Evaluation/Calibration Report

Ohio, SPS 1

Task Order 3, CLIN 2
Visit Date: April 14 and 15, 2004

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1 Executive Summary

A visit was made to the Ohio SPS-1 on April 14 and 15, 2004 for the purposes of conducting a field performance evaluation and calibration of the WIM system located on US route 23 at milepost 19.7. The calibration procedures were in accordance with LTPP's SPS WIM Data Collection Guide dated August 31, 2001.

The site did not meet research quality standards at the completion of the validation visit.

The system currently does not use weight as part of the classification algorithm. Therefore the system is unable to provide research quality classification information.

The site is instrumented with Mettler-Toledo load cell sensors and WIM controller.

The validation used the following trucks:

1) 3S2 with a tractor having air suspension and split rear tandem trailer having air suspension, loaded to 78,050 lbs.
2) 3S2 with a tractor having air suspension and trailer having air suspension, loaded to 52,170 lbs.
3) 3S2 with a tractor having air suspension and trailer having a standard two leaf spring suspension, unloaded, weighing 32,430 lbs.

The validation speeds ranged from 42 to 57 miles per hour. The pavement temperatures ranged from 38.5 to 97 degrees Fahrenheit.

Table 1 Post-Validation results – 390100 - 15 April 2004

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Loaded single axles	±20 percent	-4.8% ± 5.9%	Pass
Loaded tandem axles	±15 percent	6.7% ± 14.4%	**Fail**
Gross vehicle weights	±10 percent	1.8% ± 9.5%	**Fail**
Vehicle speed	±1 mph [2 km/hr]		
Axle spacing length	± 0.5 ft [150 mm]	-0.2 ± 0.1 ft	Pass

Verification of speeds post-calibration was not completed. Speed was not an influence on the classification outcome.

This site as currently calibrated fails LTPP precision requirements for gross vehicle weights and loaded tandem axles. The failure is due to the wide variation in the error for the tandem and gross vehicle weights attributable to the range of weights in the population used for testing. For any individual truck, the variability of the individual values was within the allowable limits. However, the variation in the

means was large enough that the overall variability was exceeded. The variability for individual trucks increased as the test truck weights decreased, indicating a probable pavement effect on the truck dynamics.

In the field, significant truck bouncing was observed at the transition from asphalt to concrete pavement approximately 165 feet prior to the WIM scale area. Profiling data supported this observation and indicated high index values throughout the WIM scale area, specifically the most critical area from 300 feet prior to the scale area, to 100 feet after the scale area.

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.

MACTEC field personnel worked with the agency and vendor representative to compute factor adjustments. The agency representative made all equipment changes. This was expected given the information on the Traffic Sheet 18 completed as part of the assessment visit held on November 12th and 13th, 2003.

As reported following the site assessment conducted on November 12th and 13th, 2003 the pavement condition was unsatisfactory for conducting a performance evaluation. There was significant distress observed at the point of asphalt to concrete pavement transition approximately 165 feet prior to the WIM scale area that may be influencing the WIM scale/truck interaction, increasingly as truck weights decrease. The WIM index was exceeded throughout the area, specifically the most critical area 300 feet prior to and 100 feet following the WIM scale. This is believed to also be diminishing the quality of the WIM system performance by at least moderately affecting the dynamics of the test trucks as they pass over the WIM scale, with the effect becoming increasingly worse as the truck weights decrease.

During the initial validation, the WIM system demonstrated an increased error effect of the weights as the weights of the trucks decrease. At that time it was recommended that the agency coordinate with the manufacturer to complete an assessment and calibration of the "span" setting for each weight sensor in the LTPP lane. Alternatively, it was also recommended that pavement remediation be performed. During the recent validation it was noted that although the "span" adjustment was performed the error effect still existed. Hence, the second recommendation to grind the pavement to smooth out the problems indicated in profile/WIM Profile Index should be performed. Reinstallation of the load cell sensors may be necessary.

2 Corrective Actions Recommended

The system's classification algorithms should be augmented with weight parameters to correct the problem of small Class 5 vehicles being classified as Class 3s and 4s and vice versa.

The system's calibration should also be set up to allow for speed dependency compensation, rather than the overall span compensation currently being used. This would permit calibration factors that are speed dependent rather than using one factor to try to cover all conditions.

If the above mentioned adjustments cannot reduce the variability of the tandem and gross axle weights, pavement remediation will need to be performed to reduce the effect of the pavement on the truck dynamics.

It was noted in the field that there were technical problems with the WIM scales themselves, which caused ghost axles. This then caused misclassification of the vehicles. This was identified on site, investigated by the vendor's representative, but no definite conclusions as to the cause were discovered. Test truck runs with ghost axles were not included in the analysis and additional runs were substituted for them. The agency is aware of the problem and will work with the vendor to further investigate the cause of the ghost axles and will make repairs accordingly.

The backup of the water being drained from the sensors identified during the assessment was reevaluated. The condition described at that time remains. Although there appears to be adequate room for a significant amount of water, if the drainage pipe was to back up and become frozen, the scale pit will begin to fill eventually keeping the scale from operating properly.

3 Post Calibration Analysis

This final analysis is based on test runs conducted April 15, 2004 from 2:40 p.m. till 5:10 p.m. at test site 390100 on US 23 at 7.6 miles north of SR 37. This SPS-1 site is at milepost 19.7 on the southbound, right hand lane of a divided four-lane facility. No auto-calibration was used during test runs. The three trucks used for initial calibration and for the subsequent testing included:

1) 3S2 with a tractor having air suspension and split rear tandem trailer having air suspension, loaded to 78,050 lbs.
2) 3S2 with a tractor having air suspension and trailer having air suspension, loaded to 52,170 lbs.
3) 3S2 with a tractor having air suspension and trailer having a standard two leaf spring suspension, unloaded, weighing 32,430 lbs.

All three trucks made a total of 40 passes over the WIM scale. Speeds ranged from 42.0 to 54.0 miles per hour. Pavement surface temperatures recorded during the test runs

ranged from 72.0 to 97.0 degrees Fahrenheit. The computed values of 95% confidence limits of each statistic for the total population are in Table 2.

As seen in Table 2 the site passed all the values except the loaded tandem axles and the gross vehicle weights.

Table 2 Post-Validation Results – 390100 – 15 April 2004

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Loaded single axles	±20 percent	-4.8% ± 5.9%	Pass
Loaded tandem axles	±15 percent	6.7% ± 14.4%	**Fail**
Gross vehicle weights	±10 percent	1.8% ± 9.5%	**Fail**
Vehicle speed	±1 mph [2 km/hr]		
Axle spacing length	± 0.5 ft [150 mm]	-0.2 ± 0.1 ft	Pass

The runs were conducted during the late afternoon hours resulting in a moderate 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 and temperature groups. The distribution of runs within these groupings is illustrated in Figure 3-1. The speed groups were divided as follows: Low speed = 42.0-45.0 mph, Medium speed = 46.0-51.0 mph and High speed = 52.0+ mph. The three temperature groups were created by splitting the runs between those from 70.0 to 77.0 degrees Fahrenheit for Low temperature, 78.0 to 90.0 degrees Fahrenheit for Medium temperature and 91.0 degrees Fahrenheit and above for High temperature.

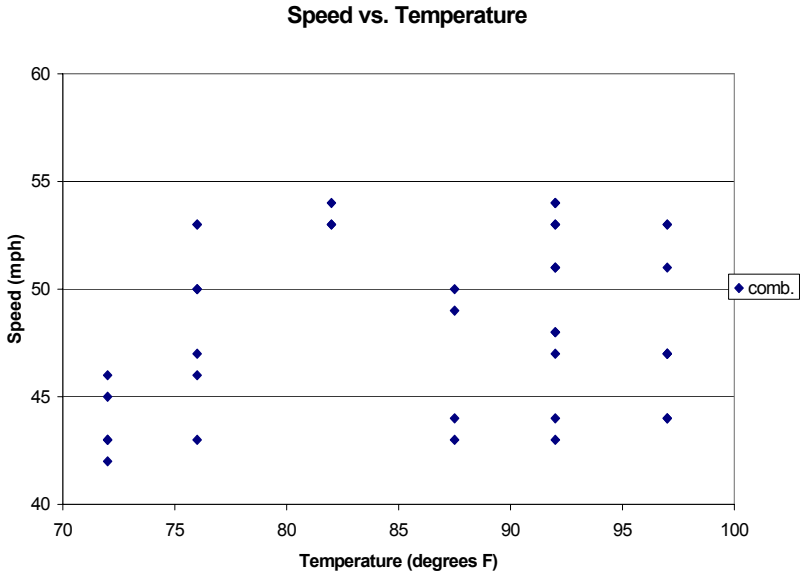


Figure 3-1 Post-Validation Speed-Temperature Distribution – 390100 - 15 April 2004

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

Figure 3-2 shows the By Truck GVW Percent Error vs. Speed graph for the population as a whole. From the figure it appears that the errors in GVW are larger for a light truck compared to the medium and heavy loaded trucks. The light trucks for which the equipment underestimates GVW by 5 to 9 percent are represented by triangles. The medium trucks represented by diamonds tend to have GVW overestimated by 2 to 6 percent. The heavy trucks shown with squares are generally having their GVWs underestimated by 2 to 5 percent. The medium and heavy trucks estimates trend down with increasing speed while light truck estimates trend up with increasing speed.

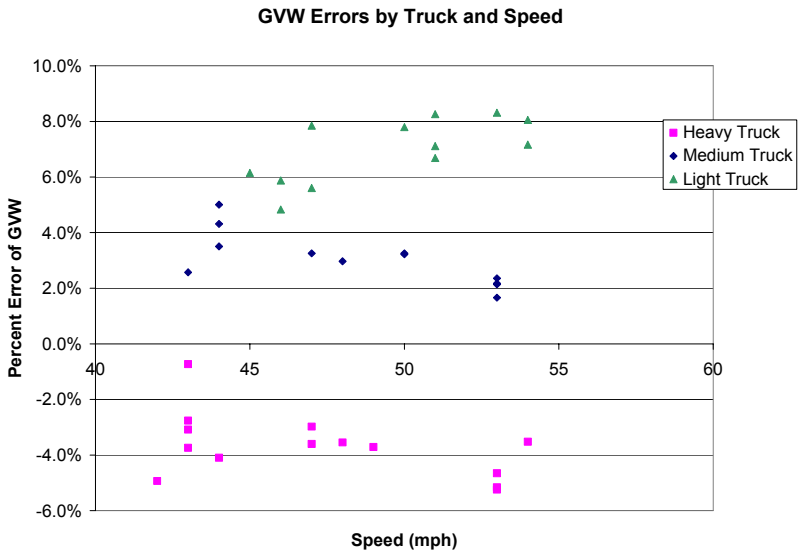


Figure 3-2 Post-validation GVW Percent Error vs. Speed by Truck – 390100 - 15 April 2004

Figure 3-3 shows the lack of relationship between temperature and GVW percentage error. While the truck errors are in distinct bands, there does not appear to be any trend errors with temperature variation.

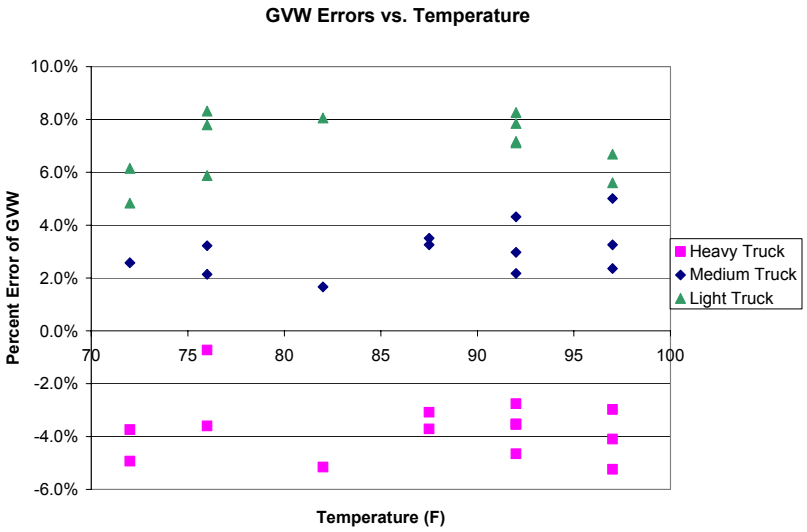


Figure 3-3 Post-Validation GVW Percent Error vs. Temperature by Truck – 390100 - 15 April 2004

Figure 3-4 shows the relationship between the spacing errors in feet and speeds. From the figure it appears that the axle spacing error is not significantly affected by the speed.

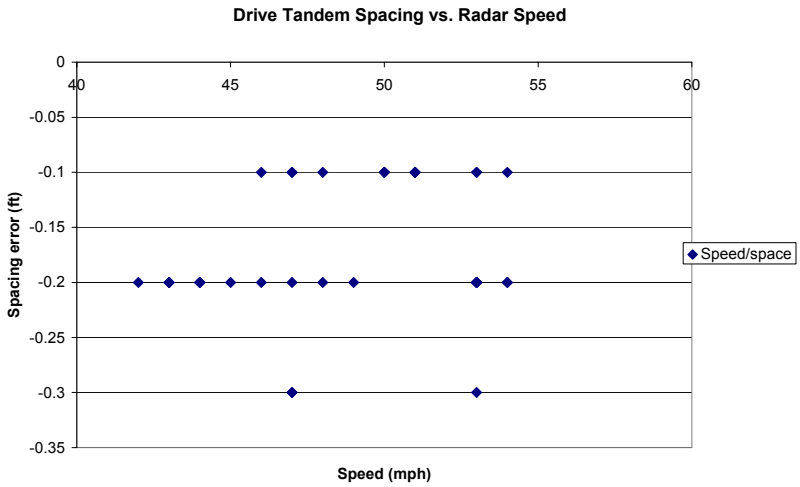


Figure 3-4 Post-Validation Speed vs. Spacing - 390100 - 15 April 2004

3.1 Temperature-based Analysis

The three temperature groups were created by splitting the runs between those from 70.0 to 77.0 degrees Fahrenheit for Low temperature, 78.0 to 90.0 degrees Fahrenheit for Medium temperature and 91.0 degrees Fahrenheit and above for High temperature.

Table 3 Post-Validation Results by Temperature Bin –390100 - 15 April 2004

Element	95% Limit	Low Temp.	Med. Temp.	High Temp.
Single axles	±20 %	-4.6% ± 8.2%	-5.1% ± 5.1%	-4.8% ± 5.3%
Tandem axles	±15 %	7.7% ± 15.7%	5.0% ± 15.8%	6.5% ± 14.7%
GVW	±10 %	2.3% ± 10.2%	0.6% ± 11.7%	1.9% ± 10.2%
Speed	±1 mph			
Axle spacing	± 0.5 ft	-0.2 ± 0.1 ft	-0.2 ± 0.1 ft	-0.2 ± 0.1 ft

From Table 3, Figure 3-5 and Figure 3-6 it appears that the error in GVW and the error in single axle weights are not significantly affected by the variation in temperature.

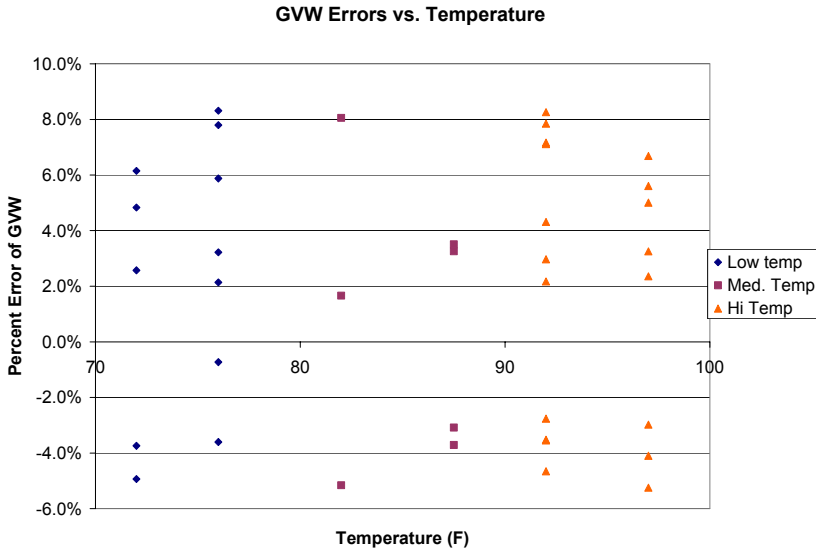


Figure 3-5 Post-Validation GVW Percent Error vs. Temperature by Group – 390100 - 15 April 2004

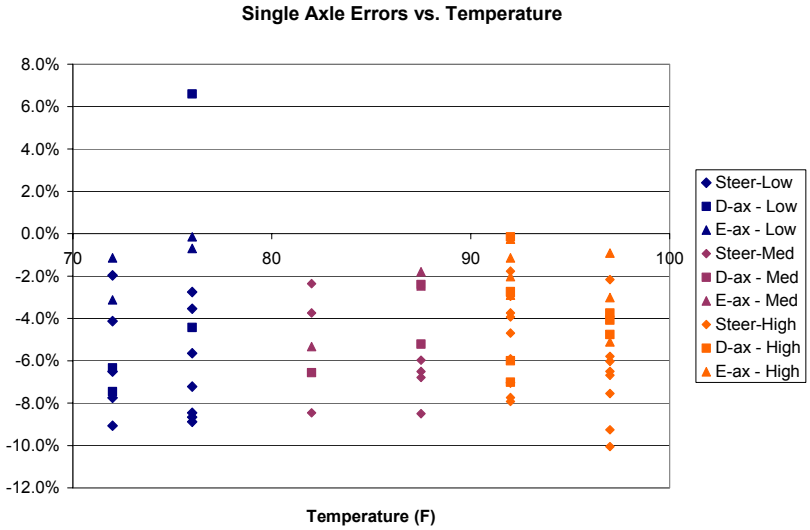


Figure 3-6 Post-Validation Single Axle Error vs. Temperature by Group - 390100 - 15 April 2004

3.2 Speed-based Analysis

The speed groups were divided as follows: Low speed = 42.0-44.0 mph, Medium speed = 46.0-51.0 mph and High speed = 52.0 and greater.

