Validation Report

Arizona, SPS-2
Task Order 15, CLIN 2
April 30 to May 1, 2007

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1 Executive Summary

A visit was made to the Arizona 0200 on April 30 to May 1, 2007 for the purposes of conducting a validation of the WIM system located on I-10 between Tonopah, Arizona and AZ 85. The SPS-2 is located in the righthand, eastbound lane of a four-lane divided facility. The LTPP lane is the only lane that is instrumented at this site. The validation procedures were in accordance with LTPP's SPS WIM Data Collection Guide dated August 21, 2001.

This site was installed as part of a relocation of the abandoned site located approximately 330 feet west of this site. This is the first 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 Traffic.

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

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

The validation used the following trucks:

1) 5-axle tractor-trailer with a tractor having an air suspension and trailer with a standard rear tandem and an air suspension loaded to 77,870 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 64,870 lbs., the "partial" truck.

The validation speeds ranged from 49 to 72 miles per hour. The pavement temperatures ranged from 87 to 111 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 – 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%	Pass
Tandem axles	±15 percent	-0.3 ± 10.8%	Pass
GVW	±10 percent	-0.2 ± 7.2%	Pass
Speed	±1 mph [2 km/hr]	0.0 ± 0.6 mph	Pass
Axle spacing	± 0.5 ft [150mm]	0.0 ± 0.2 ft	Pass

The pavement condition appeared satisfactory for conducting a performance evaluation. There were no distresses observed that would influence truck motions significantly. A visual survey determined that there is no discernable bouncing or avoidance by trucks in the sensor area. No profile data was available for the after installation condition to evaluate the WIMIndex for this site. At present, profile data collection is scheduled for sometime this summer. When this data is received we will file an amended report incorporating that data into this report.

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

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

Characteristic	Limits for Allowable Error	Percent within Allowable Error	Pass/Fail
Single Axles	± 20%	97.5%	Pass
Axle Groups	± 15%	98.8%	Pass
GVW	± 10%	100%	Pass

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

2 Corrective Actions Recommended

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

3 Post Calibration Analysis

This final analysis is based on test runs conducted May 1, 2007 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 the validation included:

1. 5-axle tractor-trailer with a tractor having an air suspension and trailer with a standard rear tandem and an air suspension loaded to 77,870 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 64,870 lbs., the "partial" truck.

Each truck made a total of 20 passes over the WIM scale at speeds ranging from approximately 49 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 87 to 111 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 – 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%	Pass
Tandem axles	±15 percent	-0.3 ± 10.8%	Pass
GVW	±10 percent	-0.2 ± 7.2%	Pass
Speed	±1 mph [2 km/hr]	0.0 ± 0.6 mph	Pass
Axle spacing	± 0.5 ft [150mm]	0.0 ± 0.2 ft	Pass

The test runs were conducted primarily during the morning and afternoon hours. Overcast skies during the afternoon hours resulted in a very narrow range of pavement temperatures. The runs were also conducted at various speeds to determine the effects of these variables on the performance of the WIM scale. To investigate these effects, the dataset was split into three speed groups and 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.

The three speed groups were divided as follows: Low speed – 45 to 56 mph, Medium speed – 57 to 66 mph and High speed – 67 + mph. The two temperature groups were created by splitting the runs between those at 87 to 99 degrees Fahrenheit for Low temperature and 100 to 111 degrees Fahrenheit for High temperature.

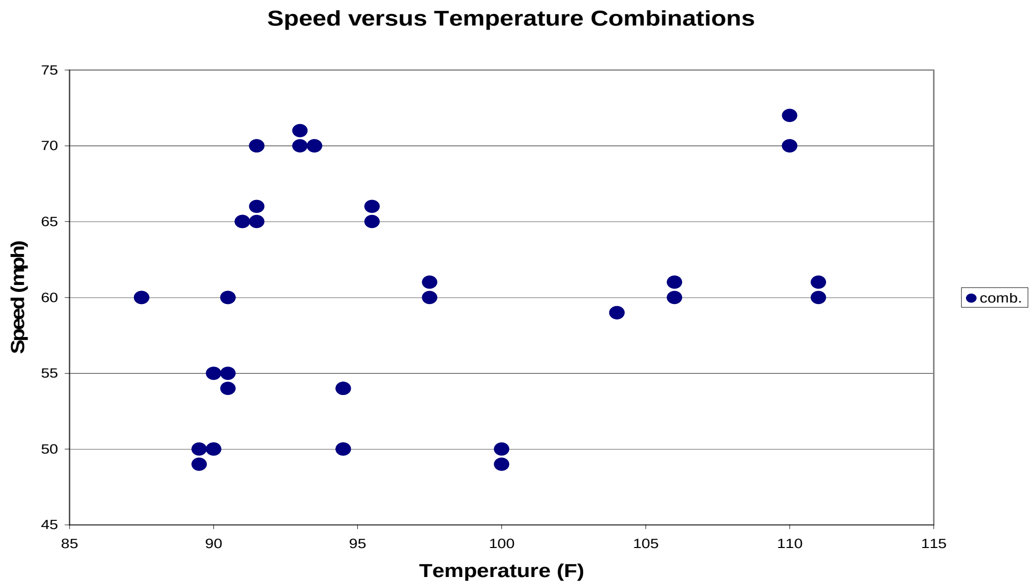


Figure 3-1 Post-Validation Speed-Temperature Distribution – 040200 – 01-May-2007

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

From the figure, it appears that the equipment estimates GVW reasonably well at all speeds. Variability in error increases as speed increases.

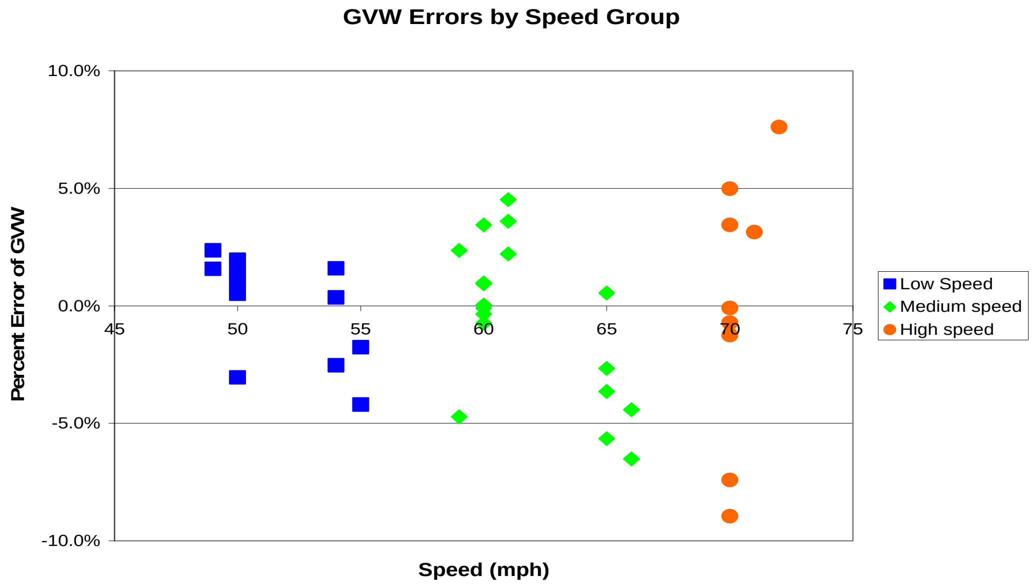


Figure 3-2 Post-validation GVW Percent Error vs. Speed – 040200 – 01-May-2007

Figure 3-3 shows the shows how the system appears to increasingly overestimate GVW as the temperature increases.

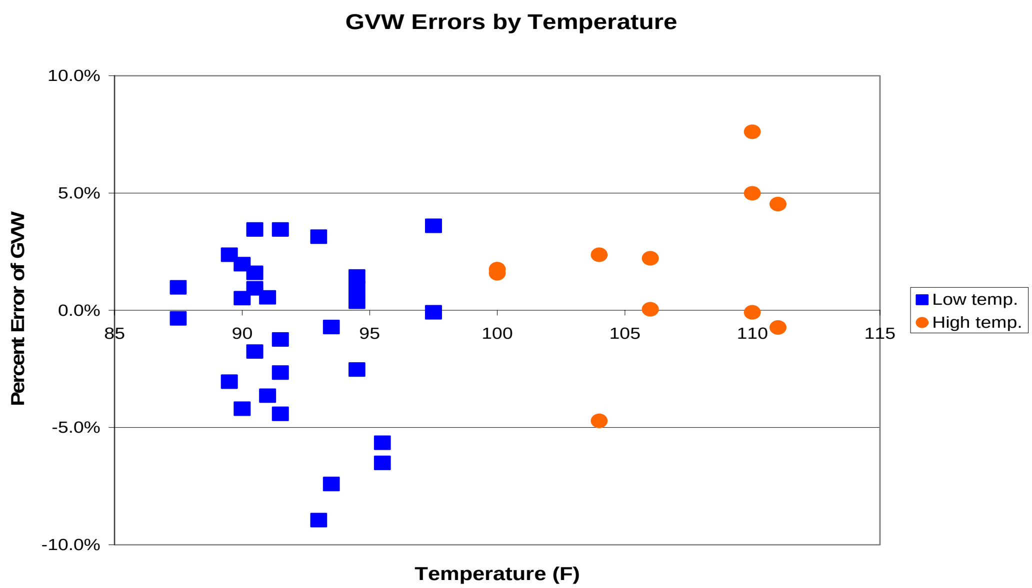


Figure 3-3 Post-Validation GVW Percent Error vs. Temperature – 040200 – 01-May-2007

Figure 3-4 shows the relationship between the drive tandem spacing errors in feet and speeds. This graph is used as a potential indicator of classification errors due to failure to correctly identify spacings on a vehicle. Since the most common reference value is the drive tandem on a Class 9 vehicle, this is the spacing evaluated and plotted for validations. The graph indicates that the errors in tandem spacings for the test trucks were not affected by changes in speed. Variability in speed error is greater at the higher speeds when the means and standard deviations are computed by speed group.

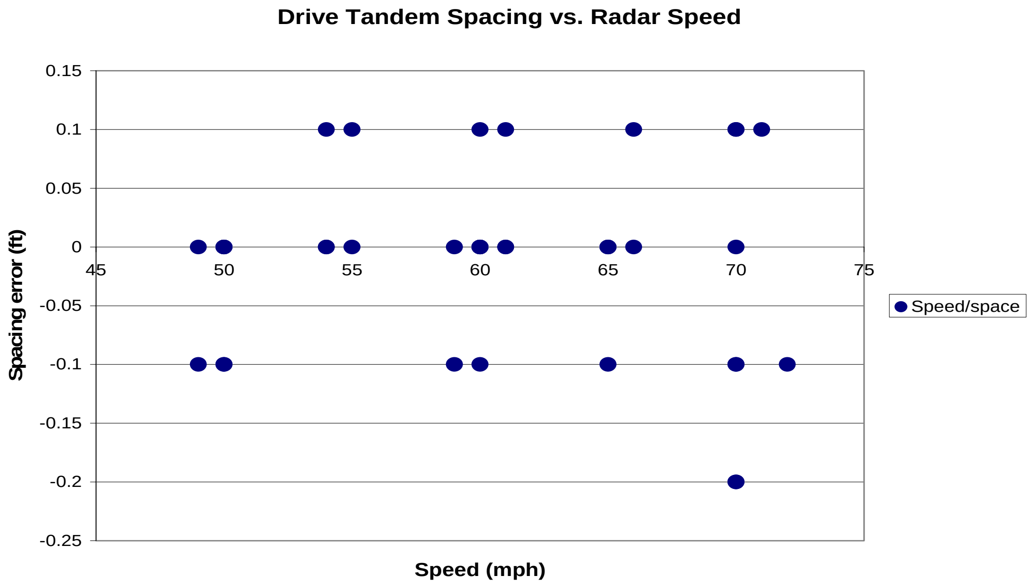


Figure 3-4 Post-Validation Spacing vs. Speed – 040200 – 01-May-2007

3.1 Temperature-based Analysis

The two temperature groups were created by splitting the runs between those at 87 to 99 degrees Fahrenheit for Low temperature and 100 to 111 degrees Fahrenheit for High temperature.

Table 3-2 Post-Validation Results by Temperature Bin – 040200 – 01-May-2007

Element	95% Limit	Low Temperature 87 to 99 °F	High Temperature 100 to 111 °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%	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

From Table 3-2, it appears that the equipment underestimates GVW and tandem weights at lower temperatures, and overestimates them at the higher temperatures. For steering axle weights, the system appears to overestimate at all 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 variability seen with temperature is actually variability by truck. It cannot be determined from the temperature distribution by number of runs if a temperature influence in fact exists

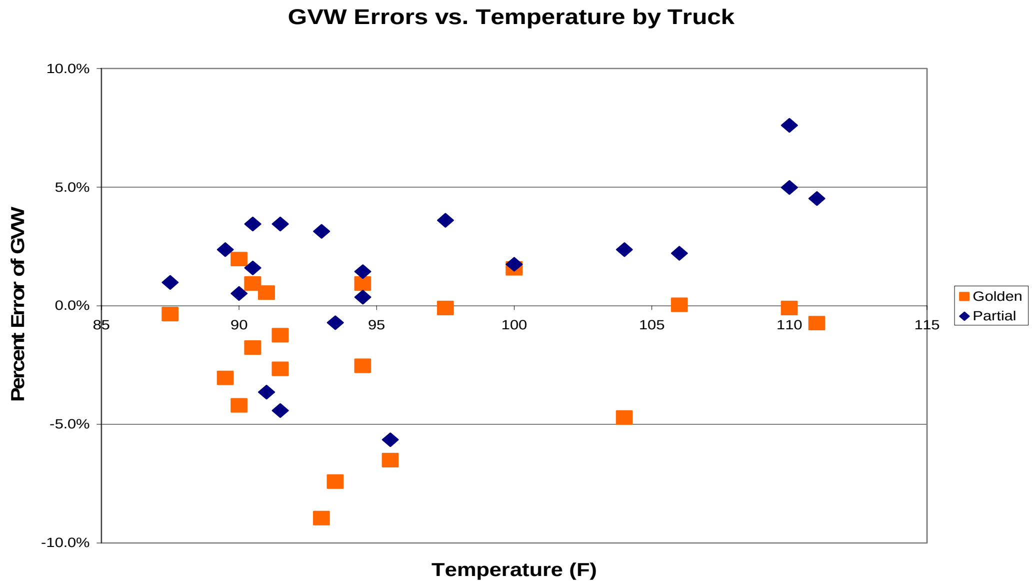


Figure 3-5 Post-Validation GVW Percent Error vs. Temperature by Truck – 040200 – 01-May-2007

