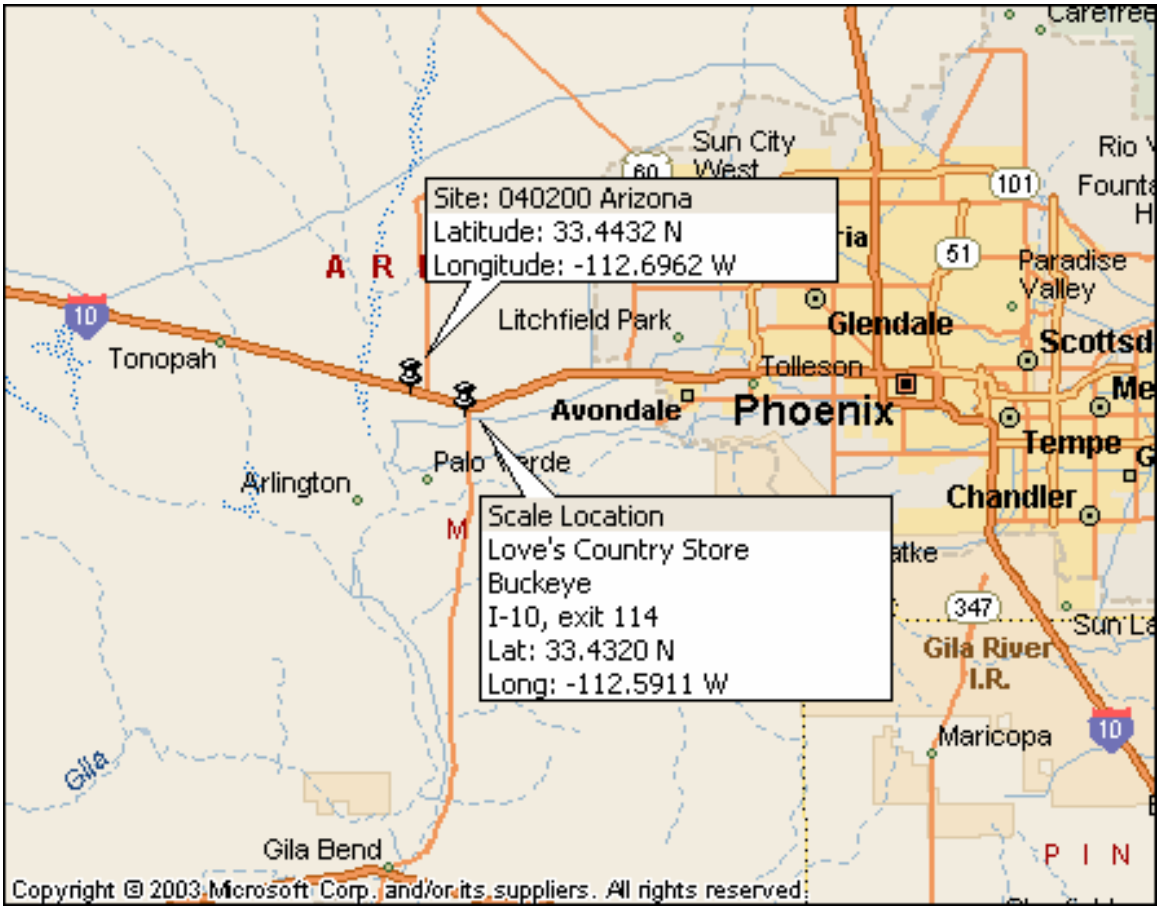


Figure 6-2 - Site map of 040200 in Arizona

Photo 6-1 04_0200_Upstream_02_11_08.jpg

Photo 6-2 04_0200_Downstream_02_11_08.jpg

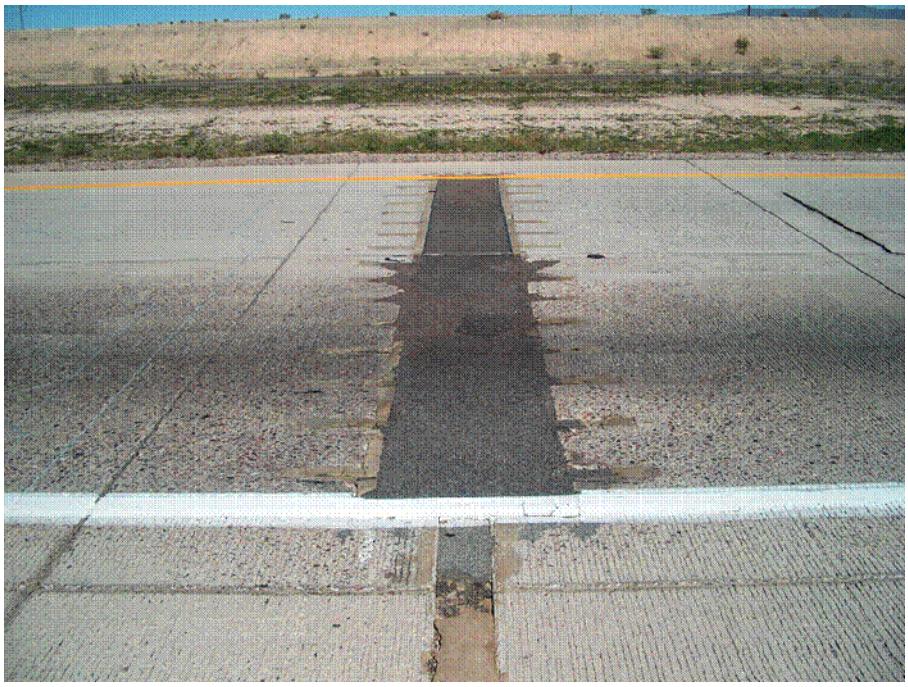


Photo 6-3 04_0200_Old_WIM_Site_02_11_08.jpg

Photo 6-4 04_0200_Old_WIM_Site_2_02_11_08.jpg

Photo 6-5 04_0200_Solar_Panels_02_11_08.jpg

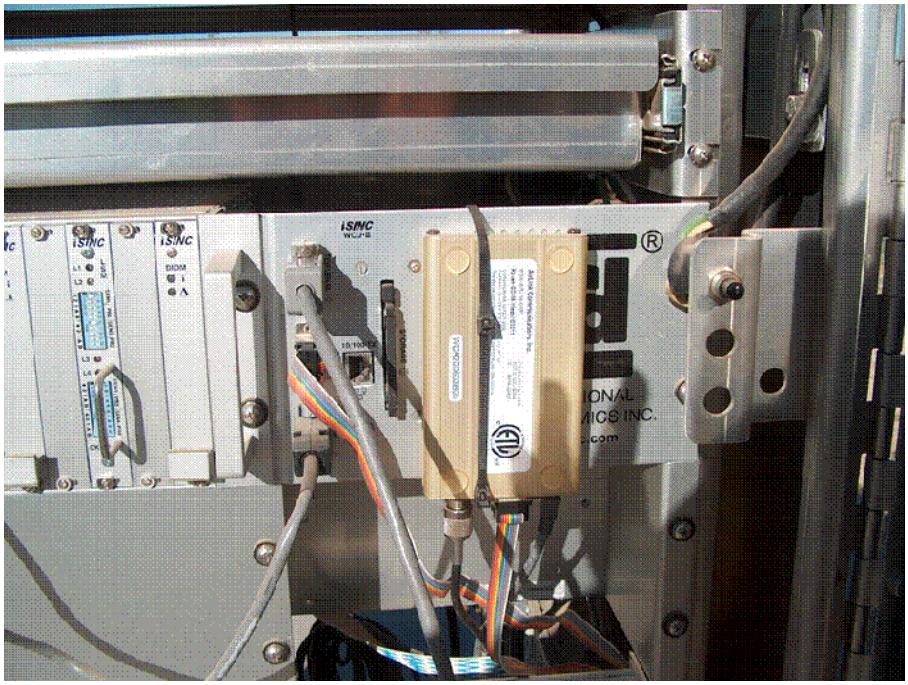


Photo 6-6 04_0200_Cell_Modem_02_11_08.jpg

Photo 6-7 04_0200_Cabinet_Exterior_02_11_08.jpg

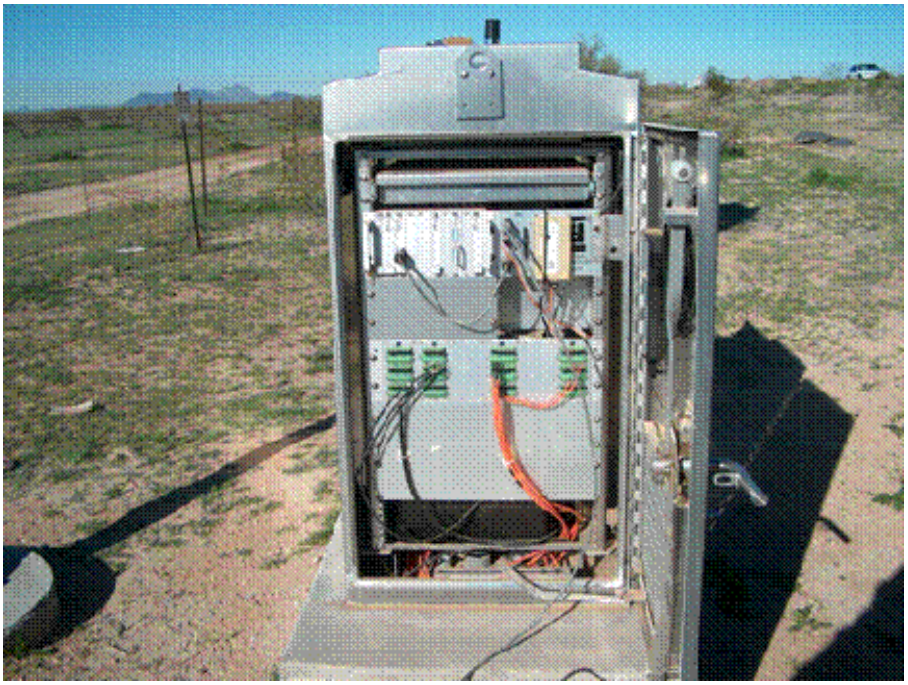


Photo 6-8 04_0200_Cabinet_Interior_Front_02_11_08.jpg

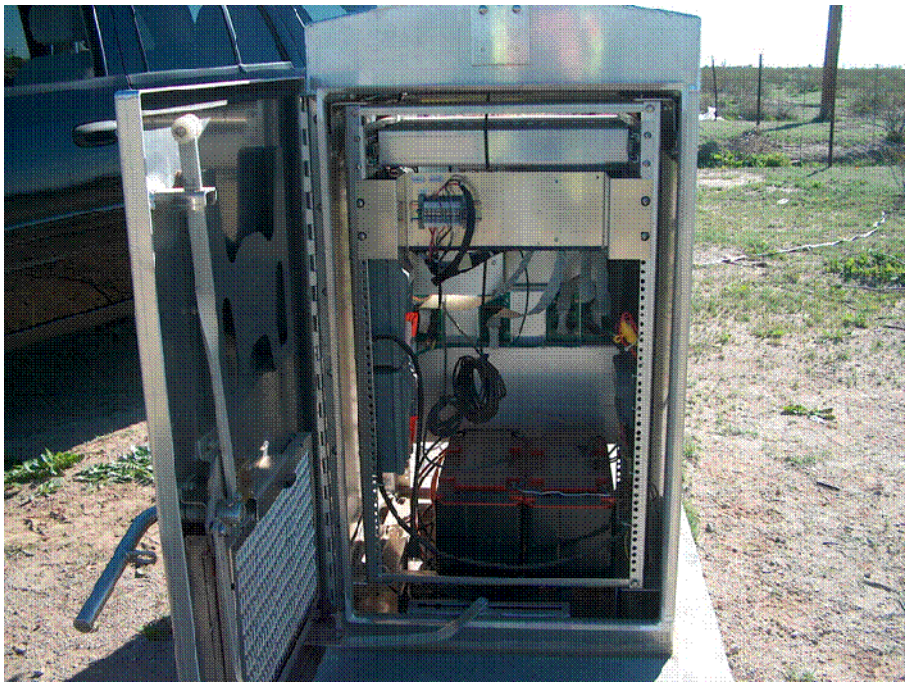


Photo 6-9 04_0200_Cabinet_Interior_Rear_02_11_08.jpg

Photo 6-10 04_0200_Leading_Weighpad_02_11_08.jpg

Photo 6-11 04_0200_Trailing_Weighpad_02_11_08.jpg

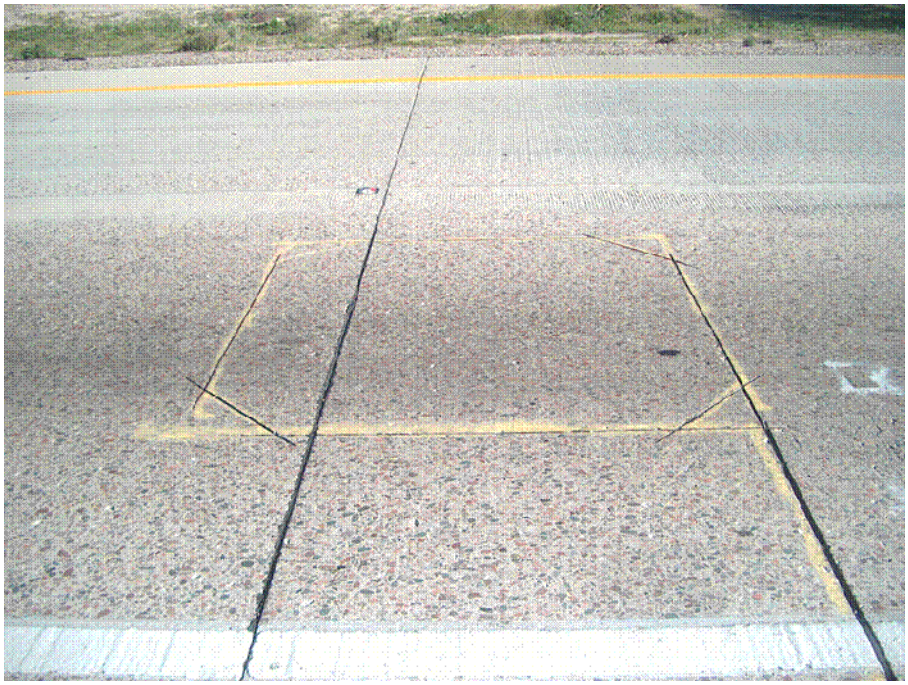


Photo 6-12 04_0200_Leading_Loop_02_11_08.jpg

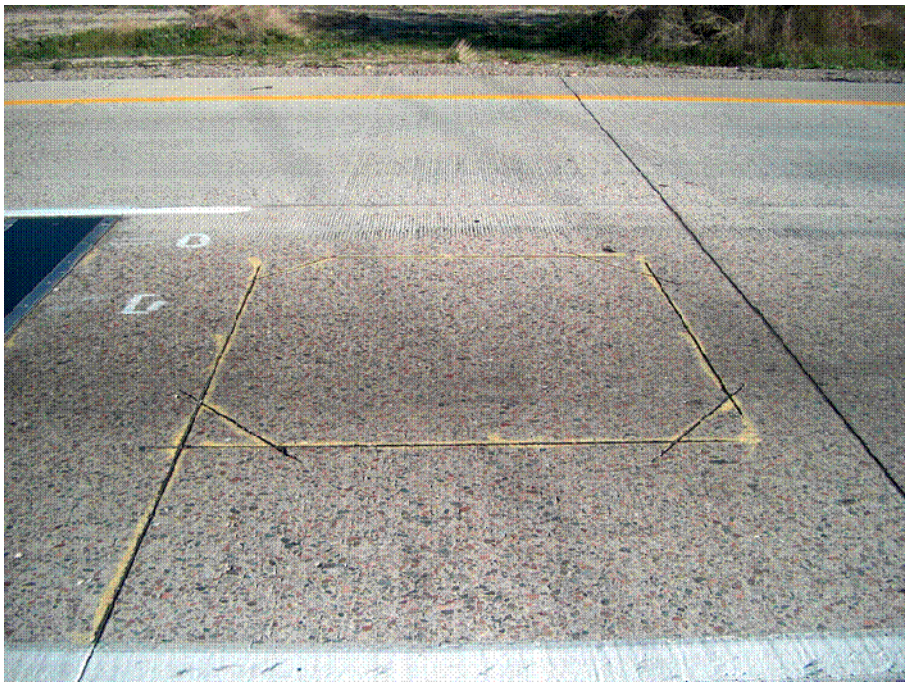


Photo 6-13 04_0200_Trailing_Loop_02_11_08.jpg

SHEET 18	STATE CODE [4]
LTPP MONITORED TRAFFIC DATA	SPS PROJECT ID [0200]
WIM SITE COORDINATION	DATE: (mm/dd/yyyy) 2/11/2008

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 – _____

e. Test Vehicles
   i. Trucks –
      1st – Air suspension 3S2 ☐ State ☒ LTPP
      2nd – _3S2 65k, air/steel__ ☐ 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: AZDOT

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 [0200]

SITE CALIBRATION INFORMATION

1. * DATE OF CALIBRATION (MONTH/DAY/YEAR) [2/11/2008]

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	___2.2	STANDARD DEVIATION	___3.2
DYNAMIC AND STATIC SINGLE AXLES	___5.0	STANDARD DEVIATION	___3.0
DYNAMIC AND STATIC DOUBLE AXLES	___1.7	STANDARD DEVIATION	___4.0

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

9. DEFINE THE SPEED RANGES USED (MPH) _____ _55_ __65__ __75_ __ __ __ __ _____ _____
_____ _____ _____ _____ _____ _____ _____ _____ _____ _____

10. CALIBRATION FACTOR (AT EXPECTED FREE FLOW SPEED) ___3055 / 3456___

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 ____ -27.0	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 [04] *SHRP SECTION ID [0200]

SITE CALIBRATION INFORMATION

1. * DATE OF CALIBRATION (MONTH/DAY/YEAR) [2/12/2008]

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 ___2.4 STANDARD DEVIATION ___2.8
   - DYNAMIC AND STATIC SINGLE AXLES ___3.8 STANDARD DEVIATION ___2.9
   - DYNAMIC AND STATIC DOUBLE AXLES ___2.2 STANDARD DEVIATION ___4.1

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