Table 4 Post-Validation Results by Speed Bin – 390100 - 15 April 2004

Element	95% Limit	Low Speed	Med. Speed	High Speed
Single axles	±20 %	-4.5% ± 7.9%	-4.6% ± 5.0%	-5.1% ± 5.0%
Tandem axles	±15 %	4.0% ± 13.0%	8.6% ± 14.6%	6.0% ± 16.4%
GVW	±10 %	0.2% ± 9.3%	3.3% ± 9.4%	1.2% ± 11.7%
Speed	±1 mph			
Axle spacing	± 0.5 ft	0.0 ± 0.0 ft	-0.2 ± 0.2 ft	-0.2 ± 0.1 ft

From Figure 3-7 it appears that as the speed increases the range of the GVW percent error increases. The individual trucks tend to be less variable. However, as speed increases the difference of the errors from zero is getting larger resulting in what looks like increasing variability.

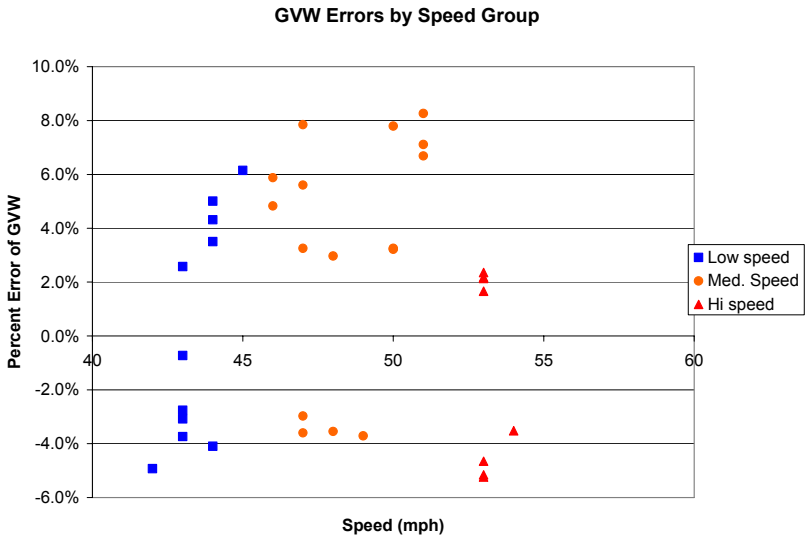


Figure 3-7 Post-Validation GVW Percent Error vs. Speed Group - 390100 - 15 April 2004

The error in GVW is influenced by truck weight. The error for the light truck (triangles) increases with increasing speed. For the medium truck (diamonds) the error is decreasing with increasing speeds and for the heavy truck (squares) the error does not vary significantly as shown in Figure 3-8. The GVW of the light truck is overestimated compared to the medium and heavy loaded trucks.

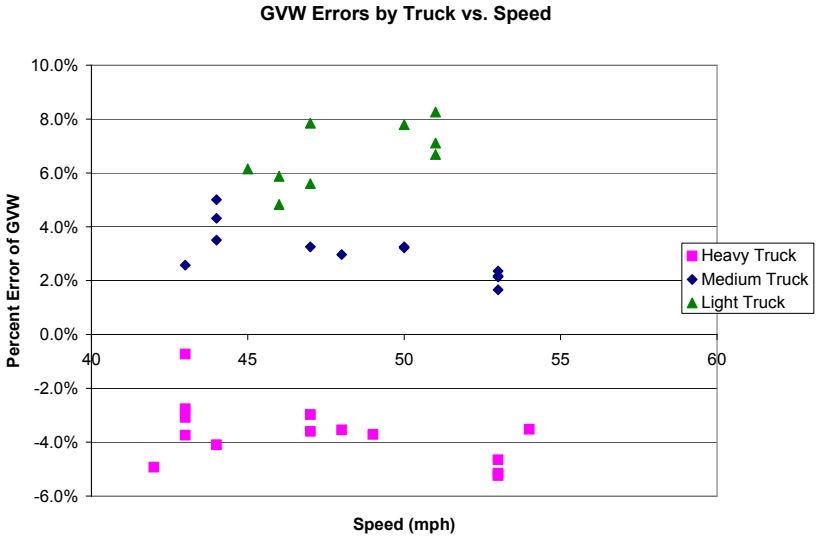


Figure 3-8 Post-Validation GVW Percent Error vs. Speed by Truck – 390100 - 15 April 2004

From Figure 3-9 it appears that the percent error of single axle weight becomes increasingly variable and the average percent error of single axle weight is not varying significantly.

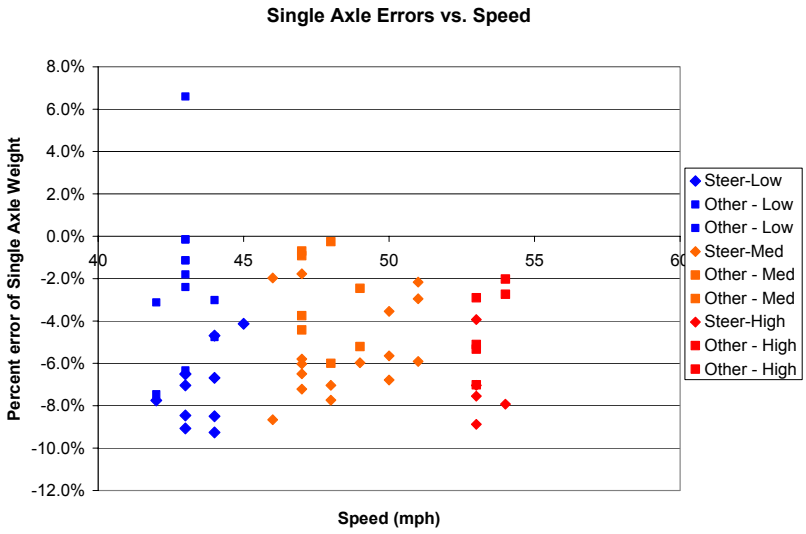


Figure 3-9 Post-Validation Single Axle Percent Error vs. Speed Group - 390100 - 15 April 2004

From Figure 3-10 it appears that the percent error in single axle weights for the light truck is becoming smaller with increasing speed. The medium truck and the heavy truck don't appear to have the same tendency.

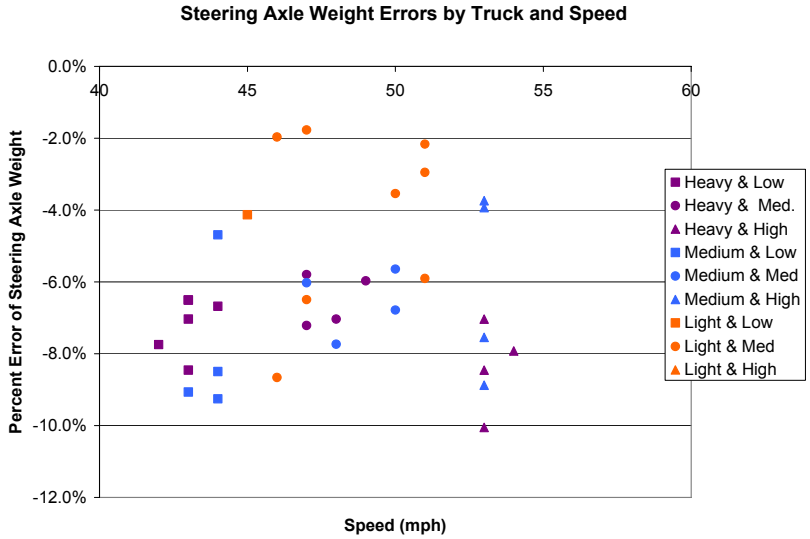


Figure 3-10 Post-Validation Steering Axle Percent Error vs. Speed by Truck - 390100 - 15 April 2004

3.3 Classification Validation

According to the agency, they use the 13-bin FHWA Classification scheme from the Traffic Monitoring Guide with a revision for Class 14, which accounts for the Michigan

grain trucks. However, as per the vendor ASCII format data files, the system collects and reports using the 6-digit Truck Weight System scheme for its native file format. The classification algorithm is strictly based on number of axles and has no provision for unknown or un-classified vehicles (Class 15s).

A sample of 100 trucks was collected at the site. Video was taken to provide ground truth for the evaluation. Based on a 100 percent sample it was determined that there are zero percent-unknown vehicles and zero percent-unclassified vehicles.

The second check is the ability of the algorithm to correctly distinguish between truck classes with no more than 2% errors in such classifications. The following are the classification error rates by class:

Table 5 Truck Misclassification Percentages for 390100 - 15 April 2004

Class	Percent Error	Class	Percent Error	Class	Percent Error
4	67	5	57	6	0
7	N/A				
8	0	9	1	10	100
11	N/A	12	100	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 Truck Classification Mean Differences for 390100 - 15 April 2004

Class	Mean Difference	Class	Mean Difference	Class	Mean Difference
4	0	5	-33	6	0
7	N/A				
8	0	9	-1	10	0
11	N/A	12	Unknown	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.

It was noted in the field that there were technical problems with the WIM scales themselves that caused ghost axles. This caused misclassification of the vehicles. This was identified on site, investigated by the vendor's representative, but no definite conclusions as to the cause were discovered. The test trucks, which demonstrated the ghost axles, were not included in the validation runs. The agency is aware of the problem and will work with the vendor to further investigate the cause of the ghost axles and will make repairs accordingly. As of the date of this report no resolution of the problem has been reported to us.

4 Pavement Discussion

This site was not recommended for validation based on the smoothness index values. Slightly more than half of the index values from the February 4, 2004 profiling are higher than the values from the assessment. The assessment values used data collected in December 2002. Most values are still clearly higher than the threshold currently identified for little if any influence on the results.

There have been no changes in condition or any maintenance activities since the assessment. The pavement condition did not appear to influence truck movement across the sensors. The discontinuity at the asphalt and portland cement concrete interface remains.

4.1 Profile analysis

The WIM site is a section of pavement that is 305 meters long with the WIM scale located at 274.5 meters from the beginning of the test section. An ICC profiler was used to collect longitudinal profiles of the test section with a sampling interval of 25 millimeters. The Long Range Index (LRI) incorporates the pavement profile starting 25.8 m prior to the scale and ending 3.2 m after the scale in the direction of travel. The Short Range Index (SRI) incorporates a shorter section of pavement profile beginning 2.7 m prior to the WIM scale and ending 0.5 m after the scale.

Profile data collected at the SPS WIM location by Stantec Inc. on February 4, 2004 was processed through the LTPP SPS WIM Index software. This WIM scale is installed in a portland cement concrete pavement. The results are shown in Table 7.

A total of 11 profiler passes have been conducted over the WIM site. Since the issuance of the LTPP directive on collection of longitudinal profile data for SPS WIM section, the requirements have been a minimum of 3 passes in the center of the lane and one shifted to each side. For this site the RSC has done 5 passes at the center of the lane, 3 passes shifted to the left side of the lane, and 3 passes shifted to the right side of the lane. Shifts to the sides of the lanes have been made such that data are collected as close to the lane edges as is safely possible. For each profiler pass, profiles are recorded under the left wheel path (LWP), and the right wheel path (RWP).

Table 7 shows the computed index values for all 11 profiler passes for this WIM site. The average values over the passes at each path are also calculated when three or more passes are completed. These are reflected in the next to last column of the table. Values above the index limits are presented in italics. Eight of twelve of these values are higher than those contained in the assessment report for profile runs done in December 2002. The right-most column includes the 2002 averages for comparison purposes.

Table 7 Long Range Index (LRI) and Short Range Index (SRI) - 390100 – 15 February-2004

Profiler Passes			**Pass 1**	**Pass 2**	**Pass 3**	**Pass 4**	**Pass 5**	**Ave. (2004)**	**Ave. (2002)**
Center	LWP	LRI (m/km)	*1.147*	*1.134*	*1.196*	*1.101*	*1.066*	***1.129***	***1.241***
		SRI (m/km)	*1.235*	*1.216*	*1.169*	*1.150*	*1.180*	***1.190***	***1.412***
	RWP	LRI (m/km)	*0.963*	*0.930*	*0.900*	*0.973*	*0.903*	***0.934***	***0.880***
		SRI (m/km)	*1.533*	*1.573*	*1.403*	*1.479*	*1.402*	***1.478***	***1.377***
Left Shift	LWP	LRI (m/km)	*1.131*	*1.404*	*1.122*			***1.219***	***1.183***
		SRI (m/km)	*1.327*	*1.720*	*1.390*			***1.479***	***0.970***
	RWP	LRI (m/km)	*0.886*	*0.900*	*0.896*			***0.894***	***0.954***
		SRI (m/km)	*1.395*	*1.224*	*1.467*			***1.362***	***1.254***
Right Shift	LWP	LRI (m/km)	*1.079*	*1.105*	*1.211*			***1.132***	***1.117***
		SRI (m/km)	*1.527*	*1.536*	*1.480*			***1.514***	***0.980***
	RWP	LRI (m/km)	*0.984*	*0.924*	*0.895*			***0.934***	***0.978***
		SRI (m/km)	*1.461*	*1.460*	*1.305*			***1.409***	***1.191***

All of the data exceeded the WIM Index value of 0.789 m/km as can be seen in the table. When all values are less than 0.789 it is presumed unlikely that pavement roughness will significantly influence sensor output. Values above that level may or may not influence the reported weights and potentially vehicle spacings. Based on the profile data analysis, the Ohio SPS-1 WIM site does not meet the requirements for WIM site locations. If any remedial action is taken it should be done for the entire section. Suggested alternatives for pavement corrections are grinding or slab replacement. It should be noted that the existing pavement is tined portland cement concrete. This tining makes it highly unlikely that the resulting profile index values will be below the performance threshold.

4.2 Distress survey and any applicable photos

The pavement is in a good condition except for the faulting at the transition of asphalt concrete pavement to cement concrete pavement 165 feet prior to the sensors. The trucks movement was slightly affected by the faulting. However, the trucks appear to stabilize before touching the sensors.

4.3 Vehicle-pavement interaction discussion

The trucks were bouncing due to the faulting at the transition of asphalt concrete pavement to cement concrete pavement 165 feet prior to the sensors. However, the trucks movement appears to stabilize before touching the sensors. The truck speed was not reduced as they approached or left the sensors. Most of the trucks were traveling along the wheel path. The tires appear to be fully touching the sensors.

5 Equipment Discussion

The traffic monitoring equipment at this location includes Mettler-Toledo load cell sensors and WIM controller. These sensors are installed in a staggered configuration in concrete pavement.

Since the validation on February 3 and 4, 2004 and before this validation the vendor performed static load tests and made adjustments to the operating parameters. These adjustments did not appear to have improved the linearity of the weights.

Ghost axles were observed in the course of the validation. Possible causes were investigated including vehicle type dependencies, vehicle weight dependencies and vehicle tracking. No generalization could be made as to a cause(s).

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.

A complete visual inspection of all WIM system and support components was also performed. All components were found to be in good physical condition.

The backup of the water being drained from the sensors identified during the assessment was reevaluated. The condition described at that time remains. Although there appears to be adequate room for a significant amount of water, if the drainage pipe was to back up and become frozen, the scale pit will begin to fill eventually keeping the scale from operating properly.

5.2 Calibration Process

A total of 3 iterations of the calibration process were done between the initial 43 runs and the final 40 runs.

5.2.1 Calibration Iteration 1

The results of the 43 pre-calibration runs performed by the three test trucks produced an average combined GVW error of +4.0%. The span adjustment factor, which is used to compensate for non-linear bias output, and is adjusted on a “trial and error” basis and not as a result of any mathematical calculation, was increased from 1.93 to 1.98 based on the recommendation of the vendor’s representative.

The first set of 11 iterations performed by the three trucks produced a mean error of +6.0%. The factor to be adjusted was the P4 factor, which is modified so that if weights are underestimated it is increased. If weights are overestimated it is decreased. The

adjustment increment used was the absolute value of the percent errors. The value of P4 was increased from 7.9000 to 14.0000 to reduce the size of the underestimate for GVW. The span adjustment was increased from 1.98 to 2.00.

Figure 5-1 shows the results of Calibration 1 adjustment. The runs were conducted at three different speeds. It appears that as the speed increased the percent of error for heavy (squares) and medium (diamonds) loaded trucks decreased whereas for light (triangles) truck there was no affect. The standard deviation for tandem and GVW errors decreased while their mean errors increased.

Table 8 Calibration Iteration 1 Results - 390100 - 15 April 2004 (beginning 7:54 a.m.)

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Loaded single axles	±20 percent	0.8% ± 7.3%	Pass
Loaded tandem axles	±15 percent	9.7% ± 12.3%	**Fail**
Gross vehicle weights	±10 percent	6.0% ± 8.8%	**Fail**
Vehicle speed	±1 mph [2 km/hr]		
Axle spacing length	± 0.5 ft [150 mm]	-0.2 ± 0.2 ft	Pass

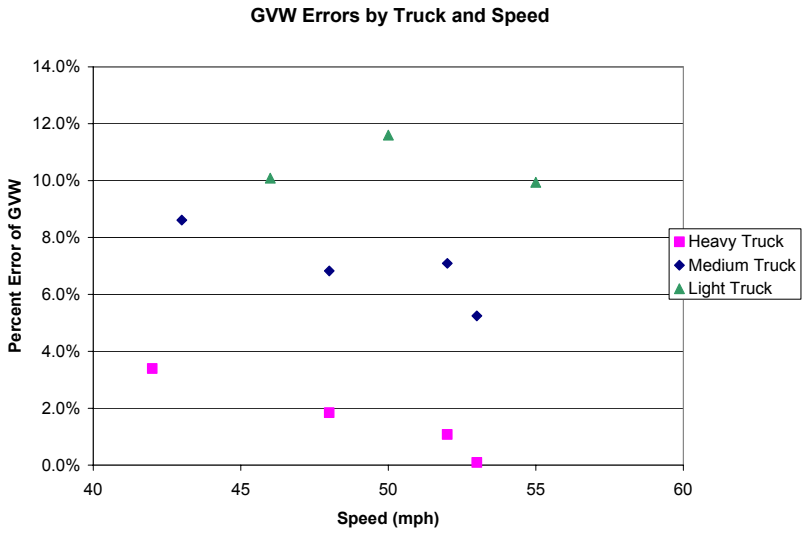


Figure 5-1 Calibration Iteration 1 GVW Percent Error vs. Speed Group - 390100 - 15 April 2004(beginning 7:54 a.m.)

5.2.2 Calibration Iteration 2

The results of the second set of 10 iterations performed by the three test trucks produced an average combined GVW error of +1.8%. The compensation factor (P4) setting was increased from 14.0000 to 16.0000. The span adjustment was increased from 2.00 to 2.03.

