Validation Report

Michigan SPS-1

Task Order 12, CLIN 2
December 6 through 7, 2005

List of Tables

List of Figures

1 Executive Summary

A visit was made to the Michigan SPS-1 beginning on December 6 and continuing through December 7, 2005 for the purposes of conducting a validation of the WIM system located on US Route 127 located approximately 2.6 miles north of M-21. The validation procedures were in accordance with LTPP's SPS WIM Data Collection Guide dated August 21, 2001.

The site is instrumented with quartz piezo WIM sensors and an IRD/PAT Traffic WIM controller.

The agency is utilizing a slightly modified version of the FHWA 13-bin classification scheme. Classification 15 has been added to record the number of unclassified vehicles.

This site was installed in June 2005 as part of the relocation of the WIM system. In addition to the LTPP Lane the Agency instrumented the other three lanes at this location. The LTPP Lane is installed in the southbound direction and identified as Lane 4 in the controller. This validation was also the initial calibration effort performed at this site.

The site is located within an area of newly installed PCC pavement approximately 2.9 miles north of the original site. The LTPP designation for this site did not change; however, the Agency changed their designation of the site from 318 to 317.

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

This site meets the overall classification requirement of less than two percent unclassified. However, it does not meet the less than two percent trucks misclassified criteria.

The vehicles that were misclassified were one class 7 that was classified as a Class 6, and one Class 4 that was classified as a Class 5. With the anticipated changes to the classification requirements that will not include Class 3 through 5 vehicles, this site meets the less than two percent misclassified criteria.

The validation used the following trucks:

1) 3S2 with a tractor having an air suspension tandem and a trailer with a standard tandem and air suspension tandem loaded to 77,270 lbs.
2) 3S2 with a tractor having air suspension tandem and a trailer with a standard tandem and air suspension tandem loaded to 61,760 lbs.

The validation speeds ranged from 45 to 66 miles per hour. The site is currently posted with a speed limit of 70 miles per hour for cars and 55 miles per hour for trucks. Since the agency had already identified that the 85th percentile speed for trucks was in excess to the posted speed limit, the Agency received approval from the Motor Carrier

Enforcement Group to run the test trucks at speeds greater than the posted speed limit, so long as the test trucks matched the speeds being driven by the surrounding traffic.

The pavement temperatures ranged from 1 to 29 degrees Fahrenheit.

Table 1-1 Post-Validation results – 260100 – 07-Dec-2005

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	-4.2 ± 8.1%	Pass
Tandem axles	±15 percent	-1.7 ± 8.6%	Pass
Gross vehicle weights	±10 percent	-2.1 ± 6.9%	Pass
Speed	**±1 mph [2 km/hr]**	**0.3 ± 1.5 mph**	**Fail**
Axle spacing	± 0.5 ft [150 mm]	0.0 ± 0.1 ft	Pass

The pavement condition was 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.

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, and the field validation procedures do not include verification of that information.

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

Characteristic	Limits for Allowable Error	Percent within Allowable Error	Pass/Fail
Single Axles	± 20%	100%	Pass
Axle Groups	± 15%	98.8%	Pass
GVW	± 10%	97.6%	Pass

2 Corrective Actions Recommended

There are no corrective measures recommended for this site at this time.

3 Post Calibration Analysis

This final analysis is based on test runs conducted December 7, 2005 from early afternoon to early evening at test site 260100 on US Route 127. This SPS-1 site is located 2.56 miles north of M-21 on the southbound, right hand lane of a divided four-lane facility. No auto-calibration was used during test runs. The two trucks used for initial calibration and for the subsequent testing included:

1. 3S2 with a tractor having an air suspension tandem and trailer with standard rear tandem and air suspension loaded to 77,270 lbs. (Golden Truck 2)
2. 3S2 with a tractor having an air suspension tandem and trailer with standard rear tandem and air suspension loaded to 61,760 lbs. (3S2-62k)

This is a different "golden" truck then was provided by the trucking firm on the first day of testing. The change of equipment does not impact the results of the validation process as both vehicles met the criteria for a "golden" truck.

Each truck made a total of 20 passes over the WIM scale at speeds ranging from approximately 45 to 66 miles per hour. Pavement surface temperatures were recorded during the test runs ranging from about 1 to 29 degrees Fahrenheit. The computed values of 95% confidence limits of each statistic for the total population are in Table 3-1.

As shown in Table 3-1 the site meets and passed all LTPP performance criteria for research quality data for weight and spacing. It did not meet the requirements for speed which is not considered sufficient to disqualify the site as having research quality data.

It should be noted, that since the axle spacing measurements (which are dependant on accurate speed measurements) did meet the performance requirements, it is likely that the failure of speed measurements is the result of errors in the speed values that were obtained by radar and to which the WIM equipment output was compared.

Table 3-1 Post-Validation Results - 260100 – 07-Dec-2005

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	-4.2 ± 8.1%	Pass
Tandem axles	±15 percent	-1.7 ± 8.6%	Pass
Gross vehicle weights	±10 percent	-2.1 ± 6.9%	Pass
Speed	**±1 mph [2 km/hr]**	**0.3 ± 1.5 mph**	**Fail**
Axle spacing	± 0.5 ft [150 mm]	0.0 ± 0.1 ft	Pass

The test runs were conducted primarily during the afternoon and early evening hours, resulting in 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 3 speed groups and 3 temperature groups. The distribution of runs by speed and temperature is illustrated in Figure 3-1. The figure indicates that the desired distribution of speed and temperature combinations was achieved for this set of validation runs.

The speed groups were divided as follows: Low speed – 40 to 50 mph, Medium speed – 51 to 60 mph and High speed - 61+ mph. The three temperature groups were created by splitting the runs between those at 0 to 10 degrees Fahrenheit for Low temperature, 11 to 22 degrees Fahrenheit for Medium temperature and 23 to 30 degrees Fahrenheit for High temperature.

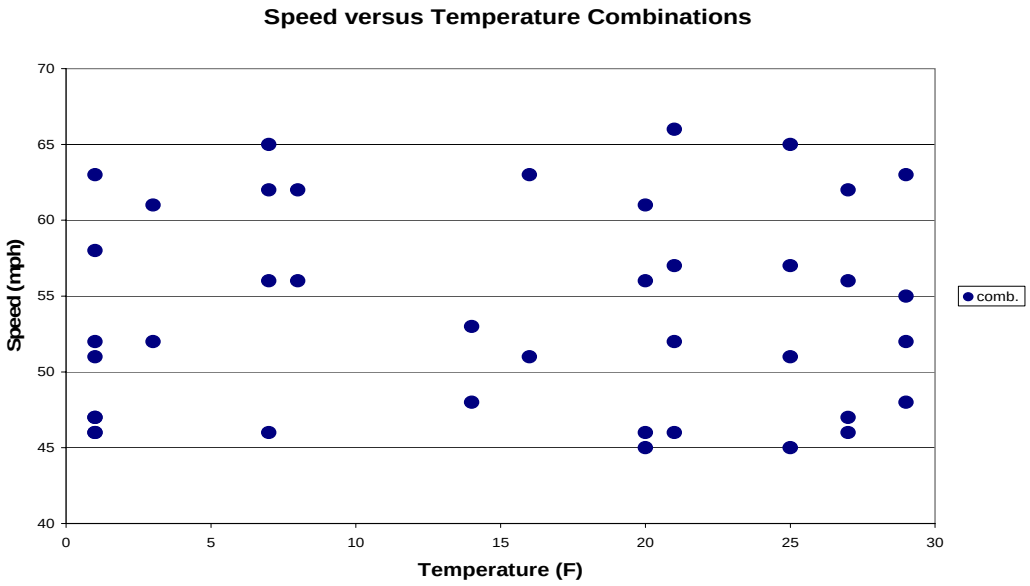

Figure 3-1 Post-Validation Speed-Temperature Distribution – 260100 – 07-Dec-2005

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 Figure 3-2 it can be seen that the GVW error estimate of the WIM equipment progresses toward an underestimation as speeds reach the higher end of the test range. The scatter of the percent error appears to be slightly greater at the lower speeds.

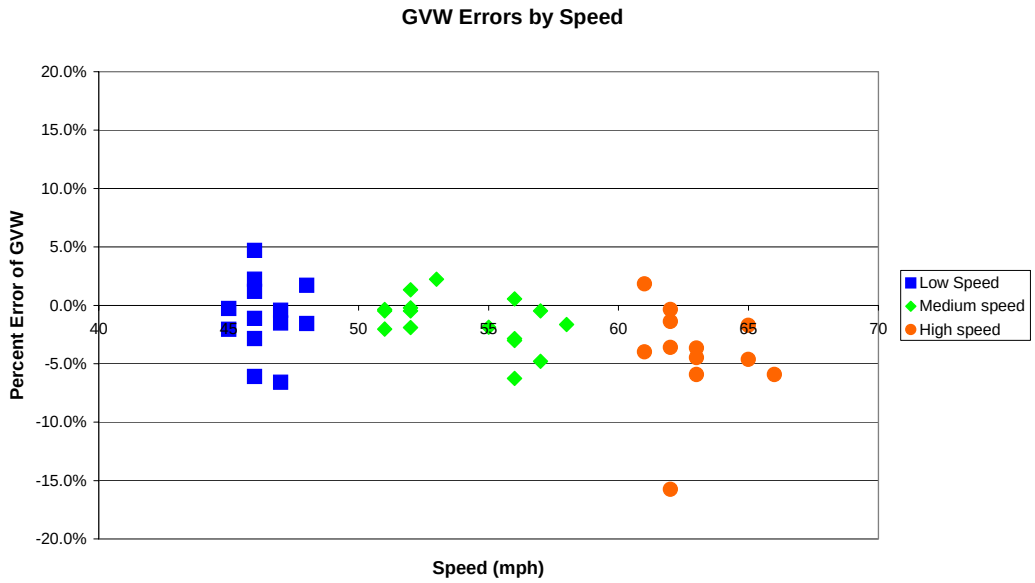

Figure 3-2 Post-validation GVW Percent Error vs. Speed – 260100 – 07-Dec-2005

Figure 3-3 shows the relationship between temperature and GVW percentage error. The graph illustrates that there does not appear to be a significant relationship between GVW error and pavement temperature although there is a minor trend upward.

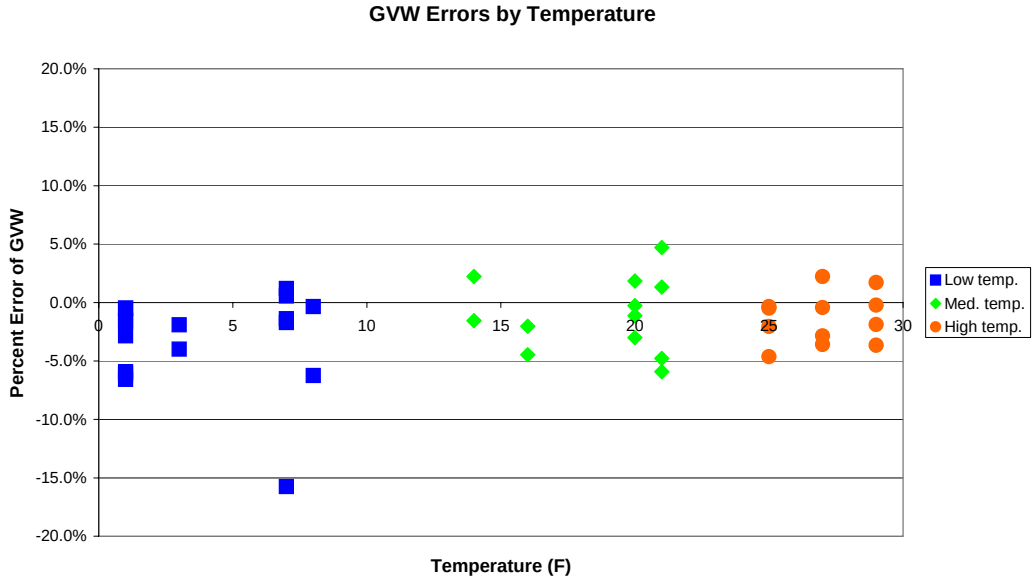

Figure 3-3 Post-Validation GVW Percent Error vs. Temperature– 260100 – 07-Dec-2005

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.

Axle spacing errors appear to be consistent throughout the test truck speed range and are limited to maximums of about 0.1 feet. Vehicles speeds appear to have no effect on the error of measured axle spacing. Based on the consistency of spacing errors, the speed difference between the radar gun used to capture vehicle speeds and the reported WIM speeds, is more likely to be measurement error in the radar gun technique.

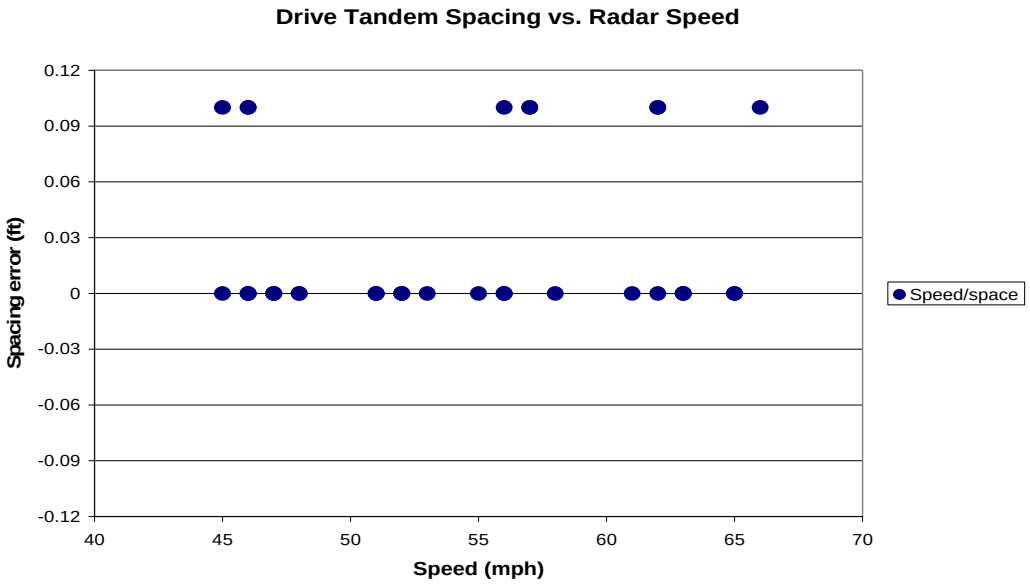

Figure 3-4 Post-Validation Spacing vs. Speed - 260100 – 07-Dec-2005

3.1 Temperature-based Analysis

The three temperature groups were created by splitting the runs between those at 0 to 10 degrees Fahrenheit for low temperature, 11 to 22 degrees Fahrenheit for Medium temperature and 23 to 30 degrees Fahrenheit for High temperature.

Table 3-2 Post-Validation Results by Temperature Bin – 260100 – 07-Dec-2005

Element	95% Limit	Low Temperature 0 - 10 °F	Medium Temperature 11 - 22 °F	High Temperature 23 - 30 °F
Steering axles	± 20 %	-5.3 ± 7.9%	-2.9 ± 8.3%	-4.0 ± 9.8%
Tandem axles	± 15 %	-2.9 ± 9.9%	-0.9 ± 8.4%	-0.9 ± 7.0%
GVW	± 10 %	-3.2± 8.6%	-1.1 ± 7.1%	-1.3 ± 4.7%
Speed	± 1 mph	0.3 ± 1.8 mph	0.4 ± 1.7 mph	0.3 ± 1.4 mph
Axle spacing	± 0.5 ft	-0.1 ± 0.1 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft

From Table 3-2 it appears that changes in temperature do not significantly affect mean errors of weight estimates. The equipment underestimates all weights at all temperatures. The scatter of single axle errors appears to increase as temperature increases, while tandem axle and GVW error scatter appears to be slightly greater at medium temperatures when compared to the low and high temperatures.

Figure 3-5 shows the distribution of GVW errors versus temperature by truck. The GVW results for the fully loaded Golden Truck 2 (triangles) and the partially loaded 3S2 – 62k (diamonds) indicate a lack of a relationship between the GVW mean error and the pavement temperature.