9. DEFINE THE SPEED RANGES USED (MPH) _____ _55_ __65__ __75_ __ __ __ __ _____ _____
   _____ _____ _____ _____ _____ _____ _____ _____ _____ _____

10. CALIBRATION FACTOR (AT EXPECTED FREE FLOW SPEED) ___3055 / 3456___

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 ____ -20.0
   - 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

APPENDIX A

HENRY

7173
W0587

Sheet 19	* STATE_CODE 04
LTPP Traffic Data	* SPS PROJECT ID 0200
*CALIBRATION TEST TRUCK # 1	* DATE 2/11/03

Rev. 08/31/01

driver cell - 915-329-5935

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 LOADED VAN

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

b). Trailer Tare Weight (units): _____

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

A to B 19.5 B to C 4.9 C to D 39.1

D to E 4.0 E to F ~~X0~~

Wheelbase (measured A to last) _____ Computed 57.

13. *Kingpin Offset From Axle B (units) X1.7 (_____)

(+ 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	"
D	11R22.5	"
E	11R22.5	"
F	~~11R22.5~~	

Sheet 19	* STATE_CODE 04
LTPP Traffic Data	* SPS PROJECT ID 0200
*CALIBRATION TEST TRUCK # 1	* DATE 02/11/08

Rev. 08/31/01

PART II

Day 1

*b) Average Pre-Test Loaded weight	77927 ~~77890~~
*c) Post Test Loaded Weight	77170
*d) Difference Post Test – Pre-test	~~-720~~ -757

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10740	17300	17300	16300	16300		77940
2	10690	17360	17360	16290	16290		77990
3	10280	17590	17590	16220	16220		77900
Average	~~10570~~ 10553 two	~~17400~~ 17417 two	~~17400~~ 17417 two	16270	16270		~~77890~~ 77927

Table 6. Raw data – Axle scales –

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	~~10320~~						
2	10300						
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	10320	17200	17200	16220	16220		77180
2	10300	17220	17220	16220	16220		77180
3							
Average	10310	17210	17210	16220	16220		77170

Measured By RL Verified By QN Weight date 02/11/08

Sheet 19	* STATE_CODE	04
LTPP Traffic Data	* SPS PROJECT ID	0200
*CALIBRATION TEST TRUCK # 1	* DATE	02/12/08

Rev. 08/31/01

Day 2

7.2 *b) Average Pre-Test Loaded weight 77760
*c) Post Test Loaded Weight 76500
*d) Difference Post Test – Pre-test 1260

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10640	16730	16730	16830	16830		77760
2	10540	16790	16790	16810	16810		77740
3	10680	16720	16720	16830	16830		77780
Average	10620	~~16750~~ 16747 500	~~16750~~ 16747 500	~~16820~~ 16823 500	~~16820~~ 16823 500		77760

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	10160	16550	16550	16620	16620		76500