Figure 5-2 shows the results of Calibration 2 adjustment. The runs were conducted at three different speeds.

Table 9 Calibration Iteration 2 Results - 390100 - 15 April 2004 (beginning 9:31 a.m.)

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Loaded single axles	±20 percent	-3.1% ± 5.3%	Pass
Loaded tandem axles	±15 percent	4.6% ± 10.8%	**Fail**
Gross vehicle weights	±10 percent	1.8% ± 9.8%	**Fail**
Vehicle speed	±1 mph [2 km/hr]		
Axle spacing length	± 0.5 ft [150 mm]	-0.2 ± 0.1 ft	Pass

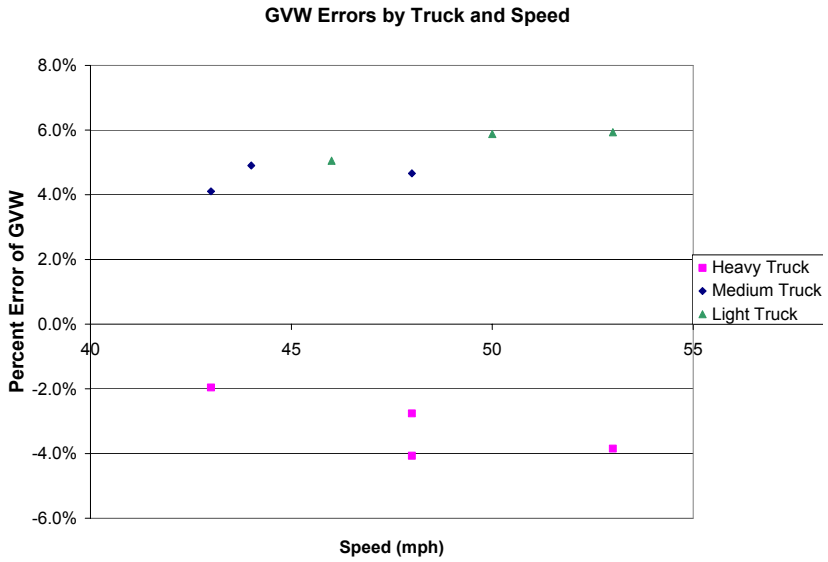


Figure 5-2 Calibration Iteration 2 GVW Percent Error vs. Speed Group - 390100 - 15 April 2004(beginning 9:31 a.m.)

5.2.3 Calibration Iteration 3

The results of the third set of 12 iterations performed by the three test trucks produced an average combined GVW error of +1.2%.

After the third set of iterations, it was determined that the span adjustment was not having the desired affect on the linearity problem being demonstrated by the WIM controller. Although adjustments to the P4 factor may improve the collective bias of the system, it would also not correct the non-linearity problem and further adjustments to either factor would not produce acceptable results. The system was determined as not be able to be calibrated to within LTPP research quality performance specifications. No further adjustments were made and the required 40 post calibration runs were performed.

Figure 5-3 shows the results of Calibration 3 adjustment. The runs were conducted at three different speeds.

Table 10 Calibration Iteration 3 Results - 390100 - 15 April 2004 (beginning 11:04 a.m.)

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Loaded single axles	±20 percent	-4.7% ± 6.0%	Pass
Loaded tandem axles	±15 percent	5.0% ± 11.7%	**Fail**
Gross vehicle weights	±10 percent	1.2% ± 10.0%	**Fail**
Vehicle speed	±1 mph [2 km/hr]		
Axle spacing length	± 0.5 ft [150 mm]	-0.2 ± 0.2	Pass

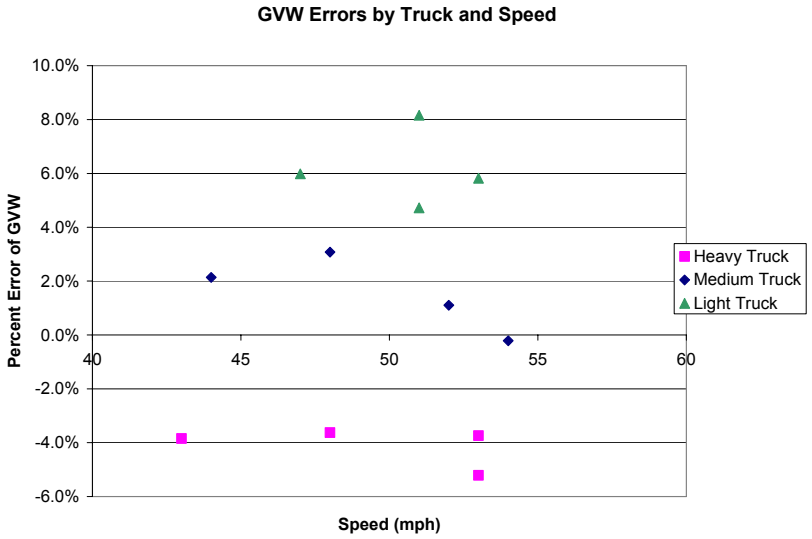


Figure 5-3 Calibration Iteration 3 GVW Percent Error vs. Speed Group - 390100 - 15 April 2004(beginning 11:04 a.m.)

The end result of the testing process was a set of runs with generally smaller mean errors and similar or small standard deviations of the errors.

5.3 Summary of Traffic Sheet 16s

This site has validation information from previous visits as well as the current one in the tables below.

Table 11 Classification Validation History – 390100

Date	Method	Mean Difference				Percent Unclassified
		Class 9	Class 8	Other (1)	Other (2)	
2/4/2004	No. of Trucks	1	0	-29 (Class 5)		1
4/14/2004	No. of Trucks	0	0	33 (Class 7)		0
4/15/2004	No. of Trucks	1	0	-33 (Class 5)		0

Table 12 Weight Validation History - 390100

Date	Method	Mean Error and (SD)		
		GVW	Single Axles	Tandem Axles
2/3/2004	Test Trucks	4.4 (4.4)	-4.5 (1.8)	8.3 (7.6)
2/4/2004	Test Trucks	1.8 (5.5)	-6.6 (2.2)	5.3 (9.9)
4/14/2004	Test Trucks	4.0 (4.7)	-1.8 (2.7)	8.3 (6.8)
4/15/2004	Test Trucks	1.8 (4.7)	-4.8 (2.3)	6.7 (7.2)

It should be noted that the 2002 validation was done with a single truck whereas both validations in 2004 were done using three trucks.

The equipment has been Mettler-Toledo load cells since the installation of the site.

5.4 Projected Maintenance/Replacement Requirements

Corrective maintenance on each WIM scale to resolve drainage deficiencies should be investigated and performed.

Grinding of the pavement to smooth out the problems indicated in the executive summary should be performed. Reinstallation of the load cell sensors may be necessary.

Corrective actions for the ghost axle problem should be determined and implemented.

6 Pre-Validation Analysis

This initial analysis is based on test runs conducted in the afternoon on April 14, 2004 at test site 390100 on US 23 south, 7.6 miles north of SR 37.

For the initial validation all of the trucks made a total of 43 passes over the WIM scale at speeds ranging from 42 to 57 miles per hour. Pavement surface temperatures were recorded during the test runs and ranged from 64.5 to 82.5 degrees Fahrenheit. The computed values of 95% confidence limits of each statistic for the total population are within Table 13.

As seen in Table 13 the site passed all the values except the loaded tandem axles and the gross vehicle weights.

Table 13 Pre-Validation Results - 390100 - 14 April 2004

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Loaded single axles	±20 percent	-1.8% ± 4.9%	Pass

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Loaded tandem axles	±15 percent	8.3% ± 13.6%	**Fail**
Gross vehicle weights	±10 percent	4.0% ± 9.5%	**Fail**
Vehicle speed	±1 mph [2 km/hr]	0.0 ± 0.5 mph	Pass
Axle spacing length	± 0.5 ft [150 mm]	-0.2 ± 0.1 ft	Pass

The test runs were conducted during the late morning hours until late afternoon, resulting in a modest range of pavement temperatures. The runs were conducted at various speeds to determine the effects of these variables on the performance of the WIM scale. To investigate these effects, the dataset was split into three speed and temperature groups. The distribution of runs within these groupings is illustrated in Figure 6-1. The speed groups were divided as follows: Low speed = 42.0-45.0 mph, Medium speed = 46.0-51.0 mph and High speed = 52.0+ mph. The three temperature groups were created by splitting the runs between those at 64.5 to 66.0 degrees Fahrenheit for Low temperature, 67.0 to 75.0 degrees Fahrenheit for Medium temperature and 76.0 degrees Fahrenheit and above for High temperature.

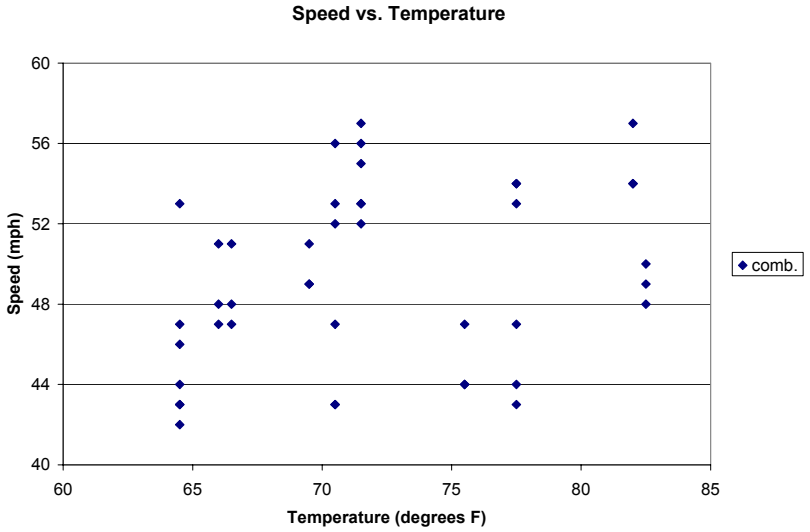


Figure 6-1 Pre-Validation Speed-Temperature Distribution – 390100 - 14 April 2004

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

Figure 6-2 shows the by truck GVW percent error vs. Speed graph for the population as a whole. From the figure it appears that the error was varying significantly by truck. The GVW was slightly underestimated for the heavy truck (squares) compared to the medium (diamonds) and light (triangles) loaded trucks, which were overestimated.

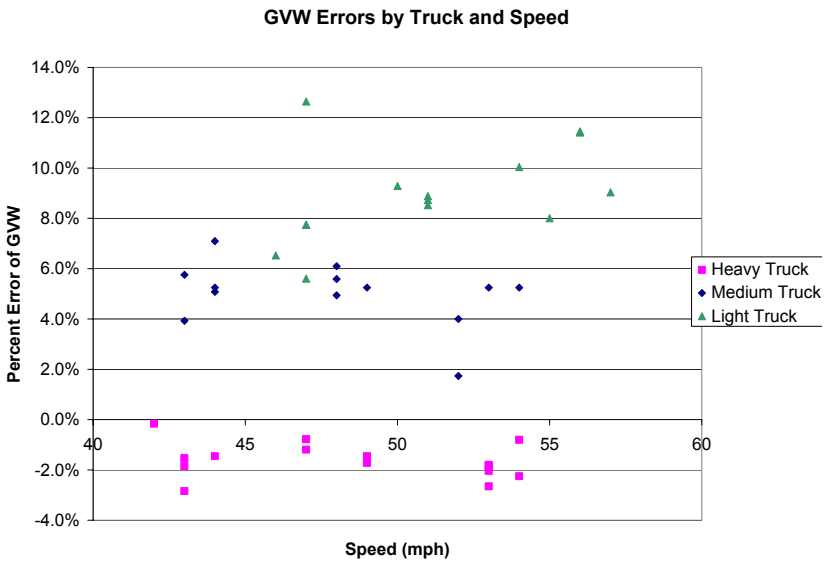


Figure 6-2 Pre-validation GVW Percent Error vs. Speed by Truck– 390100 - 14 April 2004

Figure 6-3 shows the relationship between temperature and GVW percentage error. From the figure it appears that the errors are not influenced by temperature.

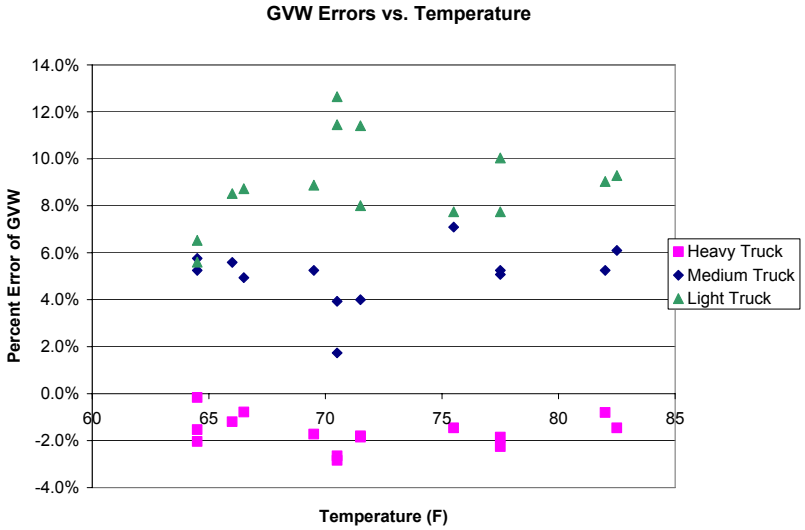


Figure 6-3 Pre-Validation GVW Percent Error vs. Temperature by Truck – 390100 - 14 April 2004

Figure 6-4 shows the relationship between the spacing errors in feet and speeds. From the figure it appears that the speed did not significantly affect the errors in spacing.

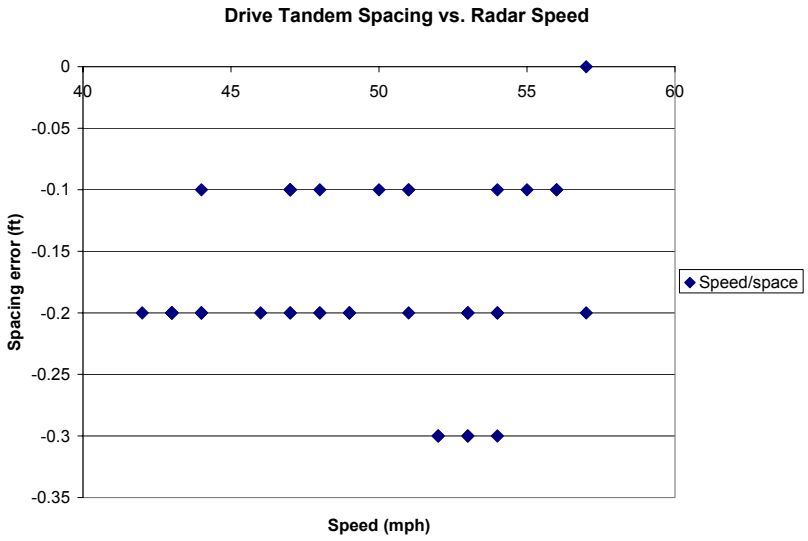


Figure 6-4 Pre-Validation Speed vs. Spacing - 390100 - 14 April 2004

6.1 Temperature-based Analysis

The three temperature groups were created by splitting the runs between those at 64.5 to 66.0 degrees Fahrenheit for Low temperature, 67.0 to 75.0 degrees Fahrenheit for Medium temperature and 76.0 degrees Fahrenheit and above for High temperature.

Table 14 Pre-Validation Results by Temperature Bin - 390100 - 14 April 2004

Element	95% Limit	Low Temp.	Med. Temp.	High Temp.
Single axles	±20 %	-1.7% ± 5.3%	-2.0% ± 5.8%	-1.6% ± 4.2%
Tandem axles	±15 %	7.1% ± 11.1%	8.6% ± 18.3%	8.9% ± 11.9%
GVW	±10 %	3.5% ± 8.7%	4.0% ± 12.3%	4.3% ± 9.8%
Speed	±1 mph			
Axle spacing	± 0.5 ft	-0.2 ± 0.1 ft	-0.2 ± 0.2 ft	-0.2 ± 0.2 ft

From Table 14 there are numeric trends for single axles and GVW errors. For single axles the average error is getting smaller and the two standard deviation limits are increasing. For GVW, the average error and the two standard deviation limits are increasing. For tandem axles the average error increases with temperature but there is no pattern to the standard deviation.

Graphically Figure 6-5 shows no particular relation between GVW errors and temperature.

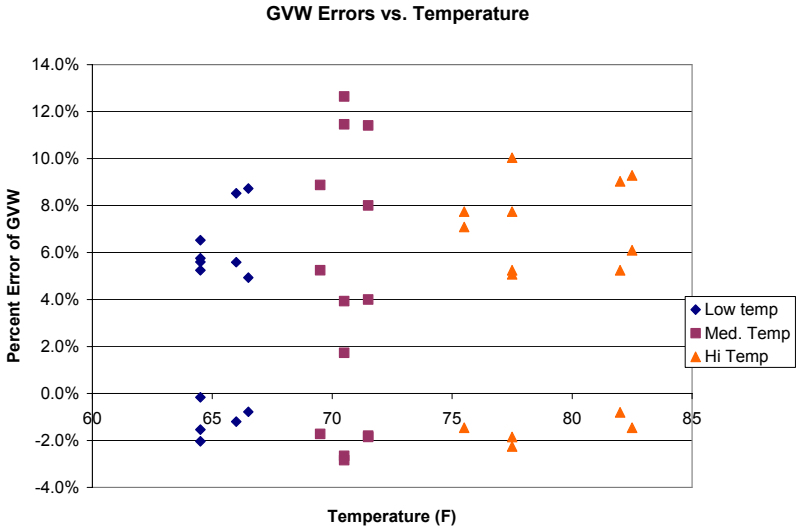


Figure 6-5 Pre-Validation GVW Percent Error vs. Temperature by Group – 390100 - 14 April 2004

Figure 6-6 shows the trend of decreasing average errors with temperature.

