Evaluation/Calibration Report

Ohio, SPS 1

Task Order 3, CLIN 2
Visit Dates: February 3 and 4, 2004

1 Executive Summary 1
2 Corrective Actions Recommended 3
3 Post Calibration Analysis 3
3.1 Temperature-based Analysis 7
3.2 Speed-based Analysis 8
3.3 Classification Validation 12
4 Pavement Discussion 12
4.1 Profile analysis 13
4.2 Distress survey and any applicable photos 14
4.3 Vehicle-pavement interaction discussion 14
5 Equipment Discussion 14
5.1 Pre-Evaluation Diagnostics 14
5.2 Calibration Process 15
5.2.1 Calibration Iteration 1 15
5.2.2 Calibration Iteration 2 16
5.3 Historical calibration information 17
5.4 Projected Maintenance/Replacement Requirements 17
6 Pre-Validation Analysis 18
6.1 Temperature-based Analysis 20
6.2 Speed-based Analysis 22
6.3 Classification Validation 25
7 Data Availability and Quality 25
8 Data Sheets 28
9 Updated handout guide and Sheet 17 28
10 Updated Sheet 18 29
11 Traffic Sheet 16(s) 29

List of Tables

Table 1 Post-Validation results – 390100 - 4 February 2004 1
Table 2 Post-Validation Results – 390100 - 4 February 2004..... 4
Table 3 Post-Validation Results by Temperature Bin – 390100 - 4 February 2004..... 7
Table 4 Post-Validation Results by Speed Bin – 390100- 4 February 2004 8
Table 5 Error rates for Truck Classification 12
Table 6 Long Range Index (LRI) and Short Range Index (SRI) - 390100 – 04 February-2004..... 13
Table 7 Calibration 1 Results – 390100 - 4 February 2004..... 15
Table 8 Calibration 2 Results – 390100 - 4 February 2004..... 16
Table 9 Classification Validation History – 390100..... 17
Table 10 Weight Validation History - 390100 17
Table 11 Pre-Validation Results – 390100 - 3 February 2004 18
Table 12 Pre-Validation Results by Temperature Bin – 390100 – 3 February 2004 21
Table 13 Pre-Validation Results by Speed Bin - 390100- 3 February 2004 22
Table 14 Error rates for Truck Classification 25
Table 15Amount of Traffic Data Available 390100 – 4 February 2004 26
Table 16 GVW Characteristics of Major sub-groups of Trucks - 390100 – 4 February 2004..... 26

List of Figures

Figure 3-1 Post-Validation Speed-Temperature Distribution Graph – 390100 - 4 February 2004..... 5
Figure 3-2 Post-validation GVW Percent Error vs. Speed by truck – 390100 - 4 February 2004..... 6
Figure 3-3 Post-Validation GVW Percent Error vs. Temperature by Truck – 390100 - 4 February 2004 6
Figure 3-4 Post-Validation Speed versus Spacing – 390100 - 4 February 2004 7
Figure 3-5 Post-Validation GVW Percent Error vs. Temperature by Group – 390100 - 4 February 2004 8
Figure 3-6 Post-Validation Steering Axle error vs. Temperature by group – 390100 - 4 February 2004 8
Figure 3-7 Post-Validation GVW Percent Error vs. Speed group - 390100 - 4 February 2004..... 9
Figure 3-8 Post-Validation GVW Percent Error vs. Speed by Truck – 390100 - 4 February 2004 10
Figure 3-9 Post-Validation Steering Axle Percent Error vs. Speed group – 390100 - 4 February 2004 10
Figure 3-10 Post-Validation Steering Axle Percent Error vs. Speed by truck – 390100 - 4 February 2004 11

Figure 3-11 Tandem Axles by Truck and Location vs. Speed – 390200 – 4 February 2004 12
Figure 5-1 GVW Error vs. Speed Results for Calibration 1 – 390100 – 4 February 200416
Figure 5-2 GVW Error vs. Speed Results for Calibration 2 – 390100 – 4 February 200417
Figure 6-1 Pre-Validation Speed-Temperature Distribution Graph – 390100 - 3 February 2004..... 19
Figure 6-2 Pre-validation GVW Percent Error vs. Speed by truck– 390100 - 3 February 2004..... 19
Figure 6-3 Pre-Validation GVW Percent Error vs. Temperature by Truck – 390100 - 3 February 2004 20
Figure 6-4 Pre-Validation Speed versus spacing graph – 390100 - 3 February 2004 20
Figure 6-5 Pre-Validation GVW Percent Error vs. Temperature by Group – 390100 - 3 February 2004 21
Figure 6-6 Pre-Validation Steering Axle Error vs. Temperature by group – 390100 - 3 February 2004 22
Figure 6-7 Pre-Validation GVW Percent Error vs. Speed group - 390100- 3 February 2004..... 23
Figure 6-8 Pre-Validation GVW Percent Error vs. Speed by Truck – 390100- 3 February 2004..... 23
Figure 6-9 Pre-Validation Steering Axle Percent Error vs. Speed group – 390100 - 3 February 2004 24
Figure 6-10 Pre-Validation Steering Axle Percent Error vs. Speed by truck – 390100 - 3 February 2004 24
Figure 7-1 Graph of Expected GVW distribution Class 9 – 390100 - 4 February 2004 .. 27
Figure 7-2 Expected Vehicle Distribution – 390100 - 4 February 2004 27
Figure 7-3 Expected Speed Distribution – 390100 - 4 February 2004 28

1 Executive Summary

A visit was made to the Ohio SPS-1 site on February 3rd and 4th, 2004 for the purpose of conducting a field performance evaluation and calibration of the WIM system located on US Route 23 South at milepost 19.7. **At this time, this site does not meet research quality standards.**

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

The validation used the following trucks:

1) 3S2 with a tractor having air suspension and trailer having a standard two leaf spring suspension, unloaded, weighing 31,470 lbs.
2) 3S2 with a tractor having air suspension and trailer having a standard two leaf spring suspension, loaded to 48,070 lbs.
3) 3S2 with a tractor having air suspension and trailer having a standard two leaf spring suspension, loaded to 75,810 lbs.

The speeds ranged from 41 to 59 miles per hour and had a target range of 45 to 55 miles per hour. The temperatures ranged from 28 to 37 degrees Fahrenheit.

Table 1 Post-Validation results – 390100 - 4 February 2004

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Loaded single axles	±20 percent	-6.6% ± 4.4%	Pass
Loaded tandem axles	±15 percent	5.3% ± 19.8%	**Fail**
Gross vehicle weights	±10 percent	1.8% ± 11.2%	**Fail**
Vehicle speed	±1 mph [2 km/hr]	1.0 ± 3.1 mph	**Fail**
Axle spacing length	± 0.5 ft [150 mm]	-0.1± 0.2 ft	Pass

This site as currently calibrated fails all LTPP precision requirements except loaded single axles and axle spacing. 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, as the percentage of Class 5s misclassified is 9%.

MACTEC field personnel worked with the agency 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.

The following remedial actions are recommended so that this site may meet LTPP precision requirements. First, the agency should coordinate with the manufacturer to complete an assessment and calibration of the "span" setting for each weight sensor in the LTPP lane. This would significantly diminish the increased error effect of the weights reported by the WIM system as the weights of the trucks decrease. If that does not permit the system to supply research quality data, then the second recommendation would be to grind the pavement to smooth out the problems indicated in profile/WIM Profile Index. Should this action be required, reinstallation of the load cell sensors may be necessary.

2 Corrective Actions Recommended

An assessment and adjustment to the system's span value needs to be performed. This should be conducted under observation of the WIM equipment manufacturer. The "span" setting is a setting for each load cell sensor that compensates for the inherent nonlinear increase in weight error as the raw weight input from the sensor decreases (fully loaded truck 0% error, half-loaded trucks 4% error, empty truck 10% error).

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.

3 Post Calibration Analysis

This final analysis is based on test runs conducted February 4, 2004 from 12:00 p.m. till 3:30 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 an air suspension and a trailer having a standard leaf spring suspension, unloaded, weighing 31,470 lbs.
2) 3S2 with a tractor having an air suspension and a trailer having a standard leaf spring suspension, loaded to 48,070 lbs.
3) 3S2 with a tractor having an air suspension and a trailer having a standard leaf spring suspension, loaded to 75,810 lbs.

The front axle suspension of the unloaded five axle tractor semi-trailer (truck #1) consisted of one standard leaf spring. The drive tandem axle of the tractor was air suspension. The axle tandem of the trailer was leaf spring suspension, with one standard leaf on the front axle and one standard leaf on the rear axle.

The front axle suspension of the partially loaded five-axle tractor semi-trailer (truck #2) consisted of two standard leaf springs. The drive tandem axle of the tractor used air suspension. The axle tandem of the trailer was leaf spring suspension, with three standard leafs on the front axle and three standard leafs on the rear axle.

The front axle suspension of the fully loaded five-axle tractor semi-trailer (truck #3) consisted of two standard leaf springs. The drive tandem axle of the tractor used air

suspension. The axle tandem of the trailer was leaf spring suspension, with one standard leaf on the front axle and on standard leaf on the rear axle.

The three trucks made a total of 40 passes over the WIM scale at speeds ranging from approximately 42.0 to 57.0 miles per hour. Pavement surface temperature was essentially the same at 36 degrees Fahrenheit due to the winter season and limited sunshine. The computed values of 95% confidence limits for all statistics for the total population are not within the allowable values for research quality data.

As seen in Table 2 the site failed the LTPP precision requirements except for the loaded single axles and the axle spacing length.

Table 2 Post-Validation Results – 390100 - 4 February 2004

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Loaded single axles	±20 percent	-6.6% ± 4.4%	Pass
Loaded tandem axles	±15 percent	5.3% ± 19.8%	**Fail**
Gross vehicle weights	±10 percent	1.8% ± 11.2%	**Fail**
Vehicle speed	±1 mph [2 km/hr]	1.0 ± 3.1 mph	**Fail**
Axle spacing length	± 0.5 ft [150 mm]	-0.1 ± 0.2 ft	Pass

The runs were conducted early afternoon and resulted in a very narrow range of temperatures. The runs were also conducted at various speeds to determine the effects of these variables on the performance of the WIM scale. To investigate these effects, the dataset was split into 3 speed groups and one temperature group. The distribution of runs by speed and the limited temperature range is illustrated in Figure 3-1. The speed groups were divided as follows: Low speed = 42.0-47.0 mph, Medium speed = 48.0-52.0 mph and High speed = 53.0+ mph. There were no temperature ranges as the temperature was remained almost constant during the test.

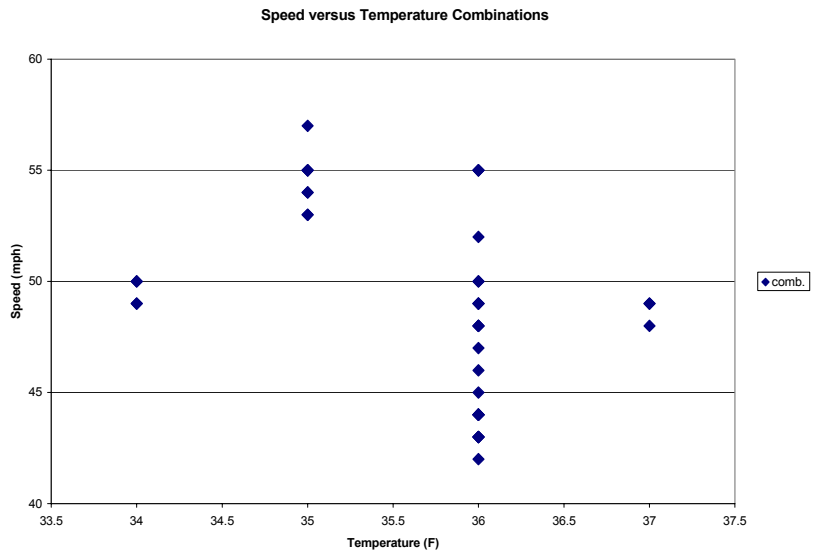


Figure 3-1 Post-Validation Speed-Temperature Distribution Graph – 390100 - 4 February 2004

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 Truck GVW percent Error vs. Speed graph for the population as a whole. From Figure 3-2 it appears that the errors in GVW are larger for a light truck compared to the medium and heavy loaded trucks. The light trucks are the squares. The medium trucks are the diamonds. The heavy trucks are the triangles. The equipment is overestimating the weight of the light truck and under estimating that of the heavy truck. This occurs since it was decided to leave the site calibrated with respect to the population mean error. In selecting the calibration factor to use for data collection, the Agency decided that they wanted the output to be unbiased with respect to the population. The mean error for the forty calibration runs should therefore be close to zero. As one alternative the Agency could have selected for weights of heavy trucks to be unbiased. This would have shifted all of the points up and left. The triangles would then appear on the x-axis rather than below the 0.0% line.