2							
3							
Average	10160	16550	16550	16620	16620		76500

Measured By DW Verified By RP Weight date 02/12/08

Sheet 19	* STATE_CODE 04
LTPP Traffic Data	* SPS PROJECT ID 0200
*CALIBRATION TEST TRUCK # 2	* DATE 07/10/08

Rev. 08/31/01

PART I. driver cell - 602-481-4112

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 VAN

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~~ 4.3 C to D 34.2

D to E 4.1 E to F _____

Wheelbase (measured A to last) _____ Computed 57.1

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	"
D	11R22.5	"
E	11R22.5	"
F		

Sheet 19	* STATE CODE 01
LTPP Traffic Data	* SPS PROJECT ID 0200
*CALIBRATION TEST TRUCK # 2	* DATE 02/11/08

Rev. 08/31/01

PART II

Day 1

*b) Average Pre-Test Loaded weight 64900
*c) Post Test Loaded Weight 64220
*d) Difference Post Test – Pre-test -680

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	13620	11540 25080	11540 28240	19120	19120		69940
2	10260	13210 26420	13210 28220	14110	14110		69900
3	10220	13210	13210	14110	14110		69860
Average	10240	13210	13210	14110 14113	14110 14113		64900

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	10060	13030	13030	14050	14050		64220
2							
3							
Average	10060	13030	13030	14050	14050		64220

Measured By RP Verified By RPW Weight date 2/11/08

Sheet 19	* STATE_CODE	04
LTPP Traffic Data	* SPS PROJECT ID	0200
*CALIBRATION TEST TRUCK # 2	* DATE	02/12/08

Rev. 08/31/01

Day 2

7.2 *b) Average Pre-Test Loaded weight 64680

*c) Post Test Loaded Weight ~~63640~~ 63740 lbs

*d) Difference Post Test – Pre-test ~~1040~~ -940 lbs

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10200	13000	13000	14250	14250		64700
2	10140	13020	13020	14240	14240		64660
3	10240	12970	12970	14250	14250		64680
Average	10190	~~13000~~ 12995 Rear	~~13000~~ 12995 Rear	~~14250~~ 14247 Rear	~~14250~~ 14247 Rear		64680

Table 6.2. Raw data – Axle scales –

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	9900	12720	12720	14180	14180		63640
2							
3							
Average	9900	12720	12720	14150	~~14180~~		63640

Table 7.2 Raw data – Axle scales – post-test

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	9900	~~12720~~	~~12720~~	14150	14150		~~63640~~
2		12770	12770				63740
3							
Average	9900	~~12720~~ 12770	~~12720~~ 12770	14150	14150		~~63640~~ 63740

Measured By DW Verified By RP Weight date 02/12/08

Sheet 20	* STATE_CODE 04
LTPP Traffic Data	*SPS PROJECT_ID 0200
Speed and Classification Checks * 1 of* 2	* DATE 02/11/2008

Rev. 08/31/2001....