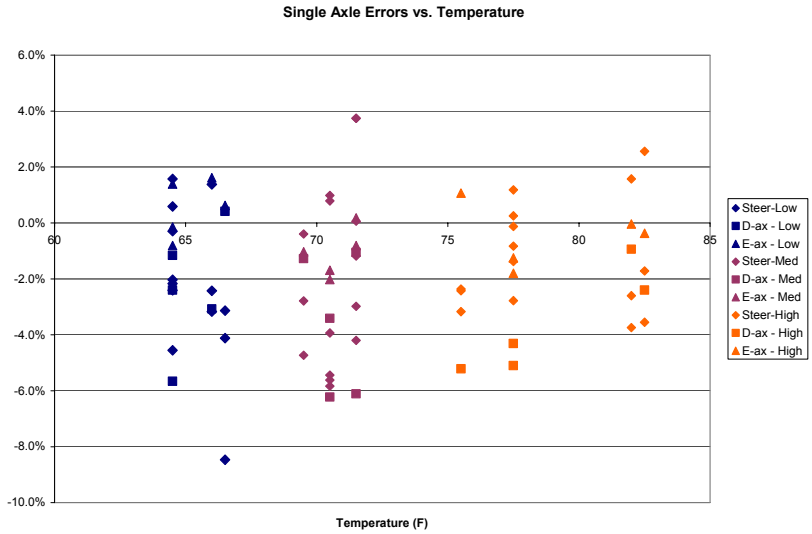


Figure 6-6 Pre-Validation Single Axle Error vs. Temperature by Group - 390100 - 14 April 2004

6.2 Speed-based Analysis

The speed groups were divided as follows: Low speed = 42.0-45.0 mph, Medium speed = 46.0-51.0 mph and High speed = 52.0+ mph.

Table 15 shows the error statistics by speed group. The error variability is increasing with increasing speed for all weight elements. There is no particular trend with speed for

the mean errors except for the single axles where mean errors are decreasing with increasing speed.

Table 15 Pre-Validation Results by Speed Bin - 390100 - 14 April 2004

Element	95% Limit	Low Speed	Med. Speed	High Speed
Single axles	±20 %	-2.3% ± 5.3%	-1.6% ± 5.0%	-1.6% ± 5.2%
Tandem axles	±15 %	5.9% ± 10.5%	9.8% ± 13.7%	7.9% ± 15.8%
GVW	±10 %	1.9% ± 8.6%	5.4% ± 9.1%	3.7% ± 11.5%
Speed	±1 mph			
Axle spacing	± 0.5 ft	0.1 ± 0.1 ft	-0.2 ± 0.1 ft	-0.2 ± 0.2 ft

From Figure 6-7 it appears that the error variability for GVW increased with increase in speed.

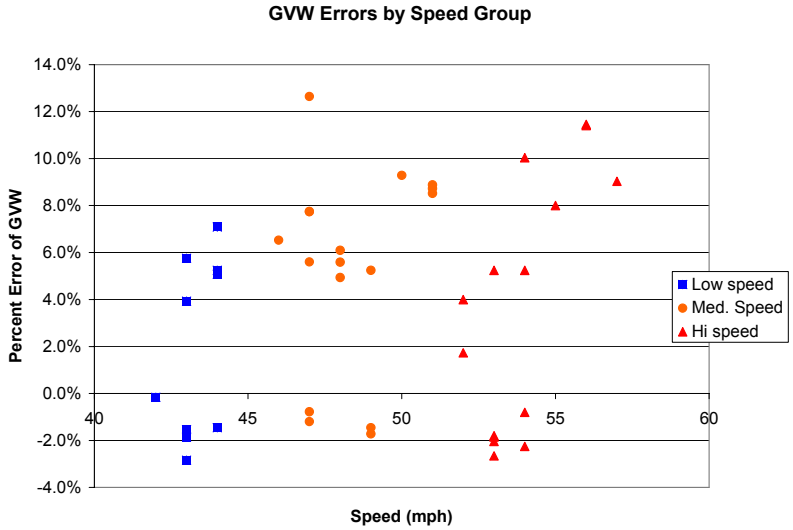


Figure 6-7 Pre-Validation GVW Percent Error vs. Speed Group - 390100 - 14 April 2004

From Figure 6-8 it appears that a distinct by vehicle pattern emerges that is independent of speed for the medium and heavy vehicles. Each vehicle displays its own characteristics with respect to the mean and the variability of the GVW error. As initially observed the light truck (triangles) is over-estimated by at six to twelve percent and the errors appear to increase with speed. The medium truck (diamonds) is estimated at two to seven percent over its actual weight and trend might slightly lower with increasing speed. The heavy truck (squares) is about two percent underestimated and appears to have consistent errors independent of the speed.

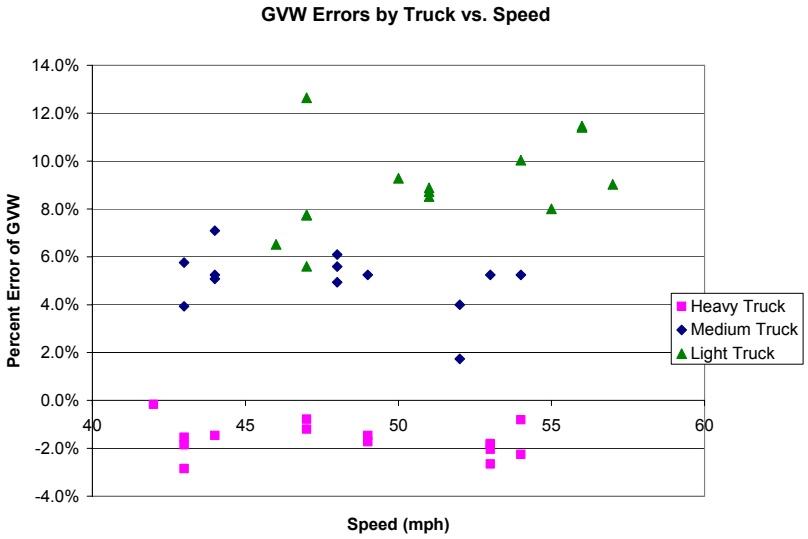


Figure 6-8 Pre-Validation GVW Percent Error vs. Speed by Truck – 390100 - 14 April 2004

From Figure 6-9 it appears that the error in single axle weights increases with increase in speed.

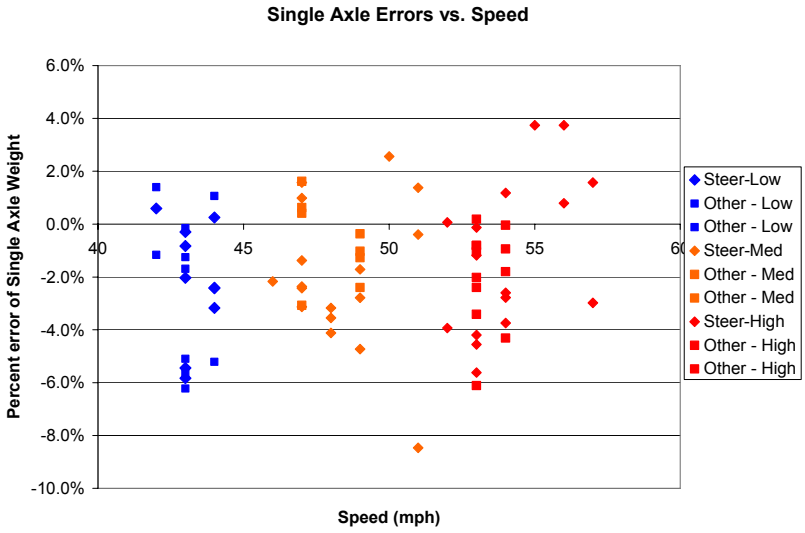


Figure 6-9 Pre-Validation Single Axle Percent Error vs. Speed Group - 390100 - 14 April 2004

From Figure 6-10 it appears that the single axle weight errors increased with increasing speed for the light truck whereas the errors were not significantly influenced for the heavy and medium loaded trucks.

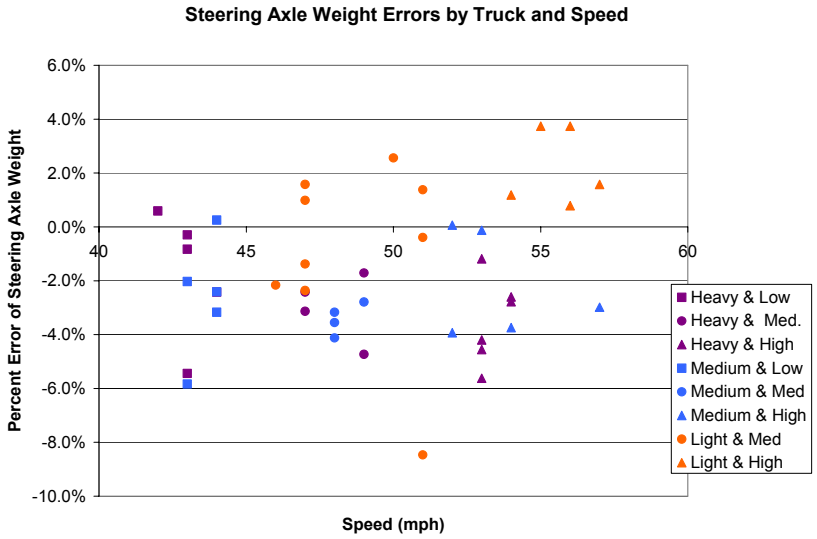


Figure 6-10 Pre-Validation Steering Axle Percent Error vs. Speed by Truck - 390100 - 14 April 2004

6.3 Classification Validation

According to the agency, they use the 13-bin FHWA Classification scheme from the Traffic Monitoring Guide with a revision for Class 14, which accounts for the Michigan grain trucks. However, as per the vendor ASCII format data files, the system collects and reports using the 6-digit Truck Weight System scheme for its native file format. The classification algorithm is strictly based on number of axles and has no provision for unknown or un-classified vehicles (Class 15s).

A sample of 100 trucks was collected at the site. Video was taken to provide ground truth for the evaluation. Based on a 100 percent sample it was determined that there are zero percent unknown and 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. The following are the classification error rates by class:

Table 16 Truck Misclassification Percentages for 390100 – 14 April 2004

Class	Percent Error	Class	Percent Error	Class	Percent Error
4	0	5	14	6	0
7	60				
8	0	9	0	10	14
11	0	12	N/A	13	N/A

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

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

Table 17 Truck Classification Mean Differences for 390100 – 14 April 2004

Class	Mean Difference	Class	Mean Difference	Class	Mean Difference
4	0	5	-14	6	0
7	33				
8	0	9	0	10	17
11	0	12	N/A	13	N/A

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

7 Data Availability and Quality

As of April 15, 2004 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 18. 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 1998, 2000 and 2001 have a sufficient quantity to be considered complete years of data. Calibration information has not been provided for this site as of the December 2003 upload. In the absence of previously gathered validation information it can be seen that at least 5 additional years of research quality data are needed to meet the goal of a minimum of 5 years of research quality classification and weight data.

Table 18 Amount of Traffic Data Available 390100 – 15 April 2004

Year	Classification Days	Months	Coverage	Weight Days	Months	Coverage
1998	261	11	Complete Week	273	11	Complete Week
2000	291	11	Complete Week	299	12	Complete Week
2001	283	12	Complete Week	289	12	Complete 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 constitutes 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 RSCs 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 19 GVW Characteristics of Major sub-groups of Trucks - 390100 - 16 April 2004

	Class 9
Percentage Overweights	0.0 %
Percentage Underweights	2.1%
Unloaded Peak	36,000 lbs
Loaded Peak	80,000 lbs

The expected percentage of unclassified vehicles is zero.

The graphical screening comparison figures are found in Figure 7-1 through Figure 7-3.

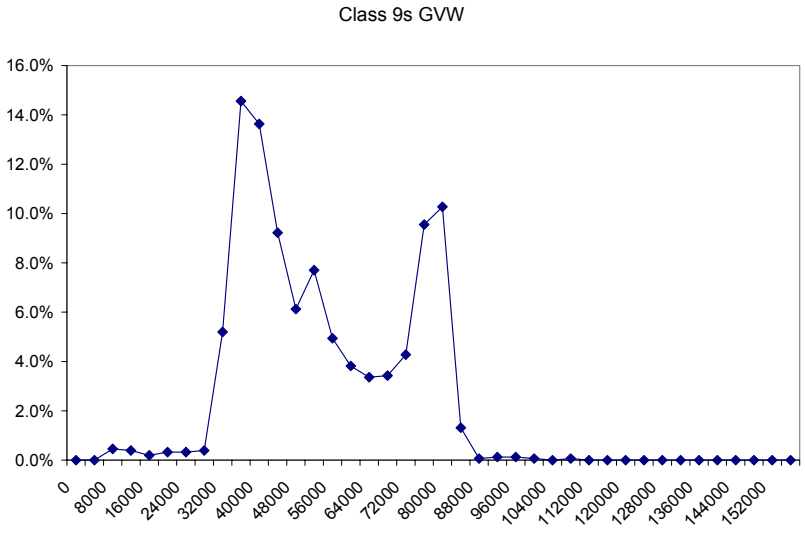


Figure 7-1 Expected GVW Distribution Class 9 – 390100 - 16 April 2004

The Class 15s shown in Figure 7-2 represent 0.3 percent of the population. This data was obtained from the raw data file. Class 15s may not appear in the processed traffic data in which case the vehicle distribution pattern will change in the graphs generated using the processed traffic data.

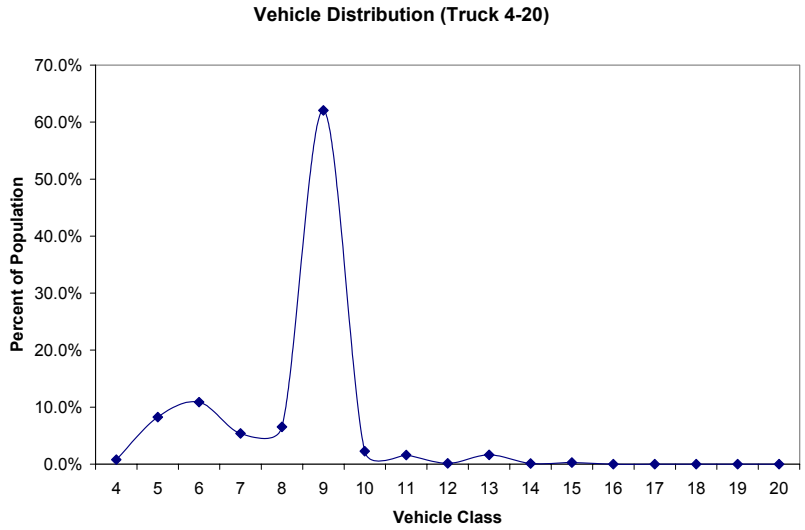


Figure 7-2 Expected vehicle distribution - 390100 - 16 April 2004

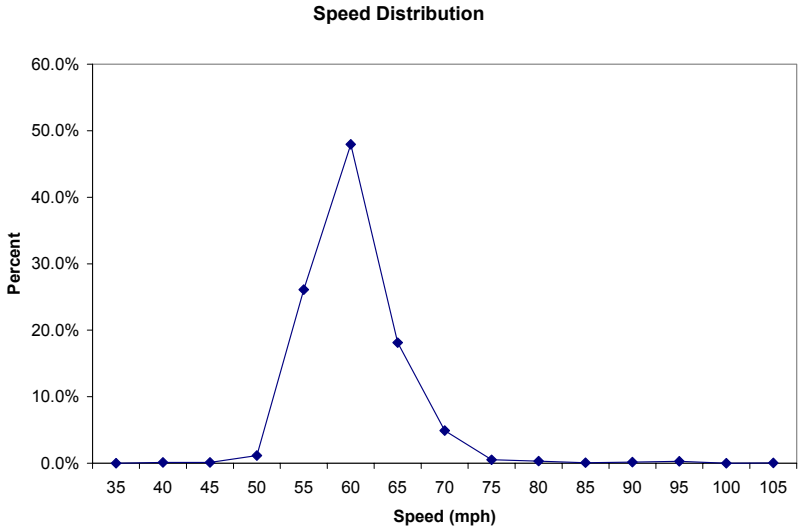


Figure 7-3 Expected speed distribution - 390100 - 16 April 2004

8 Data Sheets

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

Sheet 19 – Truck 1 – Class 9 fully loaded (4 pages)
Sheet 19 – Truck 2 – Class 9 partially loaded (4 pages)
Sheet 19 – Truck 3 – Class 9 empty (4 pages)

Sheet 20 – Speed and Class verification pre-validation (2 pages)
Sheet 20 – Classification verification – post-validation (2 pages)

Sheet 21 – Pre-validation (6 pages)
Sheet 21 – Calibration Iteration 1 – (2 pages)
Sheet 21 – Calibration Iteration 2 – (2 pages)
Sheet 21 – Calibration Iteration 3 - (2 pages)
Sheet 21 – Post-validation (5 pages)

Pre and post validation analysis of the A-file data – 3 pages

9 Updated handout guide and Sheet 17

A copy of the handout has been included following page 30. 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 at the very end of the report.