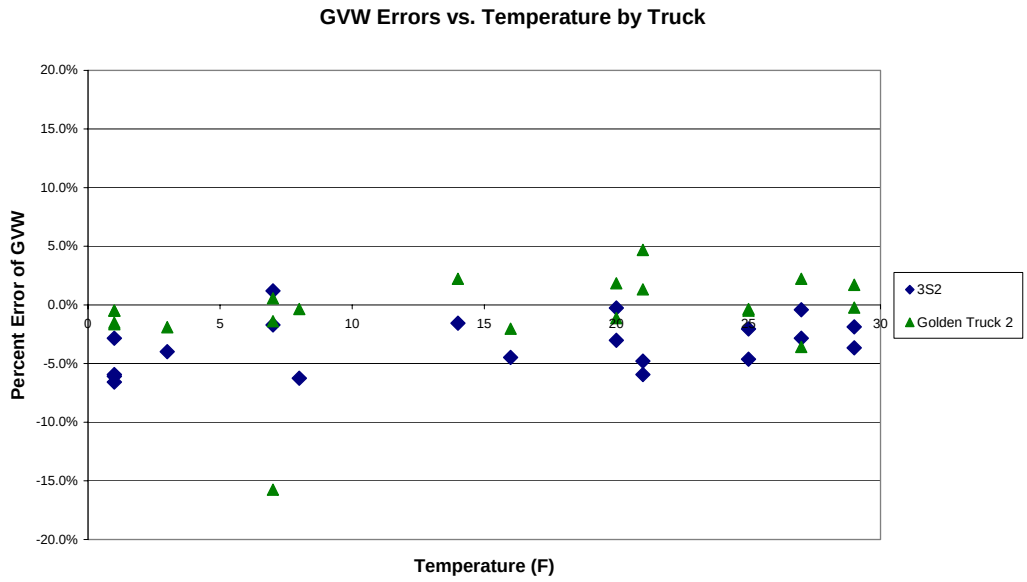

Figure 3-5 Post-Validation GVW Percent Error vs. Temperature by Truck – 260100 – 07-Dec-2005

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 trucks. The figure illustrates a tendency to underestimate weights of steering axle weights by this WIM equipment at all temperatures.

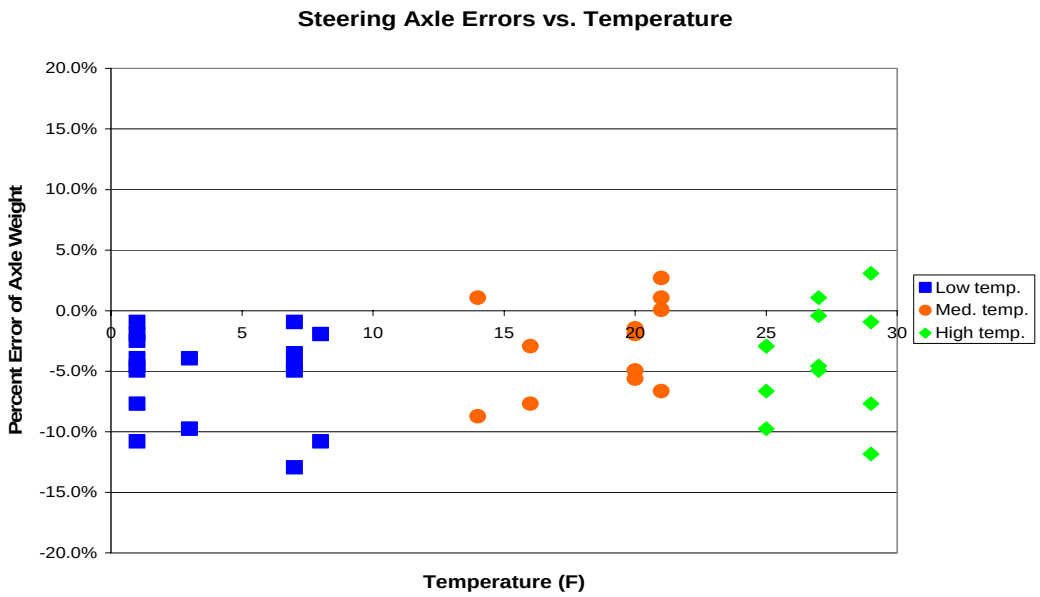

Figure 3-6 Post-Validation Steering Axle Error vs. Temperature by Group - 260100 – 07-Dec-2005

3.2 Speed-based Analysis

The speed groups were divided as follows: Low speed – 40 to 50 mph, Medium speed – 51 to 60 mph and High speed - 61+ mph.

Table 3-3 Post-Validation Results by Speed Bin – 260100 – 07-Dec-2005

Element	95% Limit	Low Speed 40 to 50 mph	Medium Speed 51 to 60 mph	High Speed 61+ mph
Steering axles	± 20 %	-4.2 ± 6.3%	-2.1 ± 7.6%	-7.2 ± 8.4%
Tandem axles	± 15 %	-0.5 ± 8.9%	-1.3 ± 5.7%	-2.5 ± 9.2%
GVW	± 10 %	-1.0 ± 6.8%	-1.4 ± 4.6%	-4.1 ± 9.5%
Speed	± 1 mph	0.2 ± 1.3 mph	0.0 ± 1.3 mph	0.9 ± 1.7 mph
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft	0.0 ± 0.1 ft	-0.1 ± 0.1 ft

From Table 3-3 it appears that the mean error for single axles is greater than the mean error for tandem and GVW weights at all speeds and the scatter for single axle error increases as speed increases. For tandem and GVW weights the mean errors increase as speeds increases and scatter appears to be lesser at medium speeds when compared to low and high speeds.

Figure 3-7 illustrates the tendency of the WIM equipment to report a fairly consistent GVW weights for the fully loaded Golden Truck 2 over the entire speed range, while the equipment appears to increasingly underestimate the GVW weight of the partially loaded 3S2 – 62k truck as the speeds increase.

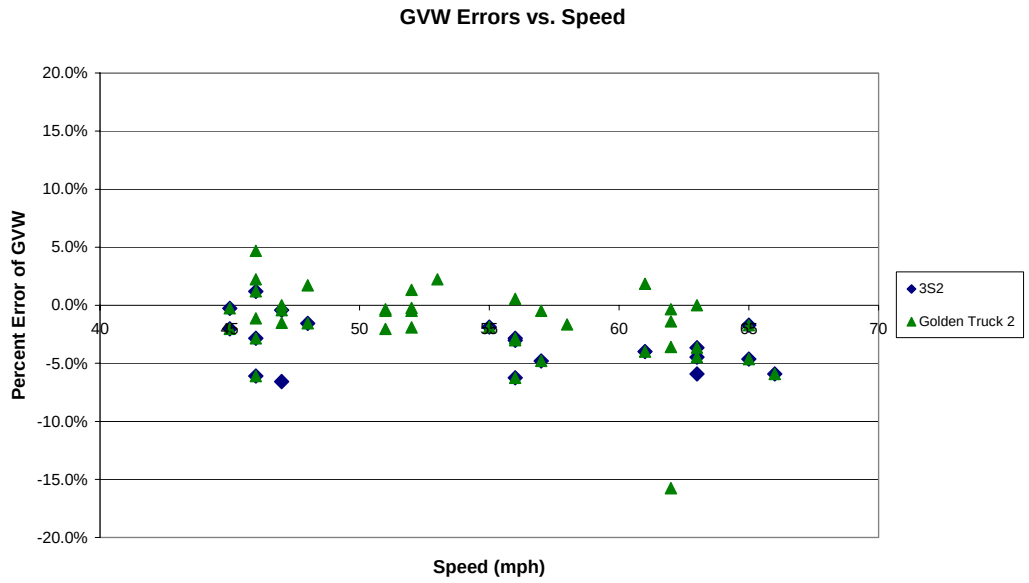

Figure 3-7 Post-Validation GVW Percent Error vs. Speed by Truck – 260100 – 07-Dec-2005

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 calibration. This site does not use auto-calibration. The steering axles in this graph are associated only with Class 9 trucks. Figure 3-8 shows how the WIM equipment generally underestimates the steering axle weights. The underestimate slightly decreases at medium speeds. Variability of the error is generally constant throughout the entire speed range.

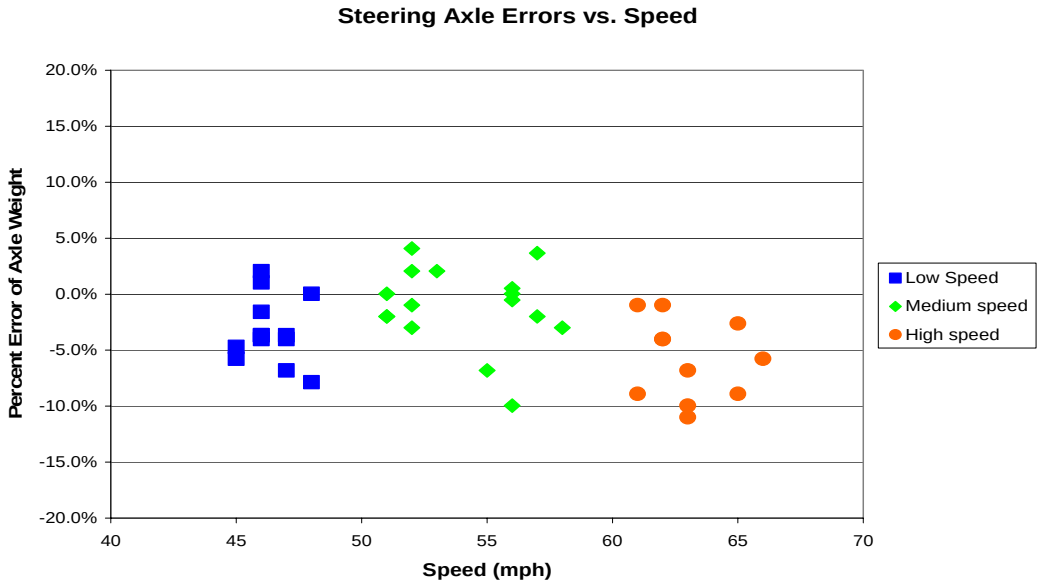

Figure 3-8 Post-Validation Steering Axle Percent Error vs. Speed by Group - 260100 – 07-Dec-2005

3.3 Classification Validation

The agency uses a variant of the FHWA 13-bin classification scheme. Classification 15 has been added to record the number of unclassified vehicles.

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 3.9 percent and is attributed to single class 4 and 7 misclassifications. The percent error for Class 7 is misleading since only 2 were observed in the sample. With the anticipated change to the classification requirements that will not include Class 3 through 5 vehicles, this site meets the less than two percent misclassified criteria.

Table 3-4 Truck Misclassification Percentages for 260100 - 07-Dec-2005

Class	Percent Error	Class	Percent Error	Class	Percent Error
4	100	5	4	6	50
7	50				
8	0	9	0	10	0
11	N/A	12	N/A	13	0

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 260100 - 07-Dec-2005

Class	Mean Difference	Class	Mean Difference	Class	Mean Difference
4	Unknown	5	-4	6	100
7	-50				
8	0	9	0	10	0
11	N/A	12	N/A	13	0

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 more than those that might actually present exist. N/A means no vehicles of the class recorded by either the equipment or the observer.

The –50 for Class 7 vehicles is misleading because there were only 2 Class 7s in the sample.

3.4 Evaluation by ASTM E-1318 Criteria

The ASTM E-1318 standard 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, and our validation did not include verification of that information.

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

Characteristic	Limits for Allowable Error	Percent within Allowable Error	Pass/Fail
Single Axles	± 20%	100%	Pass
Axle Groups	± 15%	98.8%	Pass
GVW	± 10%	97.6%	Pass

4 Pavement Discussion

In determining the site location, the Agency utilized the services of the Regional Support Contractor to perform a pavement smoothness analysis over all four lanes in the area of the present WIIM installation. However, the pavement smoothness was not assessed prior to the validation since profile data that includes the WIM installation has not yet been collected.

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

4.1 Profile analysis

Upon receipt of post-WIM installation profiling data, it will be processed and an amended report submitted.

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

5 Equipment Discussion

The traffic monitoring equipment at this location includes quartz piezo WIM sensors and an IRD/PAT Traffic DAW-190 WIM controller. The sensors are installed ten feet apart in a staggered configuration in a portland concrete cement pavement.

5.1 Pre-Evaluation Diagnostics

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

5.2 Calibration Process

The equipment required 2 iterations of the calibration process between the initial 40 runs and the final 40 runs.

5.2.1 Calibration Iteration 1

As a result of the initial 40 pre-validation runs, it was determined that the equipment was generally overestimating by 19.7%. After discussion with the Agency representative, the overall sensitivity correction factor was lowered by the Agency by 22.0% from 1000 to 780. The results of the ten calibration verification test runs are illustrated in Table 5-1.

Table 5-1 Calibration Iteration 1 Results - 260100 – 07-Dec-2005 (beginning at 1:14 PM)

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	± 20 percent	-7.5 ± 6.0%	Pass
Tandem axles	± 15 percent	-5.0 ± 9.1%	Pass
Gross vehicle weights	**± 10 percent**	**-5.3 ± 6.3%**	**Fail**
Vehicle speed	**±1 mph [2 km/hr]**	**0.4 ± 1.9 mph**	**Fail**
Axle spacing length	± 0.5 ft [150 mm]	-0.1 ± 0.1 ft	Pass

As illustrated in Figure 5-1, as a result of the calibration, the equipment underestimated all weights by approximately 5 percent and the GVW weights were outside of acceptable tolerance. Based on this, it was determined that a second iteration of the calibration must be performed.

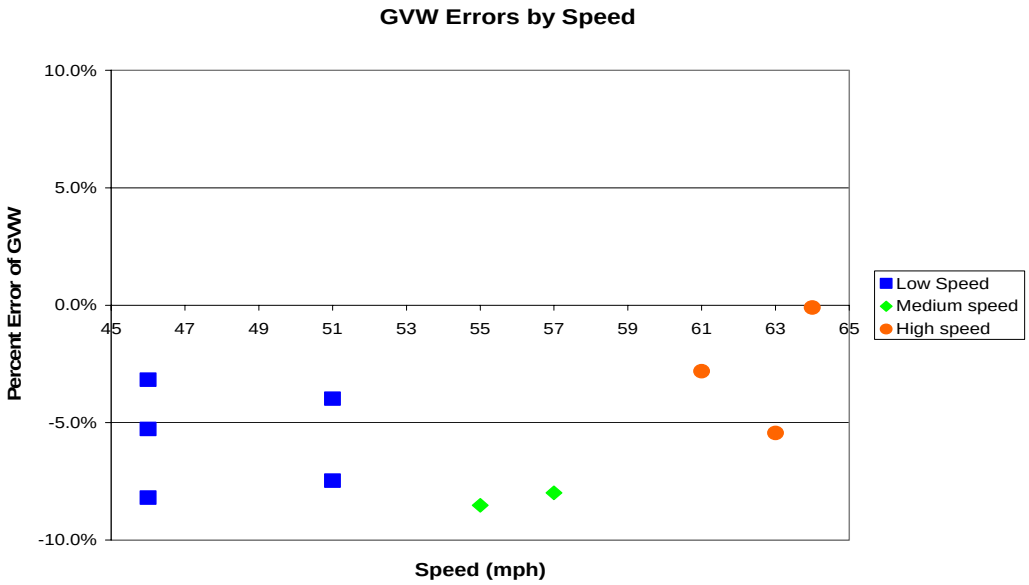

Figure 5-1 Calibration Iteration 1 GVW Percent Error vs. Speed Group - 260100 –06-Dec-2005 (beginning at 1:14 PM)

5.2.2 Calibration Iteration 2

As a result of the first calibration iteration, it was determined that the equipment was generally underestimating all weights by 5.0%. After discussion with the Agency representative, the overall sensitivity correction factor was increased by the Agency by 5.0%, from 780 to 820. The results of the second set of ten calibration verification test runs are illustrated in Table 5-2.

Table 5-2 Calibration Iteration 2 Results - 260100 – 07-Dec-2005 (beginning at 2:07 PM)

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	± 20 percent	-3.0 ± 11.0%	Pass
Tandem axles	± 15 percent	-0.6 ± 6.6%	Pass
Gross vehicle weights	± 10 percent	-1.0 ± 5.3%	Pass
Vehicle speed	**±1 mph [2 km/hr]**	**0.3 ± 1.5 mph**	**Fail**
Axle spacing length	± 0.5 ft [150 mm]	0.0 ± 0.1 ft	Pass

As illustrated in Figure 5-2, as a result of the second iteration of the calibration process, this site meets all LTPP precision requirements except speed and no further calibrations of the equipment were deemed necessary. Thirty additional test runs to complete post-validation were then conducted.

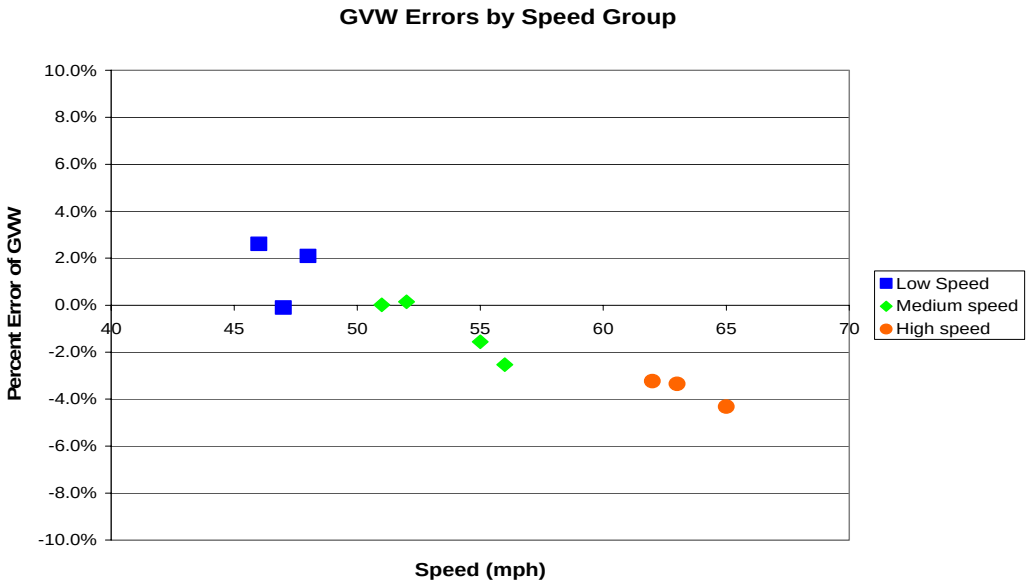

Figure 5-2 Calibration Iteration 2 GVW Percent Error vs. Speed Group - 260100 –06-Dec-2005 (beginning at 2:07 PM)

5.3 Summary of Traffic Sheet 16s

The equipment at this site was installed in the June 2005. Therefore, Table 5-3 has only validation information found in the Sheet 16s submitted for the current visit.