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
66	11	41243	65	11	72	9	41359	71	9
75	9	41247	73	9	60	11	362	60	11
69	9	251	68	9	62	9	363	61	9
74	9	253	72	9	70	9	367	69	9
78	9	255	77	9	62	9	368	62	9
77	5	259	75	5	69	9	374	68	9
75	9	262	73	9	70	5	377	71	8
64	9	264	63	9	76	9	378	74	9
73	9	267	71	9	65	5	380	63	5
72	5	268	68	8	64	9	385	62	9
70	9	273	70	9	67	9	582	65	9
74	9	280	72	9	69	9	587	68	9
65	11	282	64	11	60	8	589	60	8
74	9	286	72	9	78	5	599	75	5
68	5	287	65	5	75	9	600	73	9
67	11	291	66	11	75	8	601	75	8
60	9	292	61	9	63	9	603	67	9
66	11	298	66	11	71	9	606	71	9
60	9	303	60	9	68	9	607	68	9
68	9	304	66	9	70	9	608	68	9
72	9	328	68	9	69	9	614	68	9
72	9	331	70	9	52	5	616	50	5
64	9	332	63	9	70	9	757	68	9
68	9	337	68	9	70	9	758	70	9
69	11	353	68	11	67	12	759	65	12

Recorded by RP Direction WB Lane 1 Time from 09:51 to 11:15

Sheet 20	* STATE_CODE	04
LTPP Traffic Data	*SPS PROJECT_ID	0200
Speed and Classification Checks * 2 of* 2	* DATE	02/11/2008

Rev. 08/31/2001....

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
71	6	41889	71	6	58	8	42144	55	8
73	9	891	72	9	70	9	147	69	9
70	9	900	68	9	73	5	148	70	5
63	9	901	61	9	67	8	154	64	8
67	9	905	66	9	59	8	156	57	8
70	9	42003	69	9	68	12	157	64	12
70	9	004	69	9	66	9	165	65	9
64	5	005	61	8	74	9	169	71	9
57	8	007	53	8	78	9	171	81	9
75	9	049	72	9	62	5	173	61	5
65	9	052	65	9	71	9	175	70	9
62	8	055	61	8	62	9	177	62	9
72	11	057	70	11	72	11	179	70	11
67	11	059	65	11	62	8	187	60	8
62	5	062	59	5	68	9	190	67	9
73	9	068	71	9	69	9	191	67	9
65	9	074	64	9	67	9	193	66	9
65	11	078	63	11	70	9	198	68	9
80	9	088	75	9	65	9	201	63	9
62	11	089	62	11	64	4	207	63	5
64	9	092	62	9	72	9	210	70	9
67	9	096	66	9	64	6S	214	62	5
72	5	110	70	5	77	5	220	73	5
67	9	116	65	9	66	11	223	65	11
75	9	119	73	9	68	9	258	66	9

Recorded by RP Direction EB Lane 1 Time from 11:15 to 12:30

Sheet 20	* STATE_CODE 04
LTPP Traffic Data	*SPS PROJECT_ID 0200
Speed and Classification Checks * 1 of* 2	* DATE 02/12/2008

Rev. 08/31/2001....

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
62	9	49176	62	9	60	7	272	60	7
66	9	178	64	9	68	9	275	67	9
60	9	180	60	9	67	9	276	66	9
65	9	183	65	9	66	9	277	66	9
67	11	186	67	11	67	11	282	66	11
72	9	212	71	9	61	9	284	62	9
68	9	215	68	9	62	11	285	62	11
66	9	219	65	9	70	9	286	68	9
62	9	222	63	9	67	9	288	66	9
64	9	224	64	9	78	5	289	76	5
68	9	226	68	9	72	9	295	71	9
68	9	229	68	9	68	9	296	67	9
70	9	231	70	9	60	11	300	60	11
71	9	235	71	9	62	9	302	61	9
65	9	237	65	9	62	3	424	62	5
64	9	239	64	9	77	9	425	76	9
67	9	243	65	9	70	9	426	72	9
66	9	244	65	9	63	9	434	64	9
69	5	250	65	8	75	9	438	74	9
66	9	251	65	9	71	8	439	74	8
72	11	256	71	10	68	9	442	68	9
72	9	262	71	9	65	9	521	66	9
68	9	263	69	9	66	9	522	66	9
60	9	266	60	9	66	9	528	65	9
65	9	270	65	9	61	8	529	64	8

Recorded by RP Direction E Lane 1 Time from 8:34 to 9:52

Sheet 20	* STATE_CODE 04
LTPP Traffic Data	*SPS PROJECT_ID 0200
Speed and Classification Checks * 2 of* 2	* DATE 02/12/2008

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	4	49532	68	5	68	9	49665	68	9
65	9	539	65	9	67	9	667	67	9
75	9	541	75	9	67	9	668	66	9
66	6	542	66	6	64	9	669	64	9
65	11	543	64	11	70	9	671	69	9
64	9	544	63	9	83	5	674	81	5
67	9	547	67	9	68	8	676	67	8
64	5	549	64	5	68	9	816	68	9
64	9	552	65	9	73	9	819	73	9
65	9	558	66	9	72	8	822	72	8
68	9	562	67	9	79	9	826	81	9
65	10	568	62	10	75	9	829	74	9
64	9	580	64	9	71	9	860	73	9
65	9	585	64	9	65	9	861	64	9
62	11	589	64	11	72	9	867	72	9
71	11	590	71	11	70	9	870	72	9
80	10	594	80	10	64	9	871	64	9
70	9	637	69	9	66	11	987	66	11
67	5	639	2667	5	72	9	989	71	9
66	11	641	64	11	67	9	990	68	9
75	9	644	74	9	62	9	991	62	9
65	9	647	64	9	71	9	994	70	9
67	9	649	67	9	68	12	997	67	12
57	9	651	55	9	68	13	999	69	13
52	9	662	52	9	71	9	50002	70	9

Recorded by RP Direction E Lane 1 Time from 9:53 to 10:02

Sheet 21	* STATE_CODE 04
LTPP Traffic Data	*SPS PROJECT_ID 0200
WIM System Test Truck Records 1 of 43	* DATE 02/11/2008