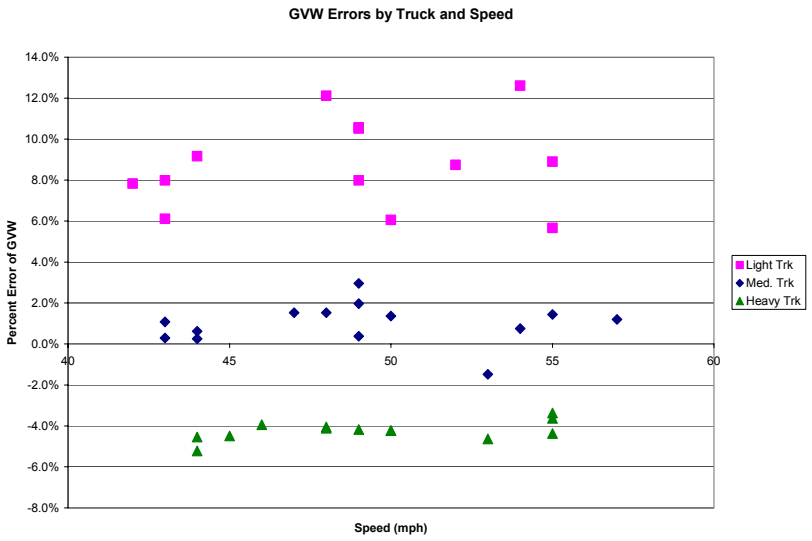


Figure 3-2 Post-validation GVW Percent Error vs. Speed by Truck – 390100 - 4 February 2004

Figure 3-3 shows the relationship between temperature and GVW percentage error by truck. As seen in Figure 3-3 no definitive conclusions can be made since the temperature variation is effectively non-existent (34-37 degrees F).

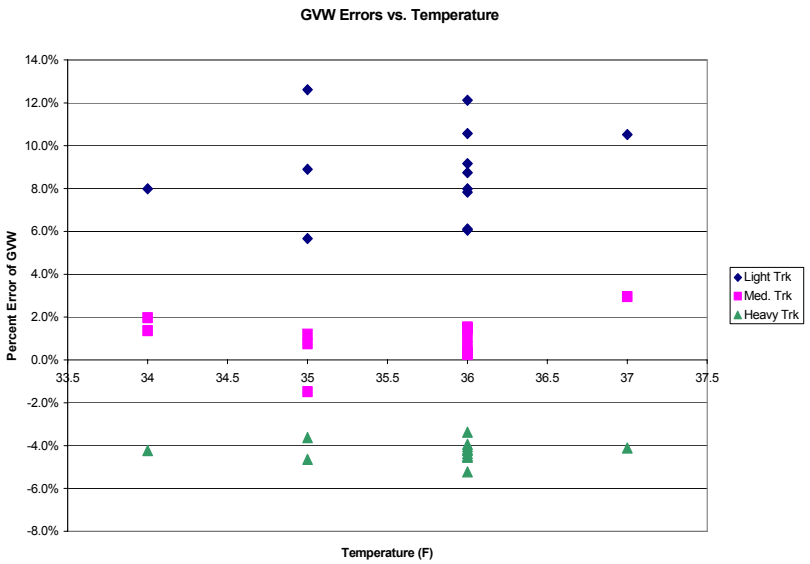


Figure 3-3 Post-Validation GVW Percent Error vs. Temperature by Truck – 390100 - 4 February 2004

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

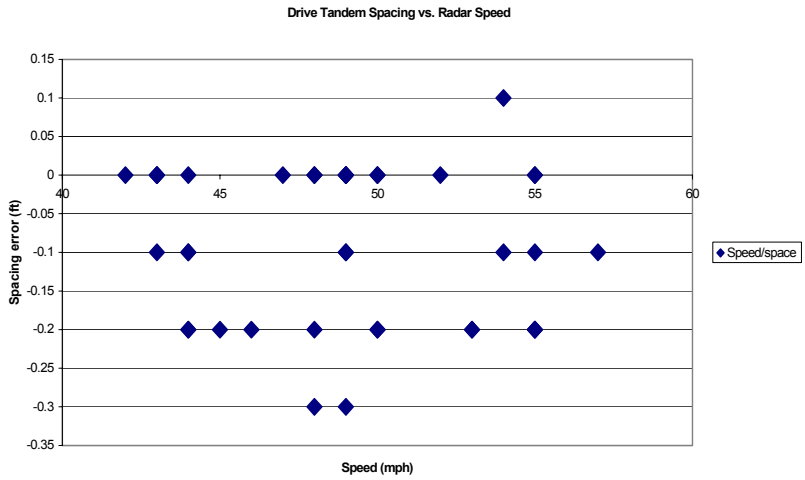


Figure 3-4 Post-Validation Speed Spacing – 390100 - 4 February 2004

3.1 Temperature-based Analysis

There were no temperature ranges because the temperature was essentially the same during the post calibration process.

Table 3 Post-Validation Results by Temperature Bin – 390100 - 4 February 2004

Element	95% Limit	High Temp.	Pass/ Fail
Single axles	±20 %	-6.6% ± 4.4%	Pass
Tandem axles	±15 %	5.3% ± 19.8%	**Fail**
GVW	±10 %	1.8% ± 11.2%	**Fail**
Speed	±1 mph	1.0 ± 3.1 mph	**Fail**
Axle spacing	± 0.5 ft	-0.1 ± 0.2 ft	Pass

From Table 3, Figure 3-5 and Figure 3-6 no conclusions can be made since the temperature did not vary. The various graphs are presented for reporting consistency.

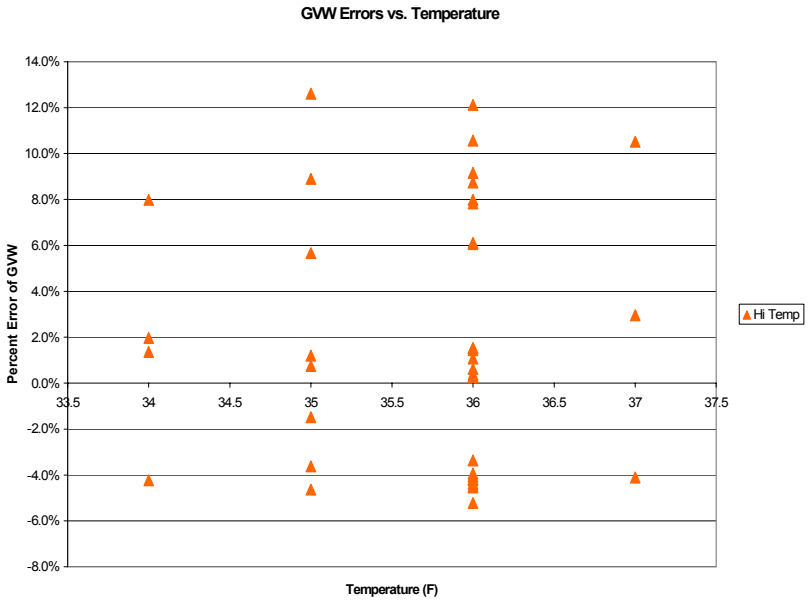


Figure 3-5 Post-Validation GVW Percent Error vs. Temperature by Group – 390100 - 4 February 2004

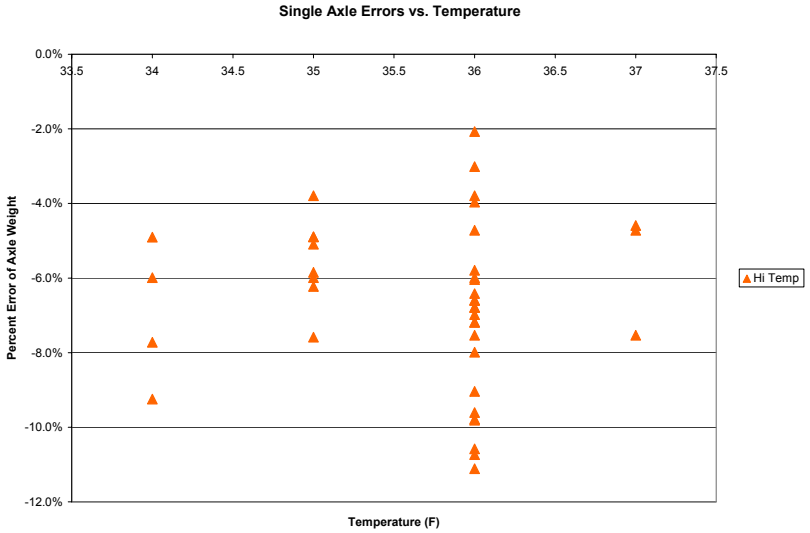


Figure 3-6 Post-Validation Steering Axle Error vs. Temperature by Group – 390100 - 4 February 2004

3.2 Speed-based Analysis

The speed groups were divided as follows: Low speed = 42.0-47.0 mph, Medium speed = 48.0-52.0 mph and High speed = 53.0+ mph.

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

Element	95% Limit	Low Speed	Med. Speed	High Speed
Single axles	±20 %	-8.2% ± 5.2%	-6.4% ± 3.0%	-5.1% ± 3.6%
Tandem axles	±15 %	5.2% ± 17.6%	7.1% ± 20.2%	2.9% ± 23.5%
GVW	±10 %	1.3% ± 11.1%	2.7% ± 12.7%	1.2% ± 12.7%
Speed	±1 mph	1.8 ± 2.0 mph	0.6 ± 3.1 mph	0.5 ± 4.2 mph
Axle spacing	± 0.5 ft	0.2 ± 0.2%	0.2 ± 0.2 ft	-0.1 ± 0.2 ft

Table 4 shows decreasing mean errors for single and tandem axles and speed with increasing speeds. Increasing speeds also results in increasing variability in the tandem axle values and speeds.

Figure 3-7 and Figure 3-8 shows that the error is GVW is not affected by increase in speed. The low speed group is represented by squares, the medium by dots and the high by triangles.

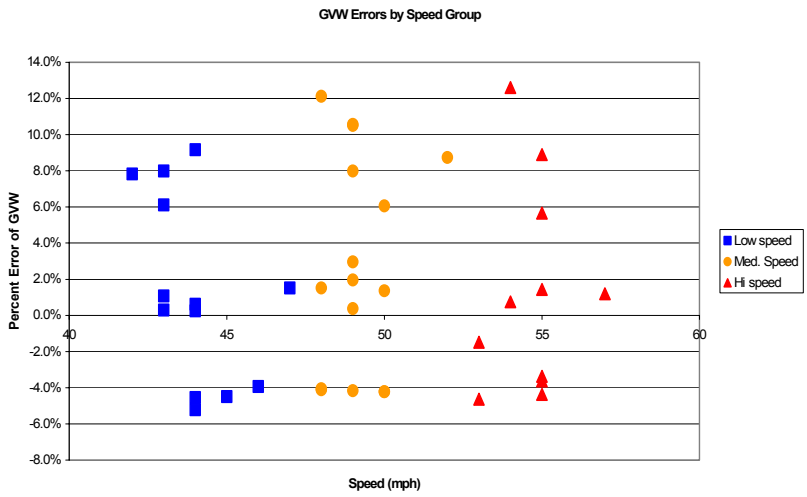


Figure 3-7 Post-Validation GVW Percent Error vs. Speed Group - 390100 - 4 February 2004

The error in GVW is influenced by truck weight. The error for the light truck (asterisks) varies the most and the heavy truck (plus signs) the least as shown in Figure 3-8. The GVW of the light truck is overestimated compared to the medium (dots) and heavy loaded trucks based again on the decision on the calibration point.