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

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

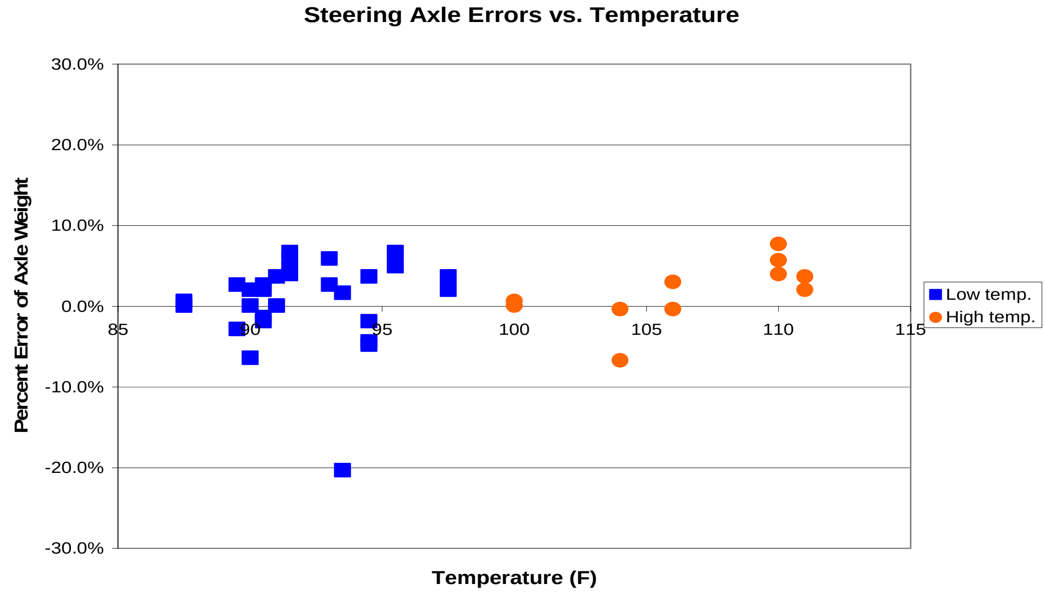


Figure 3-6 Post-Validation Steering Axle Error vs. Temperature by Group – 040200 – 01-May-2007

3.2 Speed-based Analysis

The three speed groups were divided using 45 to 56 mph for Low speed, 57 to 66 mph for Medium speed and 67+ mph for High speed.

Table 3-3 Post-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+ mph
Steering axles	±20 %	-1.1 ± 6.6%	2.2 ± 6.5%	2.0 ± 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%	0.1 ± 12.7%
Speed	±1 mph	0.1 ± 0.6 mph	0.1 ± 0.5 mph	-0.2 ± 1.0 mph
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft	0.0 ± 0.3 ft

From Table 3-3, it can be seen that the equipment tends to slightly underestimate steering axle weights at the lower speeds and overestimate them at medium and high speeds. GVW and tandem weights are estimated with reasonable accuracy at low and medium speeds. Variability generally increases as speed increases, more than doubling between medium and high speeds. Note that at high speed the data does not meet the definition of research quality for loading. From the Sheet 20 for Post-Validation speed checks this error occurs at speeds below the 50th percentile. Conversely, half the observed trucks may have measurements that do not meet the definition of research quality loading data.

Figure 3-7 illustrates the ability of the equipment to generally overestimate GVW for the Partial truck, and generally underestimate GVW for the Golden truck, except at 65 mph, where both trucks' GVW is underestimated. As speed increases, it appears that GVW for the Golden truck is increasingly underestimated while GVW for the Partial truck is increasingly overestimated. Variability in error appears to be slightly greater at the higher speeds.

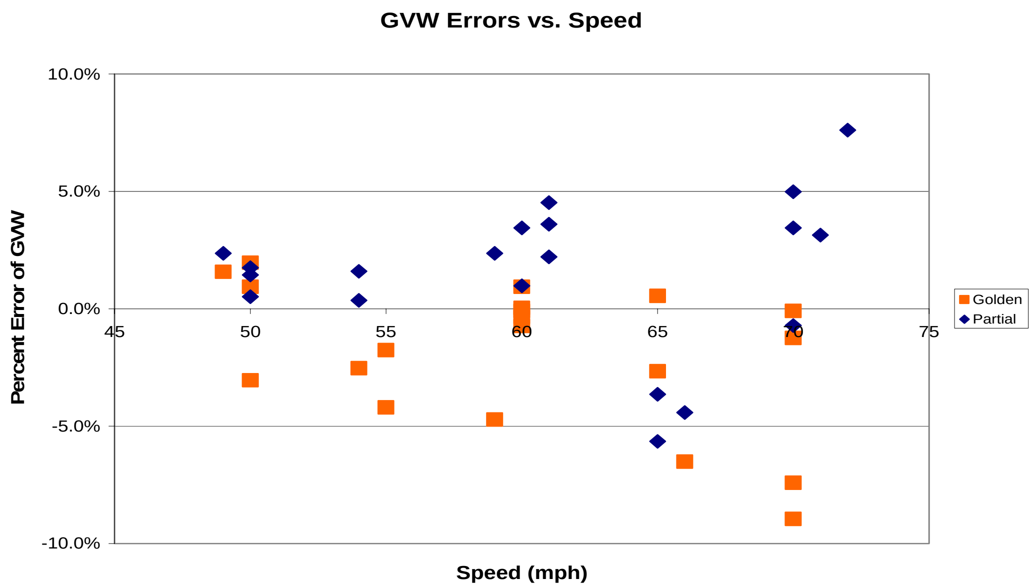


Figure 3-7 Post-Validation GVW Percent Error vs. Speed by Truck – 040200 – 01-May-2007

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

From the figure, it appears that the WIM equipment estimates steering axle weights with reasonable accuracy throughout the entire speed range. Variability is reasonably consistent throughout the entire speed range. The outlier in the figure was verified as real and not a data entry error.

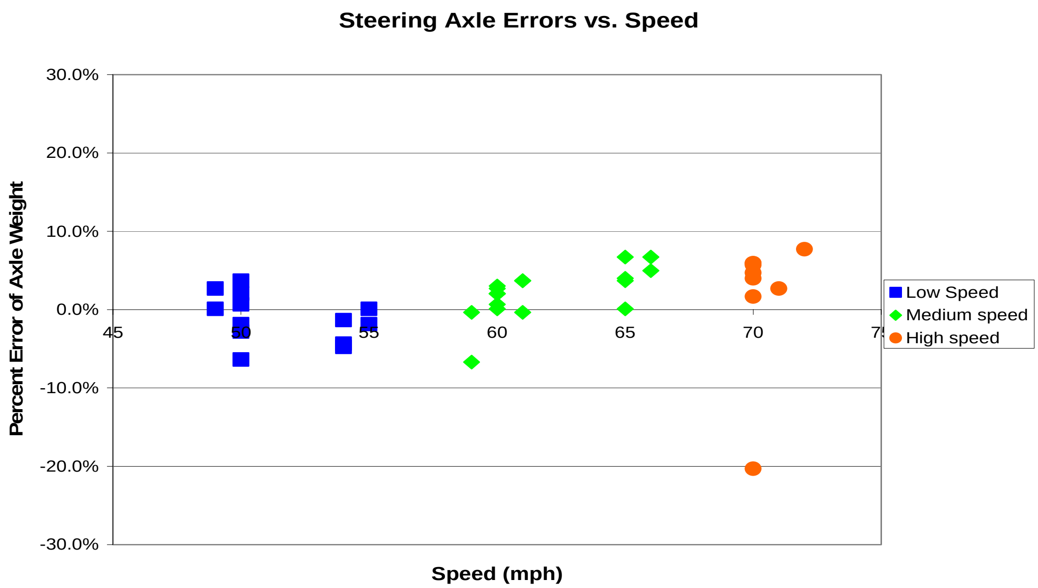


Figure 3-8 Post-Validation Steering Axle Percent Error vs. Speed by Group – 040200 – 01-May-2007

3.3 Classification Validation

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

The classification validation is intended to find gross errors in vehicle classification, not to validate the installed algorithm. A sample of 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 0 percent.

Table 3-4 Truck Misclassification Percentages for 040200 – 01-May-2007

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

The misclassification percentage is computed as the probability that a pair containing the class of interest does NOT include a match. Thus if there are eight pairs of observations with at least one Class 9 and only six of them are matches, the error rate is 25 percent.

The percent error and the mean differences reported below do not represent the same statistic. It is possible to have error rates greater than 0 with a mean difference of zero.

Table 3-5 Truck Classification Mean Differences for 040200 – 01-May-2007

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

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

3.4 Evaluation by ASTM E-1318 Criteria

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

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

Characteristic	Limits for Allowable Error	Percent within Allowable Error	Pass/Fail
Single Axles	± 20%	97.5%	Pass
Axle Groups	± 15%	98.8%	Pass
GVW	± 10%	100%	Pass

4 Pavement Discussion

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

4.1 Profile Analysis

A profile visit since the final installation activities has not occurred. There are tentative plans for a late summer profile visit to this location.

4.2 Distress Survey and Any Applicable Photos

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

4.3 Vehicle-pavement Interaction Discussion

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

5 Equipment Discussion

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

Since the assessment on March 4, 2004, new equipment was installed at a location 330 feet further east than the original site.

5.1 Pre-Evaluation Diagnostics

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

5.2 Calibration Process

The equipment required no iterations of the calibration process between the initial 40 runs and the final 40 runs. It was determined that the variability at high speed was not subject to factors calibration could influence.

5.3 Summary of Traffic Sheet 16s

This site only has validation information from the current visit. It is shown in the tables below. Table 5-1 has the information for TRF_CALIBRATION_AVC for Sheet 16s submitted for this validation.

Table 5-1 Classification Validation History – 040200 – 01-May-2007

Date	Method	Mean Difference				Percent Unclassified
		Class 9	Class 8	Other 1	Other 2	
05/01/07	Manual	0	0			0
04/30/07	Manual	0	0			0

Table 5-2 has the information for TRF_CALIBRATION_WIM for Sheet 16s for the current visit.

Table 5-2 Weight Validation History – 040200 – 01-May-2007

Date	Method	Mean Error and (SD)		
		GVW	Single Axles	Tandem Axles
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)

5.4 Projected Maintenance/Replacement Requirements

There are no 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 April 30, 2007 during the morning and afternoon hours at 040200 located between Tonopah, Arizona and AZ 85. This SPS-2 site is at milepost 108.6 on I-10 in the eastbound, righthand of a four-lane divided facility. No auto-calibration was used during test runs. The two trucks used for initial validation included:

1. 5-axle tractor semi-trailer combination with a tractor having an air suspension and trailer with standard rear tandem and an air suspension loaded to 77,360 lbs.
2. 5-axle tractor semi-trailer with a tractor having an air suspension and a trailer with a standard rear tandem and an air suspension loaded to 64,690 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 49 to 71 miles per hour. The desired speed range was achieved during this validation. Pavement surface temperatures were recorded during the test runs ranging from about 93 to 121 degrees Fahrenheit. The desired 30 degree Fahrenheit temperature range was achieved. The computed values of 95% confidence limits of each statistic for the total population are in

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 no adjustments to the system parameters were necessary.

Table 6-1 Pre-Validation Results – 040200 – 30-Apr-2007

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	1.4 ± 8.6%	Pass
Tandem axles	±15 percent	1.6 ± 8.0%	Pass
GVW	±10 percent	1.5 ± 6.1%	Pass
Speed	±1 mph [2 km/hr]	0.1 ± 0.8 mph	Pass
Axle spacing	± 0.5 ft [150mm]	0 ± 0.1 ft	Pass

The test runs were conducted primarily during the morning and afternoon hours. Clear, sunny skies resulted in a wide 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 three 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 achieved for this set of validation runs.

The three speed groups were divided into 49 to 55 mph for Low speed, 56 to 64 mph for Medium speed and 65+ mph for High speed. The three temperature groups were created by splitting the runs between those at 93 to 100 degrees Fahrenheit for Low temperature, 101 to 110 degrees Fahrenheit for Medium temperature and 111 to 121 degrees Fahrenheit for High temperature.

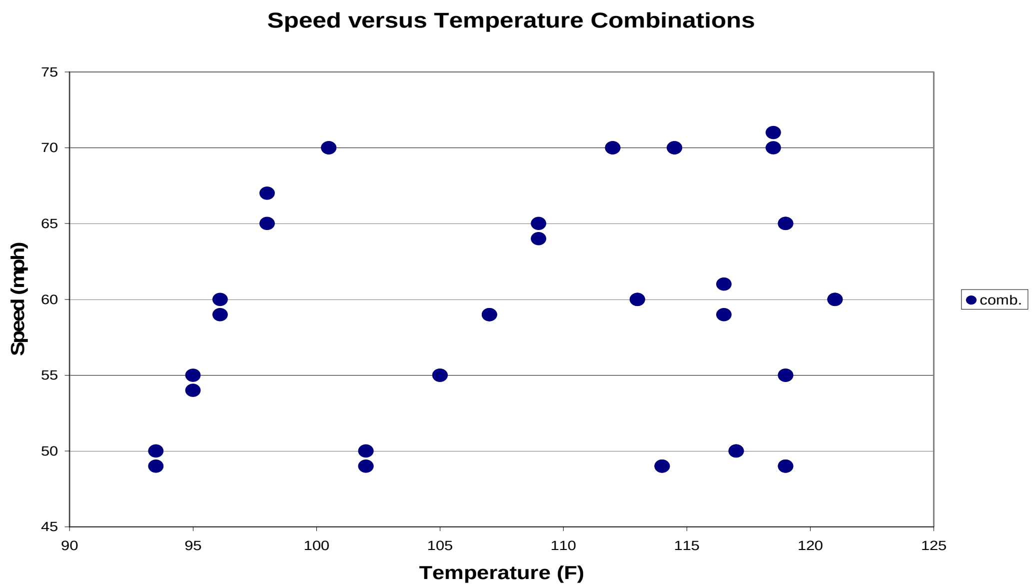


Figure 6-1 Pre-Validation Speed-Temperature Distribution – 040200 – 30-Apr-2007

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

Figure 6-2 shows the GVW Percent Error vs. Speed graph for the population as a whole.