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
61.0	53	1	1	9:51	41215	54	5.6/5.3	9.2/7.5	9.0/7.7	9.2/7.5	8.0/7.6		76.7	14.7	4.4	34.6	4.1	
	52	2	1	9:51	41216	54	5.3/5.2	7.1/6.5	7.1/6.6	7.5/7.1	7.8/6.3		66.6	14.9	4.4	34.7	4.1	
66.0	64	1	2	10:06	308	64	5.6/5.2	9.3/8.3	8.7/8.3	8.8/7.1	8.5/7.5		77.3	14.7	4.5	34.7	4.1	
	63	2	2	10:06	309	64	5.7/5.0	7.5/6.3	8.4/6.4	8.1/6.2	8.6/5.9		66.5	14.7	4.4	34.5	4.1	
63.0	46	1	3	10:20	403	49	5.4/5.2	9.5/7.2	9.1/7.9	8.8/7.4	7.9/7.3		75.7	14.7	4.5	34.6	4.1	
	47	2	3	10:20	404	50	5.2/4.7	7.3/6.4	6.9/6.1	8.0/6.5	8.7/6.0		65.8	14.8	4.4	34.6	4.1	
66.0	72	1	4	10:38	519	72	5.8/5.2	9.0/7.2	9.2/8.2	8.8/6.8	7.9/6.9		75.0	14.6	4.4	34.5	4.1	
	72	2	4	10:38	520	72	5.1/5.4	6.3/7.1	6.7/6.6	7.5/7.7	7.9/6.3		67.2	14.9	4.4	34.9	4.2	
66.5	53	1	5	10:53	626	55	5.6/5.5	9.2/7.1	8.8/8.1	8.4/7.1	7.9/7.7		76.0	14.7	4.5	34.7	4.1	
	53	2	5	10:53	627	54	5.5/5.6	7.3/7.0	7.3/6.7	7.6/7.4	8.1/6.5		68.8	14.8	4.4	34.7	4.1	
70.5	61	1	6	11:08	722	69	6.1/4.5	9.4/7.1	9.0/8.3	8.5/6.9	8.9/7.0		75.9	14.6	4.5	34.7	4.1	
	61	2	6	11:08	723	64	5.8/5.0	7.1/6.8	7.2/6.7	7.8/6.9	8.4/5.8		67.1	14.8	4.4	34.6	4.1	
70.5	71	1	7	11:23	812	72	5.8/4.9	9.4/7.6	8.3/7.8	9.0/6.9	8.1/6.9		79.9	14.6	4.5	34.6	4.1	
	70	2	7	11:23	813	72	5.2/5.2	6.8/7.2	6.9/7.2	7.4/6.6	8.0/6.1		66.1	14.8	4.4	34.8	4.1	
74.0	52	1	8	11:37	908	54	5.6/5.4	9.1/7.1	9.1/8.0	9.4/7.4	7.9/7.4		77.0	14.7	4.5	34.7	4.2	
	51	2	8	11:37	909	54	5.5/5.4	7.1/6.3	7.3/6.2	7.6/6.5	8.2/6.4		66.7	14.8	4.4	34.5	4.1	

Recorded by RP Checked by DW

Sheet 21	* STATE_CODE	04
LTPP Traffic Data	*SPS PROJECT_ID	0200
WIM System Test Truck Records 2 of #3	* DATE	02/11/2008

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
74.5	64	1	9	11:51	42014	65	5.6/5.2	9.0/8.7	8.5/9.1	8.6/7.7	8.9/8.2	7	79.0	14.8	4.5	34.9	4.1	
[illegible]	64	2	9	11:51	42015	65	5.7/5.2	7.1/7.1	7.2/6.9	7.7/6.4	8.4/5.8		67.5	14.9	4.4	34.6	4.1	
77.5	71	1	10	12:06	120	72	6.3/5.1	9.6/7.8	8.6/8.0	9.5/6.9	8.9/7.0		77.7	14.6	4.5	34.5	4.1	
	71	2	10	12:06	121	72	5.2/5.7	6.8/7.7	6.8/8.1	7.3/7.5	8.5/6.5		70.0	14.9	4.4	34.9	4.1	
78.5	52	1	11	12:21	225	54	6.1/4.6	9.5/7.0	9.2/7.8	9.1/7.2	8.3/7.4		76.1	14.6	4.4	34.4	4.1	
	52	2	11	12:21	226	55	5.5/5.5	7.2/6.5	7.3/6.5	7.7/7.1	8.2/6.2		67.8	14.9	4.4	34.8	4.1	
81.0	62	1	12	13:33	763	65	5.7/5.1	8.9/8.7	8.7/9.2	8.5/7.5	8.6/7.2		78.1	14.8	4.5	34.8	4.1	
	63	2	12	13:33	764	65	5.7/5.2	6.9/7.2	6.3/7.2	7.9/6.7	8.3/6.0		67.6	14.8	4.4	34.7	4.1	
83.0	70	2	13	13:47	859	72	5.4/5.2	6.9/7.7	6.6/6.8	7.6/7.6	8.0/6.2		68.0	14.9	4.4	34.8	4.2	
	71	1	13	13:47	858	73	5.5/5.7	8.7/8.7	8.2/9.7	8.5/8.5	8.4/9.3		81.2	14.8	4.5	34.8	4.1	
80.0	53	1	14	14:01	964	54	5.7/5.4	9.4/7.3	9.4/7.5	9.2/7.1	8.8/7.3		77.0	14.6	4.4	34.5	4.1	
	52	2	14	14:01	965	55	5.4/5.1	7.6/6.3	7.8/6.3	7.9/6.5	8.8/5.8		67.5	14.8	4.3	34.6	4.1	
79.5	52	1	15	14:15	43082	52	5.4/5.2	9.6/7.0	9.2/7.5	9.0/6.5	8.5/6.9		79.6	14.6	4.5	34.5	4.1	
	51	2	15	14:15	083	54	5.5/5.1	7.1/6.1	7.9/6.3	8.0/6.9	8.4/6.2		67.0	14.8	4.4	34.7	4.1	
80.0	64	1	16	14:30	193	65	5.9/5.3	9.3/8.1	9.3/8.8	8.5/7.4	8.5/7.5		79.0	14.8	4.5	34.7	4.1	
	63	2	16	14:30	194	64	5.6/5.1	7.1/6.6	6.8/6.8	8.0/6.5	8.9/5.6		67.1	14.8	4.4	34.6	4.1	

Entered in reverse order on Speed sheet

Recorded by RP

Checked by DW

Sheet 21	* STATE_CODE	04
LTPP Traffic Data	*SPS PROJECT_ID	0200
WIM System Test Truck Records 3 of 3	* DATE	02/11/2008

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
	71	1	17	14:45	43305	73	5.6/5.3	8.8/8.0	9.7/8.8	9.2/7.2	8.8/8.2	7	79.7	14.7	4.5	34.7	4.1	
76.5	70	2	17	14:45	306	73	5.3/5.4	6.2/8.0	6.6/8.4	7.2/8.3	8.3/6.9		70.7	14.9	4.4	35.0	4.2	
	64	1	18	15:03	458	65	6.2/5.1	9.2/7.9	9.5/8.6	8.8/7.1	8.5/7.5		78.3	14.7	4.5	34.7	4.1	
77.0	64	2	18	15:03	459	66	5.3/5.1	6.6/7.2	6.7/7.7	7.6/7.1	8.1/6.0		67.3	14.9	4.4	34.8	4.1	
	54	1	19	15:17	583	55	5.6/5.4	9.5/8.3	9.0/9.7	8.8/7.7	7.8/8.2		79.0	14.7	4.5	34.9	4.2	
73.5	54	2	19	15:17	584	55	5.3/5.3	7.1/6.6	7.5/6.5	7.7/7.0	8.1/6.4		67.5	14.8	4.4	34.8	4.1	
	70	1	20	15:32	692	72	5.8/6.1	9.0/8.6	8.0/8.9	8.7/8.0	7.7/9.2		79.9	14.8	4.5	34.8	4.1	
77.0	70	2	20	15:32	693	71	5.0/5.0	6.5/7.5	7.1/7.8	7.1/7.0	7.7/5.7		66.5	14.9	4.4	34.9	4.2	

Recorded by RP

Checked by DW

Sheet 21	* STATE_CODE 04
LTPP Traffic Data	*SPS PROJECT_ID 0200
WIM System Test Truck Records 1 of 1	* DATE 02/12/2008