Table 5-3 Classification Validation History - 260100 –06-Dec-2005

Date	Method	Mean Difference				Percent Unclassified
		Class 9	Class 8	Other 1	Other 2	
12/06/2005	Test Trucks	0.0	0.0			0.0
12/07/2005	Test Trucks	0.0	0.0			0.0

Table 5-4 has the information found in the Sheet 16s submitted for this validation visit.

Table 5-4 Weight Validation History - 260100 – 06-Dec-2005

Date	Method	Mean Error and (SD)		
		GVW	Single Axles	Tandem Axles
12/06/2005	Test Trucks	19.8 (7.6)	19.6 (3.6)	19.7 (9.7)
12/07/2005	Test Trucks	-2.1 (3.4)	-4.2 (4.0)	-1.7 (4.3)

5.4 Projected Maintenance/Replacement Requirements

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

6 Pre-Validation Analysis

This pre-validation analysis is based on test runs conducted December 6, 2005 during the morning and afternoon hours at test site 260100 on US Route 127. This SPS-1 site is at 2.56 miles north of M-21 on the southbound, right hand lane of a divided four-lane facility. No auto-calibration was used during test runs. The two trucks used for initial calibration and for the subsequent testing included:

1. 3S2 with a tractor having an air suspension and trailer with standard rear tandem and air suspension loaded to 74,280 lbs. (Golden Truck 1)
2. 3S2 with a tractor having air suspension and trailer with standard rear tandem and air suspension loaded to 62,390 lbs. (3S2 – 62k)

For the initial validation each truck made a total of 20 passes over the WIM scale at speeds ranging from approximately 41 to 63 miles per hour. Pavement surface temperatures were recorded during the test runs ranging from about 17 to 25 degrees Fahrenheit. The computed values of 95% confidence limits of each statistic for the total population are within Table 6-1.

As shown in Table 6-1, this site did not meet any of the precision requirements for research quality data except spacing during the initial validation runs.

Table 6-1 Pre-Validation Results - 260100 – 06-Dec-2005

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	**± 20 percent**	**19.6 ± 7.3%**	**Fail**
Tandem axles	**±15 percent**	**19.7 ± 19.3%**	**Fail**
Gross vehicle weights	**±10 percent**	**19.8 ± 15.3%**	**Fail**
Vehicle speed	**±1 mph [2 km/hr]**	**0.8 ± 1.4 mph**	**Fail**
Axle spacing length	± 0.5 ft [150 mm]	0.2 ± 0.1 ft	Pass

The test runs were conducted primarily during the morning and afternoon hours. A very narrow range of pavement temperatures was obtained due in part to the time of year and lack of solar radiation to heat the pavement. 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 3 speed groups and 1 temperature group. 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. This is due to a very small change in ambient temperatures over the course of the day.

The speed groups were divided as follows: Low speed – 40 to 48 mph, Medium speed – 49 to 57 mph and High speed - 58+ mph. All runs were grouped together in one medium temperature range, from 14 to 25 degrees Fahrenheit.

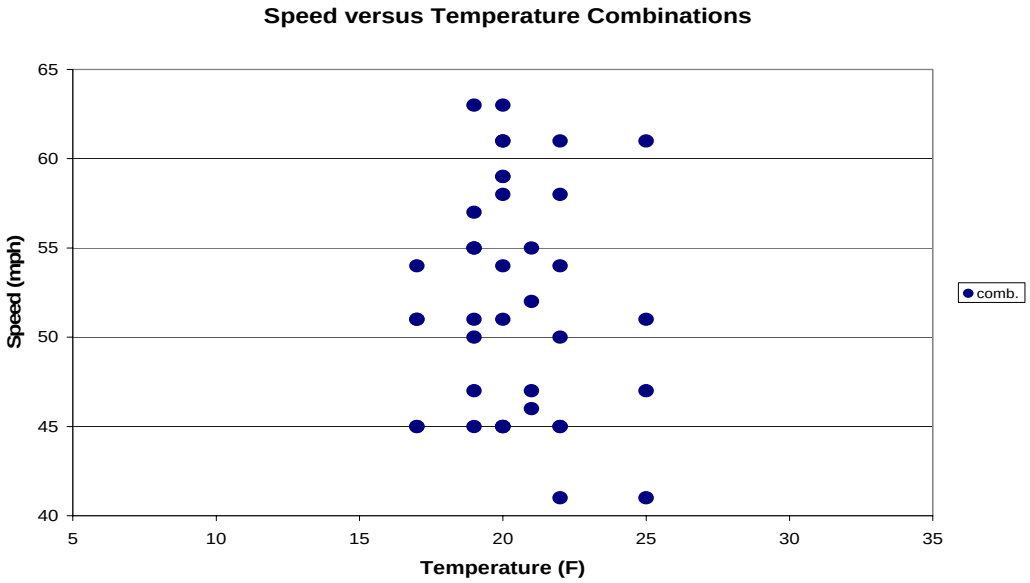

Figure 6-1 Pre-Validation Speed-Temperature Distribution – 260100 – 06-Dec-2005

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 WIM equipment overestimates the GVW at all speeds. Variability in GVW error is reasonably constant throughout the entire speed range.

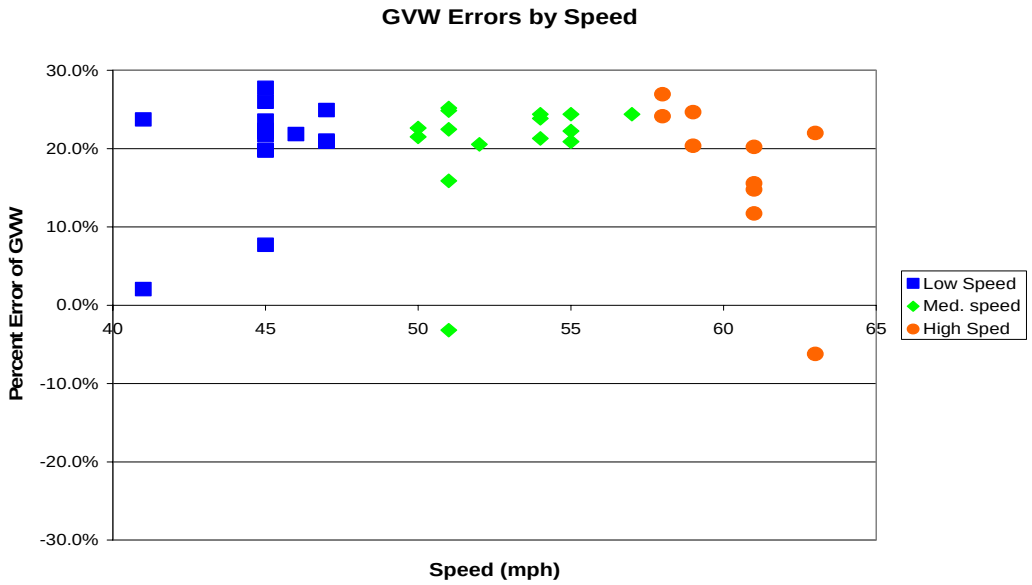

Figure 6-2 Pre-validation GVW Percent Error vs. Speed – 260100 – 06-Dec-2005

Figure 6-3 shows the relationship between temperature and GVW percentage error. Due to the limited temperature range, no assessment of the impact of temperature on scale performance can be made.

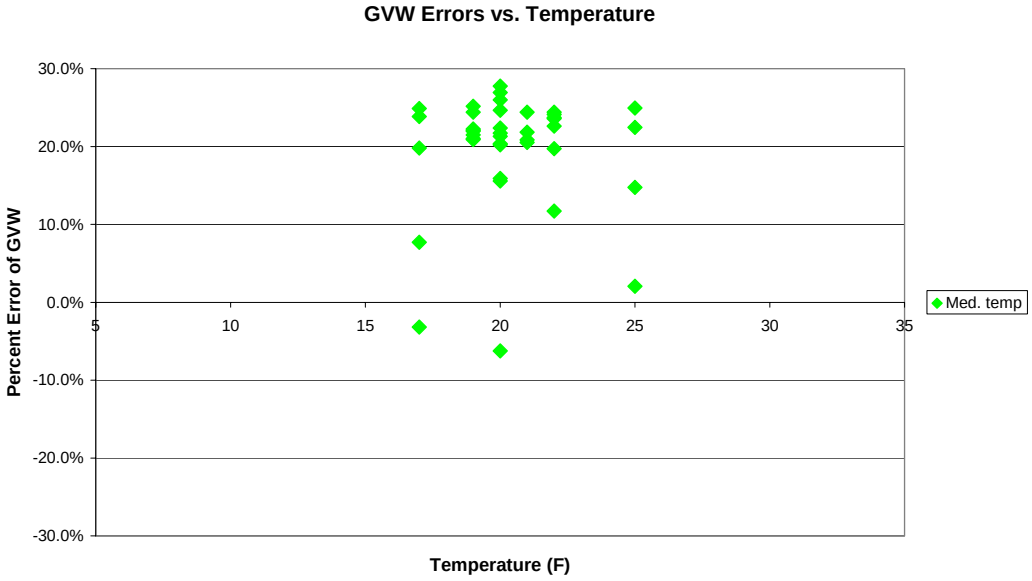

Figure 6-3 Pre-Validation GVW Percent Error vs. Temperature – 260100 – 06-Dec-2005

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. This figure indicates that there is no effect from speed on the ability of the WIM equipment to measure axle spacing.

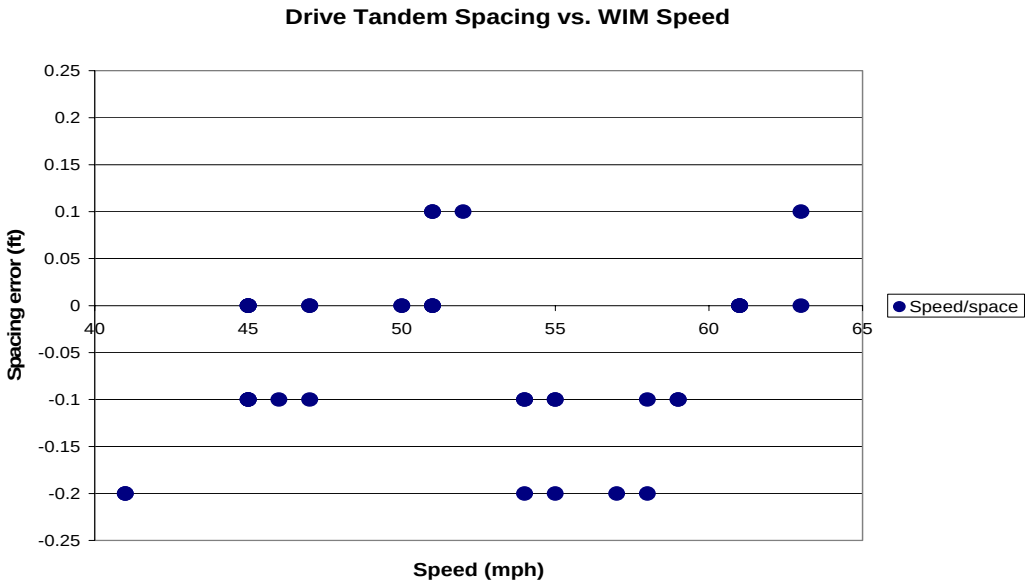

Figure 6-4 Pre-Validation Spacing vs. Speed - 260100 – 06-Dec-2005

6.1 Temperature-based Analysis

Due to the very narrow range of temperatures, all test runs were grouped together in one temperature range for this analysis, from 17 to 25 degrees Fahrenheit.

Table 6-2 Pre-Validation Results by Temperature Bin - 260100 –06-Dec-2005

Element	95% Limit	Low Temperature N/A	Medium Temperature 17 to 25 °F	High Temperature N/A
Steering axles	± 20 %		19.6 ± 7.3%	
Tandem axles	± 15 %		19.7 ± 19.3%	
GVW	± 10 %		19.8 ± 15.3%	
Speed	± 1 mph		0.8 ± 1.4 mph	
Axle spacing	± 0.5 ft		-0.2 ± 0.1 ft	

As shown in Table 6-2, the equipment overestimates all weights by approximately 20 percent. Variability for mean error is greater for tandem and GVW weights when compared with steering axle weights.

Figure 6-3 shows the distribution of GVW errors versus temperature by truck. The WIM equipment appears to generally overestimate the GVW for both trucks over the course of the entire temperature range. The scatter of the errors for the partially loaded 3S2 – 62k

truck (diamonds) appears to be much greater than that of the fully loaded Golden Truck 1 (squares).

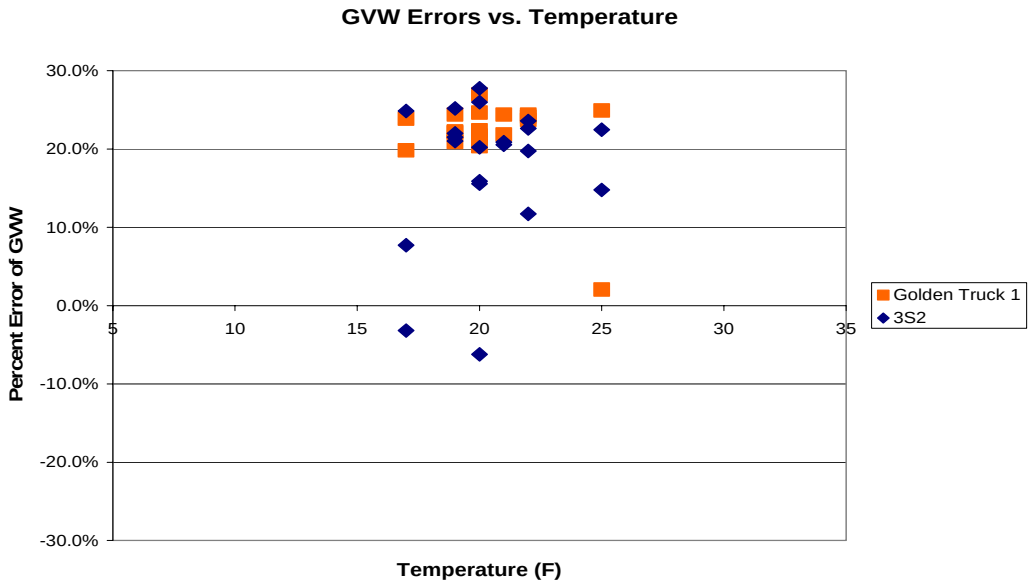

Figure 6-5 Pre-Validation GVW Percent Error vs. Temperature by Truck – 260100 – 06-Dec-2005

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 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 consistently overestimates steering axle weights.

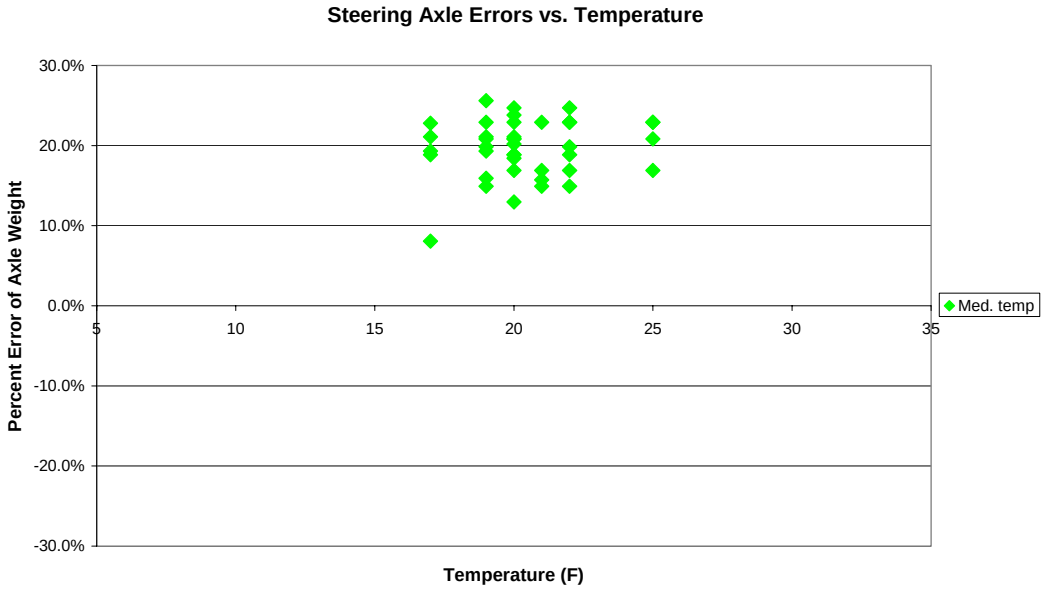

Figure 6-6 Pre-Validation Steering Axle Error vs. Temperature by Group - 260100 – 06-Dec-2005

6.2 Speed-based Analysis

The speed groups were divided as follows: Low speed – 40 to 48 mph, Medium speed – 49 to 57 mph and High speed - 58+ mph.