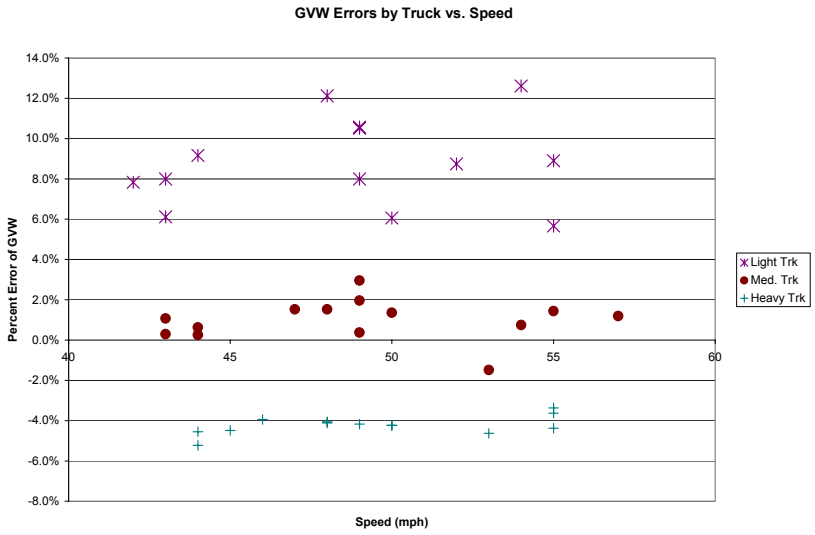


Figure 3-8 Post-Validation GVW Percent Error vs. Speed by Truck – 390100 - 4 February 2004

The error in single axle weights in Figure 3-9 for all the trucks decreased with increasing speed. It should be noted that the weights of the front axles are virtually the same. There is clearly some speed impact on these weights. The equipment is currently being operated with auto calibration off. As a result this will not distort data output as the equipment experiences vehicles operating at different mixes of speed but equivalent axle weights.

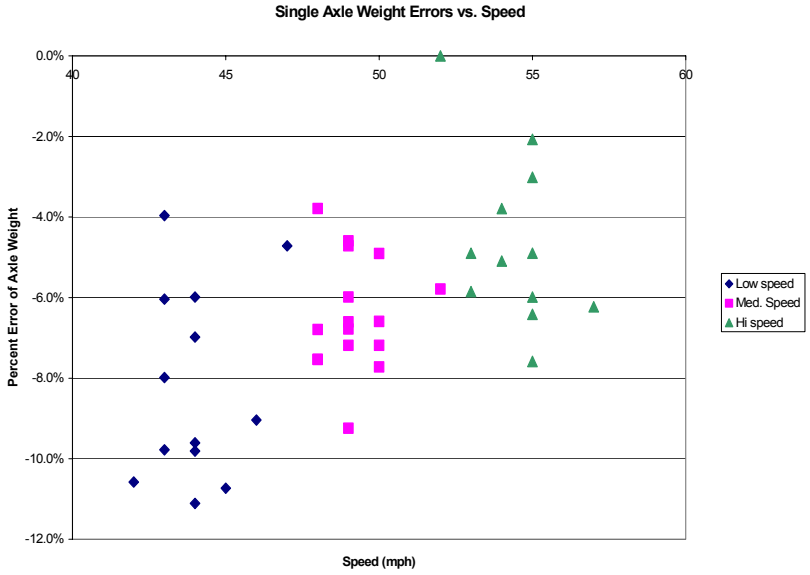


Figure 3-9 Post-Validation Steering Axle Percent Error vs. Speed Group – 390100 - 4 February 2004

A different truck dependency in this outcome is shown in Figure 3-10 where the symbols for the various trucks are intermixed, although with somewhat decreasing variance. The heavy truck (open triangles) shows a distinct decrease in mean error with increasing speed although variability seems unaffected. The other two trucks (squares and dots) are essentially unchanged with respect to mean but have apparently decreasing variability with increasing speed.

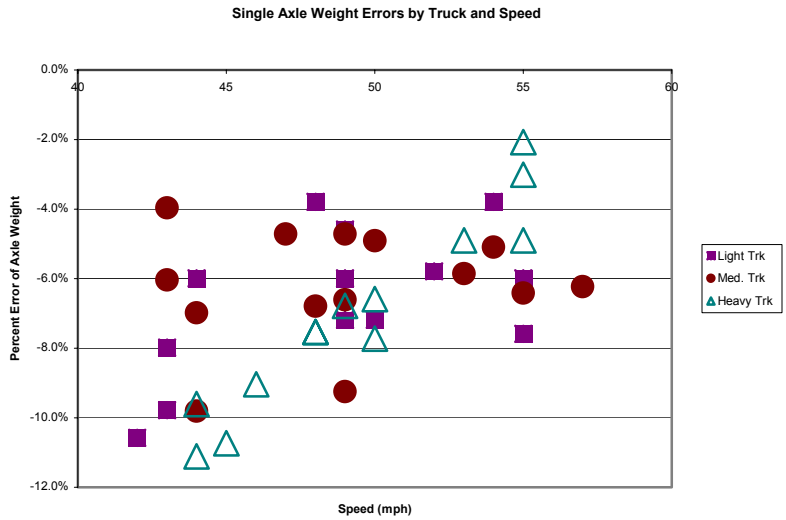


Figure 3-10 Post-Validation Steering Axle Percent Error vs. Speed by Truck – 390100 - 4 February 2004

To further explore the issues at this site, an additional graph of the tandem axles by truck and position on the vehicle was created. As shown in Figure 3-11, the tandem axles that drive vehicle weight are not behaving in the same fashion for all trucks. The pairs of squares and diamonds in the top group are associated with the light truck. They show that while the drive tandem (diamonds) has essentially constant error, the error associated with the tandem on the trailer varies on either side of that error. For the other two vehicles the error of the trailer tandem in relation to the drive tandem doesn't change. The error of the drive tandem is found above that of the trailer for them. It should also be noted that for these vehicles for one of the tandems there is essentially no error. These axle groups are two to four times heavier than those on the light truck.

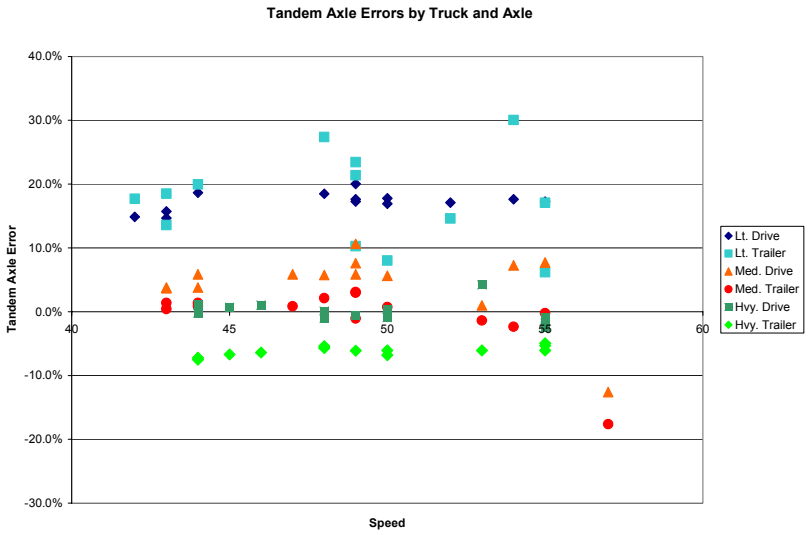


Figure 3-11 Tandem Axles by Truck and Location vs. Speed – 390200 – 4 February 2004

3.3 Classification Validation

The agency uses the FHWA 13-bin classification scheme from the Traffic Monitoring Guide.

A sample of 100 trucks was collected at the site. Video was taken at the site to provide ground truth for the evaluation. Based the sample it was determined that there are … percent unknown vehicles and one percent unclassified vehicles. The unclassified vehicle in the sample was a Class 9.

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 error rates by class. The rates are expressed as expected failures per hundred vehicles observed of that class. Since these are based on a hundred-truck sample they are in this case the actual percentage missed.

Table 5 Error rates for Truck Classification

Class	Error rate	Class	Error rate	Class	Error rate
4	**-50***	**5**	**29***	**6**	0
7	N/A				
8	0	**9**	1	**10**	0
11	N/A	**12**	N/A	**13**	N/A

* Only two Class 4's, and seven Class 5's were observed in the sample.

4 Pavement Discussion

The pavement smoothness did contribute to out-of-range results. The updated index results are discussed in this section

The pavement condition did not influence truck movement across the sensors. No additional distresses or remediation was noted since the assessment.

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 on a Portland cement concrete pavement. The results are shown in Table 6.

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 6 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 reflects the 2002 averages for comparison purposes.

Table 6 Long Range Index (LRI) and Short Range Index (SRI) - 390100 – 04 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. Whether or not this is an agency requirement was not investigated. However, the 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.

There were no changes in basic equipment operating condition since the assessment on November 12th and 13th, 2003. Only the electronics could be evaluated at that time.

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 in working order.

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

The backup of the water being drained from the sensors identified during the assessment could not be reevaluated due to the accumulation of ice and snow in the median area where the drained water is accumulated. In conversation with the agency representative, it was explained that the water has backed up into the scale pit area and become frozen.

Although there is 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. It was observed while recording test truck runs at the colder temperatures that vehicle axles were missed or "ghost axles" added. It could not be determined if this was an effect of the scale not working properly, or the WIM controller.

5.2 Calibration Process

Two iterations of the calibration process between the initial 40 runs and the final 40 runs were conducted.

5.2.1 Calibration Iteration 1

The results of the 40 pre-calibration runs performed by the three test trucks produced an average combined GVW error of +4.0%. The compensation factor (P4) setting for that particular lane was increased from the original 8.016170 by 4.0% to 8.336800.

Table 7 Calibration 1 Results – 390100 - 4 February 2004

Element	95% Limit	Mean plus or minus Standard Deviations	Pass/ Fail
Single axles	±20 %	-5.1% ± 6.4%	Pass
Tandem axles	±15 %	8.4% ± 22.6%	**Fail**
GVW	±10 %	4.0% ± 14.5%	**Fail**
Speed	±1 mph	1.1 ± 1.9 mph	**Fail**
Axle spacing	± 0.5 ft	-0.1 ± 0.2 ft	Pass

The first set of 12 iterations performed by the three trucks produced a mean error of 3.66%. It was then determined that the P4 factor was not based on a percentage of the error, but actually represented a denominator that is a linear percentage adjustment to the scale weights, inversely proportional to the adjustment. The factor of 8.336800 was then increased to 12.0000.

Figure 5-1 shows the results of the Calibration 1 adjustment. All runs were done at the middle of the speed range, this fact distorts the variability with speed.