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
[redacted]	53	1	1	08:26	49188	54	5.3/4.8	8.2/7.7	7.4/8.3	8.5/7.2	7.9/7.9		73.2	19.8	4.5	39.8	4.1	
49.5	52	2	1	8:26	189	54	5.0/5.1	7.1/6.3	7.1/6.4	7.2/7.4	7.9/6.5		66.0	19.8	4.4	39.7	4.1	
	62	1	2	8:41	304	64	5.5/4.8	8.1/7.6	7.6/8.6	9.1/7.2	8.1/7.3		73.9	19.7	4.5	39.8	4.1	
51.0	63	2	2	8:41	305	65	5.5/5.1	7.1/6.4	7.0/6.4	7.1/6.5	7.8/5.8		69.7	19.8	4.4	39.5	4.1	
	70	1	3	8:55	397	70	5.4/4.9	7.3/7.0	6.8/8.2	8.1/7.3	7.8/7.1		70.0	19.7	4.5	39.7	4.1	
52.5	72	2	3	8:55	398	72	4.8/4.8	6.2/6.7	6.6/6.0	7.5/6.7	7.4/5.9		62.6	19.8	4.4	39.7	4.1	
	54	1	4	9:09	489	54	5.5/5.1	8.5/8.1	7.7/8.9	8.9/8.0	9.1/8.5		78.3	19.7	4.5	39.7	4.1	
56.0	54	2	4	9:09	490	54	5.2/5.2	7.3/6.3	7.1/6.2	7.0/7.4	7.5/6.6		65.9	19.8	4.4	39.6	4.1	
	63	1	5	9:23	598	64	5.9/4.6	8.5/7.7	7.9/8.4	9.1/7.0	8.1/7.3		74.4	19.7	4.5	39.7	4.1	
58.0	63	2	5	9:23	599	65	5.2/4.6	7.2/6.4	6.2/6.5	7.4/6.4	7.8/6.2		63.9	19.8	4.4	39.6	4.1	
	69	1	6	9:37	696	70	5.2/5.0	7.5/7.6	6.9/7.9	7.9/7.2	7.6/6.7		69.6	19.7	4.5	39.7	4.1	
58.5	68	2	6	9:37	697	70	4.9/4.7	6.3/6.6	6.5/6.1	7.0/6.9	7.1/6.2		62.3	19.8	4.4	39.7	4.1	

Recorded by RP

Checked by [signature]

Sheet 21	* STATE_CODE	04
LTPP Traffic Data	*SPS PROJECT_ID	0200
WIM System Test Truck Records 1 of ___	* DATE	02/12/2008

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
	52	1	1	10:13	49961	55	5.5/5.0	8.5/7.8	8.0/8.9	9.0/7.7	8.5/8.1		76.9	14.7	4.5	34.7	4.1	
65.0	53	2	1	10:13	962	54	5.3/5.1	6.9/5.8	6.6/6.0	7.2/6.8	7.8/6.2		63.8	14.8	4.4	34.6	4.1	
	64	1	2	10:28	50070	65	5.8/5.1	8.4/8.0	8.2/9.0	9.6/7.0	8.8/7.3		77.4	14.7	4.5	34.8	4.1	
67.5	64	2	2	10:28	071	65	5.5/5.0	7.1/6.8	6.7/6.7	7.3/6.9	7.8/6.1		66.0	14.9	4.4	34.7	4.1	
	69	1	3	10:41	176	70	5.7/4.7	8.0/7.7	6.9/8.2	7.9/7.2	7.7/7.2		71.3	14.7	4.5	34.7	4.1	
70.0	70	2	3	10:41	177	71	5.0/5.1	6.9/7.4	5.9/7.7	6.9/7.0	7.6/6.6		65.2	14.9	4.4	35.0	4.2	
	72	1	4	10:59	311	73	5.5/5.6	7.8/8.8	7.2/10.2	8.5/9.0	9.2/7.8		79.8	14.8	4.5	34.8	4.1	
71.5	72	2	4	10:59	312	72	5.1/5.3	6.2/7.7	5.7/6.8	7.1/8.2	8.0/6.8		66.8	14.9	4.5	34.9	4.2	
	53	1	5	11:15	429	55	5.9/5.3	8.3/7.8	7.8/8.4	8.2/7.7	9.9/7.6		75.9	14.7	4.5	34.8	4.1	
71.5	53	2	5	11:15	430	55	5.4/4.4	7.5/6.2	7.9/6.3	7.7/6.7	8.0/6.1		65.7	14.7	4.4	34.5	4.1	
	65	1	6	11:31	551	65	5.5/5.1	8.0/9.1	7.1/9.2	8.8/8.2	9.9/7.5		77.8	14.8	4.5	34.9	4.1	
71.5	64	2	6	11:31	552	65	5.5/5.2	6.7/7.6	6.7/6.9	6.9/7.7	7.7/7.0		68.0	14.9	4.4	34.7	4.1	

Recorded by RP

Checked by _____

CAL 2

Sheet 21	* STATE_CODE	04
LTPP Traffic Data	*SPS PROJECT_ID	0200
WIM System Test Truck Records 1 of 2	* DATE	02/12/2008

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
	72	1	1	11:46	50670	73	5.4/5.4	8.0/9.2	6.6/9.6	8.6/8.8	9.5/8.4		79.6	14.8	4.6	34.9	4.1	
76.0	71	2	1	11:46	671	72	5.0/5.0	6.3/7.4	5.9/6.7	6.6/7.5	8.2/6.4		69.9	14.9	4.4	34.8	4.1	
	53	1	2	12:05	815	54	5.5/5.4	8.5/8.2	7.3/8.7	8.5/7.9	9.8/7.6		77.4	14.8	4.5	34.8	4.0	
78.0	52	2	2	12:05	816	54	5.5/5.4	7.1/6.7	6.9/6.4	7.3/8.0	8.3/7.1		68.8	14.9	4.4	34.9	4.1	
	64	1	3	12:22	943	64	5.9/5.0	8.1/8.9	8.0/9.5	8.7/8.0	9.7/7.6		79.4	14.6	4.5	34.5	4.1	
82.0	63	2	3	12:22	944	65	5.6/5.0	6.8/7.3	6.9/7.2	6.9/7.3	7.5/6.6		67.1	14.7	4.4	34.4	4.1	
	69	1	4	12:38	51058	72	6.0/5.1	7.7/7.8	7.4/8.6	8.4/7.9	9.2/7.9		75.9	14.8	4.5	34.8	4.1	
78.5	69	2	4	12:38	059	72	5.4/5.2	6.6/7.6	6.7/7.8	6.7/7.4	7.8/6.3		67.5	14.9	4.4	35.0	4.2	
	55	1	5	13:37	51489	55	5.6/5.2	8.2/8.2	7.5/8.8	8.6/7.7	9.8/7.2		76.8	14.7	4.5	34.8	4.1	
82.5	54	2	5	13:37	490	54	5.4/5.3	7.4/6.1	7.7/6.1	7.5/6.8	8.4/6.3		67.0	14.8	4.4	34.6	4.1	
	64	1	6	13:52	606	65	5.7/5.2	7.7/9.3	7.4/9.9	7.7/8.0	10.0/6.9		77.7	14.9	4.5	35.0	4.1	
77.0	64	2	6	13:52	607	65	5.6/5.0	7.0/6.8	7.2/6.7	7.6/6.7	8.3/6.4		67.5	14.8	4.4	34.7	4.1	
	62	1	7	14:07	703	62	5.5/5.0	8.1/8.8	7.4/9.1	8.6/7.6	9.0/7.0		77.1	14.8	4.5	34.9	4.1	
76.0	61	2	7	14:07	704	60	5.2/5.0	86.6/7.2	7.0/7.1	7.1/7.3	7.9/6.6		66.8	14.9	4.4	34.8	4.1	
	72	1	8	14:23	818	73	5.5/5.5	7.5/9.0	7.0/10.3	8.4/9.1	9.6/8.6		80.5	14.8	4.5	34.9	4.1	
73.5	72	2	8	14:23	819	73	4.9/5.3	6.3/7.8	5.7/7.2	7.0/8.0	7.6/7.0		66.8	14.9	4.4	34.9	4.2	