The figure illustrates the tendency for the equipment to overestimate GVW at the low and high ends of the speed range. Variability appears to increase as speed increases. The outlier in the high speed group is real and not a data entry error.

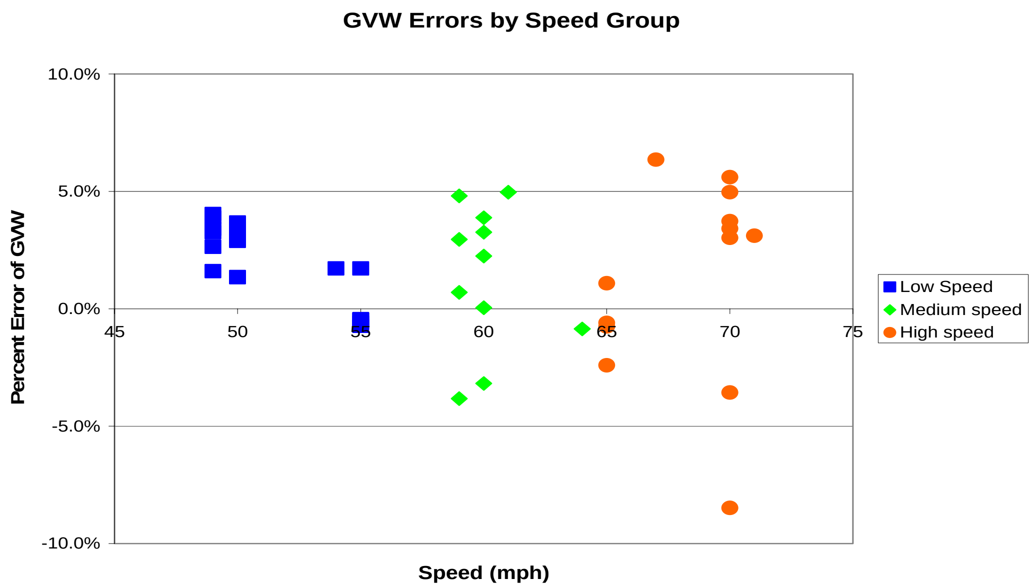


Figure 6-2 Pre-validation GVW Percent Error vs. Speed – 040200 – 30-Apr-2007

Figure 6-3 shows the lack of relationship between temperature and GVW percentage error. The outlier in the high temperature group is real and not a data entry error.

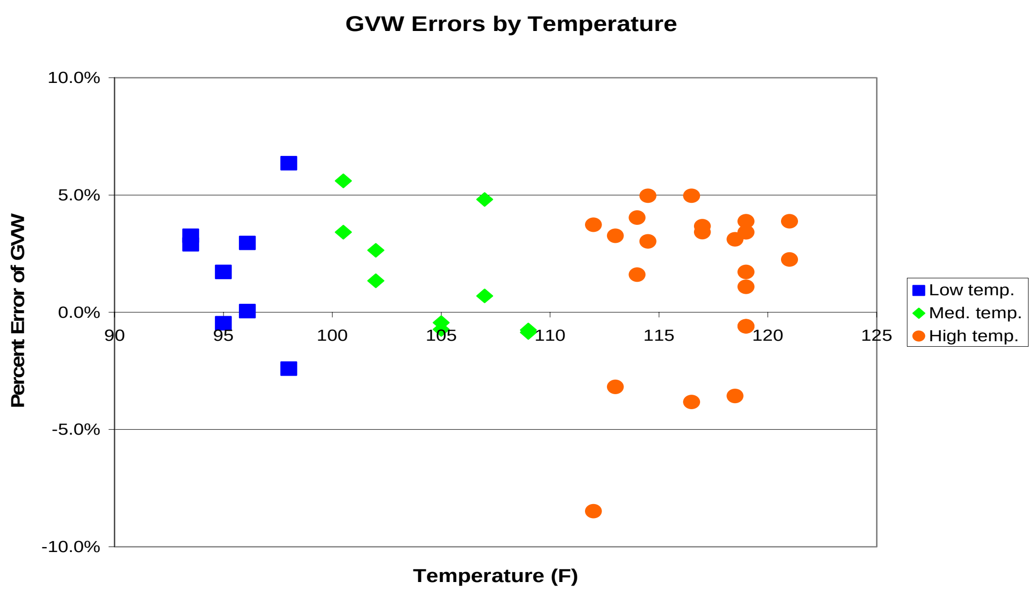


Figure 6-3 Pre-Validation GVW Percent Error vs. Temperature – 040200 – 30-Apr-2007

Figure 6-4 shows the relationship between the drive tandem spacing errors in feet and speeds. This graph is used as a potential indicator of classification errors due to failure to correctly identify spacings on a vehicle. Since the most common reference value is the drive tandem on a Class 9 vehicle, this is the spacing evaluated and plotted for validations. The graph indicates that the errors in tandem spacings for the test trucks differed at various speeds. At lower speeds underestimates were observed. At higher speeds overestimates were observed.

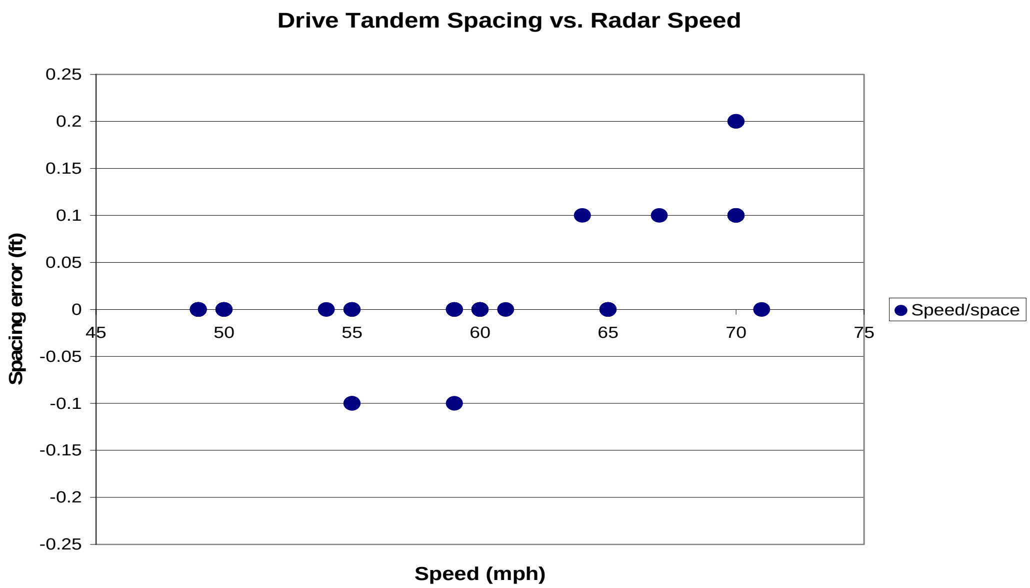


Figure 6-4 Pre-Validation Spacing vs. Speed - 040200 – 30-Apr-2007

6.1 Temperature-based Analysis

The three temperature groups were created by splitting the runs between those at 93 to 100 degrees Fahrenheit for Low temperature, 101 to 110 degrees Fahrenheit for Medium temperature and 111 to 121 degrees Fahrenheit for High temperature.

Table 6-2 Pre-Validation Results by Temperature Bin – 040200 – 30-Apr-2007

Element	95% Limit	Low Temperature 93 to 100 °F	Medium Temperature 101 to 110 °F	High Temperature 111 to 121 °F
Steering axles	±20 %	3.4 ± 6.8%	0.1 ± 8.6%	1.2 ± 9.8%
Tandem axles	±15 %	1.6 ± 7.0%	1.8 ± 5.9%	1.4 ± 9.5%
GVW	±10 %	1.8 ± 6.4%	1.6 ± 5.5%	1.4 ± 7.2%
Speed	±1 mph	0.0 ± 0.0 mph	0.2 ± 1.4 mph	0.1 ± 0.7 mph
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	0.0 ± 0.2 ft	0.0 ± 0.1 ft

From Table 6-2, it can be seen that all weights are overestimated with reasonable consistency throughout the entire temperature range. Variability appears to be greater at the high end of the temperature range for all weights.

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 overestimate at the lower temperatures, and estimate with reasonable accuracy the higher temperatures. The variability in error for the golden truck appears to greater when compared with the partial truck at all temperatures. The outlier associated with the golden truck is real and not a data entry error.

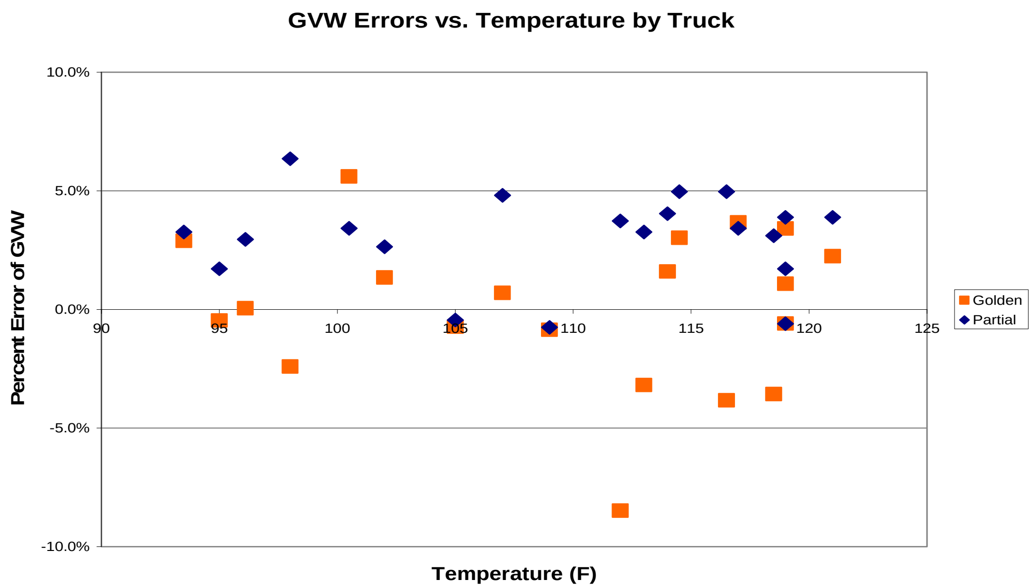


Figure 6-5 Pre-Validation GVW Percent Error vs. Temperature by Truck – 040200 – 30-Apr-2007

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

The figure shows that steering axle weights are overestimated by the equipment at the lower and upper ends of the temperature range, and estimated with reasonable accuracy at the medium temperatures. Variability in error appears to fairly consistent over the entire temperature range. The outlier associated with the high temperature range is real and not a data entry error.

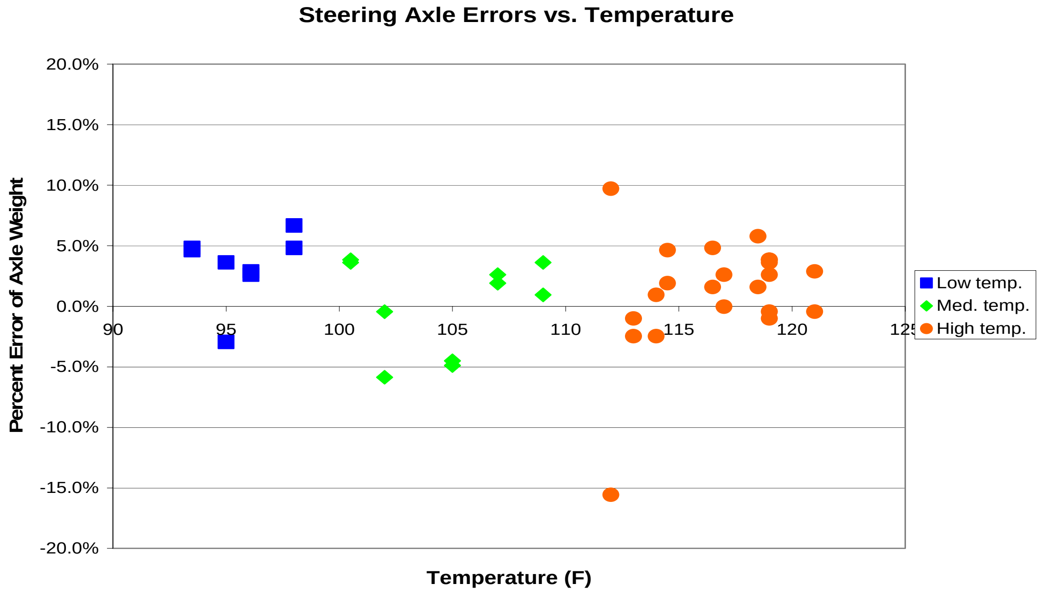


Figure 6-6 Pre-Validation Steering Axle Error vs. Temperature by Group – 040200 – 30-Apr-2007

6.2 Speed-based Analysis

The speed groups were divided as follows: Low speed – 49 to 55 mph, Medium speed – 56 to 64 mph and High speed – 65+ mph.

Table 6-3 Pre-Validation Results by Speed Bin – 040200 – 30-Apr-2007

Element	95% Limit	Low Speed 49 to 55 mph	Medium Speed 56 to 64 mph	High Speed 65+ mph
Steering axles	±20 %	0.1 ± 7.5%	1.5 ± 4.7%	2.9 ± 12.9%
Tandem axles	±15 %	2.3 ± 4.2%	1.4 ± 8.2%	0.8 ± 11.5%
GVW	±10 %	2.0 ± 3.7%	1.4 ± 6.8%	1.2 ± 9.2%
Speed	±1 mph	0.1 ± 0.9 mph	0.1 ± 0.7 mph	0.2 ± 1.0 mph
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft	0.1 ± 0.2 ft

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 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 overestimates at the low speeds and estimates with reasonable accuracy at the medium and high speeds. Individually, the trucks present different tendencies for variability. The variability in error for the partial truck remains fairly constant, however the variability in error for the golden truck increases dramatically as speed increases.