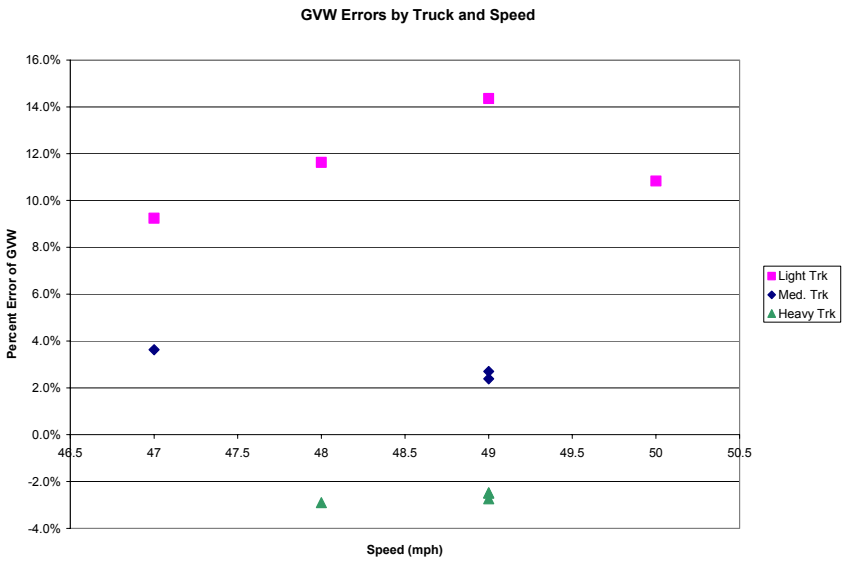


Figure 5-1 GVW Error vs. Speed Results for Calibration 1 – 390100 – 4 February 2004

5.2.2 Calibration Iteration 2

The second set of post-calibration runs produced a mean error of 2.3% for GVW.

Table 8 Calibration 2 Results – 390100 - 4 February 2004

Element	95% Limit	Mean plus or minus Standard Deviations	Pass/ Fail
Single axles	±20 %	-6.2% ± 3.7.4%	Pass
Tandem axles	±15 %	6.3% ± 19.9%	**Fail**
GVW	±10 %	2.3% ± 12.9%	**Fail**
Speed	±1 mph	0.6 ± 2.7 mph	**Fail**
Axle spacing	± 0.5 ft	-0.1 ± 0.2 ft	Pass

No further adjustments were made and 28 additional runs were performed to complete the required 40 post calibration runs.

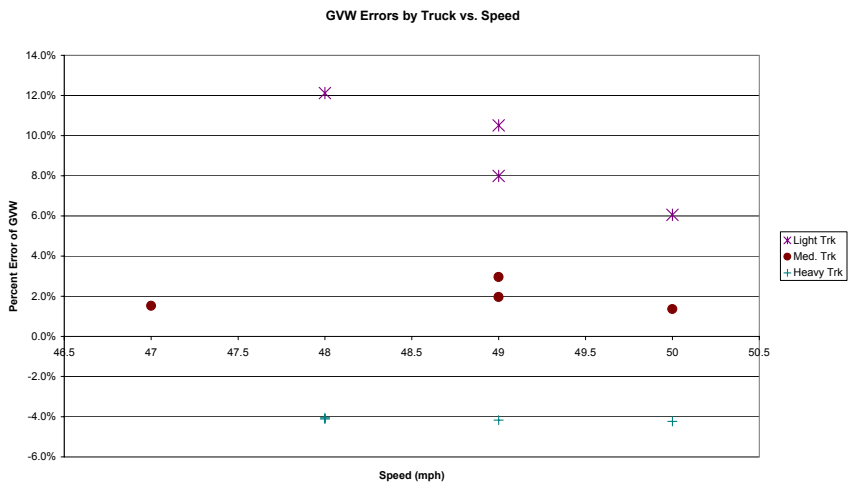


Figure 5-2 GVW Error vs. Speed Results for Calibration 2 – 390100 – 4 February 2004

5.3 Historical calibration information

This site has no validation information from previous visits.

Table 9 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

Table 10 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)

5.4 Projected Maintenance/Replacement Requirements

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

6 Pre-Validation Analysis

This initial analysis is based on test runs conducted February 3, 2004 at test site 390100 on US 23 south at 7.6 miles north of SR 37. Prior to arrival on site, the agency had conducted a calibration of the site using a single heavy truck.

For the initial validation the three trucks made a total of 40 passes over the WIM scale at speeds ranging from approximately 40.0 to 59.0 miles per hour. Pavement surface temperatures were recorded during the test runs ranging from about 28.0 to 39.0 degrees Fahrenheit. The computed values of 95% confidence limits of each statistic for the total population are shown in Table 11.

As seen in Table 11 the site failed all the values except the loaded single axles and the axle spacing length.

Table 11 Pre-Validation Results – 390100 - 3 February 2004

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Loaded single axles	±20 percent	-4.5% ± 3.6%	Pass
Loaded tandem axles	±15 percent	8.3% ± 15.1%	**Fail**
Gross vehicle weights	±10 percent	4.4% ± 9.0%	**Fail**
Vehicle speed	±1 mph [2 km/hr]	1.4 ± 5.5 mph	**Fail**
Axle spacing length	± 0.5 ft [150 mm]	0.0 ± 0.2 ft	Pass

The test runs were conducted starting during late morning hours and until mid-afternoon. The runs were also conducted at various speeds to determine the effects of these variables on the performance of the WIM scale. To investigate these effects, the dataset was split into three speed groups and two temperature groups. The distribution of runs within these groupings is illustrated in Figure 6-1. There is a distinct correlation between speed and temperature resulting from improper field procedure. The speed groups were divided as follows: Low speed = 40.0-45.0 mph, Medium speed = 45.1-50.5 mph and High speed = 50.6+ mph.

The two temperature groups were created by splitting the runs between those at 28.0 to 32.9 degrees Fahrenheit for Low temperature, and 33 to 39 degrees for High temperature.

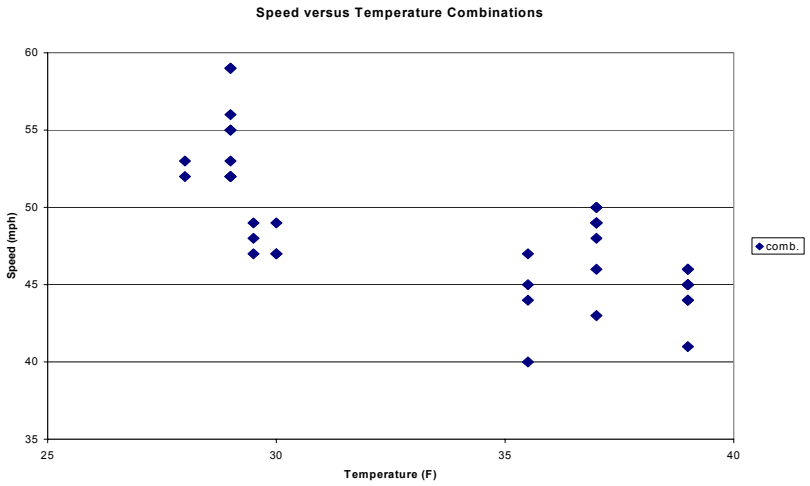


Figure 6-1 Pre-Validation Speed-Temperature Distribution – 390100 - 3 February 2004

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 Error vs. Speed graph for the population as a whole. From the figure it appears that the error was varying significantly by truck. Additionally, the GVW was overestimated for the light truck (squares) compared to the medium (diamonds) and heavily (triangles) loaded trucks.

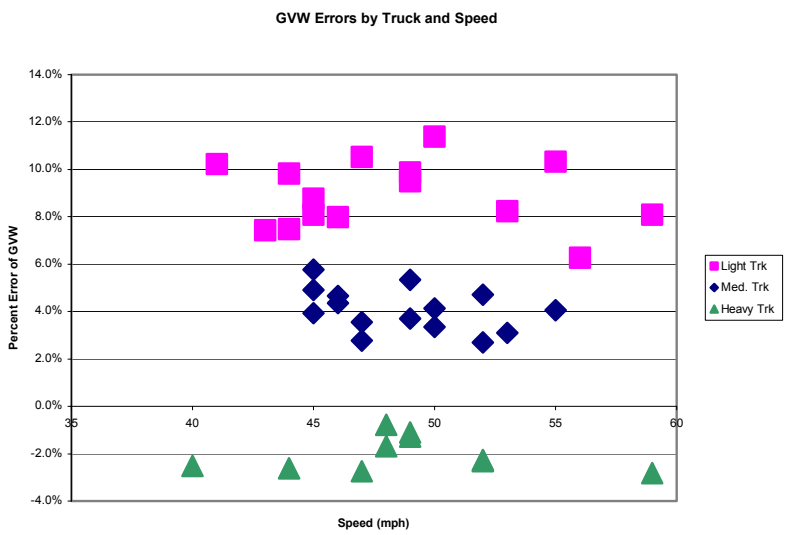


Figure 6-2 Pre-validation GVW Percent Error vs. Speed by Truck– 390100 - 3 February 2004

Figure 6-3 shows the relationship between temperature and GVW percentage error. There is little, if any indication, that temperature is influencing these results. There is no apparent trend in either mean or variability over the limited range of temperatures observed.

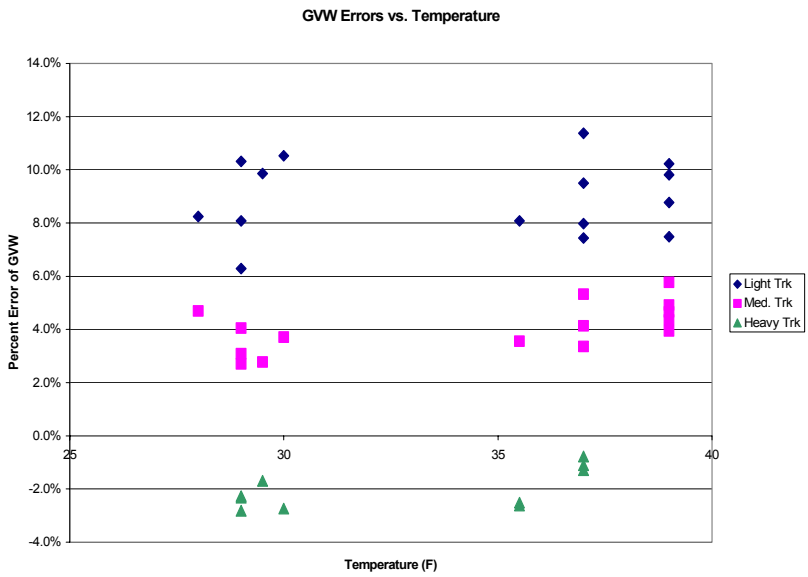


Figure 6-3 Pre-Validation GVW Percent Error vs. Temperature by Truck – 390100 - 3 February 2004

Figure 6-4 shows the relationship between the spacing errors in feet and speeds. From the figure it shows that the errors in spacing appear to increase at higher speeds.

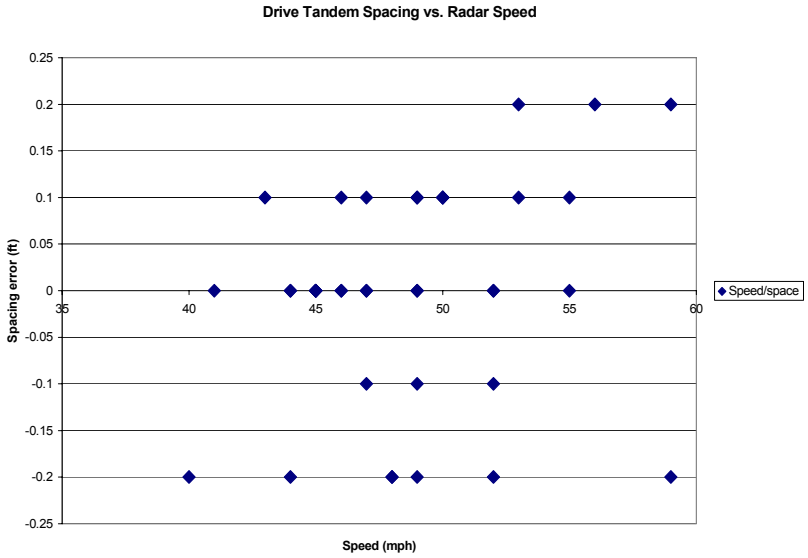


Figure 6-4 Pre-Validation Speed vs. Spacing – 390100 - 3 February 2004

6.1 Temperature-based Analysis

The two temperature groups were created by splitting the runs between those at 28.0 to 32.9 degrees Fahrenheit for low temperature, and 33.0 to 39 degrees Fahrenheit for High

temperature. No medium temperature group was created or evaluated due to the small range of temperatures.