Table 6-3 Pre-Validation Results by Speed Bin - 260100 – 06-Dec-2005

Element	95% Limit	Low Speed 40-48 mph	Medium Speed 49-57 mph	High Speed 58+ mph
Steering axles	± 20 %	19.6 ± 6.2%	19.9 ± 9.5%	19.4 ± 8.1%
Tandem axles	± 15 %	20.3 ± 19.7%	20.8 ± 17.0%	17.2 ± 24.1%
GVW	± 10 %	20.3 ± 14.5%	20.8± 15.1%	17.4 ± 21.7%
Speed	± 1 mph	1.1 ± 1.6 mph	0.7 ± 1.3 mph	0.6 ± 1.6 mph
Axle spacing	± 0.5 ft	0.2 ± 0.1 ft	0.2 ± 0.1 ft	0.2 ± 0.1 ft

It appears from Table 6-3 that for the truck population as a whole mean error appears to be fairly consistent for all weights at all speeds. The variability for GVW error appears to increase as the speed of the trucks increase. Variability for tandem axles is greater at the high speeds while variability for single axle errors is highest at medium speeds.

Figure 6-7 shows the tendency of the equipment to overestimate GVW at all speeds, although the overestimation appears to be lower for the partially loaded 3S2 – 62k truck (diamonds) at higher speeds. The combined variability for the test trucks is fairly consistent at all speeds.

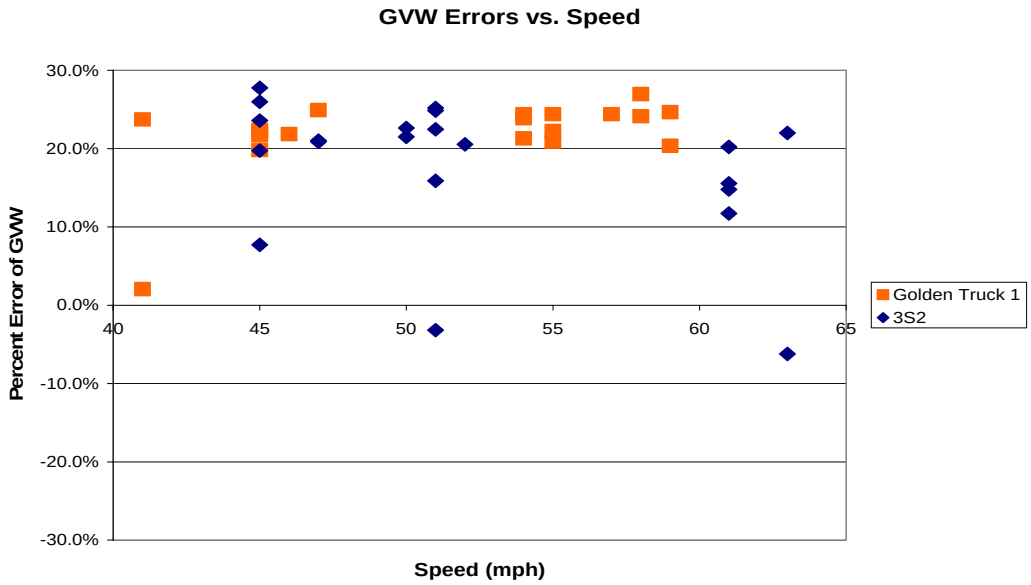

Figure 6-7 Pre-Validation GVW Percent Error vs. Speed Group - 260100 – 06-Dec-2005

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 can be seen that the mean error for steering axles and the distribution of error is generally similar at all speeds.

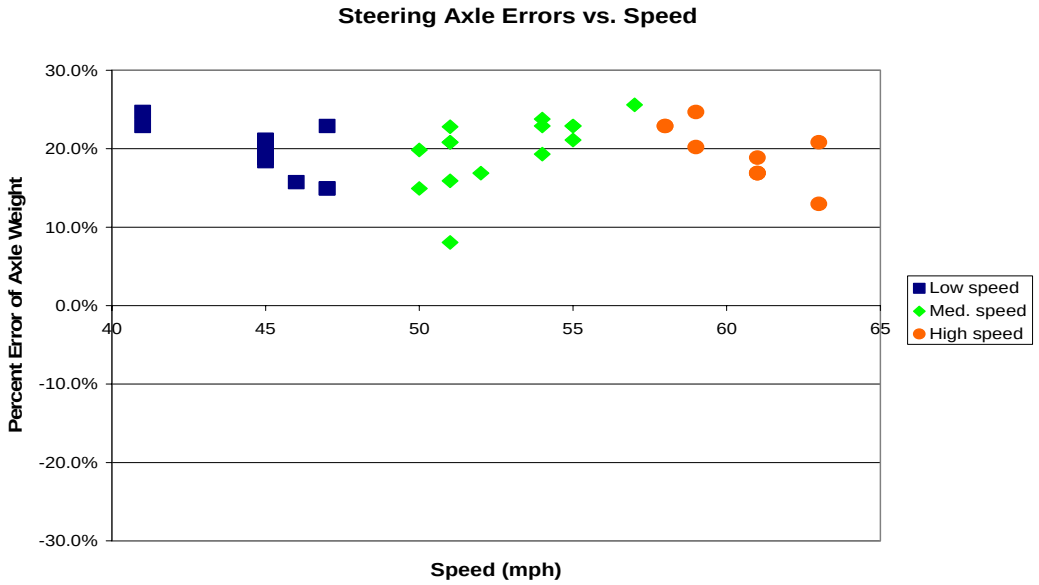

Figure 6-8 Pre-Validation Steering Axle Percent Error vs. Speed Group - 260100 – 06-Dec-2005

6.3 Classification Validation

The agency uses a modified FHWA 13-bin classification scheme. Classification 15 has been added to record the number of unclassified vehicles.

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 6-4 has the classification error rates by class. The overall misclassification rate is 2.0 percent and is the result of a single Class 9 and two Class 10 misclassifications.

Table 6-4 Truck Misclassification Percentages for 260100 - 06-Dec-2005

Class	Percent Error	Class	Percent Error	Class	Percent Error
4	N/A	5	0	6	0
7	N/A				
8	0	9	2	10	8
11	N/A	12	N/A	13	0

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 260100 - 06-Dec-2005

Class	Mean Difference	Class	Mean Difference	Class	Mean Difference
4	N/A	5	0	6	0
7	N/A				
8	0	9	2	10	-8
11	N/A	12	N/A	13	0

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 more than those that might actually present

exist. N/A means no vehicles of the class recorded by either the equipment or the observer.

6.4 Evaluation by ASTM E-1318 Criteria

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

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

Characteristic	Limits for Allowable Error	Percent within Allowable Error	Pass/Fail
Single Axles	± 20%	50.0%	**Fail**
Axle Groups	± 15%	13.8%	**Fail**
GVW	± 10%	10.0%	**Fail**

7 Data Availability and Quality

As of December 16, 2005 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 between 1996 and 2004 all years but 1996, 1998 and 1999 for classification and 1996,1999 and 2002 for a sufficient quantity to be considered complete years of data. **In the absence of previously gathered validation information it can be seen that at least five 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 260100 –06-Dec-2005

Year	Classification Days	Months	Coverage	Weight Days	Months	Coverage
1996	176	7	Full week	191	7	Full week
1997	339	12	Full week	322	11	Full week
1998	1	1	Weekday(s)	356	12	Full week

Year	Classification Days	Months	Coverage	Weight Days	Months	Coverage
1999	127	6	Full week	136	6	Full week
2000	290	11	Full week	301	12	Full week
2001	359	12	Full week	365	12	Full week
2002	348	12	Full week	N/A		
2003	300	10	Full week	298	10	Full week
2004	280	11	Full week	323	11	Full week

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

Class 9s and Class 5s 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 RSC 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 GVW Characteristics of Major sub-groups of Trucks - 260100 – 06-Dec-2005

Characteristic	Class 9	Class 5
Percentage Overweights	0.4%	0.9%
Percentage Underweights	0.0%	1.8%
Unloaded Peak	36,000	
Loaded Peak	76,000 to 84,000	
Peak		12,000

The expected percentage of unclassified vehicles is 4.2%. This is based on the percentage of unclassified vehicles in the post-validation data download. The Class 15 trucks at this site are largely Class 10 vehicles with non-standard axle spacings.

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.

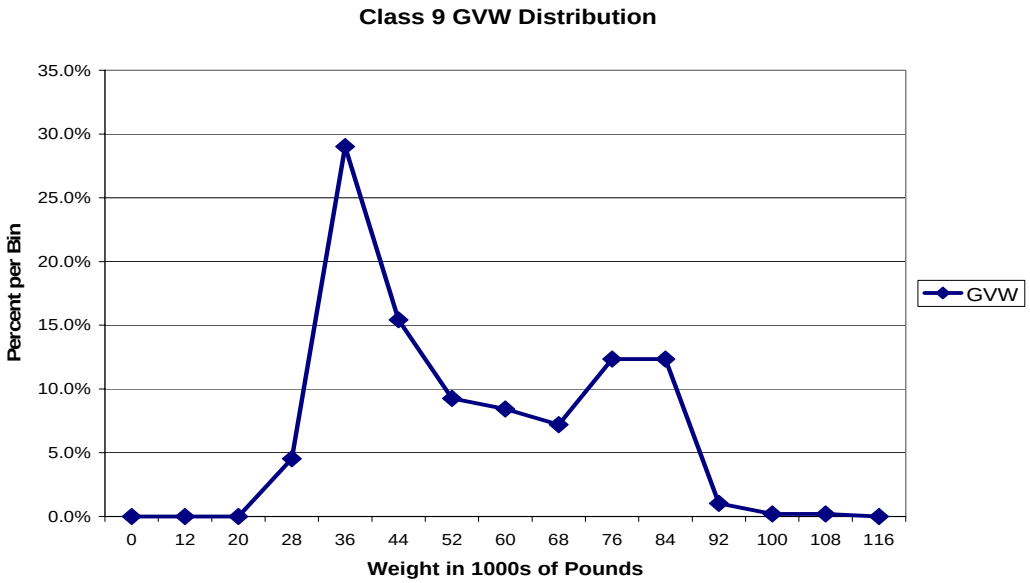

Figure 7-1 Expected GVW Distribution Class 9 – 260100 – 06-Dec-2005

Figure 7-2 Expected GVW Distribution Class 5 – 260100 – 06-Dec-2005

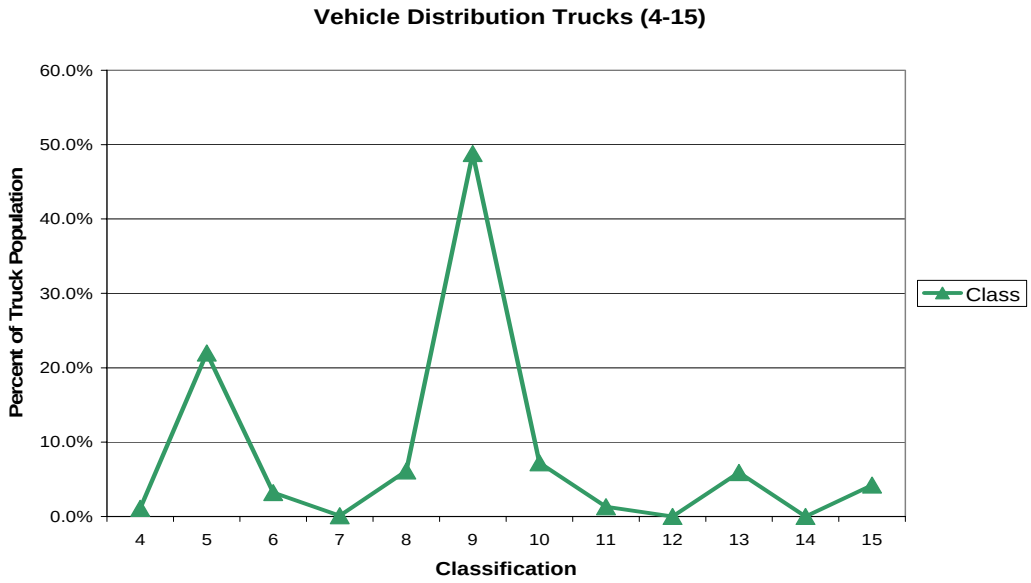

Figure 7-3 Expected Vehicle Distribution - 260100 – 06-Dec-2005

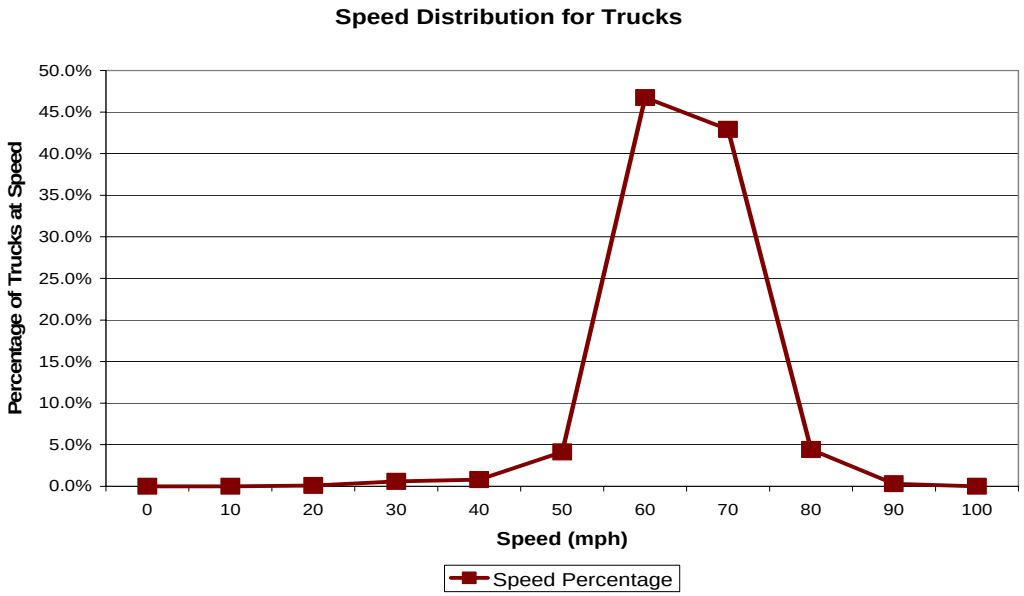

Figure 7-4 Expected Speed Distribution - 260100 – 06-Dec-2005

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 loaded air suspension (4 pages)
Sheet 19 – Truck 3 – 3S2 loaded air suspension (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 – Calibration Iteration 1 – (1 page)
Sheet 21 – Calibration Iteration 2 – (1 page)
Sheet 21 – Post-validation (3 pages)

Calibration Worksheets – (1 page)

Test Truck Photographs – (9 pages)

Michigan Modified FHWA 13 bin Classification Scheme (1 page)

9 Updated Handout Guide and Sheet 17

A copy of the handout has been included following page 27. 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: Michigan

SHRP ID: 0100

Figures

1. General Information

SITE ID: *260100*

LOCATION: *US Route 127 South, approximately 2.36 miles north of M-21.*

VISIT DATE: *December 6th through December 7th, 2005*

VISIT TYPE: *Validation*

2. Contact Information

POINTS OF CONTACT:

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

Joey Comer, 301-210-5105, wjcomer@mactec.com

Highway Agency: *Tom Hynes, 517-322-5711, hynest@mdot.state.mi.us*

James Kramer, 517-322-1716, kramerj2@michigan.gov

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

FHWA Division Office Liaison: *Ryan Rizzo, 517-702-1842, ryan.rizzo@fhwa.dot.gov*

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

3. Agenda

BRIEFING DATE: *No briefing requested for this visit*

ON SITE PERIOD: *December 6th through December 7th, 2005, beginning at 9:00am*

TRUCK ROUTE CHECK: *Completed. See Figure 5-2.*

4. Site Location/ Directions

NEAREST AIRPORT: *Capital City Airport, Lansing, MI*

DIRECTIONS TO THE SITE: *Located on* US Route *127, approximately 2.36 miles north of M-21.*

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

WIM SITE LOCATION: *US 127 South (Latitude: 43.0239^0 and Longitude: -84.5435^0)*

WIM SITE LOCATION MAP:

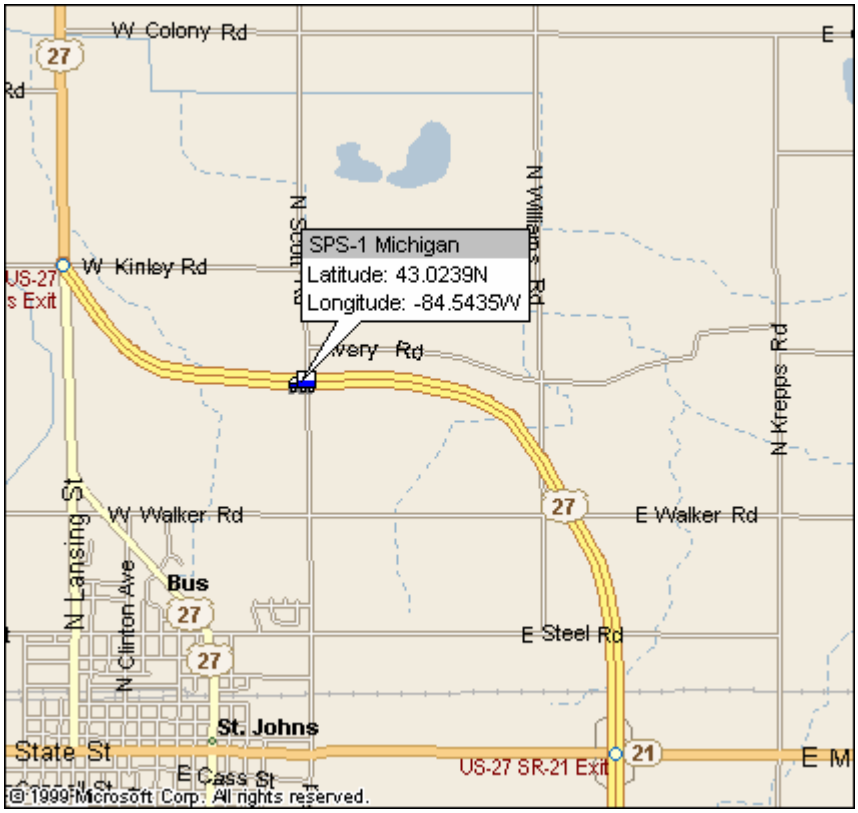

Figure 4-1 - Site Location for SPS-1 in Michigan

5. Truck Route Information

ROUTE RESTRICTIONS: *None.*

SCALE LOCATION: *See Figure 5-1.*

Windmill Truck Stop, I-96 Exit 98A & I-69 Exit 70, Dimondale, MI, Phone – (517)646-071, Open 24hrs, $8.00 per weigh.