Recorded by RP

Checked by

used oal 2 sheet for first 12 runs

Sheet 21	* STATE_CODE	04
LTPP Traffic Data	*SPS PROJECT_ID	0200
WIM System Test Truck Records 2 of 2	* DATE	02/12/2008

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
	55	1	9	14:39	51938	55	5.7/5.4	8.6/7.7	8.1/8.6	9.3/7.5	9.6/7.5		78.1	14.7	4.4	34.6	4.1	
72.5	55	2	9	14:39	939	55	5.2/5.0	7.2/6.5	7.4/5.9	7.6/6.9	8.7/6.3		66.7	14.8	4.4	34.6	4.1	
	64	1	10	14:56	52094	65	6.2/5.0	8.4/8.4	8.0/8.8	8.8/7.6	9.8/7.5		78.7	14.7	4.5	34.8	4.1	
70.5	63	2	10	14:56	095	65	5.3/4.9	6.9/7.2	6.1/7.0	7.3/7.3	7.8/6.4		66.3	14.9	4.4	34.8	4.1	
	73	1	11	15:11	220	73	5.7/5.5	8.3/8.0	7.0/9.2	8.5/8.0	9.2/8.3		77.6	14.7	4.5	34.8	4.0	
79.5	73	2	11	15:11	221	73	5.3/5.3	6.4/7.6	6.3/8.3	6.9/8.1	8.1/6.9		69.1	14.9	4.4	34.9	4.1	
	52	1	12	15:27	349	54	5.4/5.4	8.3/7.9	8.1/8.4	8.2/8.3	9.4/7.9		77.3	14.7	4.5	34.7	4.0	
72.0	53	2	12	15:27	350	55	5.3/5.4	7.4/6.7	7.2/6.5	7.3/7.9	8.2/6.9		68.8	14.9	4.4	34.9	4.1	
	63	1	13	15:42	475	65	5.6/5.3	7.9/8.8	7.3/9.7	8.5/8.4	10.0/7.6		79.0	14.8	4.5	34.9	4.1	
71.5	62	2	13	15:42	476	66	5.1/4.8	6.5/7.3	6.9/7.1	7.1/7.3	7.7/6.4		66.3	14.9	4.4	34.8	4.1	
	71	1	14	15:57	596	74	5.3/5.7	7.6/8.5	6.8/10.3	8.7/9.3	9.7/8.5		80.5	14.8	4.5	34.9	4.1	
86.0	71	2	14	15:57	597	72	4.9/4.9	6.3/7.6	6.7/7.6	6.9/7.2	7.5/6.4		66.1	14.9	4.4	34.9	4.2	

Recorded by RP

Checked by

Calibration Worksheet

Site: 040200

Calibration Iteration 1 Date 02/12/08

Beginning factors:

Speed Point (mph)	Name	Value
Overall		R / L
~~Front~~ Axle distance		341
1 – (55)	88 kph	3222 / 3644
2 – (60)	96 kph	3112 / 3520
3 – (65)	105 kph	3195 / 3613
4 – (70)	112 kph	3055 / 3456
5 – (75)	120 kph	3306 / 3739

Errors:

	55 Speed Point 1	60 Speed Point 2	65 Speed Point 3	70 Speed Point 4	75 Speed Point 5
F/A					
Tandem					
GVW	1.4	1.8	2.3	2.7	3.1

Adjustments:

	Raise	Lower	Percentage
Overall	☐	☐	
~~Front~~ Axle distance	☒	☐	1.5
Speed Point 1	☐	☑	1.4
Speed Point 2	☐	☑	1.8
Speed Point 3	☐	☑	2.2
Speed Point 4	☐	☑	2.6
Speed Point 5	☐	☑	3.0

End factors:

Speed Point (mph)	Name	Value
Overall		R / L
~~Front~~ Axle distance		346
1 – (55)	88 kph	3178 / 3594
2 – (60)	96 kph	3056 / 3456
3 – (65)	105 kph	3123 / 3532
4 – (70)	112 kph	2975 / 3366
5 – (75)	120 kph	3207 / 3627

Spreadsheet values

347

3178 3594

3056 3457

3124 3532

2976 3366

3208 3628

Data Entered for calibration

Calibration Worksheet

Site: 040200

Calibration Iteration 2 Date 2/11/09

Beginning factors:

Speed Point (mph)	Name	Value
Overall		L R
Front Axle		
1 – (55)	88 kph	3178 / 3594
2 – (60)	~~10~~ 96 kph	3056 / 3456
3 – (65)	105 kph	3123 / 3532
4 – (70)	112 kph	2975 / 3366
5 – (75)	120 kph	3207 / 3627

Errors:

	Speed Point 1 (55)	Speed Point 2 (60)	Speed Point 3 (65)	Speed Point 4 (70)	Speed Point 5 (75)
F/A					
Tandem					
GVW	-.5	-2.4	-4.3	-5.5	-6.8

Adjustments:

	Raise	Lower	Percentage
Overall	☐	☐	
Front Axle	☐	☐	
Speed Point 1	☒	☐	1.4
Speed Point 2	☒	☐	1.8
Speed Point 3	☒	☐	2.2
Speed Point 4	☒	☐	2.6
Speed Point 5	☒	☐	3.0

End factors:

Speed Point (mph)	Name	Value
Overall		L R
Front Axle		
1 – (55)	88 kph	3222 / 3644
2 – (60)	96 kph	3112 / 3520
3 – (65)	105 kph	3195 / 3613
4 – (70)	112 kph	3055 / 3456
5 – (75)	120 kph	3306 / 3739