HANDOUT GUIDE FOR SPS WIM FIELD PERFORMANCE EVALUATION AND CALIBRATION

STATE: Ohio

SHRP ID: 0100

Figures

1. General Information

SITE ID: *390100*

LOCATION: *US 23 SB (Mile Post: 19.7) near Delaware*

VISIT DATE: *April 14 and 15, 2004*

VISIT TYPE**:** *Field Performance Evaluation and Calibration*

2. Contact Information

POINTS OF CONTACT:

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

Highway Agency: *Steven Jessberger, 614-752-4057, steven.jessberger@dot.state.oh.us*

Roger Green, 614-995-5993, roger.green@dot.state.oh.us

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

FHWA Division Office Liaison: *Herman Rodrigo, 614-280-6850, herman.rodrigo@fhwa.dot.gov*

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

3. Agenda

BRIEFING DATE: *No Briefing Requested*

ONSITE PERIOD: *April 14 and 15, 2004*

TRUCK ROUTE CHECK: *Completed at Assessment Visit (See Truck Route)*

4. Site Location/ Directions

NEAREST AIRPORT: *Port Columbus International Airport, Columbus, OH*

DIRECTIONS TO THE SITE: *7.6 miles North of SR 37*

MEETING LOCATION: *On site*

WIM SITE LOCATION: *US 23 (Milepost 19.7)*

WIM SITE LOCATION MAP:*See Figure 4.1*

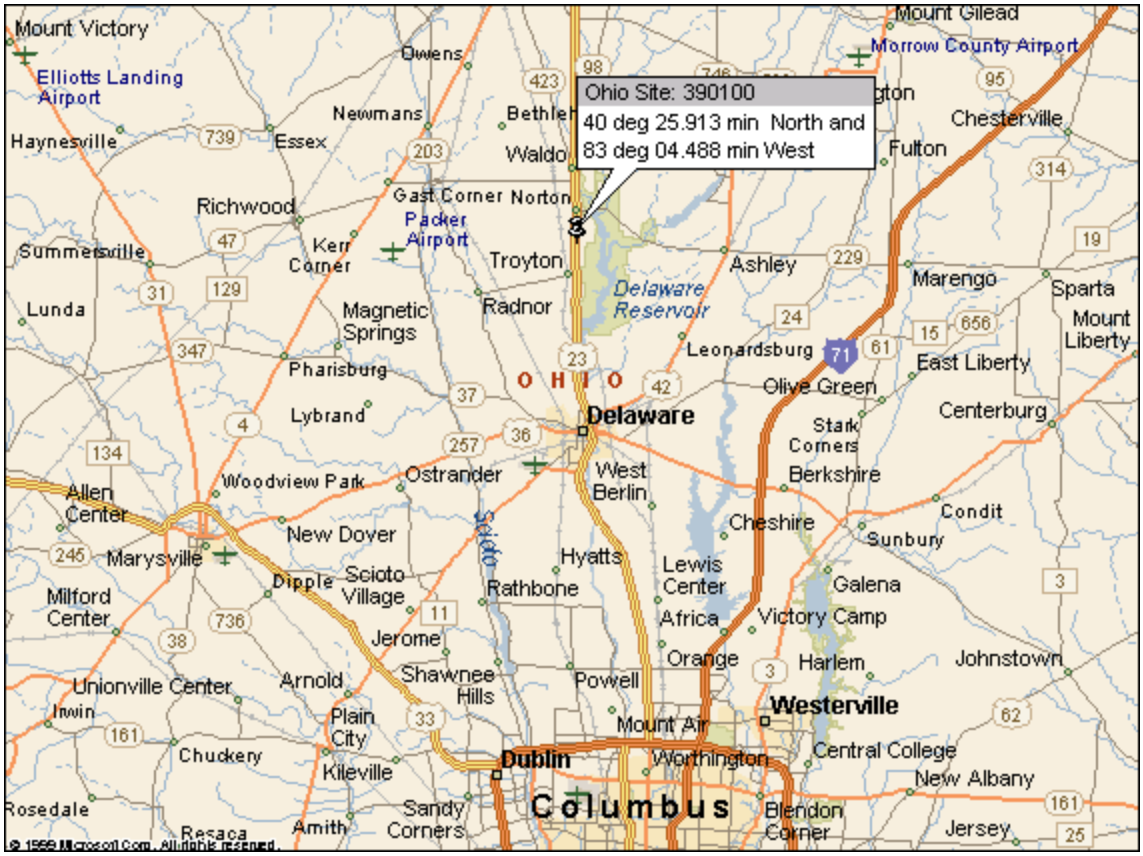


Figure 4.1: Section 390100 near Delaware, Ohio

5. Truck Route Information

ROUTE RESTRICTIONS: *None*

SCALE LOCATION:*I-71 Milepost 129, Hours: 7:00 a.m.-3:00 p.m. and 8:00 p.m.-4:00 a.m. Contact: Don Brane, Phone: (740) 965-3105.*

TRUCK ROUTE:

- *Northbound Turnaround –1.678 miles from site at SR 229 (40^0 26.035' North and 83^0 04. 363' West)*
- *Southbound Turnaround –1.424 miles from site at Irwin Road (40^0 23. 356' North and 83^0 04.459' West)*

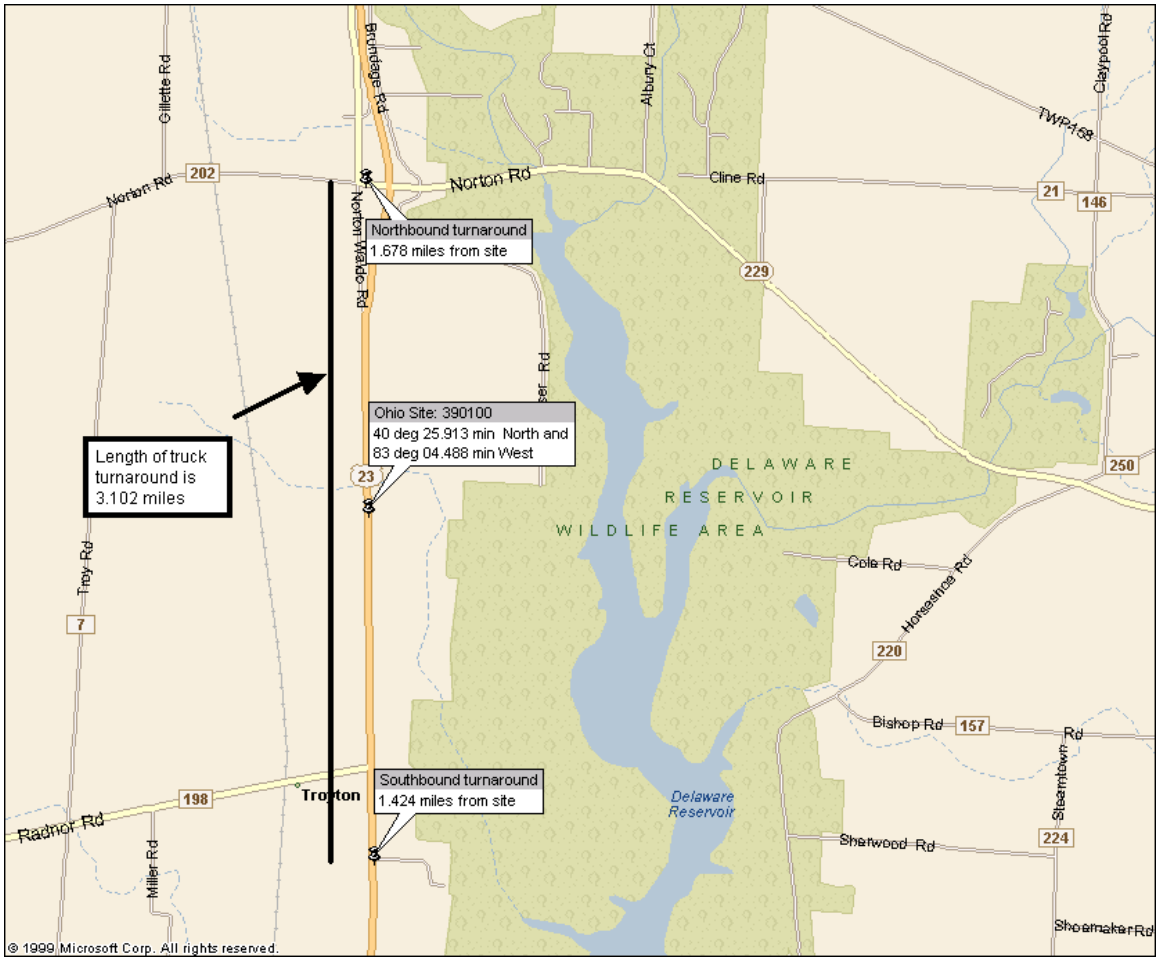


Figure 5.1: Truck Route at 390100

6. Sheet 17 – Ohio (390100)

1.* ROUTE ___US 23____MILEPOST ___19.7_LTPP DIRECTION - N S E W

2.* WIM SITE DESCRIPTION - Grade ____<1____ % Sag vertical Y / N
Nearest SPS section upstream of the site _0__ _1__ _6__ _1__
Distance from sensor to nearest upstream SPS Section ___ _3__ _1__ _2__ ft

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

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

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

Shoulder width _1_ _0__ ft

4.* PAVEMENT TYPE _____Cement Concrete_____

5.* PAVEMENT SURFACE CONDITION – Distress Survey
Date _____11-12-03_____ Distress Photo Filename __
Downstream_1_TO_1_6A_39_0100_11_12_03.JPG _____
Date _____11-12-03_____ Distress Photo Filename _
Upstream_TO_1_6A_39_0100_11_12_03.JPG _____
Date _____11-12-03_____ Distress Photo
Filename_____

6. * SENSOR SEQUENCE _____Loop-Load Cell-Staggered in wheel path__

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

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

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

Clearance under plate ___ _6__. _0__ in
Clearance/access to flush fines from under system Y / N

10. * CABINET LOCATION

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

Distance from edge of traveled lane _2_ _5_ ft

Distance from system __ __ __ ft

TYPE _____Mettler - Toledo_____

CABINET ACCESS controlled by LTPP / STATE / JOINT?

Contact - name and phone number ___Steven Jessberger 614-752-4057__

Alternate - name and phone number __Dave Gardner 614-752-5740____

11. * POWER

Distance to cabinet from drop ___ _1__ _0__ ft Overhead / underground / solar / AC in cabinet?

Service provider __Amer. Elec. Power_____ Phone number _____

12. * TELEPHONE

Distance to cabinet from drop _6__ _5__ _0__ ft Overhead / under ground / cell?

Service provider ____Verizon_____ Phone Number _____

13.* SYSTEM (software & version no.)- _____Mettler - Toledo_____

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

14. * TEST TRUCK TURNAROUND time __10_____ minutes DISTANCE _6.2__ mi.

15. PHOTOS FILENAME

Power source __AC_Meter_Box_TO_1_6A_39_0100_11_12_03.JPG_____

Phone source _ Phone_Pedestal_1_TO_1_6A_39_0100_11_12_03.JPG_____

Cabinet exterior _Cabinet_Exterior_1_TO_1_6A_39_0100_11_12_03.JPG _____

Cabinet interior _Cabinet_Interior_1_TO_1_6A_39_0100_11_12_03.JPG ____

Weight sensors _ Weigh_Sensor_TO_1_6A_39_0100_11_12_03.JPG _____

Classification sensors __ Loop_Sensor_TO_1_6A_39_0100_11_12_03.JPG _____

Other sensors _____

Description _____

Downstream direction at sensors on LTPP lane

Downstream_1_TO_1_6A_39_0100_11_12_03.JPG _____

Upstream direction at sensors on LTPP lane

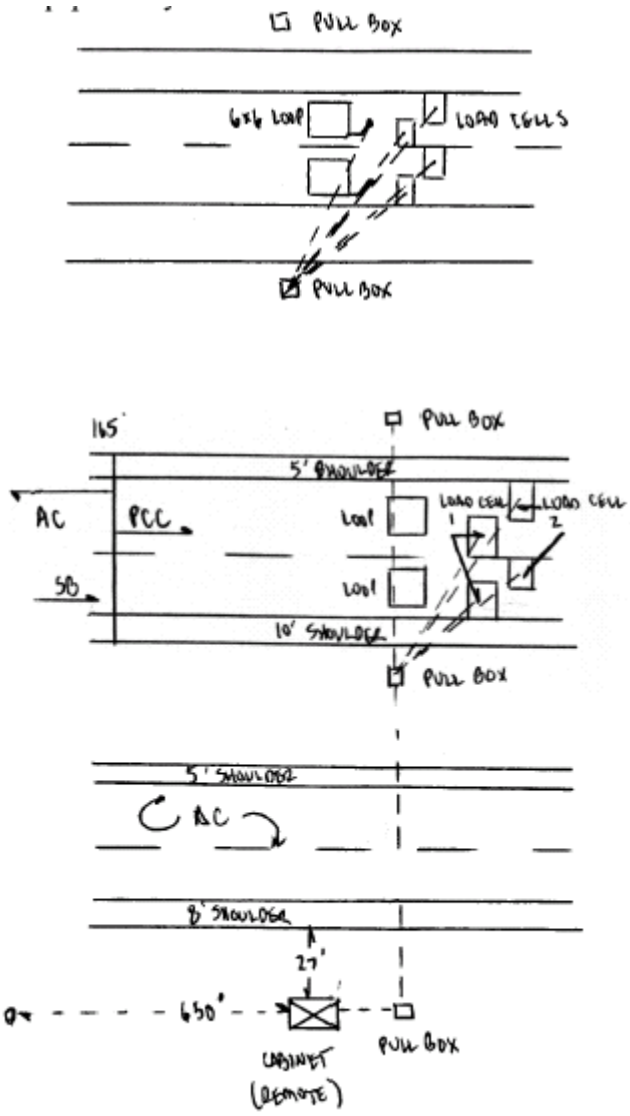
Upstream_TO_1_6A_39_0100_11_12_03.JPG _____

COMMENTS _____
_____GPS Coordinates of site: 40^0 25. 913' North and 83^0 04.488' West_____
_____
Amenities__5.5_miles_south_of_site_____
_____Food_-Wendy's & McDonalds_____
_____Gas_-_Citgo, Sunoco, mini-mart_____
_____Miscelleaneous_-_84 Lumber_____
_____Hotel_-_Travel Lodge _____
_____
_____10.0_miles south of site_____
_____Food_-_Damon's, Wendy's, Taco Bell, Kroger's_____
_____Hotel_-_Super 8, Ameri Host_____
_____Miscellaneous_- Banks, Wal-Mart, Sears Hardware_____
_____
_____ Types of Trucks: Three Class 9s_____
_____
_____Expected Weight Ranges: Truck 1 – 72,000 to 80,000 legal limit on gross and axles, air suspension; _____
Truck 2 – partially loaded 28,000 – 50,000 lbs no suspension requirements;_____
Truck 3 – Empty with no suspension requirements;_____
_____
_____
_____
Speeds to be run: 45 to 55 mph (Posted Speed Limit is 55 mph) _____
_____Corrective actions recommended: Adjustments to the drainage culvert, ____ Grinding or replacement of the travel lane pavement._____
_____
_____
_____
_____
_____
_____
_____
_____
_____

COMPLETED BY ____Dean J. Wolf_____

PHONE ___301-210-5105_____DATE COMPLETED _0_ 4_ /_1_ 5_ / _2_ 0_ 0_ 4_

Sketch of equipment layout



Site Map

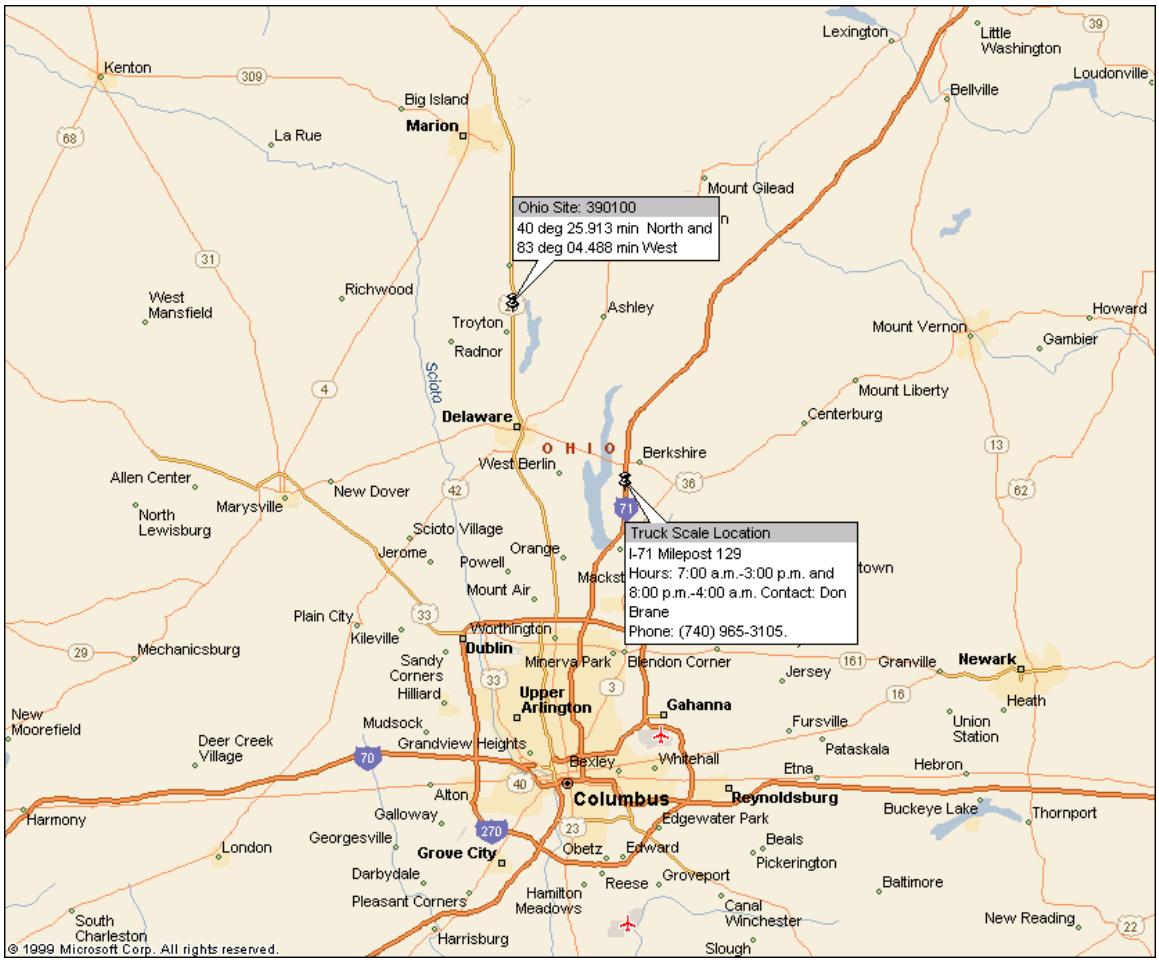


Figure 6.1: Site Map at 390100

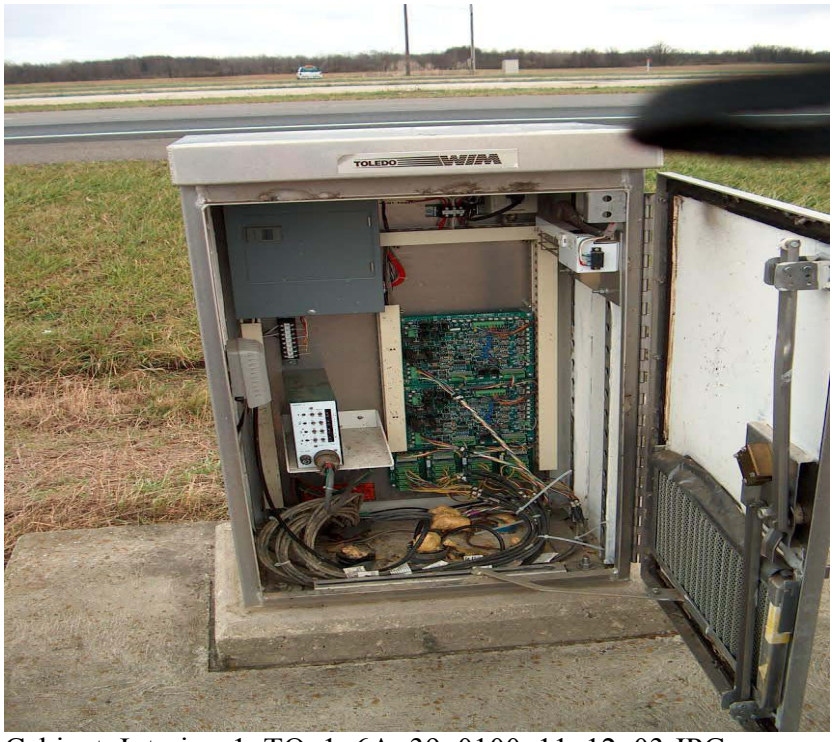
Downstream_1_TO_1_6A_39_0100_11_12_03.JPG (Distress Photo 1)