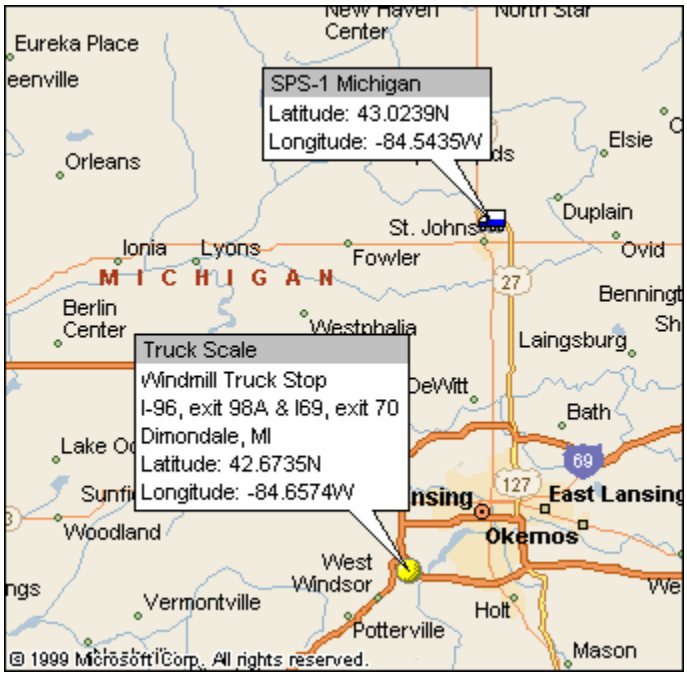

Figure 5-1 - Truck Scale Location for Michigan SPS-1

TRUCK ROUTE: *See Figure 5-2.*

Northbound to US-27 Business Exit (W. Kinsley Drive) – 1.0 miles.

Southbound to M-21 Exit – 2.36 miles.

Total distance = 6.72 miles
Total time = 10 minutes

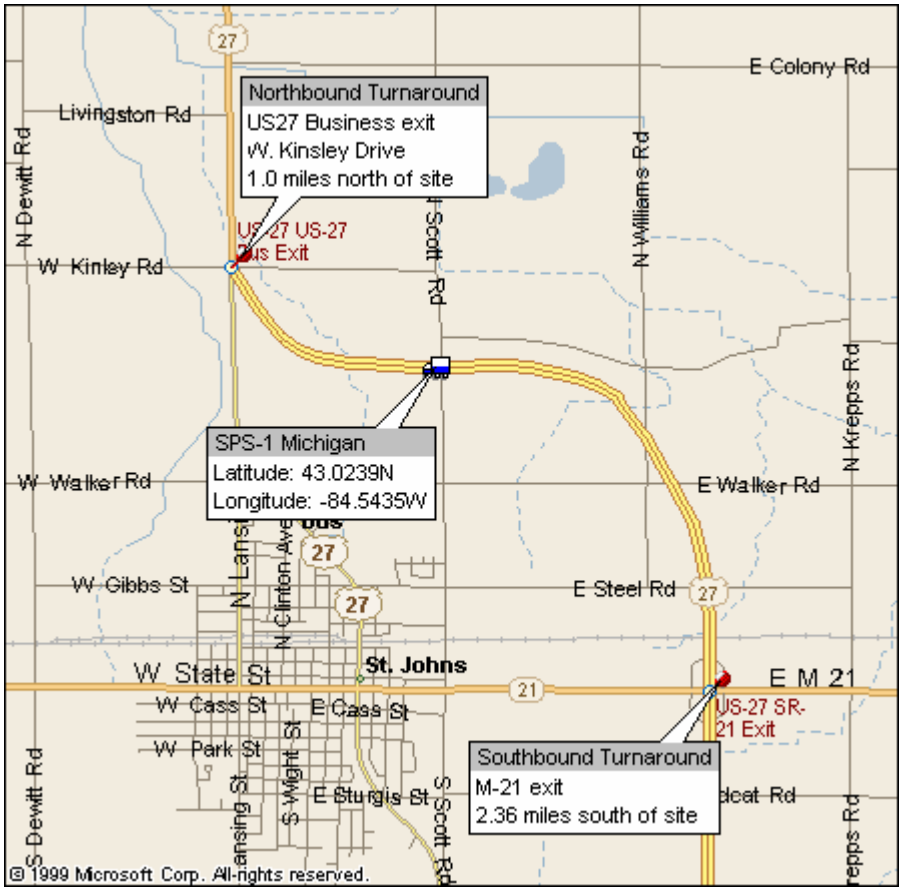

Figure 5-2 - Truck Route for SPS-1 in Michigan

6. Sheet 17 – Michigan (260100)

1.* ROUTE ___US 127_____MILEPOST _____LTPP DIRECTION - N S E W

2.* WIM SITE DESCRIPTION - Grade __<1____ % Sag vertical Y / N
Nearest SPS section upstream of the site __unknown (signs/markings not visible)
Distance from sensor to nearest upstream SPS Section __3.05 miles___

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_1___ ft

4.* PAVEMENT TYPE ____Portland Concrete Cement___

5.* PAVEMENT SURFACE CONDITION – Distress Survey
Date _____Distress Photo Filename _____
Date _____Distress Photo Filename _____
Date _____Distress Photo Filename _____

6. * SENSOR SEQUENCE
_____quartz piezo – loop – quartz piezo_____

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 ___ ___ . ___ 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 _5_1__ ft

Distance from system __4_7_ __ ft

TYPE _____M_____

CABINET ACCESS controlled by LTPP / STATE / JOINT ?

Contact - name and phone number ____Jim Kramer 517-322-1736___

Alternate - name and phone number ____Bob Brenner 517-322-1673____

11. * POWER

Distance to cabinet from drop ___1_6_5 ___ ft Overhead / underground / solar / AC in cabinet?

Service provider _____ Phone number _____

12. * TELEPHONE

Distance to cabinet from drop ___1_6_5___ ft Overhead / under ground / cell?

Service provider __Verizon_____ Phone Number _____

13.* SYSTEM (software & version no.)- ____DAW-190_____

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

14. * TEST TRUCK TURNAROUND time ___1_0_ minutes DISTANCE __6.7__ mi

15. PHOTOS FILENAME

Power source Power_Service_Box_TO_12_26_2.56_0100_12_06_05.jpg

Phone source Phone_Service_Box_TO_12_26_2.56_0100_12_06_05.jpg

Cabinet exterior Cabinet_Exterior_TO_12_26_2.56_0100_12_06_05.jpg

Cabinet interior Cabinet_Interior_TO_12_26_2.56_0100_12_06_05.jpg

Weight sensors Leading_WIM_Sensor_TO_12_26_2.56_0100_12_06_05.jpg
Trailing_WIM_Sensor_TO_12_26_2.56_0100_12_06_05.jpg

Classification sensors _____

Other sensors ___loop sensor_____

Description __Loop_Sensor_TO_12_26_2.56_0100_12_06_05.jpg _____

Downstream direction at sensors on LTPP lane _
Downstream_TO_12_26_2.56_0100_12_06_05.jpg _____

Upstream direction at sensors on LTPP lane __
Upstream_TO_12_26_2.56_0100_12_06_05.jpg _____

COMMENTS __ _____
_____GPS Coordinates: Latitude: 43.029^0 and Longitude: -84.5435^0 _____
_____
_____Amenities in St. John's – gas, food, Wal-Mart – located south 2 miles off of M-21 exit, right approximately 2 miles. _____
_____
_____Hotels in Dewitt, approximately 17 miles from site. _____
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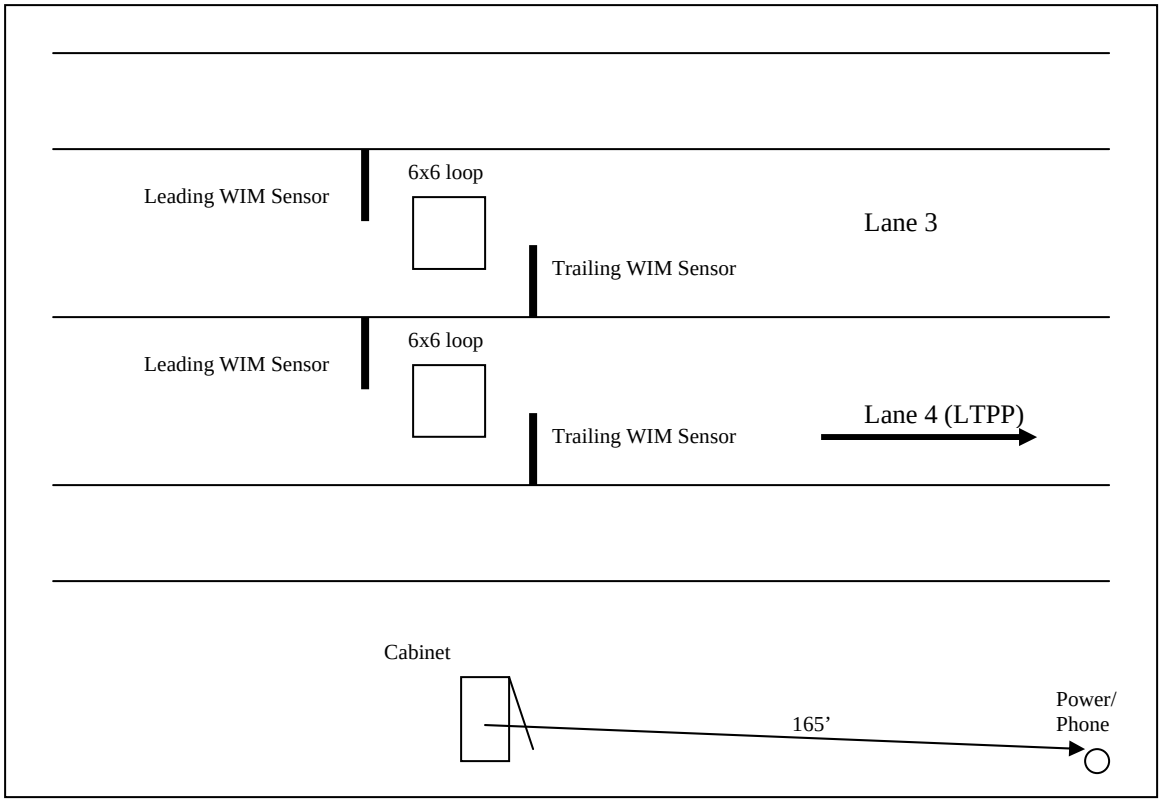
COMPLETED BY __Dean J. Wolf_____

PHONE _301-210-5105_____ DATE COMPLETED _1_2__ /_0_8_ / _2_0_0_5_

Sketch of equipment layout



Site Map

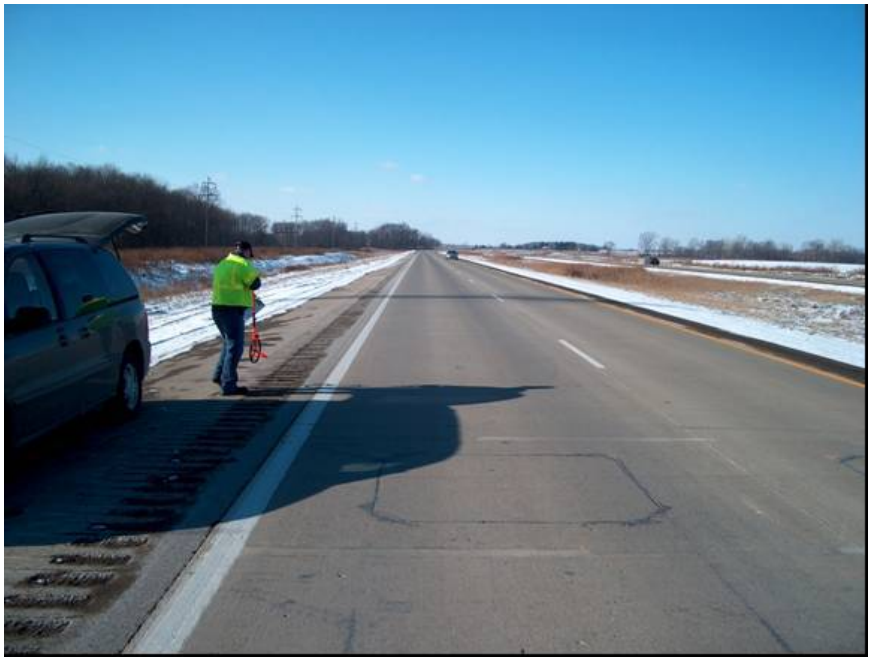


Photo 1 – Upstream_TO_12_26_2.56_0100_12_06_05.jpg

Photo 2 – Downstream_TO_12_26_2.56_0100_12_06_05.jpg

Photo 3 – WIM_Site_TO_12_26_2.56_0100_12_06_05.jpg

Photo 4 – Cabinet_Exterior_TO_12_26_2.56_0100_12_06_05.jpg

Photo 5 – Cabinet_Interior_TO_12_26_2.56_0100_12_06_05.jpg

Photo 6 – Leading_WIM_Sensor_TO_12_26_2.56_0100_12_06_05.jpg

Photo 7 – Loop_Sensor_TO_12_26_2.56_0100_12_06_05.jpg

Photo 8 – Trailing_WIM_Sensor_TO_12_26_2.56_0100_12_06_05.jpg

Photo 9 – Power_Service_Box_TO_12_26_2.56_0100_12_06_05.jpg

Photo 10 – Phone_Service_Box_TO_12_26_2.56_0100_12_06_05.jpg

SHEET 18	STATE CODE [_2_6_]
LTPP MONITORED TRAFFIC DATA	SPS PROJECT ID [_0_1_0_0]
WIM SITE COORDINATION	DATE: (mm/dd/yyyy) _1_2_ / _0_6__ / _2_0_0_5__

Rev. 05/25/04

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

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

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

2. EQUIPMENT –
   a. Purchase –
      X State
      ☐ LTPP

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

   c. Maintenance –
      ☐ Contract with purchase – Expiration Date _____
      ☐ Separate contract LTPP – Expiration Date _____
      ☐ Separate contract State – Expiration Date _____
      X State personnel

   d. Calibration –
      ☐ Vendor
      ☐ State
      X LTPP

   e. Manuals and software control –
      X State
      ☐ LTPP

   f. Power –
      i. Type –
         ☐ Overhead
         X Underground
         ☐ Solar