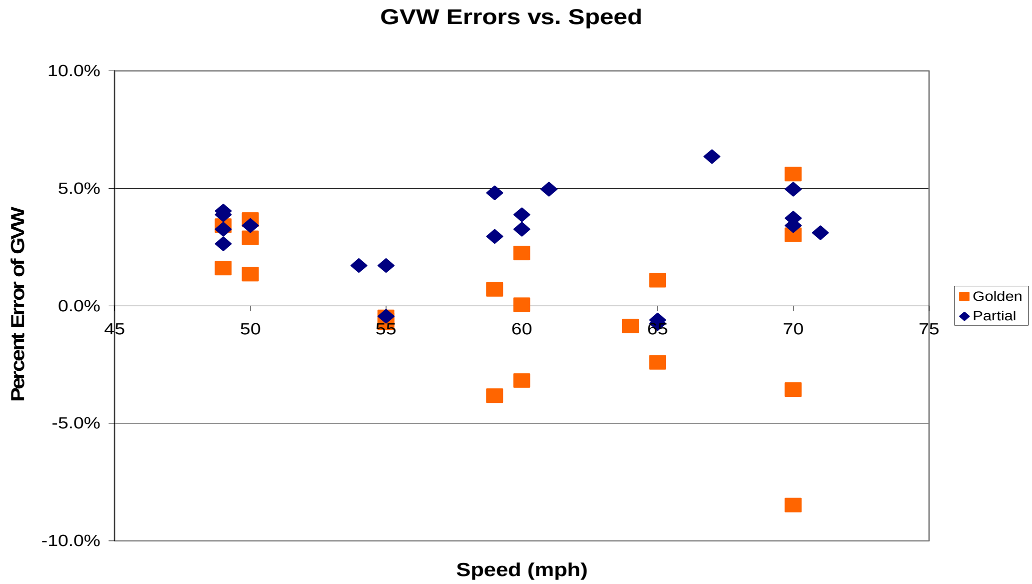


Figure 6-7 Pre-Validation GVW Percent Error vs. Speed Group - 040200 –30-Apr-2007

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

From the figure, it appears that the equipment estimates steering axle weights accurately at lower speeds, and then increasingly overestimates as speed increases. Variability in steering axle error appears to be reasonably consistent throughout the entire speed range. The outlier for high speed is real and not a data entry error.

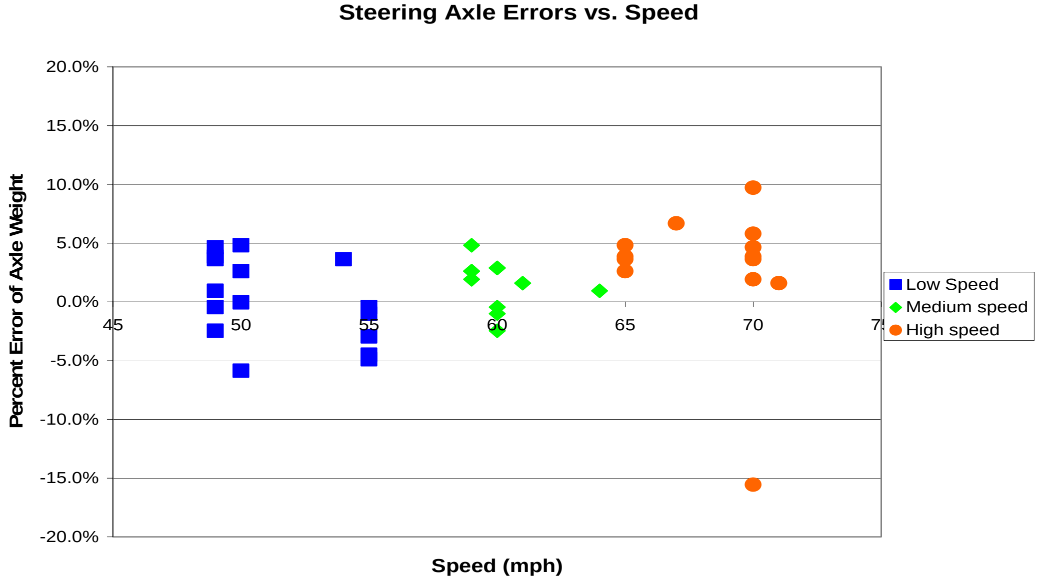


Figure 6-8 Pre-Validation Steering Axle Percent Error vs. Speed Group - 040200 – 30-Apr-2007

6.3 Classification Validation

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

The classification validation is intended to find gross errors in vehicle classification, not to validate the installed algorithm. A sample of 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 0 percent.

Table 6-4 Truck Misclassification Percentages for 040200 – 30-Apr-2007

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

The misclassification percentage is computed as the probability that a pair containing the class of interest does NOT include a match. Thus if there are eight pairs of observations with at least one Class 9 and only six of them are matches, the error rate is 25 percent.

The percent error and the mean differences reported below do not represent the same statistic. It is possible to have error rates greater than 0 with a mean difference of zero.

Table 6-5 Truck Classification Mean Differences for 040200 – 30-Apr-2007

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

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

6.4 Evaluation by ASTM E-1318 Criteria

The ASTM E-1318 criteria for a successful validation of Type I sites is 95% of the observed errors within the limits for allowable errors for each of the relevant statistics. If this site had been evaluated using ASTM E-1318-02 it would 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

7 Data Availability and Quality

As of April 30, 2007 this site does not have at least 5 years of research quality data. Research quality data is defined to be at least 210 days in a year of data of known calibration meeting LTPP's precision requirements.

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

The amount and coverage for the site is shown in Table 7-1. The value for months is a measure of the seasonal variation in the data. The indicator of coverage indicates whether day of week variation has been accounted for on an annual basis. As can be seen from the table, no year has a sufficient quantity to be considered complete years of data. Together with the previously gathered calibration information it can be seen that at least 5 additional years of research quality data are needed to meet the goal of a minimum of 5 years of research weight data.

Table 7-1 Amount of Traffic Data Available 040200 – 30-Apr-2007

Year	Classification Days	Months	Coverage	Weight Days	Months	Coverage
1994	118	5	Full Week	147	6	Full Week
1995	44	2	Full Week	44	2	Full Week
1996	151	8	Full Week	180	8	Full Week

As of May 10, 2007, one week after completion of the validation there was no data available from the Phase II contractor either directly or via their web site to establish expected GVW and vehicle distributions for this location.

8 Data Sheets

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

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

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

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

Test Truck Photographs (6 pages)

LTPP Mod 3 Classification Scheme (1 page)

Final System Parameters (1 page)

9 Updated Handout Guide and Sheet 17

A copy of the handout has been included following page 24. It includes a current Sheet 17 with all applicable maps and photographs.

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

1. General Information

SITE ID: *040200*

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

VISIT DATE: *April 30, 2007*

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: *April 30th and May 1st, 2007*

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

4. Site Location/ Directions

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

DIRECTIONS TO THE SITE: 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*

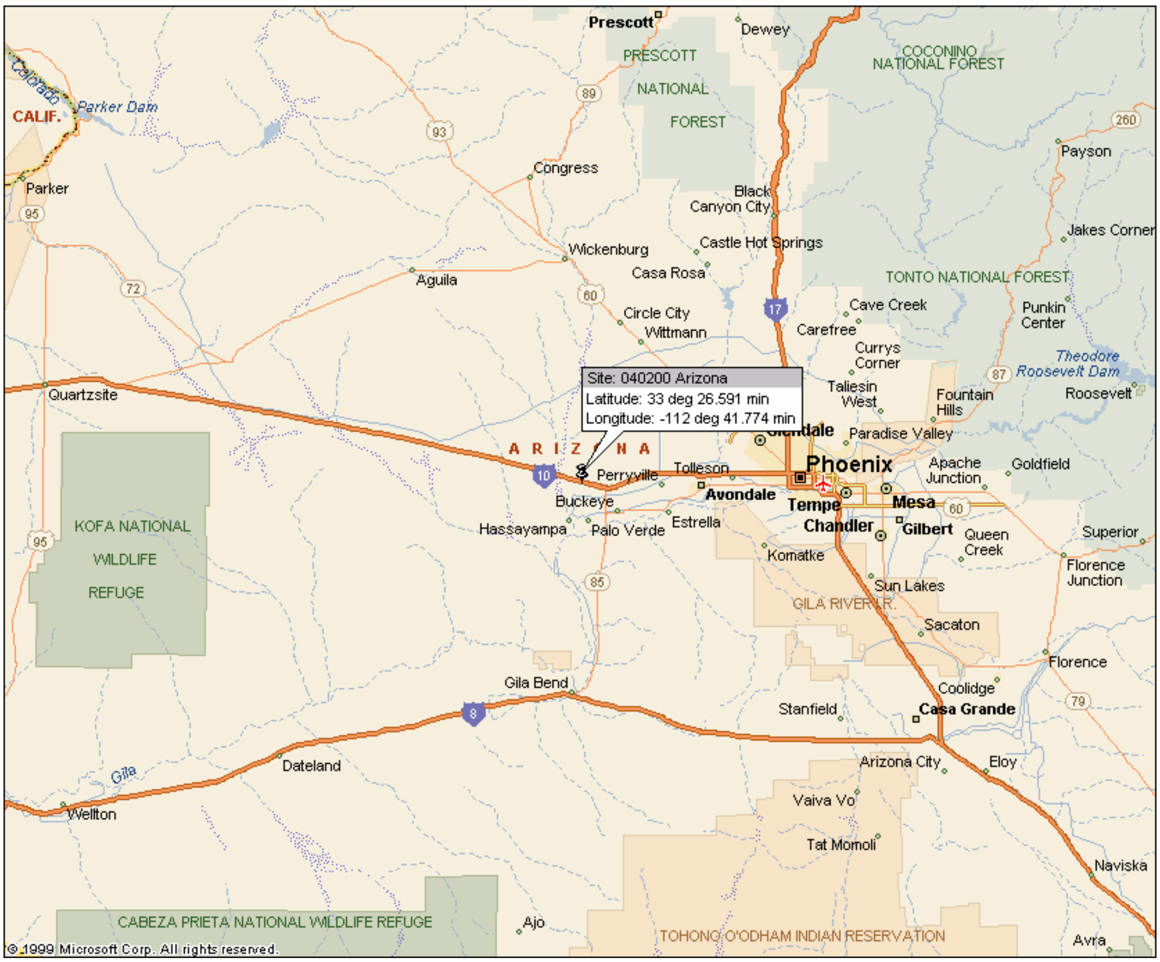


Figure 4-1 - Site 040200 in Arizona

5. Truck Route Information

ROUTE RESTRICTIONS: *None.*

SCALE LOCATION: *Lowe'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*

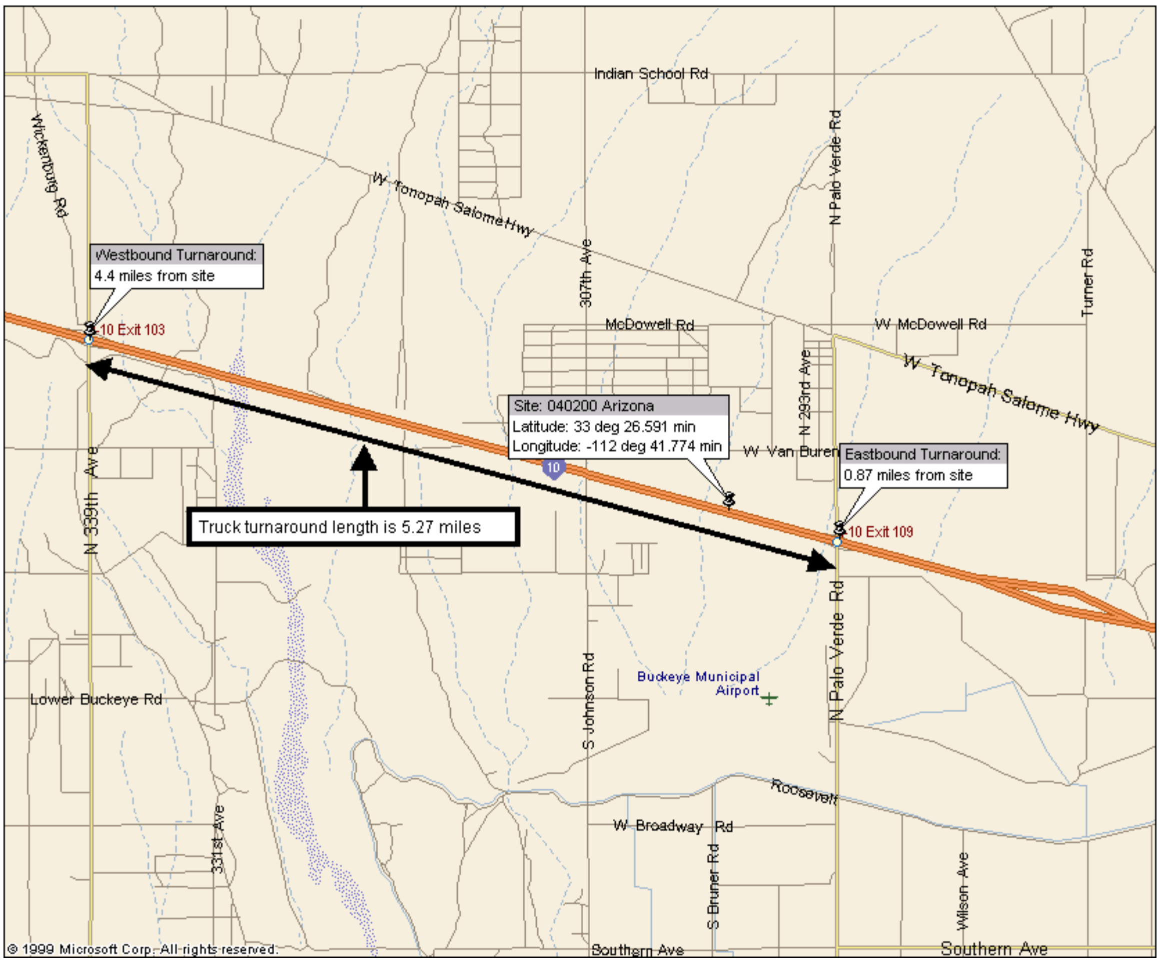


Figure 5-1 - Truck Route at 040200 in Arizona

6. Sheet 17 – Arizona (040200)

1.* ROUTE ___I-10_______MILEPOST ___108.6__LTPP DIRECTION - N S <u>E</u> 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 ___ ___ <u>3 8 2</u>__ ft