Table 12 Pre-Validation Results by Temperature Bin – 390100 – 3 February 2004

Element	95% Limit	Low Temp.	High Temp.	Pass/ Fail
Single axles	±20 %	-4.1% ± 3.0%	-4.8% ± 4.0%	Pass
Tandem axles	±15 %	7.1% ± 15.5%	9.2% ± 15.1%	**Fail**
GVW	±10 %	3.7% ± 10.1%	4.9% ± 8.7%	**Fail**
Speed	±1 mph	2.0 ± 7.5 mph	0.9 ± 3.7 mph	**Fail**
Axle spacing	± 0.5 ft	0.0 ± 0.3 ft	0.0 ± 0.2 ft	Pass

From Table 12, Figure 6-5 and Figure 6-6 it appears that the errors in GVW are not affected significantly by the change in temperature. However, the error in single axles increased with increases in temperature. This may have been confounded by the fact that the low temperature runs were all done at the higher speeds while the high temperature runs were done at higher speeds.

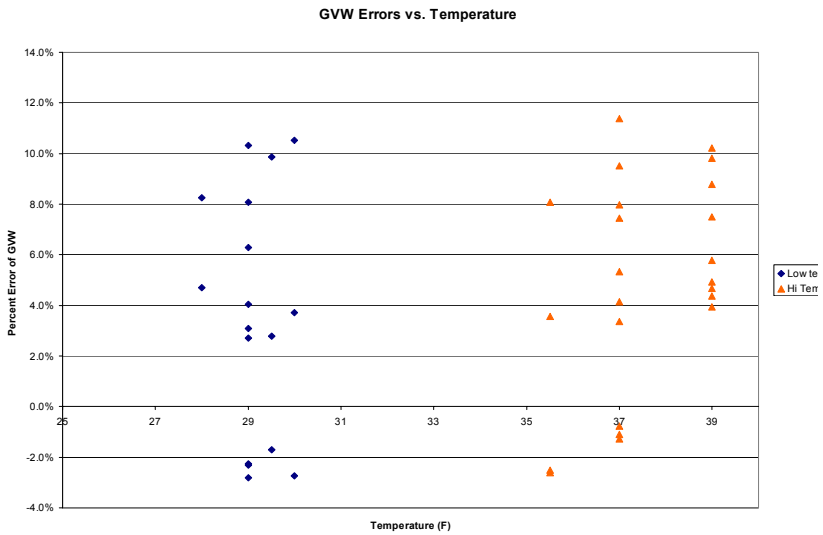


Figure 6-5 Pre-Validation GVW Percent Error vs. Temperature by Group – 390100 - 3 February 2004

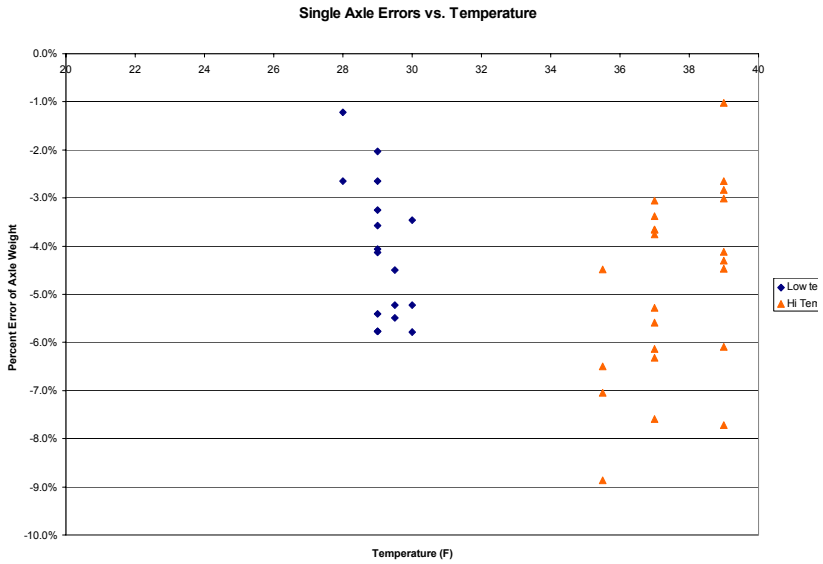


Figure 6-6 Pre-Validation Steering Axle Error vs. Temperature by Group – 390100 - 3 February 2004

6.2 Speed-based Analysis

The speed groups were divided as follows: Low speed = 40.0-45.0 mph, Medium speed = 45.1-50.5 mph and High speed = 50.6+ mph.

Table 13 indicates that the mean error for all weight values is decreasing with speed. The variability is essentially unchanged by speed. The speed variability is increasing with increasing speed.

Table 13 Pre-Validation Results by Speed Bin - 390100- 3 February 2004

Element	95% Limit	Low Speed	Med. Speed	High Speed	Pass/ Fail
Single axles	±20 %	-5.2% ± 5.3%	-4.7% ± 2.8%	-3.7% ± 3.4%	Pass
Tandem axles	±15 %	10.8% ± 16.7%	7.7% ± 15.3%	6.8% ± 14.3%	**Fail**
GVW	±10 %	5.6% ± 9.9%	4.1% ± 9.4%	-3.6% ± 10.1%	**Fail**
Speed	±1 mph	1.2 ± 4.5 mph	1.2 ± 4.8 mph	1.9 ± 8.6	**Fail**
Axle spacing	± 0.5 ft	0.2 ± 0.2 ft	0.0 ± 0.2 ft	0.0 ± 0.3	Pass

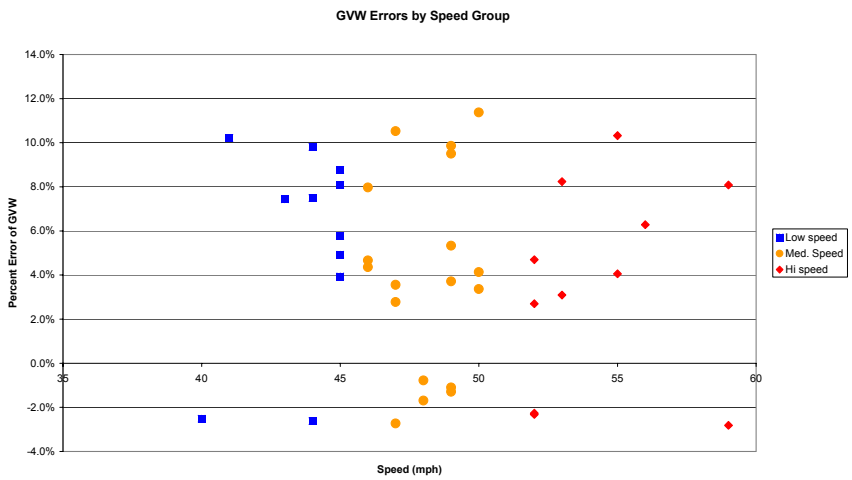


Figure 6-7 Pre-Validation GVW Percent Error vs. Speed Group - 390100- 3 February 2004

Looking at Figure 6-8 a distinct by vehicle pattern emerges that is independent of speed. Each vehicle displays its own characteristics with respect to the mean and the variability of the GVW error. As initially observed the light truck (asterisks) is over-estimated by as much as ten percent. The medium truck (dots) is estimated at two to four percent over its actual weight. The heavy truck (plus signs) is about two percent underestimated.

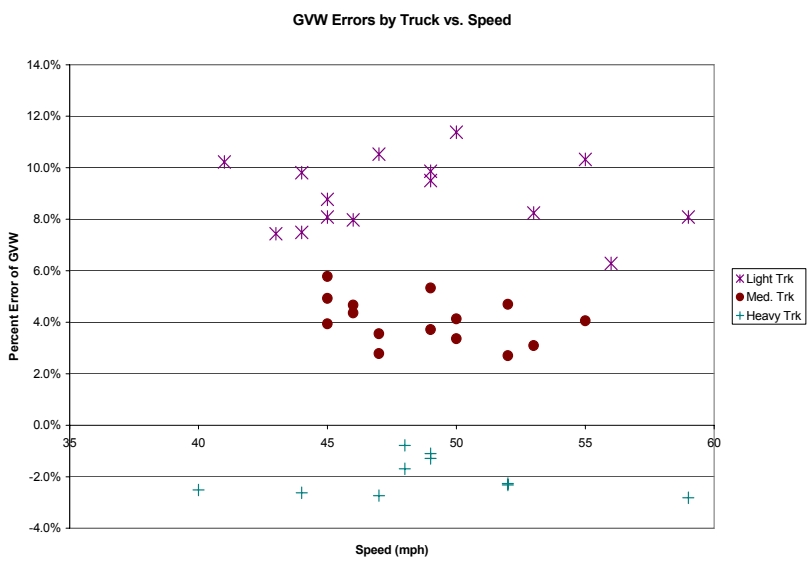


Figure 6-8 Pre-Validation GVW Percent Error vs. Speed by Truck – 390100- 3 February 2004

However, the error in single axles for all the trucks was decreasing with the increase in speeds.

Figure 6-9 shows the variability in steering axle weights with speed. It is clear that the errors in these weights are decreasing with increasing speed.

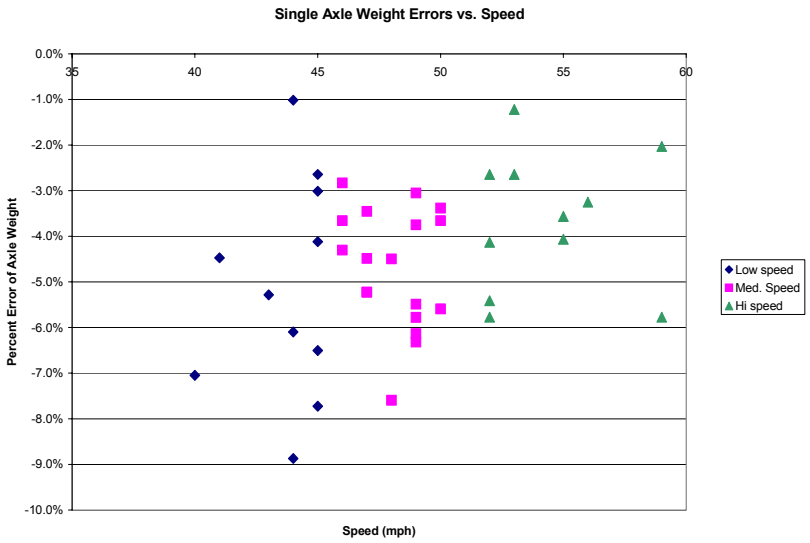


Figure 6-9 Pre-Validation Steering Axle Percent Error vs. Speed Group – 390100 - 3 February 2004

Figure 6-10 shows that the trend in single axle errors with truck type is not very pronounced.

Figure 6-10 Pre-Validation Steering Axle Percent Error vs. Speed by Truck – 390100 - 3 February 2004

6.3 Classification Validation

The agency uses the FHWA 13-bin classification scheme from the Traffic Monitoring Guide.

A sample of 100 trucks was collected at the site. Video was taken at the site to provide ground truth for the evaluation. Based the sample it was determined that there are zero percent unknown vehicles and one percent unclassified vehicles. The unclassified vehicle in the sample was a Class 9.

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 error rates by class. The rates are expressed as expected failures per hundred vehicles observed of that class. Since these are based on a hundred-truck sample they are in this case the actual percentage missed.

Table 14 Error rates for Truck Classification

Class	Error rate	Class	Error rate	Class	Error rate
4	**-50**	**5**	**29**	**6**	0
7	N/A				
8	0	**9**	1	**10**	0
11	N/A	**12**	N/A	**13**	N/A

This is an exact match for the post-calibration classification validation because it was only performed once. This agency had made a software revision in an attempt to correct the classification problems noted at the assessment.

7 Data Availability and Quality

As of February 10, 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.