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

g. Communication –

i. Type –

X Landline
☐ Cellular
☐ Other

ii. Payment –

X State
☐ LTPP
☐ N/A

3. PAVEMENT –

a. Type –

X Portland Concrete Cement
☐ Asphalt Concrete

b. Allowable rehabilitation activities –

☐ Always new
☐ Replacement as needed
☐ Grinding and maintenance as needed
X Maintenance only
☐ No remediation

c. Profiling Site Markings –

☐ Permanent
X Temporary

4. ON SITE ACTIVITIES –

a. WIM Validation Check - advance notice required __2____ ☐ days X weeks

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

i. On site lead –

X State
☐ LTPP

ii. Accept grinding –

X State
☐ LTPP

c. Authorization to calibrate site –

☐ State only
X LTPP

d. Calibration Routine –

X LTPP – X Semi-annually ☐ Annually
☐ State per LTPP protocol – ☐ Semi-annually ☐ Annually
☐ State other – _____

e. Test Vehicles

i. Trucks –

1st – Air suspension 3S2	☐ State	X LTPP
2nd – __3S2_____	☐ State	X LTPP
3rd – _____	☐ State	☐ LTPP
4th – _____	☐ State	☐ LTPP

ii. Loads – ☐ State X LTPP

iii. Drivers – ☐ State X LTPP

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

_____

g. Access to cabinet

i. Personnel Access –

X State only
☐ Joint
☐ LTPP

ii. Physical Access –

X Key
☐ Combination

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

i. Traffic Control Required – ☐Yes X No

j. Enforcement Coordination Required – ☐Yes X 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: ____Jim Kramer_____ Phone: ____517-322-1736_____

Agency: ___Michigan DOT_____

b. Maintenance (equipment) –

Name: Jim Kramer Phone: 517-322-1736

Agency: Michigan DOT

c. Data Processing and Pre-Visit Data –

Name: Jim Kramer Phone: 517-322-1736

Agency: Michigan DOT

d. Construction schedule and verification –

Name: _____ Phone: _____

Agency: _____

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

Name: _____ Phone: _____

Agency: _____

f. Traffic Control –

Name: _____ Phone: _____

Agency: _____

g. Enforcement Coordination –

Name: _____ Phone: _____

Agency: _____

h. Nearest Static Scale

Name: Windmill Truck Stop Location: I-96 Exit 98A & I-69 Exit 70

Phone: 517-646-6752

SHEET 16 **LTPP MONITORED TRAFFIC DATA** **SITE CALIBRATION SUMMARY**	*STATE ASSIGNED ID [___3_1_7__] *STATE CODE [_2_6_] *SHRP SECTION ID [_0_1_0_0__]

SITE CALIBRATION INFORMATION

1. * DATE OF CALIBRATION (MONTH/DAY/YEAR) [_1_2_ / _0_6_ / _2_0_0_5__]

2. * TYPE OF EQUIPMENT CALIBRATED _x_ WIM __ CLASSIFIER ___ BOTH

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

4. * SENSORS INSTALLED IN LTPP LANE AT THIS SITE (CHECK ALL THAT APPLY):
   ____ BARE ROUND PIEZO CERAMIC ____ BARE FLAT PIEZO ____ BENDING PLATES
   ____ CHANNELIZED ROUND PIEZO ____ LOAD CELLS __x_ 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

   __2_0__ PASSES PER TRUCK

	TRUCK	TYPE	SUSPENSION
TYPE PER FHWA 13 BIN SYSTEM	1	___9____	__1_____
SUSPENSION: 1 - AIR; 2 - LEAF SPRING	2	___9____	__1_____
3 - OTHER (DESCRIBE)	3	_____	_____

7. SUMMARY CALIBRATION RESULTS (EXPRESSED AS A PERCENT)
   MEAN DIFFERENCE BETWEEN ---
   DYNAMIC AND STATIC GVW ___ ___19.8__ STANDARD DEVIATION __ _7 . 6_
   DYNAMIC AND STATIC SINGLE AXLES ___ ___19.7__ STANDARD DEVIATION __ _3 . 6_
   DYNAMIC AND STATIC DOUBLE AXLES ___ ___19.7__ STANDARD DEVIATION __ _9 . 7_

8. ___3____ NUMBER OF SPEEDS AT WHICH CALIBRATION WAS PERFORMED

9. DEFINE THE SPEED RANGES USED (MPH) _____55, 60, 65____ _____ _____ _____ _____ _____
   _____ _____ _____ _____ _____ _____ _____ _____ _____ _____

10. CALIBRATION FACTOR (AT EXPECTED FREE FLOW SPEED) ___ __1_0_0_0___ ___

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 ____1.5__ ____ 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 Engineering & Consulting, Inc._____
CONTACT INFORMATION: _301-210-5105_____ rev. November 9, 1999

SHEET 16 **LTPP MONITORED TRAFFIC DATA** **SITE CALIBRATION SUMMARY**	*STATE ASSIGNED ID [___3_1_7__] *STATE CODE [_2_6_] *SHRP SECTION ID [_0_1_0_0__]

SITE CALIBRATION INFORMATION

1. * DATE OF CALIBRATION (MONTH/DAY/YEAR) [_1_2_ / _0_7_ / _2_0_0_5__]

2. * TYPE OF EQUIPMENT CALIBRATED _x_ WIM __ CLASSIFIER ___ BOTH

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

4. * SENSORS INSTALLED IN LTPP LANE AT THIS SITE (CHECK ALL THAT APPLY):
   ____ BARE ROUND PIEZO CERAMIC ____ BARE FLAT PIEZO ____ BENDING PLATES
   ____ CHANNELIZED ROUND PIEZO ____ LOAD CELLS __x_ 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

   __2_0__ 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 ___ ___-2.1___ STANDARD DEVIATION __ _3.4_
   DYNAMIC AND STATIC SINGLE AXLES ___ ___-4.2___ STANDARD DEVIATION __ _4.0_
   DYNAMIC AND STATIC DOUBLE AXLES ___ ___-1.7___ STANDARD DEVIATION __ _4.3_

8. ___3____ NUMBER OF SPEEDS AT WHICH CALIBRATION WAS PERFORMED

9. DEFINE THE SPEED RANGES USED (MPH) _____55, 60, 65____ _____ _____ _____ _____ _____
   _____ _____ _____ _____ _____ _____ _____ _____ _____ _____

10. CALIBRATION FACTOR (AT EXPECTED FREE FLOW SPEED) ___ __8_2_0_ ___ ___

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 Engineering & Consulting, Inc._____
CONTACT INFORMATION: _301-210-5105_____ rev. November 9, 1999

APPENDIX A

Sheet 19	* STATE CODE	2 6
LTPP Traffic Data	* SPS PROJECT ID	0 1 0 0
*CALIBRATION TEST TRUCK # 1	* DATE	1 2 / 0 6 / 2 0 0 5

Rev. 08/31/01

~~used days 1+3~~ used day 1 only

PART I.

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

lane 4 pre

½ lane 3 pre

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		11650	10880	D / C
B		16820	16680	D / C
C		16820	16680	D / C
D		14740	14690	D / C
E		14740	14690	D / C
F				D / C

GVW (same units as axles)

7. a) Empty GVW _____

*b) Average Pre-Test Loaded weight 74280

*c) Post Test Loaded Weight 73620

*d) Difference Post Test – Pre-test 660

GEOMETRY

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

9. a) * Make: FREIGHTLINER b) * Model: CENTURY

10.* Trailer Load Distribution Description:

PALLETS OF BAGGED DUST REMOVER PELLETS SPREAD EVENLY ALONG TRAILER

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

b). Trailer Tare Weight (units): _____

Sheet 19	* STATE CODE	2 6
LTPP Traffic Data	* SPS PROJECT ID	0 1 0 0
*CALIBRATION TEST TRUCK # 1	* DATE	1 2 / 0 6 / 2 0 0 5

Rev. 08/31/01

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

A to B 15'5" 15.5 B to C 4'4" 4.4 C to D 35.6

D to E 4.1 E to F

Wheelbased (measured A to last) 59.3 Computed

13. *Kingpin Offset From Axle B (units) +1.3 ( )
(+ is to the rear)

SUSPENSION

Axle	14. Tire Size	15.* Suspension Description (leaf, air, no. of leaves, taper or flat leaf, etc.)
A	275/80R 24.5	leaf - 2 full
B	295/75R 24.5	air
C	"	"
D	295/75R 22.5	"
E	"	"
F		

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

Steering Axle	Axle B	Axle C	Axle D	Axle E

Sheet 19	* STATE_CODE	2 6
LTPP Traffic Data	* SPS PROJECT ID	0 1 0 0
*CALIBRATION TEST TRUCK # 1	* DATE	1 2 / 0 6 / 2 0 0 5

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	2 6
LTPP Traffic Data	* SPS PROJECT ID	0 1 0 0
*CALIBRATION TEST TRUCK # 2	* DATE	1 2 / 0 6 / 2 0 0 5

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	11180	16810	16810	14750	14750		74300
2	11140	16840	16840	14740	14740		74300
3	11120	16820	16820	14740	14740		74240
Average	11150	16820	16820	14740	14740		74280

day 1 pre

Table 6. Raw data – Axle scales –

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10880	16680	16680	14690	14690		73620
2							
3							
Average							

day 1 post

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	11180						
2							
3							
Average							

Measured By DW Verified By _____

Sheet 19	* STATE_CODE	2 6
LTPP Traffic Data	* SPS PROJECT ID	0 1 0 0
*CALIBRATION TEST TRUCK # 1	* DATE	1 2 / 0 6 / 2 0 0 5

Rev. 08/31/01

used all 3 days

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	see pre and post validation spreadsheets			D / C
C	for pre and post test weight values.			D / C
D	lane 3 - days 1, 2, 3	(day 1+2 - pre, day 3 post)		D / C
E	lane 4 - days 1+2	(day 1 pre, day 2 post)		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: FREIGHTLINER b) * Model: CENTURY

10.* Trailer Load Distribution Description:

BALED HAY CARGO AREA

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

b). Trailer Tare Weight (units): _____

Sheet 19	* STATE CODE	2 6
LTPP Traffic Data	* SPS PROJECT ID	0 1 0 0
*CALIBRATION TEST TRUCK # 2	* DATE	1 2 / 0 6 / 2 0 0 5

Rev. 08/31/01

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

A to B 12.7 B to C 4.3 C to D 34.2

D to E 4.0 E to F

Wheelbased (measured A to last) 55.3 Computed

13. *Kingpin Offset From Axle B (units) 41.8 ( )
(+ is to the rear)

SUSPENSION

Axle	14. Tire Size	15.* Suspension Description (leaf, air, no. of leaves, taper or flat leaf, etc.)
A	275 / 80R 22.5	leaf - 2 full
B	"	"
C	"	"
D	295/75R 22.5	"
E	"	"
F		

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

Steering Axle	Axle B	Axle C	Axle D	Axle E

Sheet 19	* STATE CODE	2 6
LTPP Traffic Data	* SPS PROJECT ID	0 1 0 0
*CALIBRATION TEST TRUCK # 2	* DATE	1 2 / 0 6 / 2 0 0 5

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	2 6
LTPP Traffic Data	* SPS PROJECT ID	0 1 0 0
*CALIBRATION TEST TRUCK # 2	* DATE	1 2 / 0 6 / 2 0 0 5

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1 ✓	10160	12130	12130	13940	13940		62300
2	10300	12240	12240	13910	13960		62600
3	10080	11940	11940	14150	14150		62260
Average	10180	12100	12100	14000	14000		62390
	9800	11770	11770	14230	14230		61800

Table 6. Raw data – Axle scales –

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	9820	11830	11830	14240	14240		61760
2	9660	11800	11800	14250	14250		61760
3	9640	11810	11810	14250	14250		61760
Average	9640	11810	11810	14250	14250		61760
	9460	11470	11470	14480	14480		61360

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	9920	11740	11740	14410	14410		62220
2	9760	11800	11800	14430	14430		62220
3	9960	11650	11650	14480	14480		62220
Average	9880	11730	11730	14440	14440		62220
	9780	11550	11550	14500	14500		61880

Measured By DJV Verified By _____

Sheet 19	* STATE_CODE	26
LTPP Traffic Data	* SPS PROJECT ID	0100
*CALIBRATION TEST TRUCK # 3	* DATE	12/07/05

Rev. 08/31/01

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	see pre and post validation spreadsheets			D / C
C	for pre and post test weight values			D / C
D	lane 3 - days 2+3 (day 2 pre, day 3 post)			D / C
E	lane 4 - day 2 (all post)			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: FREIGHTLINER b) * Model: CENTURY

10.* Trailer Load Distribution Description:

PALLETIZED BAGS OF MULCH REMOVED EVENLY DISTRIBUTED ALONG TRAILER

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

b). Trailer Tare Weight (units): _____

Sheet 19	* STATE_CODE	26
LTPP Traffic Data	* SPS PROJECT ID	0100
*CALIBRATION TEST TRUCK # 3	* DATE	12/7/05

Rev. 08/31/01

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

A to B 12.7 B to C 4.3 C to D 34.8 34.2

D to E 4.0 E to F

Wheelbased (measured A to last) 55.3 Computed

13. *Kingpin Offset From Axle B (units) +1.7 +1.8 ( )

(+ is to the rear)

SUSPENSION

Axle	14. Tire Size	15.* Suspension Description (leaf, air, no. of leaves, taper or flat leaf, etc.)
A	275/80R 22.5	taper - 2 full
B	"	air
C	"	air
D	295/75R 22.5	air
E	"	air
F		

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

Steering Axle	Axle B	Axle C	Axle D	Axle E

Sheet 19	* STATE_CODE	26
LTPP Traffic Data	* SPS PROJECT ID	0100
*CALIBRATION TEST TRUCK #	* DATE	12/7/05

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	26
LTPP Traffic Data	* SPS PROJECT ID	0100
*CALIBRATION TEST TRUCK #__	* DATE	12/7/05

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	9940	16990	16990	16670	16670		77260
2	10020	16940	16940	16690	16690		77280
3	10020	16960	16960	16670	16670		77280
Average	9990	16960	16960	16680	16680		77270

day 2 pre

Table 6. Raw data – Axle scales –

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	9800	16780	16780	16670	16670		76700
2							
3							
Average							

post

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10380	16860	16860	16790	16790		77680
2	10260	16960	16960	16730	16730		77640
3	10340	16870	16870	16790	16790		77660
Average	10330	16900	16900	16770	16770		77660
	10180	16740	16740	16790	16790		77240

day 3 pre

day 3 post

Measured By DJW Verified By _____

Sheet 20	* STATE_CODE 26
LTPP Traffic Data	*SPS PROJECT_ID 0100
Speed and Classification Checks * 1 of* 2	* DATE 12/06/2005

Rev. 08/31/2001.... DAY 1 PRE LANE 4

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
58	(10)	5794	57	10	52	9	6835	50	9
65	9	5787	64	9	55	9	6840	54	9
57	5	5815	57	5	61	10	6921	61	10
63	(13)	5828	60	13	60	9	6953	65	9
59	9	5836	58	9	60	9	6954	61	9
70	9	5849	69	9	62	9	6962	61	9
63	5	5865	63	5	58	9	6976	57	9
52	9	6397	51	9	65	9	7080	65	9
58	(13)	6407	59	13	60	9	7098	60	9
45	9	6295	46	9	47	9	7109	46	9
55	9	6425	54	9	61	9	7133	61	9
47	9	6260	45	9	63	9	7151	61	9
61	9	6441	59	9	62	9	7152	62	9
62	9	6109	61	9	62	5	7160	61	5
65	(10)	6450	63	10	59	9	7171	59	9
57	5	6495	57	5	62	9	7182	62	9
59	9	6538	57	9	64	9	7192	63	9
62	9	6551	61	9	56	9	7196	57	10
59	5	6564	59	5	65	10	7229	64	10
56	9	6596	55	9	54	6	7235	53	6
60	5	6598	59	5	62	9	7257	61	9
53	(13)	6616	53	13	67	9	7287	65	9
60	(10)	6664	60	10	59	9	7293	58	9
47	9	6690	45	9	60	9	7295	59	9
46	9	6704	45	9	55	9	7303	55	9

Recorded by _____ Direction _____ Lane _____ Time from _____ to _____

Sheet 20	* STATE_CODE	26
LTPP Traffic Data	*SPS PROJECT_ID	0100
Speed and Classification Checks * 2 of* 2	* DATE	12/ /2005

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	(13)	7304	61	13	51	9	7788	51	9
57	9	7311	56	9	55	9	7791	54	9
63	(10)	7320	62	10	57	9	7808	56	9
55	9	7330	54	9	65	9	7817	65	9
59	9	7336	59	9	57	9	7819	57	9
58	5	7340	58	5	65	5	7824	65	5
63	10	7371	62	10	56	9	7833	55	9
62	9	7373	62	9	61	9	7842	59	9
62	9	7375	61	9	58	9	7856	58	9
64	9	7415	64	9	58	10	7858	57	10
57	6	7427	56	6	58	10	7868	58	10
67	9	7432	63	9	58	9	7890	58	9
63	9	7421	63	9	67	10	7914	66	10
59	9	7446	58	9	62	9	7918	61	9
64	9	7462	64	9	60	(13)	7934	60	13
55	9	7496	55	9	60	(13)	7935	60	13
57	9	7505	57	9	62	8	7944	61	8
60	9	7570	60	9	62	9	7950	61	9
54	9	7599	54	9	57	9	7965	57	9
63	9	7609	62	9	64	8	7995	64	8
59	9	7621	59	9	63	10	7998	62	10
60	9	7675	59	9	54	9	8006	52	9
57	9	7693	56	9	57	9	8020	57	9
57	9	7713	55	9	58	9	8023	57	9
67	5	7762	66	5	63	5	8035	63	5

Recorded by _____ Direction _____ Lane _____ Time from _____ to _____

Sheet 20	* STATE_CODE	26
LTPP Traffic Data	*SPS PROJECT_ID	0100
Speed and Classification Checks * 1 of* 2	* DATE	12/ __ /2005

Rev. 08/31/2001….

lane 4 post

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
58	9	5408	58	9	59	9	7453	58	9
52	5	5415	53	5	59	9	7463	59	9
58	9	5417	58	9	59	8	7465	58	8
55	9	5493	55	9	67	5	7471	67	5
62	13	5501	63	13	62	10	7510	61	10
62	8	5516	63	8	63	5	7527	63	5
59	9	5528	60	9	60	10	7540	60	10
61	5	5530	60	5	65	9	7571	65	9
54	9	5553	54	9	67	9	7577	67	9
58	7	5584	58	7	61	9	7594	61	9
53	5	5628	53	5	60	9	7604	61	9
55	9	5679	54	9	61	10	7644	60	10
62	8	5696	61	8	59	5	7653	58	5
64	9	5713	64	9	61	9	7675	60	9
63	13	5716	63	13	63	9	7680	63	9
60	9	5750	59	9	55	5	7698	55	5
56	9	5767	55	9	60	9	7851	60	9
62	8	5773	61	8	60	5	7915	58	5
60	9	5775	61	9	56	5	8043	56	5
57	9	5801	58	9	69	5	8216	68	5
58	6	5827	57	7	64	5	8233	62	5
57	5	5832	57	5	62	13	8273	62	13
54	9	5865	55	9	58	5	8274	58	5
60	9	7400	60	9	56	9	8338	55	9
64	9	7422	64	9	59	9	8542	58	9

Recorded by ____________ Direction _____ Lane _____ Time from ________ to ________

D-E -4.1
ED-34.1
B-C 4.4
A-B 12.7
King 1.6

Sheet 20	* STATE_CODE	26
LTPP Traffic Data	*SPS PROJECT_ID	0600
Speed and Classification Checks * 2 of* 2	* DATE	12/ /2005

Rev. 08/31/2001....