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

Median - 1 – painted
2 – physical barrier
<u>3</u> – <u>grass</u>
4 – none

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

Shoulder width _1__ _0__ ft

4.* PAVEMENT TYPE _____Portland Cement Concrete___________________

5.* PAVEMENT SURFACE CONDITION – Distress Survey
Date: _4/30/2007__ Photo:
6420040020_SPSWIM_TO_15_04_2.68_0200_Downstream.JPG
Date: _4/30/2007_ Photo:
6420040020_SPSWIM_TO_15_04_2.68_0200_Upstream.JPG
Date: _5/1/2007__ Photo:
6420040020_SPSWIM_TO_15_04_2.68_0200_Test_Section_Sign.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 / <u>N</u>
distance __________
Intersection/driveway within 300 m downstream of sensor location Y / <u>N</u>
distance __________
Is shoulder routinely used for turns or passing? Y / <u>N</u>

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

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

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 _____No Service______ 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 6420040020_SPSWIM_TO_15_04_2.68_0200_Solar_Panel.JPG

6420040020_SPSWIM_TO_15_04_2.68_0200_Service_Mast.JPG

Phone source 6420040020_SPSWIM_TO_15_04_2.68_0200_Cell_Modem.JPG

Cabinet exterior 6420040020_SPSWIM_TO_15_04_2.68_0200_Cabinet_Exterior.JPG

Cabinet interior

6420040020_SPSWIM_TO_15_04_2.68_0200_Cabinet_Interior_Front.JPG

6420040020_SPSWIM_TO_15_04_2.68_0200_Cabinet_Interior_Rear.JPG

Weight sensors

6420040020_SPSWIM_TO_15_04_2.68_0200_Leading_Weighpad.JPG

6420040020_SPSWIM_TO_15_04_2.68_0200_Trailing_Weighpad1.JPG

Classification sensors ____

Other sensors Loops, Temperature Sensor________________________

Description _ 6420040020_SPSWIM_TO_15_04_2.68_0200_Leading_Loop.JPG

6420040020_SPSWIM_TO_15_04_2.68_0200_Trailing_Loop.JPG

6420040020_SPSWIM_TO_15_04_2.68_0200_Temp_Sensor.JPG

Downstream direction at sensors on LTPP lane

6420040020_SPSWIM_TO_15_04_2.68_0200_Downstream.JPG

Upstream direction at sensors on LTPP lane

_6420040020_SPSWIM_TO_15_04_2.68_0200_Upstream.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

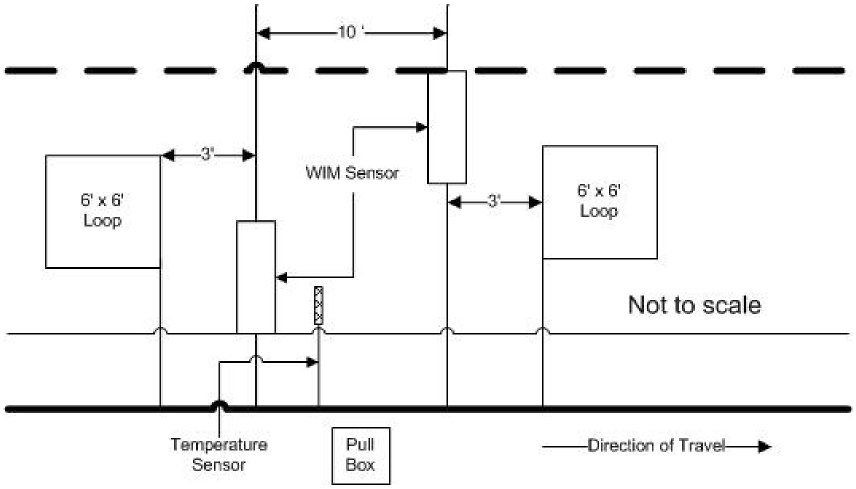
Test Truck Recommendations:
Types of Trucks: Two Class 9s
Truck 1: 72,000 to 80,000 legal limit on gross and axles, air suspension trailer;
Truck 2: approximately 66,000 on gross and axles

Expected Speeds: 55, 65 and 75 mph

COMPLETED BY ____Dean J. Wolf____________________________

PHONE __301-210-5105___DATE COMPLETED _0_4_ /_3_0_ / _2_0_0_7_

Sketch of equipment layout



Site Map

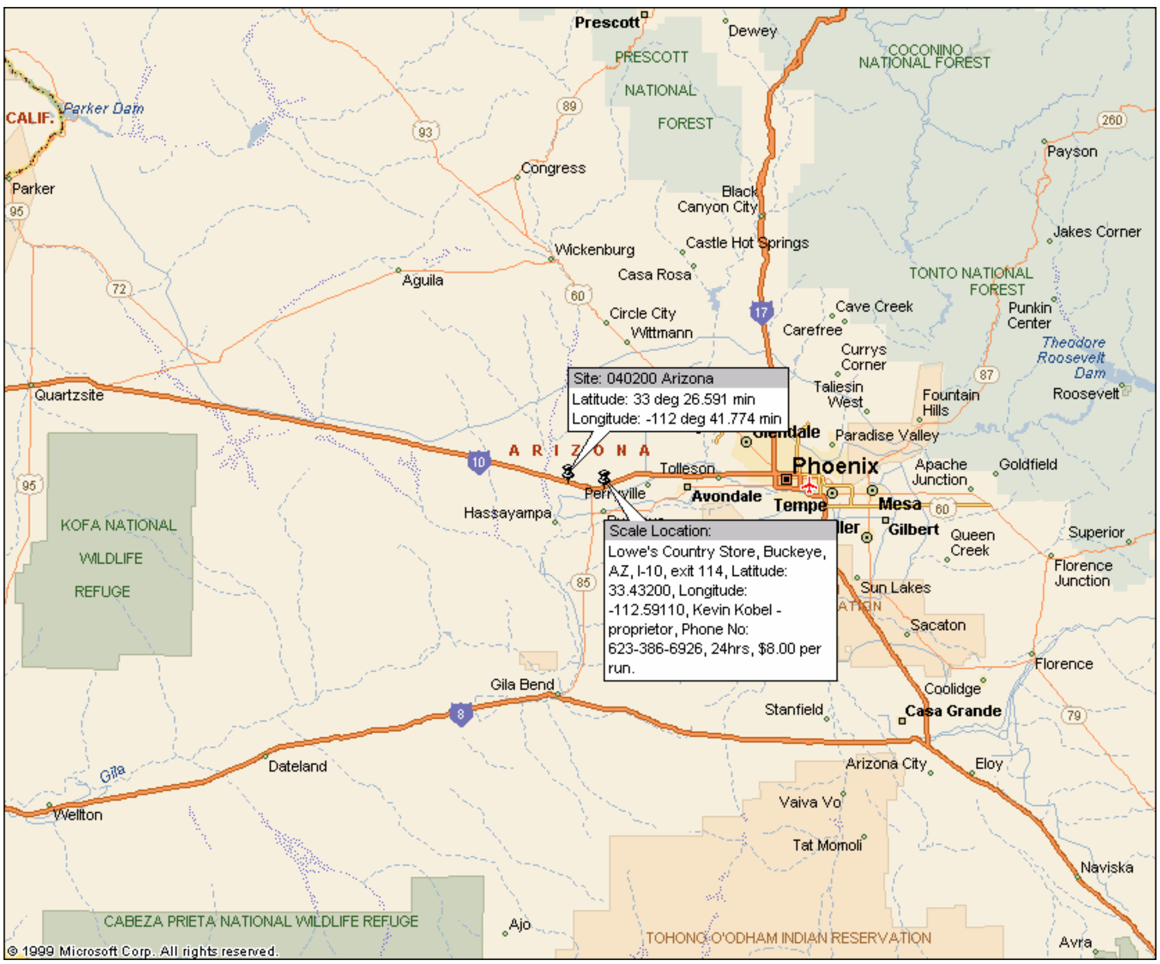


Figure 6-1 - Site map of 040200 in Arizona

Figure 6-2 6420040020_SPSWIM_TO_15_04_2.68_0200_Downstream.JPG – 4/30/2007

Figure 6-3 6420040020_SPSWIM_TO_15_04_2.68_0200_Upstream.JPG – 4/30/2007

Figure 6-4 6420040020_SPSWIM_TO_15_04_2.68_0200_Test_section.JPG – 5/1/2007

Figure 6-5 6420040020_SPSWIM_TO_15_04_2.68_0200_Solar_Panel.JPG – 4/30/2007

Figure 6-6 6420040020_SPSWIM_TO_15_04_2.68_0200_Service_Mast.JPG 4/30/2007

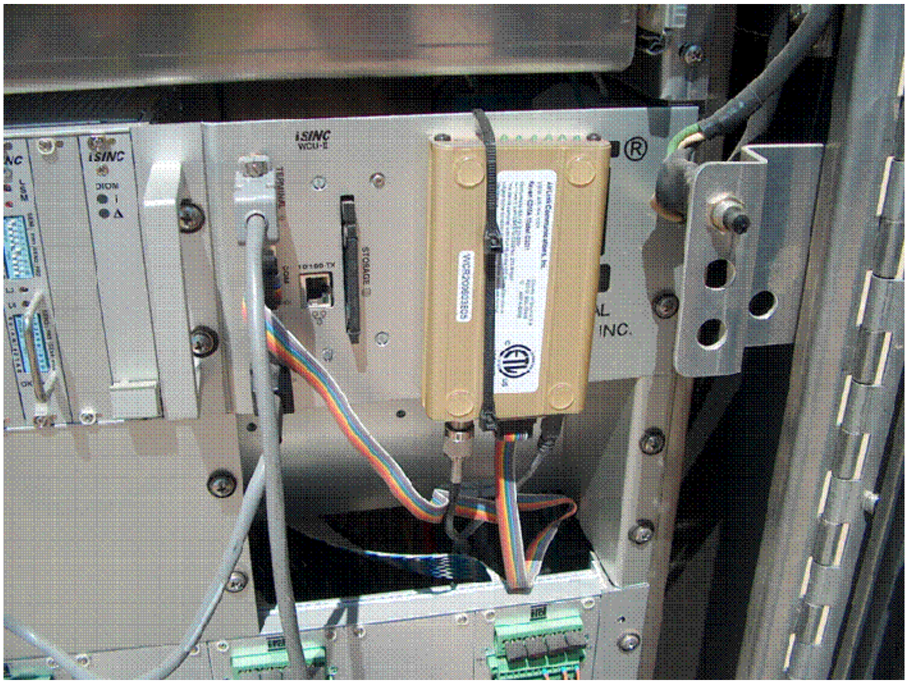


Figure 6-7 6420040020_SPSWIM_TO_15_04_2.68_0200_Cell_Modem.JPG 4/30/2007

Figure 6-8 6420040020_SPSWIM_TO_15_04_2.68_0200_Cabinet_Exterior.JPG 4/30/2007

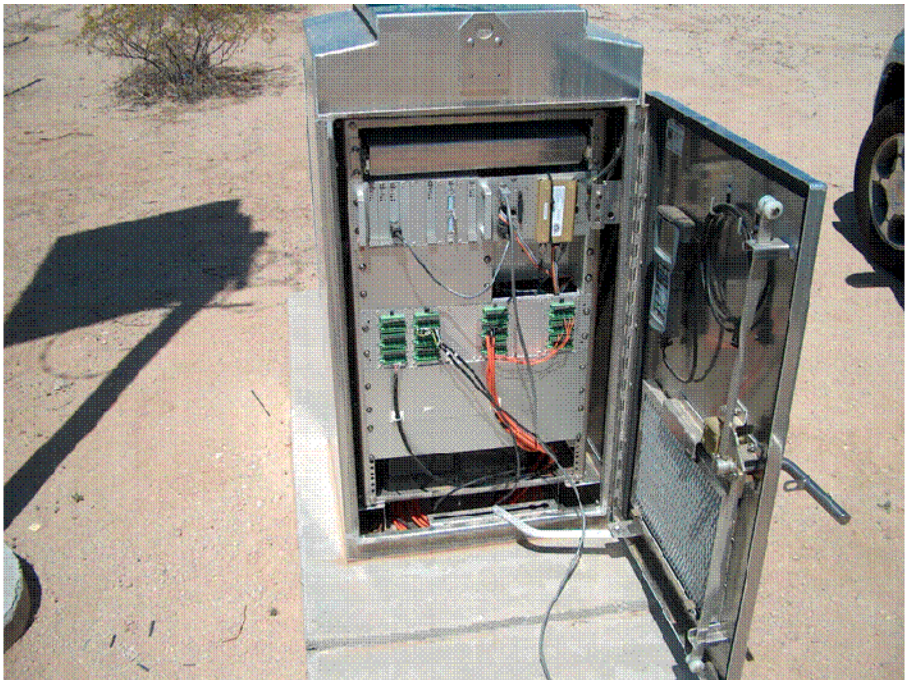


Figure 6-9 6420040020_SPSWIM_TO_15_04_2.68_0200_Cabinet_Interior_Front.JPG 4/30/2007

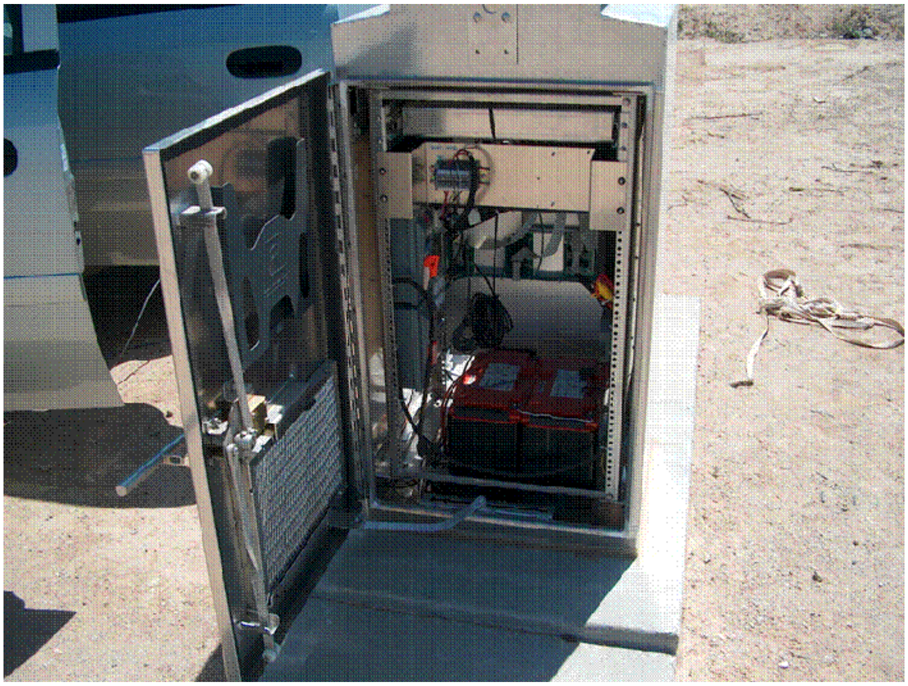


Figure 6-10
6420040020_SPSWIM_TO_15_04_2.68_0200_Cabinet_Interior_Rear.JPG
4/30/2007