Previous 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 15. 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 15 Amount of Traffic Data Available 390100 – 4 February 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 than 10 percent of the truck population are considered the major subgroups whose evaluation characteristics should be identified for use in screening.

Class 9's constitute more than 10 percent of the truck population. Based on the data collected from the end of the last calibration iteration the following are the expected values for these populations. The precise values will need to be determined by the RSC on receipt of the first 14 days of data after the first 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 16 GVW Characteristics of Major sub-groups of Trucks - 390100 – 4 February 2004

	Class 9
Percentage Overweights	1.4%
Percentage Underweights	0.6%
Unloaded Peak	36,000 lbs
Loaded Peak	80,000 lbs

The expected percentage of unclassified vehicles is one.

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

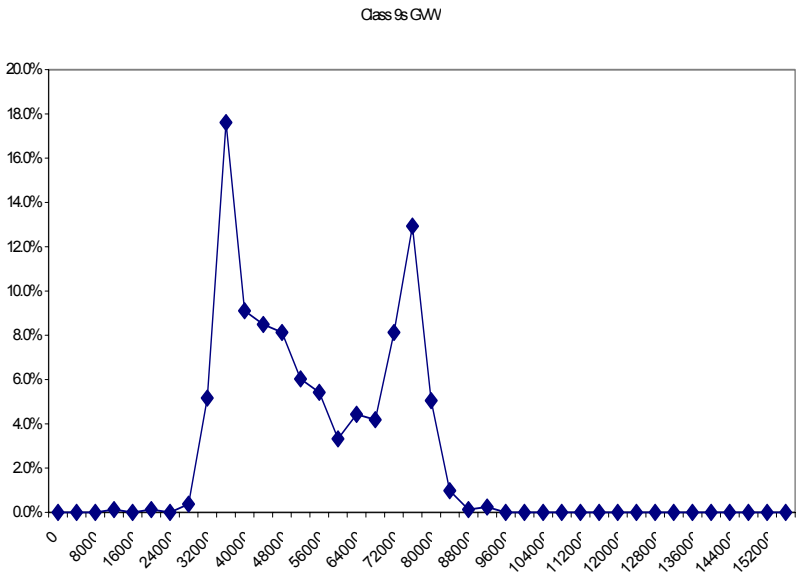


Figure 7-1 Graph of Expected GVW distribution Class 9 – 390100 - 4 February 2004

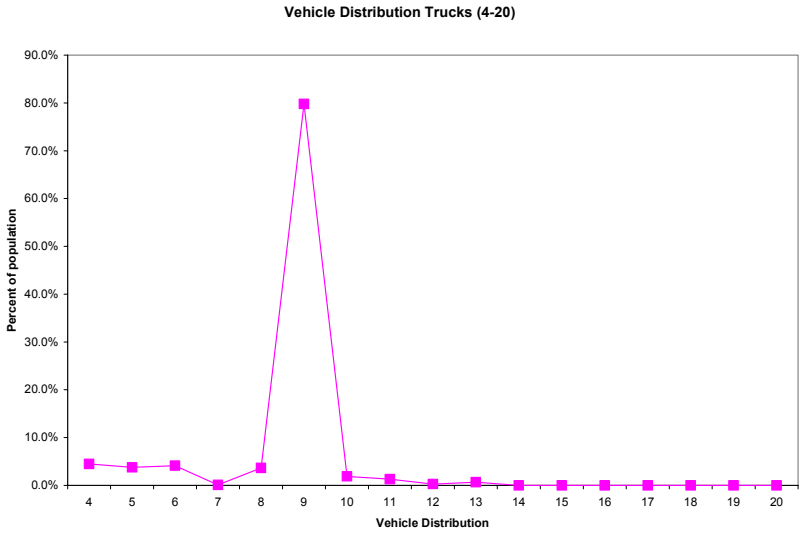


Figure 7-2 Expected Vehicle Distribution – 390100 - 4 February 2004

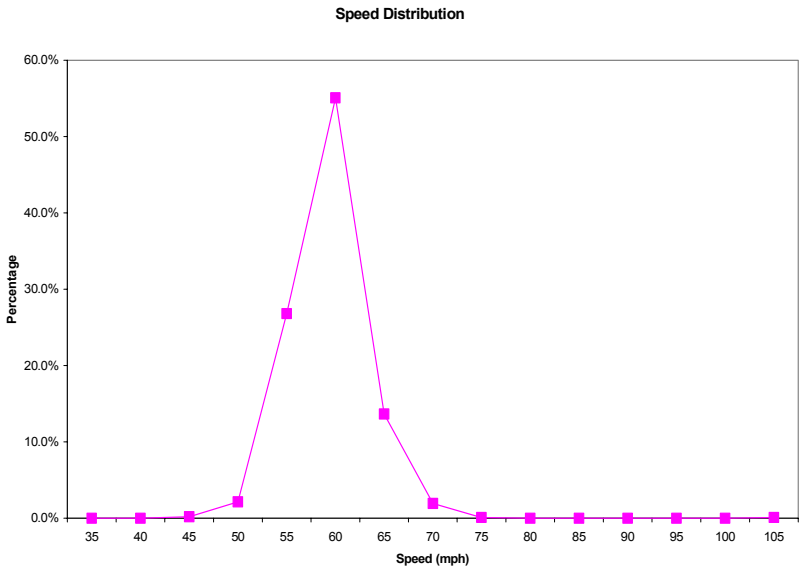


Figure 7-3 Expected Speed Distribution – 390100 - 4 February 2004

8 Data Sheets

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

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

Sheet 20 – Classification verification – post-validation (4 pages)
Sheet 20 – Classification verification – post-validation (4 pages)

Sheet 21 – Pre-validation (6 pages)
Sheet 21 – Calibration Iteration 1 – (2 page)

Sheet 21 – Calibration Iteration 2 /Post-validation (4 pages)

9 Updated handout guide and Sheet 17

A copy of the handout has been included following page 29. It includes a current Sheet 17 with all applicable maps and photographs. There are no significant changes in the information provided except for the truck scales.

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 following the Updated Sheet 18 information.

HANDOUT GUIDE FOR SPS WIM FIELD PERFORMANCE EVALUATION AND CALIBRATION

STATE: Ohio

SHRP ID: 0100

1. General Information 1
2. Contact Information 1
3. Agenda 1
4. Site Location/ Directions 2
5. Truck Route Information 3
6. Sheet 17 – Ohio (390100) 4

Figures

Figure: 4.1: Section 390100 near Delaware, Ohio 2
Figure 5.1: Truck Route at 390100 3
Figure 6.1: Site Map at 390100 8

1. General Information

SITE ID: *390100*

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

VISIT DATE: *February 3rd and 4th, 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: *February 3rd and 4th, 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*

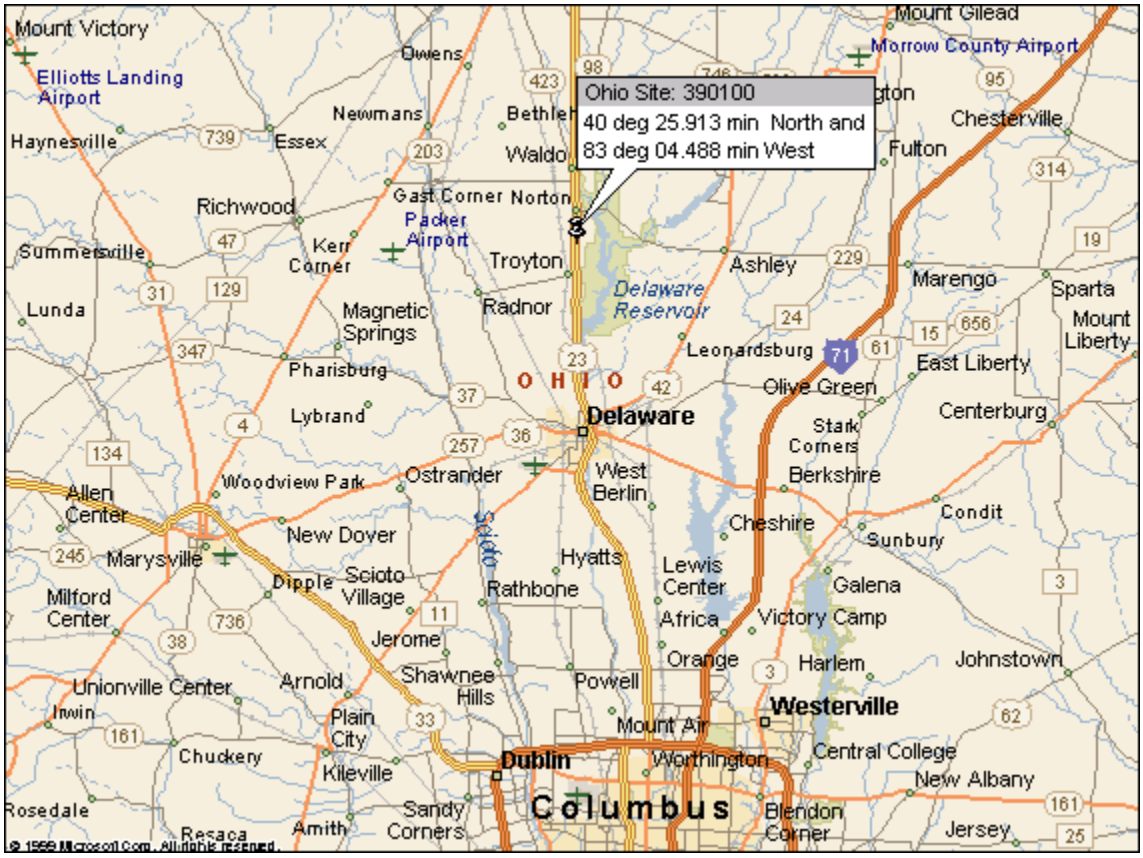


Figure 4.1: Section 390100 near Delaware, Ohio

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 (740) 965-3105. Cat Scales at Pilot Travel, I-71 at Exit 131, Sunbury, OH.*

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)*

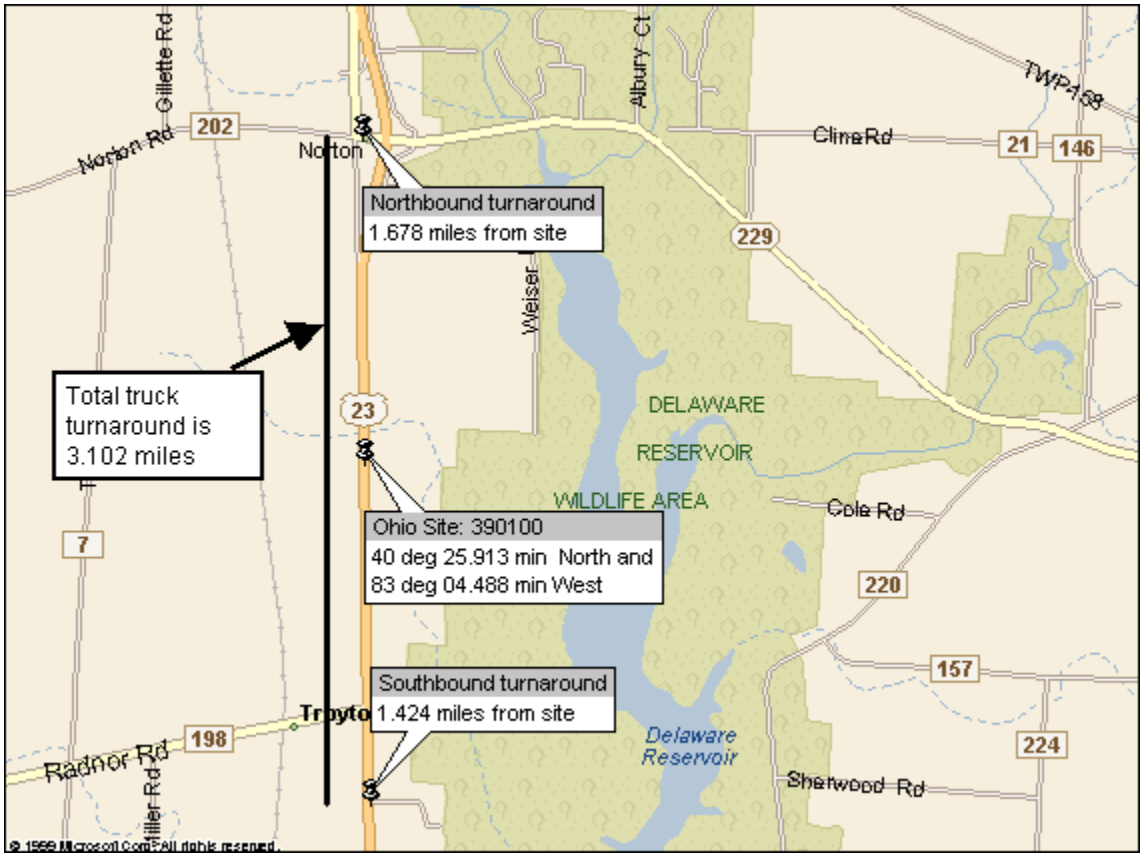


Figure 5.1: Truck Route at 390100

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__ ftOverhead / 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 _____