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
60	9	8554	60	9	55	6	9183	55	6
60	9	8556	61	9	58	9	9204	58	9
66	9	8585	66	9	45	9	9220	45	9
58	13	8601	58	13	57	9	9234	57	9
59	9	8611	59	9	59	8	9236	57	8
58	5	8660	58	5	71	5	9245	69	5
60	10	8755	58	10	55	9	9259	54	9
58	9	8764	58	9	54	9	9265	54	9
52	5	8877	57	5	55	9	9265	55	9
64	13	8881	65	13	58	9	9267	57	9
60	9	8882	60	9	61	9	9289	61	9
53	5	8897	53	5	51	9	9292	52	9
62	9	8896	62	9	59	8	9297	59	8
62	9	8899	62	9	55	5	9323	55	5
61	9	8961	61	9	58	9	9336	56	9
63	9	8977	63	9	61	9	9340	61	9
60	9	8964	60	9	58	9	9370	57	9
56	9	9028	56	9	59	5	9375	59	4
63	9	9036	63	9	52	9	9384	52	9
59	9	9034	59	9	70	10	9414	59	10
58	9	9052	57	9	56	9	9423	55	9
59	4	9099	57	5	56	5	9504	55	5
61	10	9140	59	10	56	9	9520	55	9
61	5	9175	61	5	62	9	9532	61	9
60	5	9178	60	5	55	9	9585	54	9

Recorded by _____ Direction _____ Lane ____Time from _____ to _____

Sheet 21	* STATE CODE 2 6
LTPP Traffic Data	*SPS PROJECT ID 0 1 0 0
WIM System Test Truck Records 1 of 3	* DATE 12 / 06 / 2005

Lane 4 PAE

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
22	45	2	1	10:32:34	4992	45	6.1	6.7	6.6	7.9	8.4		74.7	12.8	4.3	34.1	4	
							6	7.8	8.2	7.4	9.5							
25	51	2	2	10:43:29	5122	52	5.8	7.2	6.3	8.5	7.4		76.4	12.8	4.4	34	4.1	
							6.5	7.6	7.4	10	9.7							
25	41	1	1	10:44:23	5133	41	6.9	9.6	9.9	8.1	8.7		75.8	15.4	4.2	35.6	4.1	
							6.8	8.9	8.7	4.4	3.9							
25	61	2	3	10:53:54	5262	61	6	7	6.9	7.5	7.4		71.6	12.8	4.3	34.1	4.1	
							5.9	7.3	8.1	6.7	8.8							
25	47	1	2	10:55:30	5287	48	6.7	10.4	10.4	9.1	9.4		92.8	15.4	4.3	35.7	4	
							7	11.4	10.6	9.3	8.6							
22	45	2	4	11:04:27	5392	47	6.2	6.5	6.1	8	7.8		77.1	12.9	4.3	34.2	4.1	
							6	7.6	7.9	11.2	9.8							
22	41	1	3	11:06:07	5408	42	6.7	10.3	10.3	8.6	8.9		91.9	15.4	4.2	35.7	4.1	
							7.2	10.3	10.7	9.8	9.1							
19	50	2	5	11:15:30	5531	50	6.2	7.5	7	8.7	8.4		75.8	12.7	4.3	33.9	4.1	
							6	7.4	7.5	8	8.9							
19	55	1	4	11:17:24	5550	55	6.7	10.2	11	8.7	9.5		90.8	15.3	4.3	35.6	4	
							7	10.9	10.2	8.2	8.3							
19	63	2	6	11:26:19	5672	63	6.1	7	6.5	7	7.7		76.1	12.8	4.4	34.2	4.1	
							6.2	8	8.2	10.1	9.1							
19	57	1	5	11:28:36	5708	58	7.2	9.8	10.6	8.2	9		92.4	15.5	4.2	35.8	4	
							6.8	10.1	11.3	9.4	9.9							
19	47	2	7	11:36:54	5831	48	5.8	6.4	6.2	8.9	7.7		75.5	12.7	4.3	34	4.1	
							5.9	7.9	8	9.4	9.3							
19	45	1	6	11:39:01	5856	47	6.7	10.1	10.5	9.1	9.2		90.7	15.4	4.3	35.8	4	
							6.6	10.6	10.4	9.7	7.8							
19	51	2	8	11:48:13	5981	51	5.9	7.3	5.9	9.1	8.6		78.1	12.7	4.3	33.9	4.1	
							5.9	7.6	8	10.5	9.3							
19	55	1	7	11:49:48	5998	56	6.8	9.9	10.5	8.7	9		89.8	15.4	4.2	35.7	4	
							6.7	9.8	10.9	9.4	8.1							

Recorded by DJW Checked by

Sheet 21	* STATE CODE 2 6
LTPP Traffic Data	*SPS PROJECT ID 0 1 0 0
WIM System Test Truck Records 2 of 3	* DATE 12 / 06 / 2005

LANE 4 NB

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
20	61	2	9	11:58:41	6109	62	5.8	6.5	6.6	8.5	7.7		72.1	12.8	4.3	34.1	4.1	
							6.1	7.3	8	6.4	9.1							
20	59	1	8	12:00:27	6141	61	6.7	10.2	9.4	7.9	9.5		89.4	15.4	4.3	35.8	4	
							6.7	10.1	9.8	9.9	9.3							
20	45	2	10	12:09:34	6260	47	6.1	7	6.2	7.1	7.8		78.6	12.8	4.3	34.2	4.1	
							6	7.8	7.8	12.9	9.9							
20	45	1	9	12:10:54	6275	46	6.8	10.1	9.9	8.7	8.6		90.9	15.4	4.3	35.7	4.1	
							6.7	11.3	11	9.7	8							
20	51	2	11	12:20:02	6397	52	6.2	7.2	6.4	8.1	7.7		72.3	12.7	4.4	34	4.1	
							6.1	7.6	7.5	6.3	9.3							
20	54	1	10	12:21:56	6425	55	6.8	9.9	9.4	8.8	9.6		90.1	15.5	4.3	35.7	4	
							7	10.7	10.9	8.2	8.8							
20	61	2	12	12:30:27	6551	62	6.2	7.1	6.6	7.4	7.7		75	12.8	4.3	34	4.1	
							5.9	7.5	7.6	10.3	8.7							
20	59	1	11	12:32:32	6569	59	6.9	10.6	10.1	8.7	9.4		92.6	15.4	4.3	35.7	4	
							7	11	10.1	9.6	9.1							
20	45	2	13	12:41:16	6690	47	6.1	6.8	6.7	9.2	8.1		79.7	12.9	4.3	34.2	4.1	
							6.2	7.8	8.1	10.8	9.7							
20	45	1	12	12:42:28	6704	46	6.6	10	9.6	8.9	8.9		90.4	15.4	4.3	35.7	4	
							6.6	11	10.9	9.6	8.3							
22	50	2	14	12:52:58	6835	52	5.8	7.3	6.5	8	8.2		76.5	12.8	4.3	34	4.1	
							5.9	7.8	8.1	9.5	9.3							
22	54	1	13	12:53:11	6840	55	7	9.9	9.6	9.1	9.1		92.4	15.4	4.3	35.7	4.1	
							6.7	10.9	11.4	9.4	9.4							
22	61	2	15	13:03:37	6962	62	5.9	6.4	6.4	6.2	7.2		69.7	12.8	4.3	34.1	4.1	
							6	7.5	7.6	7.9	8.6							
22	58	1	14	13:04:30	6976	58	6.8	10.3	10	8.9	9.6		92.2	15.4	4.3	35.6	4	
							6.9	10.6	10.1	9.3	9.6							
21	47	2	16	13:14:45	7104	48	5.8	6.9	6.1	7.9	8.2		75.4	12.7	4.3	34	4.1	
							5.9	7.6	8.1	8.7	10.2							

Recorded by DJW _____ Checked by _____

Sheet 21	* STATE CODE 2 6
LTPP Traffic Data	*SPS PROJECT ID 0 1 0 0
WIM System Test Truck Records 3 of 3	* DATE 12 / 06 / 2005

LANE 4 MLE

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
21	46	1	15	13:15:12	7109	47	6.3	9.9	10.3	9.1	9.6		90.5	15.5	4.3	35.8	4.1	
							6.6	10.9	10.2	9.1	8.7							
21	52	2	17	13:25:14	7260	53	5.8	6.5	6.2	5	8.4		75.2	12.8	4.4	34.3	4.1	
							6.1	7.6	8.1	12	9.6							
21	55	1	16	13:25:53	7276	55	6.7	10.6	9.4	8.8	9.5		92.4	15.4	4.3	35.7	4	
							7	10.7	11.3	9.4	8.9							
20	63	2	18	13:35:23	7421	63	6.1	6.5	6.7	8	7.7		58.5	12.7	4.3	33.9	4	
							5.4	5.9	5.7	2.8	3.7							
20	58	1	17	13:36:39	7446	59	6.8	9.4	10.1	9.1	9.6		94.3	15.4	4.2	35.7	4	
							6.9	10.8	11	9.3	11.4							
17	45	2	19	13:49:08	7641	47	5.9	6.4	5.8	7.6	7.9		67.2	12.8	4.3	34	4.1	
							6.2	7.8	7.8	5.6	6.1							
17	45	1	18	13:49:17	7643	45	6.5	10.1	9.6	8.6	8.8		89	15.4	4.3	35.7	4.1	
							7	10.1	10	9.3	9.1							
17	51	2	20	14:00:47	7788	51	6.3	6.8	6.6	8.1	8.6		77.9	12.8	4.3	34	4.1	
							6.2	7.8	8	10.5	8.9							
17	54	1	19	14:01:01	7791	55	6.7	9.6	10.6	8.9	9.3		92	15.4	4.2	35.7	4	
							6.6	10.7	11.1	9.4	9.1							
17	51	2	21	16:33:31	10460	51	5.9	6.8	6	8.3	8.1		60.4	12.7	4.3	34	4.1	
							5.1	6.3	5.9	4.1	3.9							

Recorded by DJW Checked by

Sheet 21	* STATE CODE 2 6
LTPP Traffic Data	*SPS PROJECT ID 0 1 0 0
WIM System Test Truck Records 1 of 1	* DATE 12 / 07 / 2005

Lane 4 car 1

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
25	46	2	6	14:01:26	7650	47	4.4	4.5	4.4	5.7	5.3		59.8	12.8	4.3	34.2	4.1	
							4.2	5.2	6.8	10.9	8.4							
25	51	3	1	13:14:14	6986	51	4.7	8	8.4	8	7.7		74.2	12.6	4.3	34.1	4	
							4.6	8.1	8.3	8.1	8.3							
25	63	2	2	13:20:39	7077	65	4.5	5.3	4.2	6.3	6		58.4	12.8	4.3	34	4.1	
							4.5	6.5	6.7	7.5	7.1							
25	61	3	2	13:24:54	7128	61	4.7	8.3	8.2	7.9	7.5		75.1	12.7	4.3	34.4	4.1	
							5	8.1	8.9	8.4	8							
25	46	2	3	13:30:34	7212	47	4.5	4.5	4.1	5.9	5.6		56.7	12.8	4.3	34.1	4.1	
							4.4	5.9	6.6	6.9	8.3							
31	55	2	4	13:41:12	7355	56	4.5	4.7	4.7	5.4	5.3		56.5	12.8	4.3	34.2	4.1	
							4	5.9	5.9	8.6	7.5							
31	51	3	3	13:45:39	7417	52	4.6	8.3	8.2	6.8	7.5		71.5	12.7	4.3	34.2	4	
							4.6	7.6	7.7	7.7	8.5							
31	46	3	4	13:35:10	7276	47	4.4	8.4	8	8.1	7.3		73.2	12.8	4.4	34.6	4.1	
							4.7	8.3	7.2	8.3	8.5							
30	64	2	5	13:51:21	7508	67	4.5	5.2	4.1	6.1	6		61.7	12.8	4.4	34.1	4.1	
							4.7	7.5	6.7	9.3	7.7							
30	57	3	5	13:56:00	7573	58	4.9	8.7	8.4	7.8	7.7		71.1	12.8	4.3	34.5	4.1	
							4.4	7.3	7.4	7.7	6.9							

Recorded by DJW _____ Checked by _____

Sheet 21	* STATE CODE 2 6
LTPP Traffic Data	*SPS PROJECT ID 0 1 0 0
WIM System Test Truck Records 1 of 1	* DATE 12 / 07 / 2005

LANE 4 CAL 2

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
29	48	3	1	14:07:49	7734	48	4.8	8.7	8.2	8.5	8		78.6	12.7	4.3	34.4	4	
							5.1	8.7	8.7	9	9							
29	55	2	1	14:12:20	7799	56	4.5	4.8	4.5	6.5	6.1		60.6	12.8	4.3	34.1	4.1	
							4.4	6.5	6.4	8.8	8.2							
29	52	3	2	14:18:34	7883	52	5	8.2	8.2	8.1	8.1		77.1	12.7	4.3	34.3	4	
							5.3	8.7	8.5	8.4	8.8							
29	63	2	2	14:23:48	7958	64	4.2	4.9	4.9	5.8	6		59.4	12.8	4.3	34.2	4.1	
							4.3	6.9	6.7	7.7	8.1							
27	62	3	3	14:29:03	8041	62	4.6	8.6	8.3	7.4	7.4		74.5	12.7	4.4	34.4	4	
							4.9	8.4	8	8.4	8.5							
27	47	2	3	14:36:40	8171	48	4.7	5	4.4	4.4	6.2		61.5	12.9	4.3	34.5	4.1	
							4.5	6.9	7	9.8	8.6							
27	46	3	4	14:40:00	8226	47	4.9	8.5	8.3	8.5	7.8		79	12.9	4.4	34.8	4.1	
							5.2	9	8.2	9.3	9.4							
27	56	2	4	14:48:49	8383	56	5	5.3	4.4	4.1	5.9		60	12.9	4.4	34.6	4.2	
							4.6	6.8	6.9	8.8	8.3							
25	51	3	5	14:50:32	8422	52	5	8.3	8.3	8.1	7.8		77	12.9	4.3	34.8	4.1	
							4.7	8.6	8.8	8.6	8.9							
25	65	2	5	14:59:43	8561	66	4.4	4.5	4.6	4.3	6		58.8	13	4.3	34.4	4.1	
							4.3	6.3	6.2	10	8.2							

by DJW Checked by

Sheet 21	* STATE CODE 2 6
LTPP Traffic Data	*SPS PROJECT ID 0 1 0 0
WIM System Test Truck Records 1 of 3	* DATE 12 / 07 / 2005