Values entered in machine are not those of spreadsheet calculation b/c

TEST VEHICLE PHOTOGRAPHS FOR SPS WIM VALIDATION

February 11-12, 2008

STATE: Arizona

SHRP ID: 0200

Photo 1 - Truck_1_Tractor_ 04_0200_02_11_08.JPG

Photo 2 - Truck_1_Trailer_04_0200_02_11_08.JPG

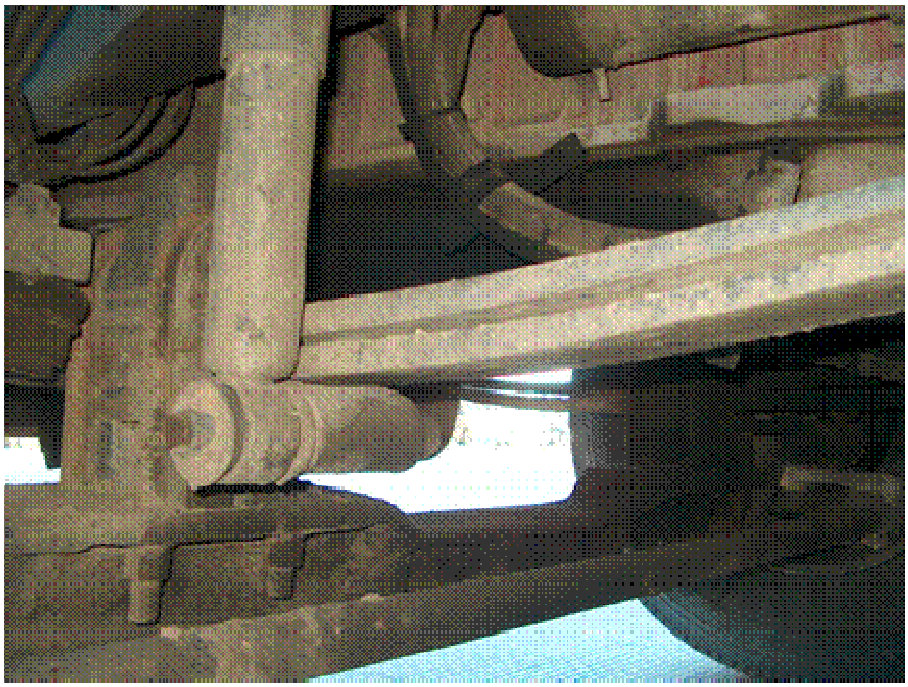


Photo 3 - Truck_1_Suspension_1_04_0200_02_11_08.JPG

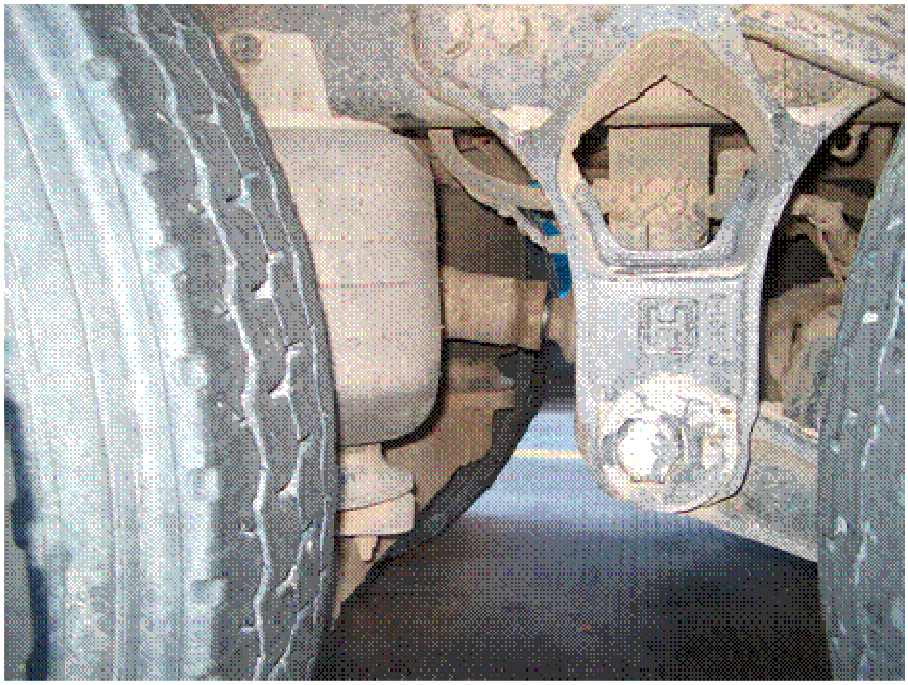


Photo 4 - Truck_1_Suspension_2_04_0200_02_11_08.JPG

Photo 5 - Truck_1_Suspension_3_04_0200_02_11_08.JPG

Photo 6 - Truck_2_Tractor_04_0200_02_11_08.JPG

Photo 7 - Truck_2_Trailer_04_0200_02_11_08.JPG

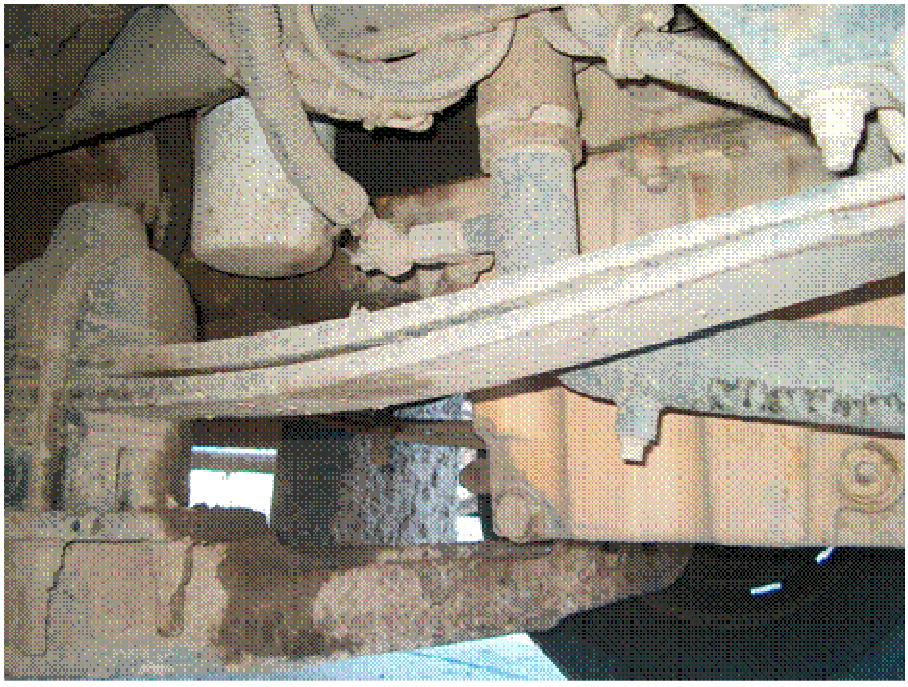


Photo 8 - Truck_2_Suspension_1_04_0200_02_11_08.JPG

Photo 9 - Truck_2_Suspension_2_04_0200_02_11_08.JPG

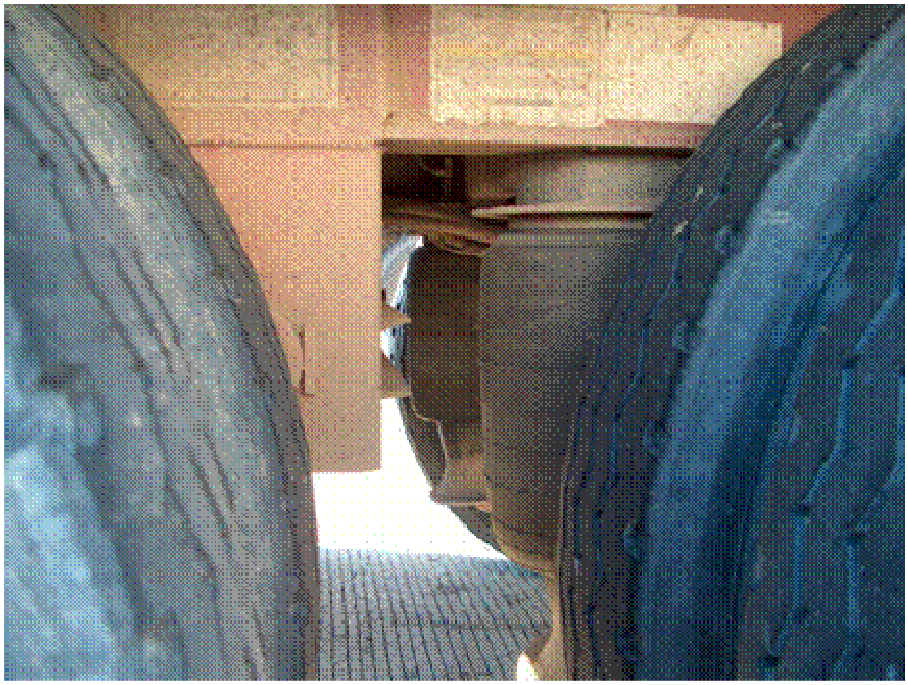


Photo 10 - Truck_2_Suspension_3_04_0200_02_11_08.JPG

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-2 (Lane 1)

Calibration Factors for Sensor #1

Validation Visit /Factor	February 12, 2008	February 11, 2008	April 30, 2007
Distance	346	341	
88 kph	3178	3222	3390
96 kph	3056	3112	3375
104 kph	3123	3195	3417
112 kph	2975	3055	3460
120 kph	3207	3306	3499

Calibration Factors for Sensor #2

Validation Visit	February 12, 2008	February 11, 2008	April 30, 2007
Distance	---	---	---
88 kph	3594	3644	3390
96 kph	3456	3520	3375
104 kph	3532	3613	3417
112 kph	3366	3456	3460
120 kph	3627	3739	3499