Upstream_TO_1_6A_39_0100_11_12_03.JPG (Distress Photo 2)

AC_Meter_Box_TO_1_6A_39_0100_11_12_03.JPG

Phone_Pedestal_1_TO_1_6A_39_0100_11_12_03.JPG

Cabinet_Exterior_1_TO_1_6A_39_0100_11_12_03.JPG



Cabinet_Interior_1_TO_1_6A_39_0100_11_12_03.JPG

Weigh_Sensor_TO_1_6A_39_0100_11_12_03.JPG

Loop_Sensor_TO_1_6A_39_0100_11_12_03.JPG

Downstream_1_TO_1_6A_39_0100_11_12_03.JPG

Upstream_TO_1_6A_39_0100_11_12_03.JPG

Sheet 18 STATE_CODE **3 9**

LTPP Traffic Data

WIM SITE COORDINATION SPS Project_ID 0 1 0 0

1. Equipment –
   - Maintenance – contract with purchase / separate contract LTPP / separate contract State / state personnel
     Contact: Steven Jessberger 614-752-4057

   - Purchase by LTPP / State
     Constraints on specifications (sensor, electronics, warranties, maintenance, installation)

   - Installation – Included with purchase / separate contract by State / state personnel / LTPP contract

   - Calibration – Vendor / State / LTPP

   - Manuals and software – State / LTPP

   - Pavement PCC/AC – always new / replacement as needed / grinding and maintenance as needed / maintenance only / no remediation

   - Power - overhead / underground / solar billed to State / LTPP / N/A

   - Communication - Landline / Cellular / Other billed to State / LTPP / N/A

2. Site visits – Evaluation

   - WIM Validation Check - advance notice required 14 days / weeks

   - Trucks – air suspension 3S2 State / LTPP
     2nd common State / LTPP
     3rd common State / LTPP
     4th common State / LTPP
     Loads State / LTPP
     Contact _____

     Drivers State / LTPP
     Contact _____

     Contractors with prior successful experience in WIM calibration in state:
     _____
     Nearest static scale (commercial or enforcement)
     _____

   - Profiling – short wave -- permanent / temporary site marking
     -- long wave – permanent / temporary site marking

WIM SITE COORDINATION SPS Project_ID 0 1 0 0

- Pre-visit data
  - Classification and speed: Contact Steven Jessberger
  --Typical operating conditions (congestion, high truck volumes)
  Contact Steven Jessberger
  -- Equipment operational status: Contact Steven Jessberger

- Access to cabinet
  State only / Joint / LTPP Key / Combination

- State personnel required on site Y / N
Contact information Steven Jessberger

- Enforcement Coordination required Y / N
Contact information _____

- Traffic Control Required Y/ N
Contact information _____

- Maximum number of personnel on site 4
  Invitees _____

- Authorization to calibrate site -- State only / LTPP

- Special conditions _____

3. Data Processing
- Down load State only / LTPP read only / LTPP download / LTPP download and copy to state
- Data Review State per LTPP guidelines / State weekly / LTPP
- Data submission for QC State - weekly; twice a month; monthly / LTPP

4. Site visits – Validation

- WIM Validation Check - advance notice required 14 days / weeks
  LTPP Semi-annually / Sate per LTPP protocol semi-annually / State other

- Trucks – air suspension 3S2 State / LTPP
  2nd common State / LTPP
  3rd common State / LTPP
  4th common State / LTPP
  Loads State / LTPP
  Contact _____

  Drivers State / LTPP

WIM SITE COORDINATION SPS Project_ID 0 1 0 0

Contact _____

Contractors with prior successful experience in WIM calibration in state:
_____

- Profiling – short wave -- permanent / temporary site marking
  -- long wave – permanent / temporary site marking

- Pre-visit data
  – Classification and speed: Contact Steven Jessberger
  -- Equipment operational status: Contact Steven Jessberger

- Access to cabinet
  State only / Joint / LTPP Key / Combination

- State personnel required on site Y / N
  Contact information Steven Jessberger

- Enforcement Coordination required Y / N
  Contact information _____

- Traffic Control Required Y/ N
  Contact information _____

- Authorization to calibrate site -- State only / LTPP

- Special conditions _____

5. Site visit – Construction

- Construction schedule and verification – Contact _____

- Notice for straightedge and grinding check - _____ days / weeks
  On site lead to direct / accept grinding – State / LTPP

- WIM Calibration - advance notice required _____ days / weeks
  Number of lanes -- _____
  LTPP / State per LTPP protocol / State Other _____

- Trucks – air suspension 3S2 State / LTPP
  2nd common State / LTPP
  Loads State / LTPP
  Drivers State / LTPP

  Contractors with prior successful experience in WIM calibration in state:

WIM SITE COORDINATION SPS Project_ID 0 1 0 0

_____

- Profiling – straight edge -- permanent / temporary site marking
  -- long wave – permanent / temporary site marking

- Pre-visit data
  – Classification and speed: Contact _____
  -- Equipment operational status: Contact _____

- Access to cabinet
  State only / Joint / LTPP Key / Combination

- State personnel required on site Y / N
  Contact information _____

- Enforcement Coordination required Y / N
  Contact information _____

- Traffic Control Required Y/ N
  Contact information _____

- Authorization to calibrate site -- State only / LTPP

- Special conditions _____

6. Special conditions
   - Funds and accountability
   - Reports
   - Other

SHEET 16 **LTPP MONITORED TRAFFIC DATA** **SITE CALIBRATION SUMMARY**	*STATE ASSIGNED ID [__ _7_ _2_ _1_] *STATE CODE [_3_ _9_] *SHRP SECTION ID [0__ _1_ _0_ _0_]

SITE CALIBRATION INFORMATION

1. * DATE OF CALIBRATION (MONTH/DAY/YEAR) [_0_ _4_ / _1_ _5_ / _2_ _0_ _0_ _4_]

2. * TYPE OF EQUIPMENT CALIBRATED __ WIM __ CLASSIFIER __XX_ BOTH

3. * REASON FOR CALIBRATION
   ____ REGULARLY SCHEDULED SITE VISIT ____ RESEARCH
   ____ EQUIPMENT REPLACEMENT ____ TRAINING
   ____ DATA TRIGGERED SYSTEM REVISION ____ NEW EQUIPMENT INSTALLATION
   _X___ OTHER (SPECIFY) ____ SITE EVALUATION AND CALIBRATION_____

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 __X__ LOAD CELLS ____ QUARTZ PIEZO
   ____ CHANNELIZED FLAT PIEZO __X__ INDUCTANCE LOOPS ____ CAPACITANCE PADS
   ____ OTHER (SPECIFY) _____

5. EQUIPMENT MANUFACTURER _____Mettler Toledo_____

WIM SYSTEM CALIBRATION SPECIFICS**

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

   __ _3_ __ NUMBER OF TRUCKS COMPARED __ _3_ __ NUMBER OF TEST TRUCKS USED

   __ _13_ __ 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	____9___	_____2_____

7. SUMMARY CALIBRATION RESULTS (EXPRESSED AS A PERCENT)
   MEAN DIFFERENCE BETWEEN ---
   DYNAMIC AND STATIC GVW ___ _1.8%__ ___ __ STANDARD DEVIATION __ _4.7%_ __
   DYNAMIC AND STATIC SINGLE AXLES ___-4.8 %__ ___ __ STANDARD DEVIATION __ _2.3%_ __
   DYNAMIC AND STATIC DOUBLE AXLES ___ __6.7%_ ___ __ STANDARD DEVIATION __ _7.2%_ __

8. __3_ ____ NUMBER OF SPEEDS AT WHICH CALIBRATION WAS PERFORMED

9. DEFINE THE SPEED RANGES USED (MPH) _____ _____ __42-45, 46-51, 52-54 mph_ _____ _____
   _____ _____ _____ _____ _____ _____ _____ _____ _____ _____

10. CALIBRATION FACTOR (AT EXPECTED FREE FLOW SPEED) __ 16.0000 (P4)_and 2.03 (Span) ___ ___ ___ ___

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 _100__ NUMBER OF TRUCKS

14. MEAN DIFFERENCE IN VOLUMES BY VEHICLE CLASSIFICATION:

*** FHWA CLASS 9 ____ _1_ ____	FHWA CLASS _5___	____ _-33___ ____ ____
*** FHWA CLASS 8 ____ _0____	FHWA CLASS ____	____ ____ ____ ____
	FHWA CLASS ____	____ ____ ____ ____
	FHWA CLASS ____	____ ____ ____ ____

   *** PERCENT "UNCLASSIFIED" VEHICLES: ____ __0__ ____

PERSON LEADING CALIBRATION EFFORT: ____Dean J. Wolf_____
CONTACT INFORMATION: _____301-210-5105_____ rev. November 9, 1999

SHEET 16 **LTPP MONITORED TRAFFIC DATA** **SITE CALIBRATION SUMMARY**	*STATE ASSIGNED ID [__ _7_ _2_ _1_] *STATE CODE [_3_ _9_] *SHRP SECTION ID [0__ _1_ _0_ _0_]

SITE CALIBRATION INFORMATION

1. * DATE OF CALIBRATION (MONTH/DAY/YEAR) [_0_ _4_ / _1_ _4_ / _2_ _0_ _0_ _4_]

2. * TYPE OF EQUIPMENT CALIBRATED __ WIM __ CLASSIFIER __XX_ BOTH

3. * REASON FOR CALIBRATION
   ____ REGULARLY SCHEDULED SITE VISIT ____ RESEARCH
   ____ EQUIPMENT REPLACEMENT ____ TRAINING
   ____ DATA TRIGGERED SYSTEM REVISION ____ NEW EQUIPMENT INSTALLATION
   _X___ OTHER (SPECIFY) ____ SITE EVALUATION AND CALIBRATION_____

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 __X__ LOAD CELLS ____ QUARTZ PIEZO
   ____ CHANNELIZED FLAT PIEZO __X__ INDUCTANCE LOOPS ____ CAPACITANCE PADS
   ____ OTHER (SPECIFY) _____

5. EQUIPMENT MANUFACTURER _____Mettler Toledo_____

WIM SYSTEM CALIBRATION SPECIFICS**

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

   __ _3_ __ NUMBER OF TRUCKS COMPARED __ _3_ __ NUMBER OF TEST TRUCKS USED

   __ _13_ __ 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	____9___	_____2_____

7. SUMMARY CALIBRATION RESULTS (EXPRESSED AS A PERCENT)
   MEAN DIFFERENCE BETWEEN ---
   DYNAMIC AND STATIC GVW ___ _4.0 %__ ___ __ STANDARD DEVIATION __ _4.7 %_ __
   DYNAMIC AND STATIC SINGLE AXLES ___ -1.8 %__ ___ __ STANDARD DEVIATION __ _2.7 %_ __
   DYNAMIC AND STATIC DOUBLE AXLES ___ __8.3 %_ ___ __ STANDARD DEVIATION __ _6.8 %_ __

8. __3_ ____ NUMBER OF SPEEDS AT WHICH CALIBRATION WAS PERFORMED

9. DEFINE THE SPEED RANGES USED (MPH) _____ _____ __42-45, 46-51, 52-57 mph_ _____ _____
   _____ _____ _____ _____ _____ _____ _____ _____ _____ _____

10. CALIBRATION FACTOR (AT EXPECTED FREE FLOW SPEED) __ 7.9000 (P4)_ and 1.98 (Span)___ ___ ___ ___

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 _100__ NUMBER OF TRUCKS

14. MEAN DIFFERENCE IN VOLUMES BY VEHICLE CLASSIFICATION:
   *** FHWA CLASS 9 ____ _0_ ____ FHWA CLASS _7___ ____ _33___ ____ ____
   *** FHWA CLASS 8 ____ _0____ FHWA CLASS ____ ____ ____ ____ ____
   FHWA CLASS ____ ____ ____ ____ ____
   FHWA CLASS ____ ____ ____ ____ ____
   *** PERCENT "UNCLASSIFIED" VEHICLES: ____ __0__ ____

PERSON LEADING CALIBRATION EFFORT: ____Dean J. Wolf_____
CONTACT INFORMATION: _____301-210-5105_____ rev. November 9, 1999

APPENDIX A

Sheet 19	* STATE_CODE	39
LTPP Traffic Data	* SPS PROJECT ID	0100 & 0200
*CALIBRATION TEST TRUCK # 1	* DATE	04/14/03 & 04/15/03

Rev. 08/31/01

Truck 1

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		11273	10933	(D) / C
B		15587	15297	(D) / C
C		15633	15403	(D) / C
D		17787	17993	(D) / C
E		18147	18057	(D) / C
F				(D) / C

GVW (same units as axles)

7. a) Empty GVW _____

*b) Average Pre-Test Loaded weight 78427
*c) Post Test Loaded Weight 77680
*d) Difference Post Test – Pre-test -747.0

GEOMETRY

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

9. a) * Make: freightliner b) * Model: FLD 120 Classic

10.* Trailer Load Distribution Description:

Lumber

11. a) Tractor Tare Weight (units): 16,000 lbs

b). Trailer Tare Weight (units): ( ) lbs

Sheet 19	* STATE_CODE	39
LTPP Traffic Data	* SPS PROJECT ID	0100 & 0200
*CALIBRATION TEST TRUCK # 1	* DATE	4/14/04 & 4/15/04

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

A to B 19.5 B to C 4.3 C to D 28.9

D to E 10.2 E to F — 62.9

Wheelbased (measured A to last) 62.9 Computed _____

13. *Kingpin Offset From Axle B (units) + 10 inches (_____)

(+ is to the rear)

SUSPENSION

Axle	14. Tire Size	15.* Suspension Description (leaf, air, no. of leaves, taper or flat leaf, etc.)
A	11R 22.5	2 leaf Springs
B	295/75R 22.5	Air
C	295/75R 22.5	Air
D	11R 22.5	Air
E	11R 22.5	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	39
LTPP Traffic Data	* SPS PROJECT ID	0100 1 0200
*CALIBRATION TEST TRUCK # 1	* DATE	04/14/04 & 04/15/04

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PART II

Table 1. Axle and GVW computations - pre-test

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

Table 2. Raw Axle and GVW measurements

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

Table 3. Axle and GVW computations - post -test

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

Sheet 19	* STATE_CODE	39
LTPP Traffic Data	* SPS PROJECT ID	0100 & 0200
*CALIBRATION TEST TRUCK # 1	* DATE	4/14/04 & 4/15/04

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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	11320	15500	15640	17420	18140		78020
2	11240	15500	15500	17980	18160		78380
3	11260	15760	15760	17960	18140		78880
Average	11273	15587	15633	17787	18147		78427

Table 6. Raw data – Axle scales –

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

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10920	15260	15380	17960	18080		77600
2	10880	15300	15400	17980	18060		77620
3	11000	15330	15430	18030	18030		77820
Average	10933	15297	15403	17990	18057		77680

Measured By KMA Verified By _____

Sheet 19	* STATE_CODE	39
LTPP Traffic Data	* SPS PROJECT ID	0100 & 0200
*CALIBRATION TEST TRUCK # 2	* DATE	4/14/04 & 4/15/04

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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		10513	10210	(D) / C
B		9800	9685	(D) / C
C		9973	9805	(D) / C
D		10987	11000	(D) / C
E		11230	11150	(D) / C
F				(D) / C

GVW (same units as axles)

7. a) Empty GVW _____

*b) Average Pre-Test Loaded weight 52493
*c) Post Test Loaded Weight 51850
*d) Difference Post Test – Pre-test -643

GEOMETRY

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

9. a) * Make: Freight liner b) * Model: FLD120

10.* Trailer Load Distribution Description:

Dump trucks loaded just before axle # 4

11. a) Tractor Tare Weight (units): 16,000 lbs

b). Trailer Tare Weight (units): 24,000 lbs

Sheet 19	* STATE_CODE	39
LTPP Traffic Data	* SPS PROJECT ID	0100 2 0209
*CALIBRATION TEST TRUCK # 2	* DATE	04/14/04 & 04/15/04

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

A to B 19.6 B to C 4.3 C to D 36.0

D to E 4.5 E to F —

Wheelbased (measured A to last) 64.4 Computed _____

13. *Kingpin Offset From Axle B (units) +1 ft 8 inches (_____)
(+ is to the rear)

SUSPENSION

Axle	14. Tire Size	15.* Suspension Description (leaf, air, no. of leaves, taper or flat leaf, etc.)
A	11 R 22.5	2 reg. leaf springs
B	295/75 R 22.5	Air
C	11	Air
D	255/70 R 22.5	Air
E	11	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	39
LTPP Traffic Data	* SPS PROJECT ID	0100 & 0200
*CALIBRATION TEST TRUCK # 2	* DATE	4/14/04 & 4/15/04

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	39
LTPP Traffic Data	* SPS PROJECT ID	0100 & 0200
*CALIBRATION TEST TRUCK # 2	* DATE	4/14/04 & 4/15/04

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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	10500	9740	10000	10940	11280		52460
2	10520	9740	10000	10900	11260		52420
3	10520	9920	9920	11120	11120		52600
Average	10513	9800	9973	10987	11220		52493

Table 6. Raw data – Axle scales –

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

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10220	9620	9860	10920	11220		51840
2	10200	9750	9750	11080	11080		51860
3							
Average							51850

Measured By KMR Verified By _____

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LTPP Traffic Data	* SPS PROJECT ID	0100 & 0200
*CALIBRATION TEST TRUCK # 3	* DATE	4/14/04 & 4/15/04

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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		10160	9910	(D) / C
B		6250	6235	(D) / C
C		6250	6225	(D) / C
D		4017	4095	(D) / C
E		5890	5835	(D) / C
F				D / C

GVW (same units as axles)