Figure 6-11 6420040020_SPSWIM_TO_15_04_2.68_0200_Leading_Weighpad.JPG
4/30/2007

Figure 6-12 6420040020_SPSWIM_TO_15_04_2.68_0200_Trailing_Weighpad1.JPG 4/30/2007

Figure 6-13 6420040020_SPSWIM_TO_15_04_2.68_0200_Leading_Loop.JPG 4/30/2007

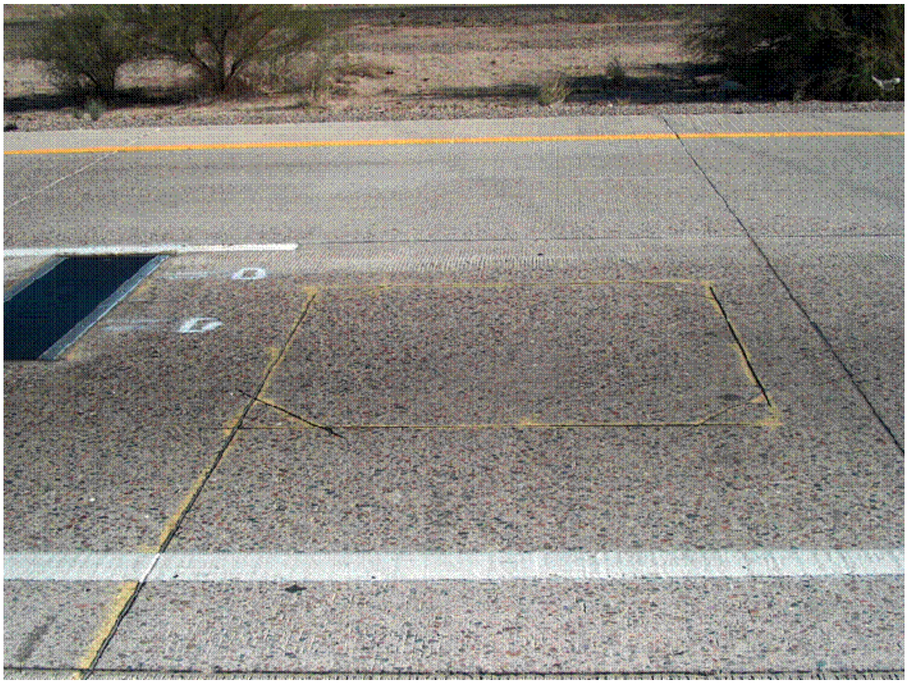


Figure 6-14 6420040020_SPSWIM_TO_15_04_2.68_0200_Trailing_Loop.JPG 4/30/2007

Figure 6-15 6420040020_SPSWIM_TO_15_04_2.68_0200_Temp_Sensor.JPG 4/30/2007

SHEET 18	STATE CODE [4]
LTPP MONITORED TRAFFIC DATA	SPS PROJECT ID [0200]
WIM SITE COORDINATION	DATE: (mm/dd/yyyy) 4/30/2007

Rev. 05/15/07

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

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

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

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

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

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

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

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

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

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

g. Communication –

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

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

3. PAVEMENT –

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

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

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

4. ON SITE ACTIVITIES –

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

b. Notice for straightedge and grinding check - __2_ ☐ days ☒ weeks

i. On site lead –
- ☐ State
- ☒ LTPP

ii. Accept grinding –
- ☐ State
- ☒ LTPP

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

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

SHEET 18	STATE CODE [4]
LTPP MONITORED TRAFFIC DATA	SPS PROJECT ID [0200]
WIM SITE COORDINATION	DATE: (mm/dd/yyyy) 4/30/2007

Rev. 05/15/07

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:
   PAT/IRD

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

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

i. Traffic Control Required – ☐Yes ☒No

j. Enforcement Coordination Required – ☐Yes ☒No

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

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

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

      Agency: IRD

b. Maintenance (equipment) –

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

Agency: IRD

c. Data Processing and Pre-Visit Data –

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

Agency: IRD

d. Construction schedule and verification –

Name: Phoenix 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) [4/30/2007]

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

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

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

5. EQUIPMENT MANUFACTURER ___IRD/ PAT Traffic___

WIM SYSTEM CALIBRATION SPECIFICS**

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

   ___ NUMBER OF TRUCKS COMPARED __2__ NUMBER OF TEST TRUCKS USED

   __20__ PASSES PER TRUCK

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

TRUCK	TYPE	SUSPENSION
1	9	1
2	9	1
3		

7. SUMMARY CALIBRATION RESULTS (EXPRESSED AS A PERCENT)
   MEAN DIFFERENCE BETWEEN ---
   DYNAMIC AND STATIC GVW ___1.5 STANDARD DEVIATION ___3.0
   DYNAMIC AND STATIC SINGLE AXLES ___1.4 STANDARD DEVIATION ___4.3
   DYNAMIC AND STATIC DOUBLE AXLES ___1.6 STANDARD DEVIATION ___4.0

8. 5 ____ NUMBER OF SPEEDS AT WHICH CALIBRATION WAS PERFORMED

9. DEFINE THE SPEED RANGES USED (MPH) ______ _50_ __55__ __60_ __65_ __70____ ______ ______
   ______ ______ ______ ______ ______ ______ ______ ______ ______ ______

10. CALIBRATION FACTOR (AT EXPECTED FREE FLOW SPEED) ___3460___

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

CLASSIFIER TEST SPECIFICS***

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

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

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

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

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) [5/1/2007]

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

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

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

5. EQUIPMENT MANUFACTURER ___IRD/ PAT Traffic___

WIM SYSTEM CALIBRATION SPECIFICS**

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

   ___ NUMBER OF TRUCKS COMPARED __2__ NUMBER OF TEST TRUCKS USED

   __20__ PASSES PER TRUCK

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

TRUCK	TYPE	SUSPENSION
1	9	1
2	9	1
3		

7. SUMMARY CALIBRATION RESULTS (EXPRESSED AS A PERCENT)
   MEAN DIFFERENCE BETWEEN ---
   DYNAMIC AND STATIC GVW ___-0.2 STANDARD DEVIATION ___3.6
   DYNAMIC AND STATIC SINGLE AXLES ___1.1 STANDARD DEVIATION ___4.9
   DYNAMIC AND STATIC DOUBLE AXLES ___-0.3 STANDARD DEVIATION ___5.4

8. 5 ____ NUMBER OF SPEEDS AT WHICH CALIBRATION WAS PERFORMED

9. DEFINE THE SPEED RANGES USED (MPH) ______ _50_ __55__ __60_ __65_ __70__ ______ ______
   ______ ______ ______ ______ ______ ______ ______ ______ ______ ______

10. CALIBRATION FACTOR (AT EXPECTED FREE FLOW SPEED) ___3460___

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

CLASSIFIER TEST SPECIFICS***

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

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

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

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

APPENDIX A

Sheet 19	* STATE_CODE 04
LTPP Traffic Data	* SPS PROJECT ID 0200
*CALIBRATION TEST TRUCK # 1	* DATE 04-30-07

Rev. 08/31/01

truck # 7121

trailer # W0587

PART I.

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

AXLES - units - lbs / 100s lbs / kg

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

GVW (same units as axles)

7. a) Empty GVW ______________

*b) Average Pre-Test Loaded weight ______________

*c) Post Test Loaded Weight ______________

*d) Difference Post Test – Pre-test ______________

GEOMETRY

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

9. a) * Make: ~~KenWorth~~ b) * Model: ~~KenWorth~~ . T-800B

10.* Trailer Load Distribution Description:

trash distributed evenly along trailer

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

b). Trailer Tare Weight (units): ______________

~~Trailer~~ 7121

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Trailer no - W0587

Sheet 19	* STATE_CODE 04
LTPP Traffic Data	* SPS PROJECT ID 0200
*CALIBRATION TEST TRUCK # 1	* DATE 04-30-07

Rev. 08/31/01

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

A to B 14.6 B to C 4.35 C to D 34.1

D to E 4.15 E to F ____

Wheelbased (measured A to last) ____ Computed ____

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

SUSPENSION

Axle	14. Tire Size	15.* Suspension Description (leaf, air, no. of leaves, taper or flat leaf, etc.)
A	11R22.5	3 tapered leaf
B	11R22.5	Air
C	11R22.5	Air
D	11R22.5	Air
E	11R22.5	Air
F		

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

Steering Axle	Axle B	Axle C	Axle D	Axle E

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Sheet 19	* STATE CODE 04
LTPP Traffic Data	* SPS PROJECT ID
*CALIBRATION TEST TRUCK #	* DATE

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PART II

Table 1. Axle and GVW computations - pre-test

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

Table 2. Raw Axle and GVW measurements

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

Table 3. Axle and GVW computations - post -test

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

Sheet 19	* STATE_CODE 04
LTPP Traffic Data	* SPS PROJECT ID 0200
*CALIBRATION TEST TRUCK # 1	* DATE 04-30-07

Rev. 08/31/01

Table 4 . Axle and GVW computations -

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

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10460	16830	16830	16830	16830		77780
2	10440	16860	16860	16820	16820		77800
3	10440	16870	16870	16830	16830		77840
Average	10450	16850	16850	16830	16830		77810
day 1 post	10160	16680	16680	16700	16700		76920 (-890)

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10440	17360	17360	16620	16620		78400
2	10440	17370	17370	16610	16610		78400
3	10500	17330	17330	16630	16630		78420
Average	10460	17350	17350	16620	16620		78410
day 2 post	10120	17100	17100	16510	16510		77340 (1060)

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

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

Measured By Ambrz

Verified By [illegible]

Sheet 19	* STATE_CODE 04
LTPP Traffic Data	* SPS PROJECT ID 0200
*CALIBRATION TEST TRUCK # 2	* DATE 04-30-07

Rev. 08/31/01

PART I.

truck # 7092
trailer # W0616

1.* FHWA Class 9

2.* Number of Axles 5

AXLES - units - lbs / 100s lbs / kg

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

GVW (same units as axles)

7. a) Empty GVW ______________

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

GEOMETRY

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

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

10.* Trailer Load Distribution Description:

TRASH LOADED EVENLY ALONG TRAILER

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

b). Trailer Tare Weight (units): ______________

Sheet 19	* STATE_CODE 04
LTPP Traffic Data	* SPS PROJECT ID 0200
*CALIBRATION TEST TRUCK # 2	* DATE 04-30-07

Rev. 08/31/01

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

A to B 14.5 B to C 4.4 C to D 34.1

D to E 4.2 E to F ______

Wheelbased (measured A to last) ______ Computed ______

13. *Kingpin Offset From Axle B (units) 1.6 (______)
(+ 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	3 tapered leaf.
B	11R22.5	Air
C	11R22.5	Air
D	11R22.5	Air
E	11R22.5	Air
F		

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

Steering Axle	Axle B	Axle C	Axle D	Axle E

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Tractor no 7092
Trailer no W0616

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Sheet 19	* STATE_CODE	04
LTPP Traffic Data	* SPS PROJECT ID	0200
*CALIBRATION TEST TRUCK #__	* DATE	04/30/07

Rev. 08/31/01

PART II

Table 1. Axle and GVW computations - pre-test

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

Table 2. Raw Axle and GVW measurements

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

Table 3. Axle and GVW computations - post -test

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

Sheet 19	* STATE_CODE 04
LTPP Traffic Data	* SPS PROJECT ID 0200
*CALIBRATION TEST TRUCK # 2	* DATE 04-30-07

Rev. 08/31/01

Table 4 . Axle and GVW computations -

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

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	9960	14690	14690	12870	12870		65080
2	10000	14640	14640	12880	12880		65040
3	10000	14650	14650	12880	12880		65060
Average	9990	14660	14660	12880	12880		65060
day 1 post	9780	14500	14500	12850	12850		64280 (-780)

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10080	14840	14840	12750	12750		65260
2	10120	14820	14820	12750	12750		65260
3	10060	14850	14850	12740	12740		65240
Average	10090	14840	14840	12750	12750		65250
day 2 post	9780	14700	14700	12650	12650		64480 (-770)

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

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

Measured By Aubie Verified By [illegible]

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SHEET_20_PRE PAGE 1 OF 2

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
64	9	52597	63	9	67	9	52866	66	9
67	9	52599	67	9	70	9	52878	70	9
68	9	52603	67	9	75	9	52879	75	9
75	9	52609	74	9	64	11	882	64	11
73	9	52615	73	9	68	9	88	68	9
69	5	52620	68	5	67	9	89	67	9
65	9	52624	66	9	65	9	90	64	9
69	5	52635	70	5	65	9	94	64	9
66	9	52638	65	9	67	9	98	67	9
71	11	52639	70	11	65	9	903	65	9
68	9	52643	68	9	72	9	921	71	9
65	9	52646	65	9	65	9	955	65	9
64	9	52649	65	9	70	5	986	69	5
66	9	52690	67	9	77	9	992	78	9
72	9	52700	72	9	72	8	995	72	8
65	11	52716	66	11	70	10	015	70	10
70	9	52719	69	9	69	10	016	69	10
66	9	52723	66	9	80	9	031	79	9
71	9	52727	70	9	73	9	036	72	9
65	11	52790	65	11	65	9	039	65	9
63	11	52794	63	11	62	11	074	63	11
70	9	52797	69	9	76	11	084	76	11
70	9	52802	69	9	65	9	099	65	9
73	9	52813	72	9	74	9	107	73	9
71	9	52815	70	9	73	9	117	73	9

Recorded by ~~9:30~~ [signature] Direction E Lane 1 Time from 9:30 to 10:53

C. Traffic Sheet 20 – Speed and Classification Checks

This sheet is provided as an alternative to a software application to compare the WIM or

2

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SHEET_20_PRE

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
64	9	53212	64	9	63	9	888	62	9
64	9	218	65	9	62	11	901	61	11
59	9	53221	59	9	70	9	906	70	9
59	9	53222	59	9	80	9	922	79	9
72	9	251	71	9	77	9	927	76	9
63	9	258	63	9	72	9	932	71	9
73	9	271	72	9	71	9	937	70	9
57	9	276	56	9	68	9	946	68	9
70	9	279	70	9	65	5	947	64	5
77	9	294	76	9	65	9	955	65	9
78	9	299	77	9	65	9	958	65	9
73	8	302	72	8	66	5	959	65	5
74	9	305	73	9	67	9	973	66	9
70	5	320	70	5	75	13	977	75	13
77	9	324	77	9	62	8	982	62	8
64	5	327	64	5	65	9	990	65	9
67	9	333	67	9	71	9	995	70	9
70	9	336	70	9	75	9	998	75	9
76	9	506	76	9	63	9	54005	63	9
67	11	513	67	11	66	9	54014	65	9
72	9	53838	73	9	49	9	54017	49	9
67	9	8604	65	9	49	9	54018	49	9
64	9	873	63	9	47	6	54040	47	6
76	9	882	74	9	72	9	54048	71	9
70	9	884	69	9	73	9	54056	73	9

Recorded by Ambis Direction 6 Lane 1 Time from 11:07 to 13:09

C. Traffic Sheet 20 – Speed and Classification Checks

This sheet is provided as an alternative to a software application to compare the WIM or

Kebero

Sheet 20	* STATE_CODE 04
LTPP Traffic Data	*SPS PROJECT_ID 0200
Speed and Classification Checks * 1 of* 2	* DATE 05/01/2007

Rev. 08/31/2001….