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

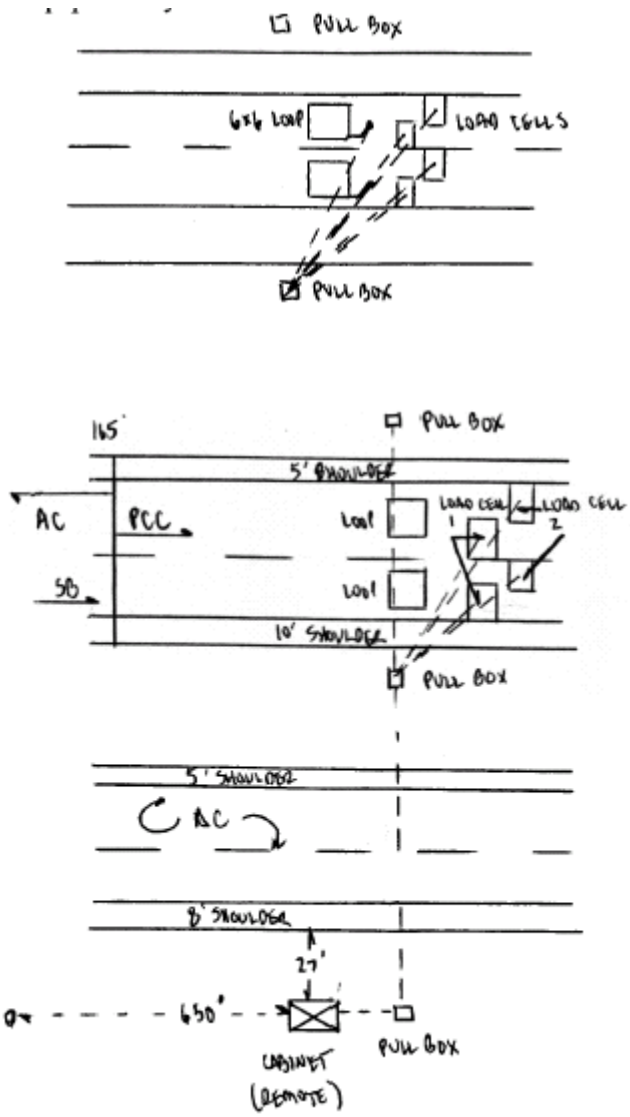
Upstream_TO_1_6A_39_0100_11_12_03.JPG _____

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 – Empty with no suspension requirements;____
Truck 2 – partially loaded 28,000 – 50,000 lbs no suspension requirements;_____
Truck 3 – 72,000 to 80,000 legal limit on gross and axles, air suspension;_____
_____
_____
_____
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_ 2_ /_0_ 4_ / _2_ 0_ 0_ 4_

Sketch of equipment layout



Site Map

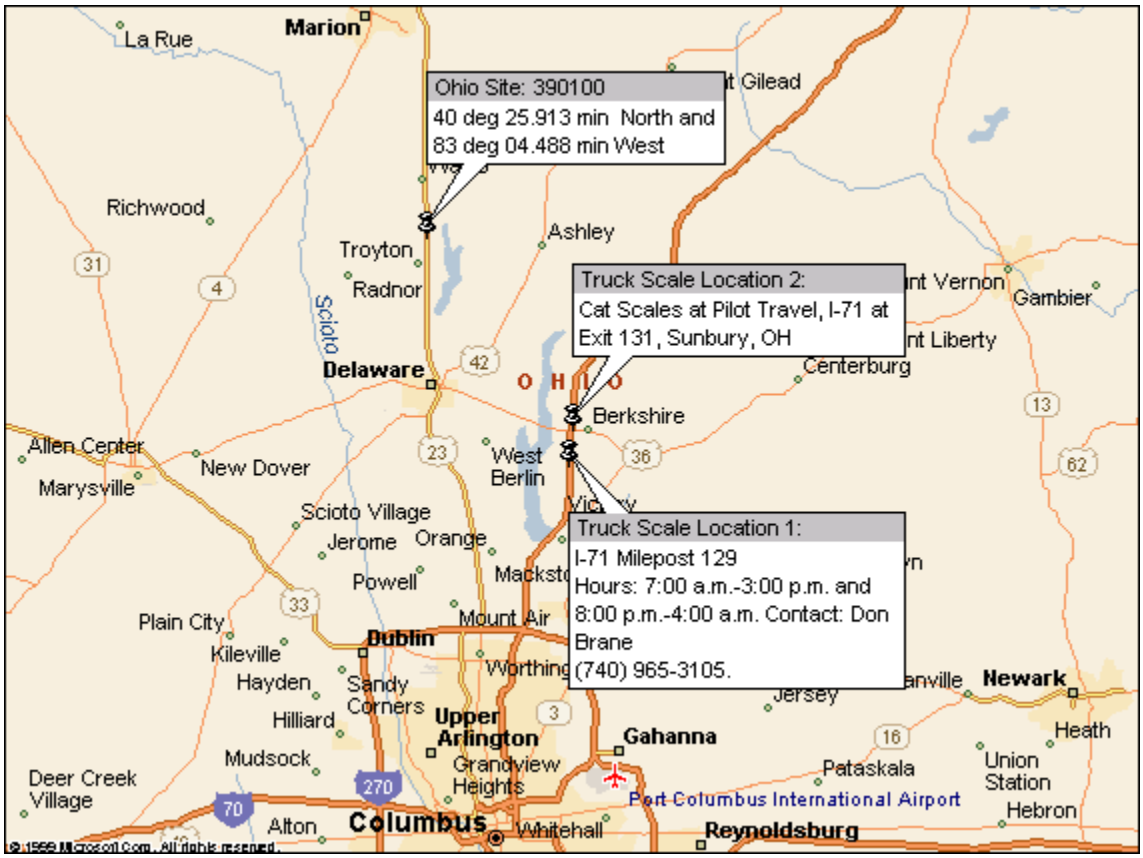


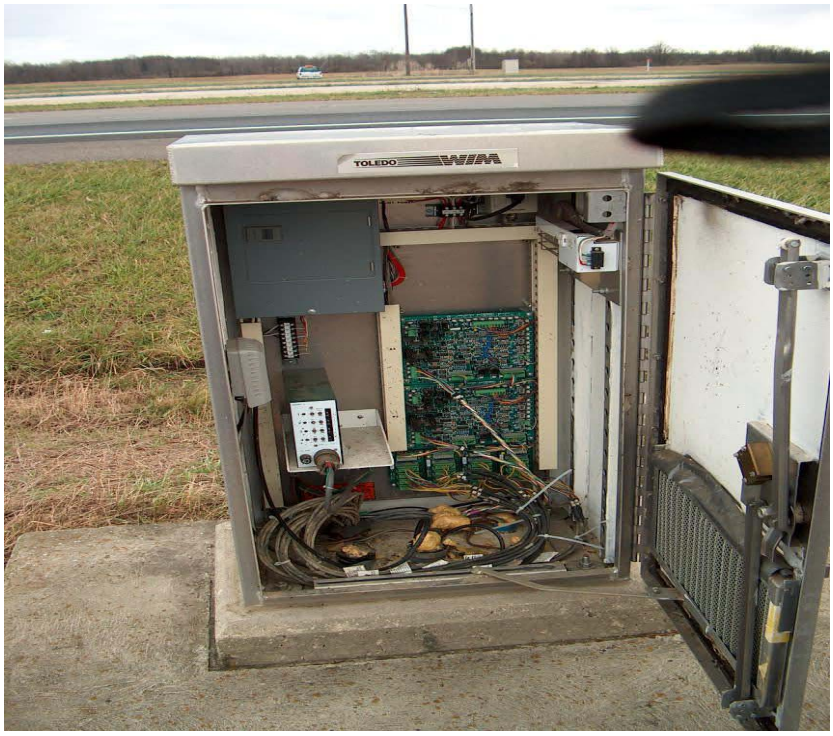
Figure 6.1: Site Map at 390100

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)

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

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_ _2_ / _0_ _3_ / _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____	_____2_____
SUSPENSION: 1 - AIR; 2 - LEAF SPRING	2	____9___	_____2_____
3 - OTHER (DESCRIBE)	3	____9___	_____2_____

7. SUMMARY CALIBRATION RESULTS (EXPRESSED AS A PERCENT)
   MEAN DIFFERENCE BETWEEN ---

DYNAMIC AND STATIC GVW	___ _4.4%__ ___ __	STANDARD DEVIATION __ _4.4%_. __
DYNAMIC AND STATIC SINGLE AXLES	___ _-4.5%__ ___. __	STANDARD DEVIATION __ _1.8%_. __
DYNAMIC AND STATIC DOUBLE AXLES	___ __8.3%_ ___. __	STANDARD DEVIATION __ _7.6%_. __

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

9. DEFINE THE SPEED RANGES USED (MPH) _____ _____ __40-45, 45.1-50.5, 50.6-59 mph_ _____ _____
   _____ _____ _____ _____ _____ _____ _____ _____ _____ _____

10. CALIBRATION FACTOR (AT EXPECTED FREE FLOW SPEED) __8.01617 (P4)_ ___ ___ . ___ ___

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___	____ ____ _29___ ____
*** FHWA CLASS 8 ____ _0.____	FHWA CLASS ____	____ ____ ____ ____
	FHWA CLASS ____	____ ____ ____ ____
	FHWA CLASS ____	____ ____ ____ ____

   *** PERCENT "UNCLASSIFIED" VEHICLES: ____ __1__ . ____

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_ _2_ / _0_ _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____	_____2_____
SUSPENSION: 1 - AIR; 2 - LEAF SPRING	2	____9___	_____2_____
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 __ _5.5%_. __
   DYNAMIC AND STATIC SINGLE AXLES ___ _-6.6%__ ___. __ STANDARD DEVIATION __ _2.2%_. __
   DYNAMIC AND STATIC DOUBLE AXLES ___ __5.3%_ ___. __ STANDARD DEVIATION __ _9.9%_. __

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

9. DEFINE THE SPEED RANGES USED (MPH) _____ _____ __42-47, 48-52, 53-57 mph_ _____ _____ _____
   _____ _____ _____ _____ _____ _____ _____ _____ _____ _____

10. CALIBRATION FACTOR (AT EXPECTED FREE FLOW SPEED) ___ ___ _12.0 (P4)___ ___

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 VEHICLES CLASSIFICATION:
   *** FHWA CLASS 9 ____ _1_ ____ FHWA CLASS _5___ ____ ____ _29__ ____
   *** FHWA CLASS 8 ____ _0.0____ FHWA CLASS ____ ____ ____ ____ ____
   FHWA CLASS ____ ____ ____ ____ ____
   FHWA CLASS ____ ____ ____ ____ ____
   *** PERCENT "UNCLASSIFIED" VEHICLES: ____ __1__ . ____

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 100 + 200
*CALIBRATION TEST TRUCK # 1	* DATE 2/3/04

Rev. 08/31/01

PART I.