LANE 4 POST

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
29	48	3	1	14:07:49	7734	48	4.8	8.7	8.2	8.5	8		78.6	12.7	4.3	34.4	4	
							5.1	8.7	8.7	9	9							
29	55	2	1	14:12:20	7799	56	4.5	4.8	4.5	6.5	6.1		60.6	12.8	4.3	34.1	4.1	
							4.4	6.5	6.4	8.8	8.2							
29	52	3	2	14:18:34	7883	52	5	8.2	8.2	8.1	8.1		77.1	12.7	4.3	34.3	4	
							5.3	8.7	8.5	8.4	8.8							
29	63	2	2	14:23:48	7958	64	4.2	4.9	4.9	5.8	6		59.4	12.8	4.3	34.2	4.1	
							4.3	6.9	6.7	7.7	8.1							
27	62	3	3	14:29:03	8041	62	4.6	8.6	8.3	7.4	7.4		74.5	12.7	4.4	34.4	4	
							4.9	8.4	8	8.4	8.5							
27	47	2	3	14:36:40	8171	48	4.7	5	4.4	4.4	6.2		61.5	12.9	4.3	34.5	4.1	
							4.5	6.9	7	9.8	8.6							
27	46	3	4	14:40:00	8226	47	4.9	8.5	8.3	8.5	7.8		79	12.9	4.4	34.8	4.1	
							5.2	9	8.2	9.3	9.4							
27	56	2	4	14:48:49	8383	56	5	5.3	4.4	4.1	5.9		60	12.9	4.4	34.6	4.2	
							4.6	6.8	6.9	8.8	8.3							
25	51	3	5	14:50:32	8422	52	5	8.3	8.3	8.1	7.8		77	12.9	4.3	34.8	4.1	
							4.7	8.6	8.8	8.6	8.9							
25	65	2	5	14:59:43	8561	66	4.4	4.5	4.6	4.3	6		58.8	13	4.3	34.4	4.1	
							4.3	6.3	6.2	10	8.2							
25	57	3	6	15:00:49	8575	58	4.9	8.6	8.9	8.3	7.9		76.9	12.8	4.4	34.7	4.1	
							4.8	8.5	8.4	8.6	8.1							
25	45	2	6	15:11:28	8749	47	4.5	4.9	4.8	5.8	5.8		60.5	12.9	4.4	34.5	4.1	
							4.5	6.3	6.1	9.1	8.6							
21	46	3	7	15:15:24	8805	48	4.8	8.6	8.2	8.5	7.8		80.9	13	4.4	35	4.1	
							5.2	9.1	9	10.6	9.1							
21	57	2	7	15:25:47	8988	57	5.1	4.9	4.1	5.5	6		58.8	13	4.4	34.8	4.2	
							4.8	6.3	6.9	6.4	8.7							
21	52	3	8	15:29:25	9053	53	4.9	8.5	8.7	8.2	7.9		78.3	13	4.4	35.2	4.2	
							5.2	8.5	8.5	8.8	9							

Recorded by DJW Checked by

Sheet 21	* STATE_CODE 2 6
LTPP Traffic Data	*SPS PROJECT_ID 0 1 0 0
WIM System Test Truck Records 2 of 3	* DATE 12 / 07 / 2005

LANE 4 LOST

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
21	66	2	8	15:36:01	9187	67	4.6	4	4.1	6.6	6		58.1	13	4.4	34.8	4.2	
						4	6.3	7.1	7	8.1								
20	61	3	9	15:39:59	9265	63	4.9	8.6	8.7	8	8		78.7	13.1	4.5	35.5	4.1	
						5	9.1	8.7	8.8	8.9								
20	45	2	9	15:47:29	9397	46	4.4	4.8	4.4	5.8	5.8		61.6	12.8	4.3	34.2	4.1	
						5	6.8	6.9	9.1	8.8								
20	46	3	10	15:50:24	9447	47	4.6	8.5	7.8	8.1	7.6		76.4	12.8	4.4	34.5	4.1	
						5	8.6	8.5	8.9	8.9								
20	56	2	10	15:58:14	9619	57	4.9	4.9	4.6	5.9	6		59.9	12.7	4.3	34	4.1	
						5	6.5	6.7	7.7	8.2								
16	51	3	11	16:00:26	9668	52	4.9	8.4	8.4	8.2	7.9		75.7	12.7	4.3	34.3	4	
						5	8	8.7	7.8	8.5								
16	63	2	11	16:09:13	9857	65	4.4	4.9	4.5	6.6	5.6		59	12.8	4.3	34.1	4.1	
						5	6.7	7	6.9	8								
14	53	3	12	16:13:05	9921	53	5	9	8.1	9.1	7.8		79	12.7	4.3	34.3	4	
						5	8.7	8.4	8.7	9.1								
14	48	2	12	16:19:28	10053	48	4.3	4.4	4.5	6.7	5.5		60.8	12.8	4.3	34.1	4.1	
						5	6.6	7	8.4	8.9								
8	62	3	13	16:22:30	10105	62	4.8	8.4	8.2	7.9	7.8		76.9	12.8	4.4	34.5	4	
						5	8.6	8.6	8.6	9								
8	56	2	13	16:29:55	10281	58	4.4	4.7	4.4	6.4	6.2		57.9	12.7	4.3	34.2	4	
						4	6.8	6.6	5.9	8.4								
7	62	3	14	16:32:04	10322	63	4.7	8.2	8.3	8.1	7.8		76.2	12.7	4.3	34.4	4.1	
						5	8.5	8.6	8.7	8.5								
7	65	2	14	16:39:32	10482	67	4.6	5.6	4.4	5.9	5.9		60.7	12.8	4.3	34.2	4.1	
						5	7.4	6.9	7.7	7.8								
7	62	3	15	16:43:46	10585	62	4.8	8.8	8.8	8.4	7.6		65.1	12.7	4.3	34.4	4	
						4	6.7	6.2	4.7	5.2								
7	46	2	15	16:49:17	10720	46	4.6	5.4	4.3	6.1	5.8		62.5	12.8	4.3	34.2	4.1	
						4.6	6.5	6.9	9.1	9.2								

Recorded by DJW Checked by

Sheet 21	* STATE CODE 2 6
LTPP Traffic Data	*SPS PROJECT ID 0 1 0 0
WIM System Test Truck Records 3 of 3	* DATE 12 / 07 / 2005

LANE 4 POST

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
7	56	3	16	16:53:56	10813	57	4.8	8.4	8.5	8.3	8		77.7	12.8	4.3	34.4	4.1	
							5.1	8.5	8.7	8.3	9.2							
3	52	3	17	17:23:17	11504	52	4.8	8.2	8.4	7.7	7.7		75.8	12.7	4.3	34.4	4.1	
							4.8	8.4	8.4	9.1	8.3							
3	61	2	16	17:24:17	11533	63	4.2	5.3	4.3	5.5	5.3		59.3	12.8	4.3	34.2	4.1	
							4.5	7.4	6.8	7.9	8.2							
1	51	3	18	17:35:00	11773	51	4.9	7.8	8.2	7.8	7.7		76.9	12.7	4.3	34.4	4.1	
							4.9	8.9	8.3	9.1	9.2							
1	63	2	17	17:35:28	11785	65	4.4	4.2	4.5	6.1	5.6		58.1	12.8	4.3	34.1	4	
							4.2	6.6	6.8	7.7	8							
1	47	3	19	17:46:18	12008	48	4.8	8.3	7.9	8.2	7.6		76.1	12.8	4.3	34.6	4.1	
							4.7	8.6	7.8	8.8	9.4							
1	47	2	18	17:48:10	12052	47	4.4	4.5	4.2	5.8	5.7		57.7	12.8	4.3	34.2	4.1	
							4.5	6.5	6.5	6.8	8.8							
1	52	3	20	17:56:41	12218	52	4.8	8.4	9.2	7.5	7.7		76.9	12.7	4.3	34.4	4.1	
							5	8.6	8.6	8.4	8.7							
1	46	2	19	18:00:28	12290	47	4.6	4.5	4.2	5.2	5.8		58	12.8	4.3	34.2	4.1	
							4.6	6.5	6.6	7.6	8.5							
1	58	3	21	18:06:51	12388	59	4.6	8.1	8.1	7.9	7.5		76	12.8	4.3	34.5	4.1	
							5	8.5	8.9	8.7	8.8							
1	46	2	20	18:11:18	12459	46	4.7	4.8	4.3	6.5	5.8		60	12.7	4.3	34.2	4.1	
							4.7	6.7	6.8	7.5	8.2							

Recorded by DJW Checked by

Calibration Worksheet

Lane 4 – 0100 – Task 2.56 **12/07/05**

Starting parameters –

Overall Sensitivity – 1000
F/A Sensitivity – 1000
Speed point 1 – 1000
Speed point 2 – 1000
Speed point 3 – 1000

Results of Pre-validation runs

GVW mean error = +19.6%

Reduced Overall Sensitivity 22% from 1000 to 780

Results of 10 Calibration Verification runs

GVW mean error = -5%

Increased Overall Sensitivity 5% from 780 to 820

Results of 10 Calibration Verification runs

GVW mean error = -1.0%

Final Parameters –

Overall Sensitivity – 820
F/A Sensitivity – 1000
Speed point 1 – 1000
Speed point 2 – 1000
Speed point 3 – 1000

CALIBRATION TEST TRUCKS FOR SPS WIM FIELD VALIDATION

STATE: Michigan

SHRP ID: 0100

Photo 1 – Cal_Truck_TO_12_26_2.56_0100_12_07_05

Photo 2 – Truck_1_tractor_TO_12_26_2.56_0100_12_07_05

Photo 3 – Truck_1_trailer_TO_12_26_2.56_0100_12_07_05

Photo 4 – Truck_1_axle_1_suspension_TO_12_26_2.56_0100_12_07_05

Photo 5 – Truck_1_axle_2_suspension_TO_12_26_2.56_0100_12_07_05

Photo 6 – Truck_1_axle_3_suspension_TO_12_26_2.56_0100_12_07_05

Photo 7 – Truck_1_axle_4_suspension_TO_12_26_2.56_0100_12_07_05

Photo 8 – Truck_1_axle_5_suspension_TO_12_26_2.56_0100_12_07_05

Photo 9 – Truck_2_tractor_TO_12_26_2.56_0100_12_07_05


Photo 10 – Truck_2_trailer_TO_12_26_2.56_0100_12_07_05

Photo 11 – Truck_2_axle_1_suspension_TO_12_26_2.56_0100_12_07_05

Photo 12 – Truck_2_axle_2_suspension_TO_12_26_2.56_0100_12_07_05

Photo 13 – Truck_2_axle_3_suspension_TO_12_26_2.56_0100_12_07_05

Photo 14 – Truck_2_axle_4_suspension_TO_12_26_2.56_0100_12_07_05

Photo 15 – Truck_2_axle_5_suspension_TO_12_26_2.56_0100_12_07_05

Photo 16 – Truck_2_kingpin_TO_12_26_2.56_0100_12_07_05

Michigan Dept of Transportation Classification and Weight Parameters for WIM

ass	Vehicle Description	# axles	Spacing 1	Spacing 2	Spacing 3	Spacing 4	Spacing 5	Spacing 6	Spacing 7	Spacing 8	Spacing 9	Spacing 10	Weight Min-Max
1	Motorcycle	2	0.1-6.0										100-3000
2	Car	2	6.0-10.1										1000-8000
3	Truck	2	10.1-16.0										1000-8000
4	Bus	2	21.09-40.0										12000 >
5	2D	2	8.0-21.09										8000 >
2	Car / 1 Axle Trailer	3	6.0-10.1	6.0-30.0									1000-12000
3	Truck / 1 Axle Trailer	3	10.1-16.0	6.0-30.0									1000-15000
4	Bus	3	21.09-40	3.0-7.0									20000 >
5	2D / 1 Axle Trailer	3	8.0-21.09	6.3-30.0									15000-12000
6	3 Axle Single Unit	3	8.0-26.0	2.5-6.3									12000 >
8	Semi 2-1	3	8.0-23.09	11.0-40.0									20000 >
2	Car / 2 Axle Trailer	4	6.0-10.1	6.0-30.0	1.0-11.99								1000-12000
3	Truck / 2 Axle Trailer	4	10.1-16.0	6.0-30.0	1.0-11.99								1000-15000
5	2D / 2 Axle Trailer	4	8.0-23.09	6.3-30.0	1.0-11.99								15000-20000
7	4 Axle Single Unit	4	8.0-23.09	2.5-6.3	2.5-13.0								12000 >
8	Semi 2-2	4	8.0-23.09	11.0-45.0	2.5-11.99								20000 >
8	Semi 3-1	4	8.0-26.00	2.5-6.3	6.1-45.0								20000 >
3	Truck / 3 Axle Trailer	5	10.1-16.0	6.0-30.0	1.0-11.99	1.0-11.99							1000-15000
7	5 Axle Single Unit	5	8.0-23.09	2.5-6.3	2.5-6.3	2.5-6.3							12000 >
9	Semi 3-2	5	8.0-26.0	2.5-6.3	6.0-45.0	2.5-27.0							20000 >
9	Semi 2-3	5	8.0-23.09	11.0-45.0	2.5-6.3	2.5-6.3							20000 >
11	Semi 2-1-2	5	8.0-26.0	11.0-26.0	6.0-20.0	11.0-26.0							12,000 >
10	Semi 3-3	6	8.0-26.0	2.5-6.3	6.1-45.0	2.5-11.99	2.5-11.99						20,000 >
10	Semi 2-4	6	8.0-23.09	11.0-45.0	2.5-6.3	2.5-6.3	2.5-6.3						20,000 >
10	Semi 4-2	6	8.0-26.0	2.5-6.3	2.5-6.3	6.1-46.0	2.5-11.99						20,000 >
12	Semi 3-1-2	6	8.0-26.0	2.5-6.3	11.0-26.0	6.0-24.0	11.0-26.0						12,000 >
10	Semi 3-4	7	8.0-26.0	2.5-6.3	10.0-20.0	6.0-12.0	6.0-12.0	6.0-12.0					20,000 >
10	Semi 3-4	7	8.0-26.0	2.5-6.3	3.5-45.0	2.5-12.0	2.5-6.3	2.5-6.3					20,000 >
13	Semi 3-*-*	7	8.0-45.0	3.0-45.0	3.0-45.0	3.0-45.0	3.0-45.0	3.0-45.0					20,000 >
10	Semi 3-5	8	8.0-26.0	2.5-6.3	3.5-45.0	2.5-6.3	2.5-6.3	2.5-6.3	2.5-6.3				20,000 >
10	Semi 3-5	8	8.0-26.0	2.5-6.3	10.0-20.0	6.0-12.0	2.5-6.3	2.5-6.3	2.5-6.3				20,000 >
13	Semi 3-*-*	8	8.0-45.0	3.0-45.0	3.0-45.0	3.0-45.0	3.0-45.0	3.0-45.0	3.0-45.0				20,000 >
10	Semi 3-6	9	8.0-26.0	2.5-6.3	3.5-45.0	2.5-6.3	2.5-6.3	2.5-6.3	2.5-6.3	2.5-6.3			20,000 >
10	Semi 3-6	9	8.0-26.0	2.5-6.3	10.0-20.0	6.0-12.0	2.5-6.3	2.5-6.3	2.5-6.3	2.5-6.3			20,000 >
10	Semi 4-5	9	8.0-26.0	2.5-6.3	2.5-6.3	6.3-15.0	2.5-6.3	2.5-6.3	2.5-6.3	2.5-6.3			20,000>
13	Semi 3-*-*	9	8.0-45.0	3.0-45.0	3.0-45.0	3.0-45.0	3.0-45.0	3.0-45.0	3.0-45.0	3.0-45.0			20,000 >
10	Semi 3-7	10	8.0-26.0	2.5-6.3	3.5-45.0	2.5-6.3	2.5-6.3	2.5-6.3	2.5-6.3	2.5-6.3	2.5-6.3		20,000 >
10	Semi 3-7	10	8.0-26.0	2.5-6.3	10.0-20.0	6.0-12.0	2.5-6.3	2.5-6.3	2.5-6.3	2.5-6.3	2.5-6.3		20,000 >
10	Semi 4-6	10	8.0-26.0	2.5-6.3	2.5-6.3	6.3-15.0	2.5-6.3	2.5-6.3	2.5-6.3	2.5-6.3	2.5-6.3		20,000>
10	Semi 5-5	10	8.0-26.0	2.5-6.3	2.5-6.3	2.5-6.3	6.3-15.0	2.5-6.3	2.5-6.3	2.5-6.3	2.5-6.3		20,000>
13	Semi 3-*-*	10	8.0-45.0	3.0-45.0	3.0-45.0	3.0-45.0	3.0-45.0	3.0-45.0	3.0-45.0	3.0-45.0	3.0-45.0		20,000 >
10	Semi 3-8	11	8.0-26.0	2.5-6.3	3.5-45.0	2.5-6.3	2.5-6.3	2.5-6.3	2.5-6.3	2.5-6.3	2.5-6.3	2.5-6.3	20,000 >
10	Semi 3-8	11	8.0-26.0	2.5-6.3	10.0-20.0	6.0-12.0	2.5-6.3	2.5-6.3	2.5-6.3	2.5-6.3	2.5-6.3	2.5-6.3	20,000 >
10	Semi 5-6	11	8.0-26.0	2.5-6.3	2.5-6.3	2.5-6.3	6.3-15.0	2.5-6.3	2.5-6.3	2.5-6.3	2.5-6.3	2.5-6.3	20,000>
13	Semi 3-*-*	11	8.0-45.0	3.0-45.0	3.0-45.0	3.0-45.0	3.0-45.0	3.0-45.0	3.0-45.0	3.0-45.0	3.0-45.0	3.0-45.0	20,000 >