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
68	9	61454	68	9	77	9	609	76	9
62	9	61460	62	9	66	9	611	66	9
71	9	62	71	9	68	9	613	68	9
73	9	63	73	9	60	9	618	60	9
76	9	85	76	9	77	9	621	77	9
66	9	92	66	9	65	11	623	64	11
77	11	95	76	11	75	9	628	75	9
70	12	96	70	12	65	9	635	65	9
75	9	506	74	9	69	9	637	69	9
70	9	16	69	9	75	9	640	75	9
66	9	21	65	9	65	9	644	65	9
66	11	525	65	11	66	9	645	66	9
67	9	529	67	9	71	9	650	70	9
69	11	534	68	11	70	9	652	70	9
70	9	537	70	9	69	9	653	69	9
64	9	540	64	9	66	11	659	66	11
63	8	542	63	8	55	9	662	55	9
62	5	550	62	5	54	9	663	54	9
50	9	61555	50	9	70	9	695	70	9
49	9	556	49	9	63	9	696	63	9
64	9	591	63	9	70	9	701	70	9
70	12	594	70	12	70	8	708	70	8
70	9	598	68	9	72	9	713	72	9
64	5	602	64	5	77	9	716	77	9
68	9	606	68	9	66	9	717	66	9

Recorded by Archie Direction E Lane 1 Time from 8:41 to 9:17

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Sheet 20	* STATE_CODE 04
LTPP Traffic Data	*SPS PROJECT_ID 0200
Speed and Classification Checks * 2 of* 2	* DATE 05/01/2007

Rev. 08/31/2001….

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
66	9	61840	65	9	67	9	62027	66	9
61	5	845	61	5	65	9	62028	65	9
72	9	848	71	9	68	9	037	67	9
67	9	849	67	9	70	9	081	70	9
65	9	852	65	9	71	9	082	71	9
66	9	853	66	9	74	9	62107	74	9
75	9	885	75	9	66	9	108	65	9
72	9	888	72	9	67	8	111	67	8
72	9	892	72	9	65	9	113	65	9
76	9	896	76	9	68	9	117	68	9
68	11	901	68	11	76	9	125	75	9
73	10	913	73	10	62	8	129	61	8
66	9	921	66	9	67	5	133	67	5
76	9	923	74	9	73	9	135	73	9
77	9	924	77	9	67	12	137	67	12
68	9	929	68	9	74	9	156	73	9
65	9	931	65	9	72	9	157	71	9
66	9	932	66	9	65	9	161	66	9
55	9	935	55	9	73	9	166	73	9
68	9	944	68	9	76	9	171	75	9
63	11	953	63	11	70	9	174	70	9
72	5	958	72	5	64	11	175	64	11
71	9	959	70	9	72	9	180	71	9
75	9	021	75	9	55	9	182	54	9
75	9	022	75	9	54	9	183	54	9

Recorded by [signature] Direction E Lane 1 Time from 9:36 to 10:24

6420040020_SPSWIM_Sheet_20.doc POST

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Sheet 21	* STATE_CODE 94
LTPP Traffic Data	*SPS PROJECT_ID 0200
WIM System Test Truck Records 1 of 3	* DATE 04/30/2007

Rev. 08/31/2001

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
93.5	50	1	1	9:24:51	52562	50	5.7/5.1	8.6/8.9	8.9/8.5	8.3/9.2	7.9/8.7		79.6	14.9	4.4	35.2	4.1	
93.5	49	2	1	9:24:53	52563	49	5.4/4.9	7.7/7.5	7.5/7.6	6.6/6.6	7.1/5.8		66.8	14.9	4.4	35.1	4.2	
95.0	55	1	2	9:39:09	52652	55	5.1/4.9	8.1/9.1	9.0/8.2	7.7/8.8	7.1/9.2		77.0	14.8	4.4	34.9	4.1	
95.0	54	2	2	9:39:11	52653	54	5.4/4.8	7.3/7.2	7.7/7.3	6.5/6.6	7.3/5.8		65.8	14.8	4.4	34.7	4.1	
96.1	60	1	3	9:53:59	52738	60	5.5/5.1	8.1/9.0	8.0/8.9	8.2/8.6	7.8/8.3		77.4	14.8	4.4	35.1	4.1	
96.1	59	2	3	9:54:00	52739	59	5.3/4.8	7.3/7.6	7.1/8.2	6.0/7.0	7.0/6.3		66.6	14.9	4.4	35.1	4.2	
98	65	1	4	10:08:38	52834	65 ~~52~~	5.8/5.0	8.0/9.9	6.2/9.1	5.8/8.5	8.0/9.2		75.5	14.8	4.4	35.0	4.2	
98	67	2	4	10:08:40	52835	67	5.3/5.2	7.4/8.4	7.0/8.7	6.0/7.6	7.1/6.1		68.8	14.9	4.5	35.8	4.2	
100.5	70	1	5	10:23:09	52923	71	5.6/5.1	7.6/10.1	8.7/9.6	8.7/8.5	8.3/9.5		81.7	14.9	4.6	35.7	4.1	
100.5	70	2	5	10:23:10	52924	71	5.2/5.0	6.6/8.8	6.6/8.2	6.0/7.1	7.0/6.3		66.9	14.9	4.5	34.6	4.1	
102.0	50	1	6	10:40:3	53044	50	5.2/4.5	8.8/8.5	9.4/8.1	9.9/8.1	8.6/8.2		78.4	14.7	4.4	34.6	4.2	
102.0	49	2	6	10:40:32	53045	48	4.8/5.0	7.4/7.4	7.5/7.8	6.4/7.1	7.1/5.7		66.4	14.9	4.4	35.1	4.1	
105.0	55	1	7	10:54:51	53127	55	5.0/4.8	7.7/8.7	9.3/8.2	8.3/8.5	7.6/8.9		76.8	14.8	4.3	34.7	4.1	
105.0	55	2	7	10:54:53	53128	55	5.0/4.4	7.2/7.3	7.5/7.2	6.1/6.9	7.0/5.8		64.4	14.9	4.4	34.9	4.2	
107.0	59	1	8	11:09:06	53221	59	5.3/5.2	7.4/9.2	8.8/8.9	7.7/8.2	7.4/9.3		77.9	14.5	4.3	34.5	4.0	
107.0	59	2	8	11:09:08	53222	59	5.3/4.8	7.3/7.9	7.4/8.1	6.1/7.3	7.4/6.3		67.8	14.6	4.4	34.5	4.1	

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Sheet 21	* STATE_CODE	04
LTPP Traffic Data	*SPS PROJECT_ID	0200
WIM System Test Truck Records 2 of 3	* DATE	04/30/2007

Rev. 08/31/2001

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
109	64	1	9	11:24:57	53342	64	5.6/4.8	7.3/9.2	7.9/8.9	8.1/8.6	7.6/8.9		76.7	14.6	4.5	34.2	4.2	
109	65	2	9	11:24:59	53343	66	5.4/4.8	7.4/8.3	4.8/8.3	4.3/7.4	7.4/6.0		64.2	14.8	4.4	35.2	4.3	
112.0	70	1	10	11:39:12	53450	70	3.8/4.9	5.8/8.9	6.6/8.4	9.7/8.5	6.1/8.1		70.8	14.6	4.5	34.3	4.1	
112.0	70	2	10	11:39:14	53451	70	5.5/5.3	6.8/8.5	7.2/7.7	6.1/7.2	6.4/6.5		67.1	14.8	4.5	34.9	4.2	
119.5	49	1	11	12:56:53	54017	49	5.4/5.3	8.5/9.0	9.2/8.3	9.2/8.4	8.3/8.5		80.0	14.8	4.4	34.7	4.1	
119.5	49	2	11	12:56:55	54018	49	5.0/5.2	7.8/7.6	7.4/7.8	6.3/6.8	7.5/5.8		67.2	14.9	4.4	34.9	4.1	
119.0	55	1	12	13:11:19	54135	55	5.4/4.8	8.7/8.0	9.8/7.6	8.8/8.3	7.5/8.3		76.9	14.6	4.3	34.4	4.2	
119.0	55	2	12	13:11:21	54136	55	5.1/4.7	7.4/7.4	7.7/7.6	5.6/7.3	6.8/6.0		65.8	14.9	4.4	35.0	4.1	
121	60	1	13	13:24:59	54258	60	5.5/5.1	8.3/9.4	8.2/9.0	8.1/8.6	8.4/8.7		79.1	14.8	4.4	34.8	4.1	
121	60	2	13	13:25:01	54259	60	5.1/4.7	7.4/7.9	7.4/8.4	6.5/7.4	6.4/6.1		67.2	14.8	4.4	35.0	4.1	
119	65	1	14	13:39:09	54372	65	5.7/5.0	8.3/9.6	8.7/9.1	8.4/8.7	5.6/9.2		78.2	14.9	4.4	35.1	4.2	
119	65	2	14	13:39:11	54373	65	5.2/4.9	7.1/8.1	7.2/8.5	6.2/7.0	3.8/6.2		64.3	14.9	4.4	35.4	4.1	
118.5	70	1	15	13:54:17	54483	70	5.6/5.3	5.3/9.6	9.5/8.7	6.4/9.1	6.1/9.1		74.6	14.8	4.5	34.8	4.1	
118.5	71	2	15	13:54:19	54484	71	5.0/5.0	7.0/8.8	6.5/8.6	6.0/7.1	6.5/6.1		66.7	14.9	4.4	35.2	4.1	
117	50	1	16	14:09:41	54599	50	5.2/5.1	8.7/8.7	9.3/8.3	9.2/9.1	7.9/8.7		80.2	14.9	4.4	35.0	4.2	
117	50	2	16	14:09:43	54600	50	4.8/5.2	8.0/7.6	7.5/7.7	6.1/6.8	7.4/6.7		66.9	14.9	4.4	35.1	4.2	

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Sheet 21	* STATE_CODE	04
LTPP Traffic Data	*SPS PROJECT_ID	0200
WIM System Test Truck Records 3 of 3	* DATE	04/30/2007

Rev. 08/31/2001

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
116.5	59	1	17	14:25:24	54730	60	5.5/5.3	8.0/8.1	8.0/8.5	8.0/8.0	6.8/8.4		74.4	14.9	4.4	34.8	4.0	
116.5	61	2	17	14:25:26	54731	61	5.3/4.8	7.5/7.6	7.3/8.1	6.4/7.1	7.6/6.2		67.9	14.9	4.4	35.0	4.2	
114.5	70	1	18	14:40:17	54853	70	5.3/5.2	7.3/10.7	8.4/9.7	8.3/8.7	7.8/9.1		79.7	14.9	4.6	35.3	4.1	
114.5	70	2	18	14:40:18	54854	70	5.1/5.2	7.1/9.1	6.8/8.8	6.0/7.2	5.9/6.7		67.9	14.8	4.5	35.2	4.2	
114.0	49	1	19	14:54:47	54972	50	5.5/4.9	8.5/8.9	9.0/8.0	8.8/8.3	8.1/8.5		78.6	14.9	4.4	35.1	4.1	
114.0	49	2	19	14:54:49	54973	50	5.0/4.6	8.0/7.5	7.4/7.7	6.1/7.3	7.3/6.2		67.3	14.8	4.4	35.1	4.2	
113.0	60	1	20	15:09:36	55104	60	5.3/4.9	8.1/8.2	7.9/8.9	7.8/8.1	6.6/9.0		74.9	14.8	4.4	34.9	4.1	
113.0	60	2	20	15:09:38	55105	60	4.7/4.9	7.1/7.7	7.0/8.5	6.1/7.3	7.0/6.4		66.8	14.8	4.4	35.2	4.2	