7. a) Empty GVW _____

*b) Average Pre-Test Loaded weight 32567

*c) Post Test Loaded Weight 32300

*d) Difference Post Test – Pre-test -267

GEOMETRY

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

9. a) * Make: MACK b) * Model: CH 613

10.* Trailer Load Distribution Description:

Empty

11. a) Tractor Tare Weight (units): 12,000 lbs

b). Trailer Tare Weight (units): 14,000 lbs

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*CALIBRATION TEST TRUCK # 3	* DATE	4/14/04 & 4/15/04

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

A to B 16.3 B to C 4.3 C to D 33.2

D to E 4.1 E to F —

Wheelbased (measured A to last) 58.2 Computed _____

13. *Kingpin Offset From Axle B (units) 2 ft 4 inches (_____)
(+ is to the rear)

SUSPENSION

Axle	14. Tire Size	15.* Suspension Description (leaf, air, no. of leaves, taper or flat leaf, etc.)
A	11R 22.5	3 reg leaf springs.
B	11R 22.5	Air
C	11R 22.5	"
D	295/75R 22.5	1 reg leaf spring & 1 Taper leaf spring
E	"	"
F	—	—

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

Steering Axle	Axle B	Axle C	Axle D	Axle E
_____	_____	_____	_____	_____
	_____	_____	_____	_____
	_____	_____	_____	_____
_____	_____	_____	_____	_____

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LTPP Traffic Data	* SPS PROJECT ID	0100 & 0200
*CALIBRATION TEST TRUCK # 3	* DATE	4/14/04 & 4/15/04

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PART II

Table 1. Axle and GVW computations - pre-test

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

Table 2. Raw Axle and GVW measurements

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

Table 3. Axle and GVW computations - post -test

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

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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	6240	6200	3920	5780		32300
2	10200	6160	6200	4100	5980		32640
3	10120	6350	6350	4030	5910		32760
Average	10160	6250	6250	4017	5890		32567

Table 6. Raw data – Axle scales –

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

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

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	9940	6220	6200	4100	5840		32300
2	9880	6250	6250	4090	5830		32300
3							
Average							32300

Measured By KMA Verified By _____

Sheet 20	* STATE_CODE	39
LTPP Traffic Data	*SPS PROJECT_ID	0100
Speed and Classification Checks * 1 of* 2	* DATE	04/14/2004

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Pre calibration

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
42	5		43	5	56	6		57	6
57	9		57	9	62	9		62	9
63	9		62	9	54	9		55	9
61	9		62	9	56	9		56	9
51	5		51	5	57	8		57	8
56	9		56	9	58	9		59	9
57	5		57	5	55	5		55	5
61	9		59	9	62	7		61	3+2"
53	9		53	9	52	9		53	9
59	9		59	9	57	9		57	9
60	10		59	10	54	5		54	5
59	9		59	9	53	9		53	9
57	9		57	9	56	9		56	9
61	5		60	5	57	9		57	9
52	10		52	10	54	9		54	9
51	10		51	10	61	5		61	5
59	9		59	9	59	9		58	9
55	9		55	9	59	9		59	9
53	4		53	4	59	9		59	9
53	9		53	9	59	8		59	8
55	9		55	9	57	9		57	9
58	9		58	9	63	3		63	5 *
61	9		60	9	58	9		58	9
61	6		61	6	60	9		60	9
59	9		59	9	54	5		53	5

Recorded by DJW Direction S Lane 1 Time from 9:17 to 9:40

+4 misclass = 2

Sheet 20	* STATE_CODE	39
LTPP Traffic Data	*SPS PROJECT_ID	0100
Speed and Classification Checks * 2 of* 2	* DATE	04/14/2004

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Re calibration on

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	
58	5		58	5	57	9		57	9	
57	9		58	9	59	11		59	11	
62	9		63	9	54	9		54	9	
63	9		63	9	57	10		58	10	
63	9		63	9	59	9		58	9	
61	6		61	6	59	9		59	9	
59	9		59	9	61	9		61	9	
56	6		56	6	57	9		56	9	
59	9		59	9	56	9		57	9	
56	5		55	5	55	9		55	9	
61	9		61	9	58	8		58	8	
57	6		57	6	61	9		60	9	
53	3		53	3	61	9		61	9	
55	9		55	9	66	10		66	10	
* 57	7		57	3+7	56	5		56	5	
60	5		60	5	59	9		59	9	
59	9		58	9	53	9		53	9	
56	9		56	9	56	9		56	9	
59	9		58	9	61	10		60	10	
61	7		61	7	59	9		59	9	
57	7		57	7	63	9		64	9	
57	9		57	9	59	9		59	9	
57	9		57	9	57	3		58	5	* +1
59	9		59	9	59	9		59	9	
* 53	10		52	7	59	9		59	9	

Recorded by NJW Direction S Lane 1 Time from 9:41 to _____

Sheet 20	* STATE_CODE	39
LTPP Traffic Data	*SPS PROJECT_ID	0100
Speed and Classification Checks * 1 of* 2	* DATE	04/19/2004

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POST CALIBRATION

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
	9			9		9			9
	12			10		9			9
	5			5		9			9
	9			9		9			9
	9			9		9			9
	9			9		9			9
	9			9		9			9
	9			9		9			9
	9			9		9			9
	9			9		9			9
	9			9		9			9
	9			9		9			9
	9			9		13			13
	5			4(BUS)		9			9
	9			9		9			9
	6			6		9			9
	9			9		9			9
	9			9		9			9
	9			9		9			9
	9			9		9			9
	9			9		9			9
	9			9		9			9
	9			9		9			9
	9			9		4			5

Recorded by _____ Direction ____ Lane ____ Time from 3:40 to 4:30

Sheet 20	* STATE_CODE 39
LTPP Traffic Data	*SPS PROJECT_ID 0100
Speed and Classification Checks * 2 of *2	* DATE 04/15/2004

Rev. 08/31/2001.... Post Calibration

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
	9			9		9			9
	3			5		8			8
	9			9		9			9
	9			9		9			9
	6			6		9			9
	4			4		9			9
	9			9		9			9
	9			9		8			8
	9			9		9			9
	9			9		9			9
	9			9		9			9
	9			9		9			9
	9			9		9			9
	9			9		9			9
	9			9		9			9
	3			5		9			9
	9			9		5			5
	9			9		9			9
	8			8		9			9
	10			9		9			9
	9			9		9			9
	9			9		9			9
	9			9		9			9
	9			9		9			9
	9			9		9			9
	5			5		9			9

Recorded by DJW Direction S Lane 1 Time from 4:30 to 5:05

1-Axle ? WIM ? ?
78.9 52.6 32.8

Sheet 21	* STATE_CODE	39
LTPP Traffic Data	*SPS PROJECT_ID	0100
WIM System Test Truck Records 1 of 6	* DATE	04/14/2004

Rev. 08/31/2001

[illegible] 40 Pre calibration

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A right / left weight.	Axle B right / left weight.	Axle C right / left weight.	Axle D right / left weight.	Axle E right / left weight.	Axle F right / left weight.	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
64.5		1	1	11:55	[illegible]	52	5680 5660	7520 7900	8640 7100	8600 8980	9360 9040		78.3	19.2	4.1	27.9	4.4	
64.5		2	2	11:56	8678	43	5360 4940	5260 5100	6090 4700	5700 6100	6480 5860		55.7	19.4	4.1	38.8	4.8	
64.5		3	3	11:57	[illegible]	47	5080 6280	3310 3510	3700 3040	2390 2800	2520 2840		34.5	16.2	4.2	37.0	3.7	
66.0		1	4	12:10	8914	47	5640 5340	7380 8080	8360 6900	8840 8400	9300 9140		77.5	19.3	4.1	23.2	10.0	
66.[illegible]		2	5	12:[illegible]	[illegible]	48	5020 4960	5130 5260	6040 5070	5540 6080	6080 5370		55.6	19.6	4.2	35.1	4.3	
[illegible]		3	6	12:12	9030	51	5100 5200	3340 3330	3340 3600	2020 2480	2740 3700		35.6	16.1	4.1	37.2	3.7	
71.5		1	7	12:24	9316	53	5700 5440	7860 8130	8900 [illegible]	8860 [illegible]	8960 9220		77.0	19.4	4.0	28.4	10.1	
71.5		2	8	12:24	9338	57	5680 [illegible]	5060 5130	5530 4950	5360 [illegible]	3300 3400		56.6	20.9	4.1	38.0	10.8	

Recorded by Qiv

Checked by ______

Sheet 21	* STATE_CODE 39
LTPP Traffic Data	*SPS PROJECT_ID 0100
WIM System Test Truck Records 2 of 6	* DATE 04/14/2004

Rev. 08/31/2001

Pre Calibration

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A right / left weight.	Axle B right / left weight.	Axle C right / left weight.	Axle D right / left weight.	Axle E right / left weight.	Axle F right / left weight.	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
71.5		3	9	12:26	9376	55	5160 5280	3180 3500	3300 3580	2480 3040	2460 3320		35.4	16.1	4.2	31.7	3.7	
77.5		1	10	12:42	9746	43	5720 5460	7540 7900	8670 7980	8560 9120	9160 9760		77.0	19.5	4.1	28.2	10.1	
77.5		2	11	12:43	9808	44	5720 4820	5160 5140	5940 4800	5780 5960	6300 6000		55.3	19.6	4.1	35.0	4.3	
77.5		3	12	12:45	9843	47	4900 5120	3420 3540	3580 3380	2780 2740	2720 3120		35.3	16.1	4.2	32.1	3.9	
82.5		1	13	1:04	10281	49	5520 5560	7320 8040	8220 7850	8860 8500	9000 9380		77.3	19.6	4.1	28.5	10.0	
82.5		2	14	1:05	10318	48	5180 4960	5760 5270	5700 5120	5620 6520	6420 5940		35.9	16.5	4.1	34.7	4.3	
82.5		3	15	1:06	10340	50	5160 5260	3740 3280	3740 3500	2640 2900	2720 2980		35.9	16.4	4.2	32.6	3.8	
82.0		1	16	1:26	10346	54	5520 5460	7680 8180	8160 7100	9080 8540	9060 9100		77.8	19.4	4.0	27.9	9.9	

Recorded by DW

Checked by _____

Sheet 21	* STATE_CODE 39
LTPP Traffic Data	*SPS PROJECT_ID 0100
WIM System Test Truck Records 3 of 6	* DATE 04/14/2004

Rev. 08/31/2001

Pre Calibration

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A right / left weight.	Axle B right / left weight.	Axle C right / left weight.	Axle D right / left weight.	Axle E right / left weight.	Axle F right / left weight.	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
82.0		2	17	1:27	10870	56	5300 4820	5200 4700	5560 5020	5100 4560	6100 6260		55.4	19.6	4.1	35.3	4.3	
82.0		3	18	1:28	10940	57	4980 5340	3580 3560	3480 3540	2880 2660	2640 3100		35.8	16.4	4.3	32.5	3.8	
77.5		1	19	1:44	11293	54	5640 5320	7580 8040	8240 7020	8480 8540	8880 9240		76.7	19.5	4.1	28.3	10.1	
77.5		2	20	1:45	11333	53	5320 5180	5100 5260	5330 5100	5900 6420	6040 6220		55.4	19.6	4.1	35.3	4.3	
77.5		3	21	1:47	11373	54	4960 5320	3470 3700	3540 3580	2900 2900	2720 3180		36.2	16.1	4.2	32.5	3.9	
75.5		1	22	2:03	11751	44	5640 5360	7620 7920	8560 7040	8780 8080	9320 9020		77.3	19.6	4.1	28.4	10.0	
75.5		2	23	2:04	11774	44	5280 4900	5360 5020	6200 5760	6120 5380	6480 5980		56.5	19.6	4.1	34.8	4.2	
75.5		3	24	2:05	11796	47	5060 4860	3700 3400	3740 3380	2700 2730	2840 2900		35.3	16.3	4.2	32.3	3.8	

Recorded by DSW

Checked by

Sheet 21	* STATE_CODE 39
LTPP Traffic Data	*SPS PROJECT_ID 0100
WIM System Test Truck Records 4 of 6	* DATE 04/19/2004

Rev. 08/31/2001

Pre Calibration

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A right / left weight.	Axle B right / left weight.	Axle C right / left weight.	Axle D right / left weight.	Axle E right / left weight.	Axle F right / left weight.	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
69.5		1	25	15:46	12608	49	5420 5320	7520 7400	8320 7120	8620 8960	9060 8860		77100	19.6	4.1	28.4	10	
69.5		2	26	15:47	12653	49	5060 5160	5280 5160	6080 4980	5340 5520	6320 5660		55400	19.5	4.1	35.4	4.3	
69.5		3	27	15:48	12680	51	4840 5280	3380 3620	3300 3740	2800 2900	2520 3360		35740	16.1	4.2	32.6	3.9	
71.5		1	28	4:02	13134	53	5500 5300	7360 8120	8220 6940	9140 8460	9100 8900		77040	19.3	4.0	28.2	10.1	
71.5		2	29	4:03	13173	52	5260 5260	5060 5220	5550 4960	5480 6120	5400 4840		54680	19.3	4.0	34.8	4.2	
71.5		3	30	4:04	13203	56	4960 5580	3340 3520	3580 3640	3200 2720	2960 3260		36760	18.4	4.2	32.8	3.9	
70.5		1	31	4:20	13731	43	5420 5240	7460 7900	8400 7320	8060 8820	9220 8620		76260	19.3	4.1	28.2	10.1	
70.5		2	32	4:22	13779	43	5080 4940	5200 5120	6160 4800	5480 5400	6420 5660		54640	19.3	4.1	34.7	4.2	

Recorded by kmb/DJW

Checked by _____

Sheet 21	* STATE_CODE 39
LTPP Traffic Data	*SPS PROJECT_ID 0100
WIM System Test Truck Records 5 of 6	* DATE 04/14/2004

Rev. 08/31/2001

Pre calibration

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A right / left weight.	Axle B right / left weight.	Axle C right / left weight.	Axle D right / left weight.	Axle E right / left weight.	Axle F right / left weight.	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
70.5		3	33	4:23	13811	47	5220 5040	3660 3360	3240 3220	3020 2880	3240 3420		37280	16.4	4.2	32.9	3.9	
70.5		1	34	4:35	14198	53	5380 5260	7420 8120	8180 7120	8960 8220	8680 9100		76.4	19.3	4.1	28.0	9.9	
70.5		2	35	4:36	14218	52	5060 5040	4940 5220	5480 5000	4960 6200	5680 5840		53420	19.1	4.0	34.5	4.2	
70.5		3	36	4:37	14246	56	4960 5280	3420 3800	3420 3760	2960 2920	2820 3440		36780	16.2	4.2	32.2	3.8	
66.5		1	37	4:49	14676	47	5580 5340	7400 7940	8460 6960	8860 9020	9140 9120		77820	19.1	4.1	28.2	9.9	
66.5		2	38	4:50	14692	48	5100 4980	5220 5140	5920 4840	4520 6180	6580 5760		55220	19.5	4.1	35.1	4.3	
66.5		3	39	4:51	14730	51	5020 4280	3500 3160	3580 3280	2900 2860	2660 3440		35680	16.2	4.2	32.6	3.9	
69.5		1	40	5:03	15112	43	5640 5600	7560 7900	8520 7120	8220 8560	9440 8630		77240	19.6	4.1	28.7	10.2	

Recorded by Kevin / DSW

Checked by _____

Sheet 21	* STATE_CODE	39
LTPP Traffic Data	*SPS PROJECT_ID	0100
WIM System Test Truck Records 6 of 6	* DATE	04/14/2004

Rev. 08/31/2001

Pre Calibration

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A right / left weight.	Axle B right / left weight.	Axle C right / left weight.	Axle D right / left weight.	Axle E right / left weight.	Axle F right / left weight.	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
64.5		2	41	5:04	15131	44	5220 5440	5940 5060	5490 5100	5060 6180	6260 6700		55400	19.6	9.2	35.2	4.2	
64.5		3	42	5:04	15155	46	4880 5060	3580 3300	3760 3220	2780 2580	2740 2940		34340	16.1	4.1	31.9	3.7	
64.5		1	43	5:20	15745	53	5480 5780	7500 8060	8360 6800	8860 8500	8960 9040		76860	19.3	41.1	28.2	10.0	

Recorded by DAW

Checked by _____

Sheet 21	* STATE_CODE 39
LTPP Traffic Data	*SPS PROJECT_ID 0100
WIM System Test Truck Records 1 of 2	* DATE 09/15/2004

Rev. 08/31/2001

Iteration #1

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A right / left weight.	Axle B right / left weight.	Axle C right / left weight.	Axle D right / left weight.	Axle E right / left weight.	Axle F right / left weight.	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
38.5		1	1	7:54	4384	53	5320 5400	7580 8300	8660 7300	8760 8720	8860 9600		78,500	19.3	4.0	28.2	9.9	
38.5		2	2	8:05	4656	52	5180 5200 10380	5440 5200 10640	6020 5040 11060	5800 6340 12140	6080 6200 12280		56,500	19.6	4.2	35.1	4.3	
39.5		1	3	8:16	4944	42	2600 5620	7700 8180	3380 7040	10360 8860	9700 9240		81180	19.3	4.1	27.8	9.3	
39.5		2	4	8:18	4974	43	5280 5160	5440 5420	6380 4900	6420 5700	6700 6040		57440	19.6	4.2	35.1	4.3	
39.5		3	5	8:19	5002	46	5040 5460	3480 3960	3920 3340	2920 2860	2980 2400		36220	16.2	4.1	32.2	3.7	
39.5		1	6	8:30	5313	48	5780 5520	7140 8160	8540 7280	9100 5400	9380 9440		79918	19.3	4.1	28.3	9.9	
39.5		2	7	8:32	5339	48	5040 5100	5240 5860	5860 5040	5240 6480	6500 5980		56340	19.3	4.1	34.6	4.2	
39.5		3	8 0	8:33	5380	50	5240 5340	3620 3640	3420 3700	3000 2880	2660 3340		36840	16.3	4.2	32.3	3.9	

Recorded by DJW

Checked by _____

Sheet 21	* STATE_CODE 39
LTPP Traffic Data	*SPS PROJECT_ID 0100
WIM System Test Truck Records 2 of 2	* DATE 04/15/2004