Recorded by Anbie

Checked by

(old number/static) x WIM = new number

PRE

(X)% + X = Y

3000

Static / WIM = New / old (old factor)/Stat = X / WIM

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Sheet 21

LTPP Traffic Data

WIM System Test Truck Records 1 of

Rev. 08/31/2001

* STATE_CODE 04

*SPS PROJECT_ID 0200

* DATE 05/01/2007

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
89.5	50	1	1	8:54:31	61555	50	5.4/4.6	8.5/8.4	8.6/8.0	7.8/7.7	7.6/9.0		75.5	15.1	4.3	35.1	4.2	
89.5	49	2	1	8:54:33	61556	49	5.3/4.9	8.0/7.4	7.5/7.4	6.7/6.4	7.5/5.2		66.4	14.8	4.4	34.8	4.1	
90.5	55	1	2	9:08:52	61662	55	5.4/4.7	8.6/8.4	9.4/7.8	7.9/8.0	7.6/8.7		76.5	14.8	4.4	34.7	4.1	
90.5	54	2	2	9:08:54	61663	54	5.1/4.7	7.7/6.7	8.2/7.3	6.3/6.4	7.5/5.8		65.9	14.7	4.4	34.5	4.1	
90.5	60	1	3	9:23:48	61761	60	5.6/4.9	8.9/8.8	7.8/8.7	8.5/8.3	8.9/9.1		78.6	14.8	4.4	34.8	4.1	
90.5	60	2	3	9:23:50	61762	60	5.4/4.8	7.6/7.7	7.4/8.1	6.3/6.7	7.2/5.9		67.1	14.9	4.5	35.1	4.3	
91.5	65	1	4	9:38:18	61852	65	5.9/4.8	8.9/9.3	7.6/8.9	6.6/8.2	6.5/9.1		75.8	14.7	4.4	34.7	4.2	
91.5	66	2	4	9:38:19	61853	66	5.8/4.8	7.5/8.0	4.9/7.9	4.3/7.1	5.7/6.1		62.0	14.9	4.5	35.3	4.1	
91.5	70	1	5	9:52:16	61962	70	5.6/5.3	5.4/9.7	6.6/9.3	8.2/8.9	8.2/9.9		76.9	14.8	4.3	34.6	4.1	
91.5	70	2	5	9:52:17	61963	70	5.3/5.1	6.9/8.4	6.8/8.6	5.9/6.8	7.1/6.2		67.1	14.9	4.5	34.8	4.1	
94.5	50	1	6	10:10:11	62086	50	5.5/4.6	9.3/8.5	9.5/8.3	7.7/8.6	7.1/9.5		78.6	14.7	4.3	34.7	4.2	
94.5	50	2	6	10:10:13	62087	50	5.4/4.9	7.7/7.4	7.3/7.9	6.3/6.5	7.0/5.5		65.8	14.9	4.4	35.0	4.2	
94.5	54	1	7	10:24:01	62182	55	5.1/4.7	8.2/8.6	9.1/8.4	7.5/7.9	7.3/9.0		75.9	14.8	4.5	34.9	4.1	
94.5	54	2	7	10:24:03	62183	54	5.0/4.5	7.7/7.2	7.7/7.4	6.3/6.8	7.2/5.4		65.1	14.8	4.4	34.7	4.1	
94.5	60	1	8	10:38:36	62283	60	5.5/5.0	8.8/9.0	7.9/8.9	7.7/8.6	7.2/9.1		77.8	14.8	4.4	34.9	4.3	
94.5	61	2	8	10:38:38	62284	61	5.4/4.9	7.1/7.9	7.1/8.3	6.3/7.0	7.2/6.2		67.2	14.8	4.5	35.1	4.2	

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Sheet 21

LTPP Traffic Data

WIM System Test Truck Records 2 of

Rev. 08/31/2001

* STATE_CODE	04
*SPS PROJECT_ID	0200
* DATE	05/01/2007

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
95.5	66	1	9	10:53:52	62403	66	5.8/5.0	8.3/9.4	5.9/9.4	5.7/8.6	5.7/9.0		72.8	14.9	4.4	35.2	4.2	
95.5	65	2	9	10:53:53	62404	65	5.6/5.0	5.6/4.9	4.9/8.2	5.3/6.8	6.0/5.9		61.2	14.8	4.4	35.1	4.2	
93.0	70	1	10	11:08:12	62509	69	5.6/5.3	4.9/10	6.5/9.6	5.4/9.5	4.9/9.5		70.9	14.9	4.5	34.9	4.1	
93.0	71	2	10	11:08:14	62510	71	5.2/5.0	7.3/8.8	6.8/8.4	5.8/6.8	6.6/6.0		66.9	14.9	4.5	34.9	4.1	
90.0	50	1	11	11:22:50	62615	50	5.3/5.2	8.9/8.9	9.1/8.3	7.7/9.7	7.5/8.8		79.4	14.8	4.4	35.0	4.3	
90.0	50	2	11	11:22:53	62616	50	4.7/4.6	7.6/7.3	7.3/8.5	6.1/6.9	7.2/6.5		65.2	14.8	4.4	35.1	4.2	
90	55	1	12	11:37:24	62735	55	5.4/4.9	9.1/8.3	9.6/7.7	7.0/7.8	6.1/8.7		74.6	14.6	4.5	35.3	4.2	
90	56	2	12	11:37:25	62736	56	4.0/4.7	6.3/7.4	6.3/7.2	5.0/6.8	5.2/5.6		58.6	15.0	4.4	35.1	4.2	
87.5	60	1	13	12:55:18	63317	60	5.6/4.7	8.6/8.7	9.4/8.4	8.3/8.4	7.5/8.1		77.6	14.7	4.4	34.6	4.2	
87.5	60	2	13	12:55:20	63318	60	5.5/4.5	7.5/7.6	7.3/7.9	6.4/6.3	6.9/5.7		65.5	14.6	4.3	34.5	4.1	
91.0	65	1	14	13:10:45	63414	65	5.6/4.7	8.9/9.2	7.4/8.9	8.4/7.6	8.2/9.2		78.3	14.9	4.3	34.6	4.1	
91.0	65	2	14	13:10:46	63415	65	5.4/4.9	7.8/7.8	5.7/7.9	4.4/6.9	5.7/5.8		62.6	14.9	4.4	34.9	4.2	
93.5	70	1	15	13:25:12	63529	70	3.5/4.7	6.3/9.2	6.8/9.0	6.6/8.8	8.3/9.0		72.1	14.7	4.2	34.5	4.2	
93.5	70	2	15	13:25:14	63530	70	5.4/4.7	8.0/8.3	7.8/7.4	7.0/6.4	3.8/5.6		64.4	15.0	4.4	34.2	3.8	
100	49	1	16	13:39:23	63625	49	5.5/4.8	9.5/8.1	9.8/8.0	8.6/8.2	7.5/9.1		79.1	14.6	4.3	34.4	4.2	
100	50	2	16	13:39:25	63626	50	5.1/4.9	7.9/7.2	7.6/7.5	6.5/6.3	7.6/5.2		66.0	14.8	4.4	34.7	4.1	

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Sheet 21
LTPP Traffic Data
WIM System Test Truck Records 3 of 3

Rev. 08/31/2001

* STATE_CODE 04
*SPS PROJECT_ID 0200
* DATE 05/01/2007

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
106	60	1	17	13:54:13	63730	60	5.5/5.1	8.3/8.9	8.9/8.7	8.2/8.7	6.7/8.9		77.9	14.9	4.4	35.1	4.1	
106	61	2	17	13:54:15	63731	61	5.4/4.5	8.0/7.5	7.8/7.9	6.2/6.6	6.8/5.6		66.3	14.7	4.4	35.1	4.2	
110	70	1	18	14:09:09	63843	70	5.7/5.0	8.5/9.8	8.5/9.5	8.2/8.6	5.1/8.8		77.8	15.1	4.2	35.3	4.1	
110	72	2	18	14:09:11	63844	71	5.4/5.3	7.7/8.5	7.4/8.1	7.0/6.7	7.4/6.3		69.8	15.0	4.1	35.1	4.2	
111	60	1	19	14:27:16	63975	60	5.5/5.0	8.3/8.9	9.0/8.7	8.1/8.1	7.2/8.5		77.3	14.7	4.4	34.8	3.9	
111	61	2	19	14:27:18	63976	61	5.2/5.1	7.5/7.8	7.3/8.0	6.3/7.0	7.7/5.9		67.8	14.8	4.4	34.9	4.2	
110	70	1	20	14:41:12	64071	69	3.5/4.9	5.6/9.1	6.9/8.6	8.3/8.3	5.4/9.4		70.3	14.7	4.3	34.4	3.8	
110	70	2	20	14:41:14	64072	70	5.4/5.1	7.2/8.3	7.3/8.8	6.5/6.8	7.0/5.7		68.1	14.8	4.3	35.0	4.2	
104	59	1	21	14:55:26	64176	59	4.8/4.8	8.6/8.4	9.1/8.3	8.7/7.9	5.5/8.0		74.2	14.8	4.3	34.6	4.1	
104	59	2	21	14:55:28	64177	60	5.2/4.7	7.6/7.7	7.6/7.9	6.2/6.8	6.9/5.8		66.4	14.7	4.4	34.9	4.1	

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TEST VEHICLE PHOTOGRAPHS FOR SPS WIM VALIDATION

April 30 and May 1, 2007

STATE: Arizona

SHRP ID: 0200

Photo 1 - 6420040020_SPSWIM_TO_15_04_2.68_0200_Truck_1_Tractor.JPG – 4/30/2007

Photo 2 - 6420040020_SPSWIM_TO_15_04_2.68_0200_Truck_1_Trailer.JPG – 4/30/2007

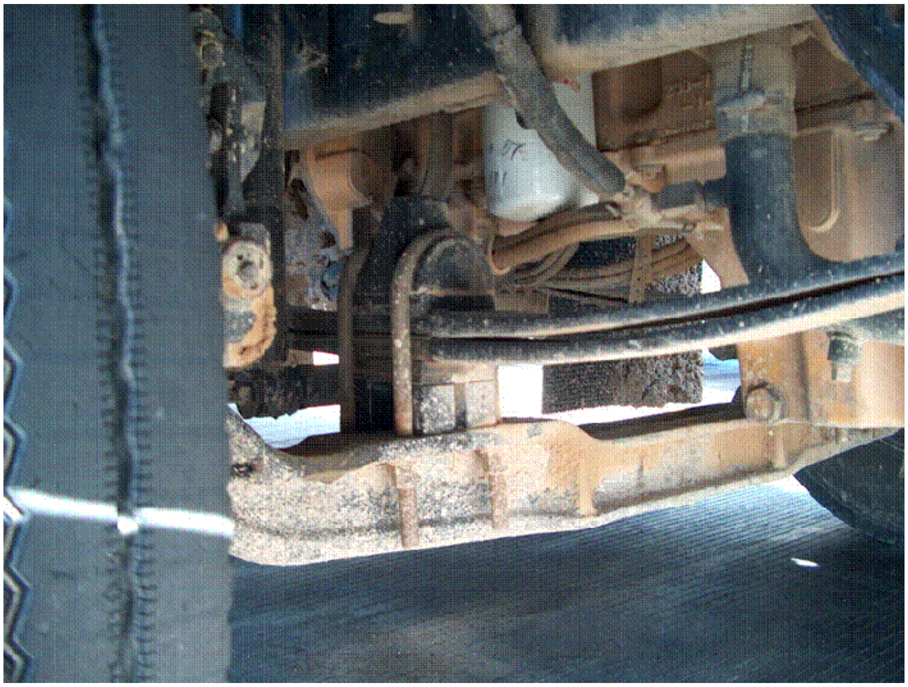

Photo 3 - 6420040020_SPSWIM_TO_15_04_2.68_0200_Truck_1_Suspension_1.JPG – 4/30/2007

Photo 4 - 6420040020_SPSWIM_TO_15_04_2.68_0200_Truck_1_Suspension_2.JPG – 4/30/2007

Photo 5 - 6420040020_SPSWIM_TO_15_04_2.68_0200_Truck_1_Suspension_3.JPG – 4/30/2007

Photo 6 - 6420040020_SPSWIM_TO_15_04_2.68_0200_Truck_2_Tractor.JPG – 4/30/2007

Photo 7 - 6420040020_SPSWIM_TO_15_04_2.68_0200_Truck_2_Trailer.JPG – 4/30/2007

Photo 8 - 6420040020_SPSWIM_TO_15_04_2.68_0200_Truck_2_Suspension_1.JPG – 4/30/2007

Photo 9 - 6420040020_SPSWIM_TO_15_04_2.68_0200_Truck_2_Suspension_2.JPG – 4/30/2007

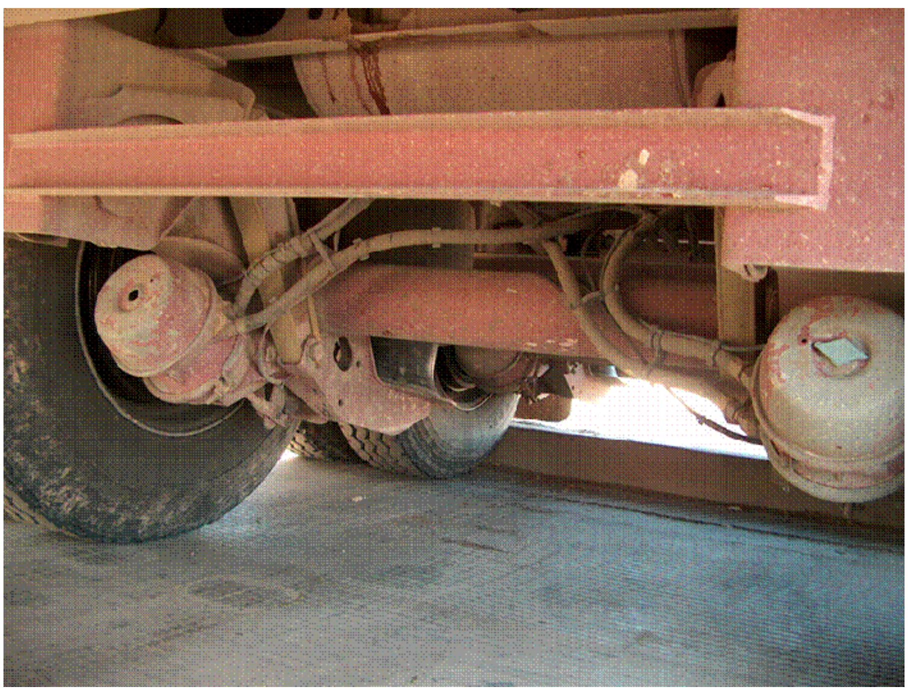

Photo 10 - 6420040020_SPSWIM_TO_15_04_2.68_0200_Truck_2_Suspension_3.JPG – 4/30/2007

ETG LTPP CLASS SCHEME, MOD 3

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

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

System Operating Parameters

Arizona SPS-2 (Lane 1)

Validation Visit – 30 April, 2007

Calibration factor for sensor #1:

88 kph:	3390
96 kph:	3375
104 kph:	3417
112 kph:	3460
120 kph:	3499

Calibration factor for sensor #2:

88 kph:	3390
96 kph:	3375
104 kph:	3417
112 kph:	3460
120 kph:	3499