Rev. 08/31/2001

Iteration #1

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A right / left weight.	Axle B right / left weight.	Axle C right / left weight.	Axle D right / left weight.	Axle E right / left weight.	Axle F right / left weight.	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
42.5		1	9	8:45	5681	52	5500 5360	7780 8240	8740 7120	9280 9000	8860 9400		79280	19.1	4.0	28.1	9.9	
42.5		2	10	8:46	5703	53	5300 5100	5060 5200	5930 4960	5400 6280	5940 6200		55400	19.6	4.1	35.0	4.2	
42.5		3	11	8:47	5740	55	5160 5300	3340 3620	3440 3680	2640 3060	2460 3460		36160	16.2	4.2	32.2	3.9	

Recorded by DSW

Checked by _____

Sheet 21	* STATE_CODE 39
LTPP Traffic Data	*SPS PROJECT_ID 0100
WIM System Test Truck Records 1 of 2	* DATE 04/15/2004

Rev. 08/31/2001

2ND ITERATION

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A right / left weight.	Axle B right / left weight.	Axle C right / left weight.	Axle D right / left weight.	Axle E right / left weight.	Axle F right / left weight.	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
58.5		1	1	9:31	6500	43	5360 5260	7360 7780	8580 6820	8900 8520	8540 9500		76920	19.5	4.1	28.1	9.8	
58.5		2	2	9:32	6520	44	5240 4940	5280 5040	5900 4700	6080 6000	6340 5680		55200	19.6	4.2	34.8	4.2	
58.5		3	3	9:33	6547	46	4900 5280	3400 3460	3540 3100	2600 2580	2620 2820		34300	16.2	4.2	32.3	3.9	
60.5		1	4	9:44	6781	48	5520 5320	7320 7820	8180 7020	8440 8160	8600 9230		76320	19.3	4.1	28.3	9.8	
60.5		2	5	9:45	6817	43	5240 4680	5100 4900	5960 4520	5860 6140	6820 5520		54740	19.4	4.1	34.9	4.3	
6.5		3	6	9:46	6841	50	5020 5140	3240 3560	3260 3360	2500 2900	2620 3000		34600	15.9	4.2	31.6	3.7	
62.5		1	7	9:57	7082	48	5400 5120	7280 7760	8300 6820	8260 8380	8880 9160		75360	19.4	4.1	28.7	10.0	
62.5		2	8	9:58	7111	48	5060 5160	5160 5020	5200 5120	5540 6300	6380 5620		55060	19.3	4.1	34.5	4.2	

Recorded by _____ Checked by _____

Sheet 21	* STATE_CODE 39
LTPP Traffic Data	*SPS PROJECT_ID 0100
WIM System Test Truck Records 2 of 2	* DATE 04/14/2004

Rev. 08/31/2001

Iteration #2

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A right / left weight.	Axle B right / left weight.	Axle C right / left weight.	Axle D right / left weight.	Axle E right / left weight.	Axle F right / left weight.	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
64.5		1	9	10:10	7396	53	5300 5160	7340 8020	8060 6980	5360 8600	8640 9060		75520	19.5	4.1	28.2	10.1	
64.5		3	10	10:13	7451	53	4940 5240	3140 3460	3400 3380	2480 2980	2460 3140		34620	16.2	4.2	32.0	3.7	

Recorded by DJW

Checked by _____

Sheet 21	* STATE_CODE 39
LTPP Traffic Data	*SPS PROJECT_ID 0100
WIM System Test Truck Records 1 of 2	* DATE 04/15/2004

Rev. 08/31/2001

ITERATION # 3

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A right / left weight.	Axle B right / left weight.	Axle C right / left weight.	Axle D right / left weight.	Axle E right / left weight.	Axle F right / left weight.	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
64.5		1	1	11:09	7724	43	5580 5360	7440 7640	8380 6960	8720 7440	9160 8840			75520	19.3	illegible	28.3	10.1
64.5		2	2	11:06	7784	44	5120 4760	5040 5040	5900 4520	5740 5880	6000 5600			53640	19.6	4.2	35.2	4.3
64.5		3	3	11:07	7817	47	4820 5060	3460 3200	3780 3160	2820 2610	2860 2800			34640	16.2	4.1	32.4	3.8
67.5		1	4	11:20	8082	48	5460 5140	7380 7800	8220 6920	8200 8560	9220 8780			75680	19.4	4.1	28.3	9.9
67.5		2	5	11:21	8115	48	4860 4720	5160 5020	5560 5180	5500 6220	6280 5660			54160	19.3	4.1	35.0	4.3
67.5		3	6	11:22	8143	51	4780 5160	3460 3440	3500 3400	2900 2880	2740 3200			354160	16.2	4.2	32.4	3.8
73		1	7	11:35	8449	53	5280 5140	7280 7660	8140 6880	8860 8040	8720 8540			74540	19.4	illegible	28.1	10.1
73		2	8	11:36	8479	54	4960 4840	4840 4940	5280 4880	5100 6180	5760 5600			52580	19.4	4.1	34.7	4.2

Recorded by [illegible] Checked by

Sheet 21	* STATE_CODE	39
LTPP Traffic Data	*SPS PROJECT_ID	0100
WIM System Test Truck Records 2 of 2	* DATE	04/15/2004

Rev. 08/31/2001

Iteration #3

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A right / left weight.	Axle B right / left weight.	Axle C right / left weight.	Axle D right / left weight.	Axle E right / left weight.	Axle F right / left weight.	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
73		3	9	11:37	8501	51	4900 4860	3520 3400	3520 3480	2480 2700	2440 2880		34180	16.6	4.3	32.8	3.9	
79.0		1	10	11:49	8758	53	5140 5140	7320 7880	8100 7080	8960 8640	9020 8320		75600	19.3	4.0	28.0	9.9	
79.0		2	11	11:50	8795	52	4960 4820	5000 5040	5720 4720	5080 6200	6000 5540		53080	19.4	4.1	35.1	4.3	
79.0		3	12	11:51	8864	53	4900 5240	3200 3320	3280 3320	2660 2840	2520 3300		31580	16.2	4.2	32.2	3.9	

Recorded by QAJ

Checked by

Sheet 21

LTPP Traffic Data

WIM System Test Truck Records 1 of 6

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* STATE_CODE	39
*SPS PROJECT_ID	0100
* DATE	04/15/2004

Pass 10 PAT Calibration

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A right / left weight.	Axle B right / left weight.	Axle C right / left weight.	Axle D right / left weight.	Axle E right / left weight.	Axle F right / left weight.	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
87.5		1	1	2:38	11234	43	5240 5300	7540 7600	8300 6970	9160 8200	9060 8760		76080	19.3	4.1	28.0	9.9	
87.5		2	2	2:39	11274	44	4920 4700	5740 4960	6040 4580	5940 6220	6480 5360		54400	19.5	4.1	35.1	4.1	
87.5		3	3		11292								33900					
87.5		1	4	2:52	11610	49	5260 5340	7200 7820	8280 6960	8180 8680	9200 8500		75620	19.5	4.1	28.4	10.0	
87.5		2	5	2:53	11630	50	4980 4820	5040 5200	5800 4980	5320 6360	6060 5700		54260	19.8	4.2	35.8	4.4	
92		3	6	2:54	11686	51	4640 4920	3340 3540	3560 3640	2720 3080	2640 3420		35500	16.2	4.2	32.3	3.7	
92		1	7	3:06	12023	53	5380 5100	7280 7920	8140 6960	8580 7960	8980 8720		74940	19.2	4.0	29.9	9.9	
92		2	8	3:07	12052	53	5120 4980	4960 5020	5600 4760	5260 6120	6120 5720		53660	19.4	4.1	34.9	4.3	

Recorded by KMA / DSW

Checked by _____

Sheet 21	* STATE_CODE 39
LTPP Traffic Data	*SPS PROJECT_ID 0100
WIM System Test Truck Records 2 of 6	* DATE 04/15/2004

Rev. 08/31/2001

Post Calibration

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A right / left weight.	Axle B right / left weight.	Axle C right / left weight.	Axle D right / left weight.	Axle E right / left weight.	Axle F right / left weight.	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
92		3	9	3:08	12086	54	4700 5080	3040 3540	3140 3600	3040 2800	2760 3380		35080	16.1	4.1	31.9	3.7	
92		1	10	3:19	12422	43	5300 5180	7340 7620	8420 6760	9260 8500	9080 8860		76320	19.2	4.1	27.9	9.8	
92		2	11	3:21	12459	44	5040 4980	5320 4940	5720 4840	6040 5820	6500 5660		34880	19.3	4.1	34.6	4.2	
92		3	12	3:22	12531	47	4920 5060	5660 3200	3700 3040	3160 2540	3580 3080		35340	16.3	4.2	32.4	3.8	
92		1	13	3:30	12789	48	5460 5020	7320 7260	8040 6900	8560 8160	9100 9000		75740	19.5	4.2	28.6	10.1	
92		2	14	3:32	12824	49	4780 4920	5160 5100	5560 5100	5320 6220	5420 5680		54100	19.3	4.1	34.8	4.3	
92		3	15	3:33	12872	51	4900 4960	3500 3420	3540 3520	2780 2740	2600 3080		35560	16.3	4.2	32.7	3.9	
92		1	16	3:40	13098	54	5380 5000	7380 7720	8260 6840	8840 8460	8820 8960		75760	19.6	4.1	48.2	10.1	

Recorded by Kurt Olson Checked by

Sheet 21	* STATE_CODE 39
LTPP Traffic Data	*SPS PROJECT_ID 0100
WIM System Test Truck Records 3 of 6	* DATE 04/15/2004

Rev. 08/31/2001

PCC Calibration

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A right / left weight.	Axle B right / left weight.	Axle C right / left weight.	Axle D right / left weight.	Axle E right / left weight.	Axle F right / left weight.	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
76.0		2	17	3:41	13150	53	4900 4680	5160 4960	5740 4680	5400 6420	6160 5720		53640	19.7	4.2	35.4	4.4	
76		3	18	3:42	13170	53	4820 5060	3560 3380	3620 3340	2960 2760	2800 3220		35520	16.1	4.2	32.8	3.9	
76		1	19	3:50	13438	43	5160 5160	7420 7620	8440 6980	9800 9160	9440 8680		77860	19.4	4.1	27.7	9.7	
76		2	20	3:50	13515								53190					
76		3	21	3:52	13549	46	4540 4740	3680 3340	3740 3120	2920 2620	3040 2820		34600	16.3	4.2	32.4	3.8	
76		1	22	4:01	13861	47	5460 5000	7320 7760	8140 7000	8920 8080	9140 8880		75700	19.3	4.1	28.2	10.0	
76		2	23	4:03	13914	50	5160 4760	5160 5000	5620 5060	5040 6560	4300 5580		54240	19.6	4.2	35.5	4.3	
76		3	24	4:04	13970	50	4820 4980	3580 3100	3720 3360	2980 2740	2780 3260		35320	16.4	4.2	32.7	3.8	

Recorded by KMA JDW Checked by

Sheet 21	* STATE_CODE 39
LTPP Traffic Data	*SPS PROJECT_ID 0100
WIM System Test Truck Records 4 of 5	* DATE 04/15/2004

Rev. 08/31/2001

Post calibration

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A right / left weight.	Axle B right / left weight.	Axle C right / left weight.	Axle D right / left weight.	Axle E right / left weight.	Axle F right / left weight.	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
82		1	25	4:10	14186	53	5260 5060	7320 7840	8260 7040	8640 7980	8400 8780		74580	19.3	4.1	28.0	9.9	
82		2	26	4:14	14370	53	5040 5080	4880 5020	5280 4940	5440 6200	5940 5560		53380	19.3	4.1	34.4	4.2	
82		3	27	4:15	14384	54	4860 5060	3180 3600	3180 3460	3160 2800	2700 3420		35420	16.2	4.2	31.9	3.8	
97		1	28	4:24	14715	44	5420 5100	7440 7480	8300 7060	7820 9120	9220 8380		75340	19.6	4.1	28.4	10.0	
97		2	29	4:25	14778	44	4860 4680	5300 5040	5940 4780	6200 6300	6480 5680		55260	19.3	4.1	34.5	4.1	
97		3	30	4:26	14819	47	4700 4800	3700 3120	3760 3260	2800 2620	2820 2920		34500	16.3	4.2	32.4	3.8	
97		1	31	4:34	15119	47	5260 5360	7260 7960	8180 7040	8460 8660	8960 9020		76160	19.1	4.0	28.0	9.9	
97		2	32	4:35	15159	47	5020 4860	5180 5020	5840 4800	5240 6320	6240 5640		54260	19.1	4.0	35.0	4.3	

Recorded by KMA/DSW Checked by

Sheet 21	* STATE_CODE 39
LTPP Traffic Data	*SPS PROJECT_ID 0100
WIM System Test Truck Records 5 of 5	* DATE 04/15/2004

Rev. 08/31/2001

Post Calibration

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A right / left weight.	Axle B right / left weight.	Axle C right / left weight.	Axle D right / left weight.	Axle E right / left weight.	Axle F right / left weight.	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
97		1	33	4:44	15469	53	5280 4960	7320 7680	8260 6840	8580 8480	8320 8900		74520	19.4	4.1	28.2	10.0	
97		2	34	4:45	15528	53	4960 4760	5020 5020	5700 4680	5740 6120	6000 5760		53760	19.5	4.1	34.8	4.2	
97		3	35	4:47	15581	51	4900 5040	3260 3420	3360 3480	2940 2660	2760 3080		34900	16.3	4.2	32.5	3.9	
72		1	36	4:54	15823	42	5460 4940	7380 7700	8400 6820	8180 8280	900 8480		74740	19.4	4.1	28.3	10.0	
72		3	37	4:56	15905	45	4600 5140	3320 3460	3380 3400	2920 2660	2580 3240		34700	16.0	4.1	32.3	3.9	
72		1	38	5:04	16168	43	5380 5160	7380 7740	8420 6920	8700 7960	9300 8640		75600	19.2	4.1	28.3	10.1	
72		2	39	5:06	16236	43	4800 4760	4920 4920	5840 4500	6220 6020	6600 5300		53880	19.3	4.1	35.1	4.2	
72		3	40	5.07	16282	46	4700 5260	3220 3400	3580 3000	2660 2740	2640 3020		34220	16.0	4.1	32.3	3.8	

Recorded by KMA/OIW Checked by

SPS 1

After reviewing the native format files (A-files) both pre validation and post validation, it was observed that in the data collected by the equipment, approximately twelve percent of the left wheel weights and one percent of the right wheel weights were being reported as zero before validation. After validation twenty percent of the left wheel weights and almost zero percent of the right wheel weights were reported as zero. Therefore, it is assumed that calibration of the equipment has not changed the data reporting. The cause of the preponderance of zero valued wheel loads in the left wheel path is unknown.

SPS 2

After reviewing the native format files (A-files) both pre validation and post validation, it was observed that in the data collected by the equipment, approximately seven percent of the left wheel weights and one percent of the right wheel weights were being reported as zero before validation. After validation forty nine percent of the left wheel weights and thirteen percent of the right wheel weights were reported as zero. It is not known whether calibration of the equipment has resulted in increase in reporting of zero weight wheels.

April 14, 2004 (SPS 1)

Class	Total veh	A left	A right	B left	B right	C left	C right	D left	D right	E left	E right	F left	F right	G left	G right	H left	H right	I left	I right
4	7	0	0	0	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5	90	0	0	0	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6	62	2	0	2	0	39	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
7	20	1	0	1	0	9	2	11	2	0	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8	54	0	0	0	0	0	1	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
9	623	5	1	5	1	6	1	9	1	10	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10	9	0	0	0	0	0	0	0	0	0	0	1	0	1	0	N/A	N/A	N/A	N/A
11	32	1	0	1	0	1	0	1	0	1	0	0	0	0	0	N/A	N/A	N/A	N/A
12	2	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A
13	10	0	0	0	0	0	0	0	0	0	0	7	0	8	3	7	2	7	1

N/A - Not applicable
Class 13 ignored

	Left Wheel	Right Wheel
Percentage reporting zero axle weights	12%	1%

April 16, 2004 (SPS 1)

Class	Total veh	A left	A right	B left	B right	C left	C right	D left	D right	E left	E right	F left	F right	G left	G right	H left	H right	I left	I right
4	19	0	0	0	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5	202	1	0	1	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6	267	4	0	0	0	190	5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
7	130	2	0	2	0	89	2	94	2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8	160	0	0	0	0	0	0	10	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
9	1533	7	0	7	0	13	0	23	0	28	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10	56	0	0	0	0	1	0	3	0	4	0	8	0	N/A	N/A	N/A	N/A	N/A	N/A
11	41	0	0	0	0	0	0	0	0	1	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A
12	4	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A
13	40	0	0	0	0	1	0	1	0	2	0	34	1	34	1	32	1	N/A	N/A

N/A - Not applicable
Class 13 ignored

	Left Wheel	Right Wheel
Percentage reporting zero axle weights	20%	0%

April 14, 2004 (SPS 2)

Class	Total veh	A left	A right	B left	B right	C left	C right	D left	D right	E left	E right	F left	F right	G left	G right	H left	H right	I left	I right
4	14	0	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5	82	1	0	1	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6	29	0	0	0	1	15	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
7	24	0	0	0	1	5	0	7	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8	44	1	0	1	0	1	0	1	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
9	685	2	0	2	0	2	1	4	1	4	2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10	17	0	0	0	0	0	0	0	0	1	0	9	0	N/A	N/A	N/A	N/A	N/A	N/A
11	18	1	0	1	0	1	0	1	0	1	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
12	5	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A
13	12	0	0	1	0	1	0	1	0	1	0	6	4	7	4	4	3	2	0

N/A - Not applicable
Class 13 ignored

	Left Wheel	Right Wheel
Percentage reporting zero axle weights	7%	1%

April 16, 2004 (SPS 2)

Class	Total veh	A left	A right	B left	B right	C left	C right	D left	D right	E left	E right	F left	F right	G left	G right	H left	H right	I left	I right
4	37	1	0	1	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5	140	1	0	1	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6	317	7	0	10	18	240	26	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
7	192	5	0	7	6	121	16	131	17	9	0	2	0	1	0	N/A	N/A	N/A	N/A
8	111	1	0	1	1	1	4	3	2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
9	1138	7	0	14	20	81	31	87	42	91	44	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10	113	2	0	6	7	35	10	39	10	49	10	68	12	3	0	N/A	N/A	N/A	N/A
11	40	1	0	1	0	1	0	1	0	1	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
12	5	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A
13	219	2	0	6	33	37	40	44	51	61	57	97	106	99	107	52	93	N/A	N/A

N/A - Not applicable
Class 13 ignored

	Left Wheel	Right Wheel
Percentage reporting zero axle weights	49%	13%