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

AXLES - units - lbs / 100s lbs / kg

	3. Empty Truck Axle Weight	4.* Pre-Test Average Loaded Axle Weight	5.* Post-Test Average Loaded Axle Weight	6.* Measured D)irectly or C)alculated?
A		~~9840~~ 9830 9840	10020	D / C
B		6160 6175	5840	D / C
C		6050 12210 6080	5910 ~~5740~~ 11580 11580	D / C
D		3700 3700	3860 9720	D / C
E		5600 ~~5610~~ ~~9310~~ 9300 5825	5860 9720	D / C
F				D / C

GVW (same units as axles) pre calc is direct measure. post calc is direct axle group measure

7. a) Empty GVW _____

*b) Average Pre-Test Loaded weight 31620

*c) Post Test Loaded Weight 31320

*d) Difference Post Test – Pre-test 300

GEOMETRY

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

9. a) * Make: MACK b) * Model: CH613

10.* Trailer Load Distribution Description:

Empty

11. a) Tractor Tare Weight (units): 19,000

b). Trailer Tare Weight (units): 12,000

2/12/04

300

Sheet 19	* STATE CODE 39
LTPP Traffic Data	* SPS PROJECT ID 1004200
*CALIBRATION TEST TRUCK # 1	* DATE 2/3/04

Rev. 08/31/01

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

A to B 16.5 B to C 4.3 C to D 34.5

D to E 4.1 E to F

Wheelbased (measured A to last) Computed 59.4

13. *Kingpin Offset From Axle B (units) +20 (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	LEAF - 1
B	11R 22.5	AIR
C	11R 22.5	AIR
D	295 75R 22.5	LEAF - 1
E	295 75R 22.5	LEAF - 1
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 100 + 200
*CALIBRATION TEST TRUCK # 1	* DATE 2/3/04

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	9840	II -I	6140	III -II	6020	IV -III	3680	V -IV	5660	V	31340
V -VI	9840	VI-VII	6180	VII-VIII	6080	VIII-IX	3720	IX`	~~5560~~ 5540	X	31360
										XI	32160
Avg.	9840	6160		6050		3700		~~5610~~ 5600		31,620	

Table 2. Raw Axle and GVW measurements

Axles	Meas.	Pre-test Weight			Post-test Weight
A	I	9840			10020
A + B	II	15980			15860
A + B + C	III	22000			21600
A + B + C + D	IV	25680			25460
A + B + C + D + E (1)	V	31340			31320
B + C + D + E	VI	~~21500~~ 21520			21300
C + D + E	VII	~~15360~~ 15340			15460
D + E	VIII	~~9340~~ 9260			9220
E	IX	~~5660~~ 5540			5860
A + B + C + D + E (2)	X	31360			31320
A + B + C + D + E (3)	XI	32160			

Table 3. Axle and GVW computations - post -test

Axle A		Axle B		Axle C		Axle D		Axle E		GVW	
I	10020	II -I	5840	III -II	5740	IV -III	3860	V -IV	5860	V	31320
V -VI		VI-VII		VII-VIII		VIII-IX		IX`		X	
										XI	
Avg.	10020	5840		5740		3860		5860		31320	

Sheet 19	* STATE_CODE 39
LTPP Traffic Data	* SPS PROJECT ID 100 + 200
*CALIBRATION TEST TRUCK # 1	* DATE 2/3/04

Rev. 08/31/01

Data entered into the Spreadsheets from below tables

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	4840	6180	6080	5720	5540	–	31560
2	4840	6140	6020	5680	5660	–	31340
3	4840	6200 ÷	6140	5700 ÷	6280	–	32160
Average	4840	6173.33	6080	5700	5866.67		31620

÷ Split based on pass 1, 2 values

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	÷ Split 50:50 Axle C	Axle D	Split ÷ 50.50 ÷ Axle E	Axle F	GVW
1	4840	5790	5790	4860	4860		31520
2							
3							
Average	4840	5790	5790	4860	4860	–	31520

Measured By Dean J. Wolf Verified By Kurt / Bro

Sheet 19	* STATE_CODE 39
LTPP Traffic Data	* SPS PROJECT ID 100 + 206
*CALIBRATION TEST TRUCK # 2	* DATE 2/3/04

Rev. 08/31/01

PART I.

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

AXLES - units - lbs / 100s lbs / kg

	3. Empty Truck Axle Weight	4.* Pre-Test Average Loaded Axle Weight	5.* Post-Test Average Loaded Axle Weight	6.* Measured D)irectly or C)alculated?
A		10830 10760 ~~10850~~	10600	D / C
B		9660 9605	9250 } 18820	D / C
C		9580 9585	9170 9620	D / C
D		7440 7465	7740 } 18840	D / C
E		10660 10775	9660 9880	D / C
F				D / C

GVW (same units as axles)

pre-cal direct measure axles
post-cal direct measure axle group weight

7. a) Empty GVW _____

*b) Average Pre-Test Loaded weight ~~48280~~ 48.00
*c) Post Test Loaded Weight 47860 47860
*d) Difference Post Test – Pre-test ~~420~~ -310

GEOMETRY

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

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

10.* Trailer Load Distribution Description:

EMPTY BEER BOTTLES CASES

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

b). Trailer Tare Weight (units): 17,000 lbs

Sheet 19	* STATE_CODE 39
LTPP Traffic Data	* SPS PROJECT ID 100 & 200
*CALIBRATION TEST TRUCK # 2	* DATE 2/3/04

Rev. 08/31/01

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

A to B 17.5 B to C 4.3 C to D 35.0

D to E 4.1 E to F

Wheelbased (measured A to last) Computed 60.9

13. *Kingpin Offset From Axle B (units) +20 (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	LEAF - 2
B	11R 22.5	AIR
C	11R 22.5	AIR
D	295/75R 22.5	LEAF - 3
E	295/75R22.5	LEAF - 3
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 100 & 200
*CALIBRATION TEST TRUCK # 2	* DATE 2/3/04

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	10840	II -I	9660	III -II	9600	IV -III	7380	V -IV	10620	V	48100 ~~48500~~
V -VI	10820	VI-VII	9660	VII-VIII	9560	VIII-IX	7500	IX`	10700	X	48240 ~~48100~~
										XI	~~48240~~
Avg.	10830	9660		9580		7440		10660		~~48260~~ 48170	

Table 2. Raw Axle and GVW measurements

Axles	Meas.	Pre-test Weight			Post-test Weight
A	I	10840			10600
A + B	II	20500			19850
A + B + C	III	30100			29070
A + B + C + D	IV	37480			36760
A + B + C + D + E (1)	V	~~48500~~ 48100			47860
B + C + D + E	VI	~~37260~~ 37420			37260
C + D + E	VII	~~27600~~ 27760			28010
D + E	VIII	~~18000~~ 18200			18840
E	IX	~~10620~~ 10700			11100
A + B + C + D + E (2)	X	~~48100~~ 48240			47860
A + B + C + D + E (3)	XI	~~48240~~			

Table 3. Axle and GVW computations - post -test

Axle A		Axle B		Axle C		Axle D		Axle E		GVW	
I	10600	II -I	9250	III -II	9170	IV -III	7740	V -IV	11100	V	47860
V -VI		VI-VII		VII-VIII		VIII-IX		IX`		X	
										XI	
Avg.	10600	9250		9170		7740		11100		47860	

Sheet 19	* STATE_CODE 39
LTPP Traffic Data	* SPS PROJECT ID 100 or 200
*CALIBRATION TEST TRUCK #2	* DATE 2/3/04

Rev. 08/31/01

Data entered into the Spreadsheets from below tables

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	10840	9660	9600	7580	10620	-	48100
2	10820	9660	9560	7500	10700	-	48240
	10880	9500 #	9600	7520 #	11000	-	48500
Average	10846.7	9606.67	9586.67	7466.67	10773.3	-	48280

~~Split based o~~

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 Split 50..50	Axle D Split 50..50	Axle E	Axle F	GVW
1	10600	9210	9210	9420	9420	-	47860
2						-	
3						-	
Average	10600	9210	9210	9420	9420	-	47860

Measured By Dean J. Wolf Verified By Kurt / Bko

Sheet 19	* STATE_CODE 39
LTPP Traffic Data	* SPS PROJECT ID 0100 + 0200
*CALIBRATION TEST TRUCK # 3	* DATE 2/3/04

Rev. 08/31/01

PART I.

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

AXLES - units - lbs / 100s lbs / kg

	3. Empty Truck Axle Weight	4.* Pre-Test Average Loaded Axle Weight	5.* Post-Test Average Loaded Axle Weight	6.* Measured D)irectly or C)alculated?
A		~~10970~~ 11560 10973	10420	D / C
B		~~15400~~ 15410	~~14885~~ 14900 15095	D / C
C		15840 15785	~~15305~~ 15580 15015	D / C
D		14750	~~14570~~ 14860 17180	D / C
E		19340 19535	~~19490~~ 19980 17180	D / C
F				D / C

pre cal direct axle measure 3d Pass by group
post cal direct group measure

GVW (same units as axles)

7. a) Empty GVW _____

*b) Average Pre-Test Loaded weight 76453
*c) Post Test Loaded Weight 75170
*d) Difference Post Test – Pre-test 1283

GEOMETRY

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

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

10.* Trailer Load Distribution Description:

GRAVEL (57)

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

b). Trailer Tare Weight (units): _____

Sheet 19	* STATE_CODE 39
LTPP Traffic Data	* SPS PROJECT ID 100 + 200
*CALIBRATION TEST TRUCK # 3	* DATE 2/3/04

Rev. 08/31/01

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

A to B 19.5 B to C 4.4 C to D 25.3

D to E 4.1 E to F

Wheelbased (measured A to last) Computed 53.3

13. *Kingpin Offset From Axle B (units) +20 (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	LEAF - 2
B	215/75R 22.5	AIR
C	295/75R 22.5	AIR
D	11R 22.5	LEAF - 1
E	11R 22.5	LEAF - 1
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 100 a 200
*CALIBRATION TEST TRUCK # 3	* DATE 2/3/04

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	10980	II -I	~~15400~~ 15420	III -II	15840	IV -III	14900	V -IV	19760	V	76,900
V -VI	10960	VI-VII	15400	VII-VIII	15840	VIII-IX	14600	IX`	18920	X	75,720
										XI	76,740
Avg.	10970	~~15400~~ 15416		15840		14750		19340		76453	

Table 2. Raw Axle and GVW measurements

Axles	Meas.	Pre-test Weight			Post-test Weight
A	I	10980			10620
A + B	II	~~26380~~ 26400			25520
A + B + C	III	~~42220~~ 42240			40840
A + B + C + D	IV	~~57120~~ 57140			55700
A + B + C + D + E (1)	V	~~76880~~ 76900			75180
B + C + D + E	VI	~~65400~~ 64760			64560
C + D + E	VII	~~50500~~ 49360			49660
D + E	VIII	~~34660~~ 33520			34340
E	IX	~~19760~~ 18920			19480
A + B + C + D + E (2)	X	75720			75160
A + B + C + D + E (3)	XI	76740			

Table 3. Axle and GVW computations - post -test

Axle A		Axle B		Axle C		Axle D		Axle E		GVW	
I	10620	II -I	14900	III -II	15320	IV -III	14860	V -IV	19480	V	75180
V -VI	10620	VI-VII	14870	VII-VIII	15290	VIII-IX	14880	IX`	19500	X	75160
										XI	
Avg.	10620	14885		15305		14870		19490		75170	

Sheet 19	* STATE_CODE 39
LTPP Traffic Data	* SPS PROJECT ID 100 & 200
*CALIBRATION TEST TRUCK # 3	* DATE 2/3/04

Rev. 08/31/01

Data entered into the Spreadsheets from below tables

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	10980	15480	15840	14900	19760	-	76900
2	10960	15400	15840	14600	18920	-	75720
	10980	15410 *	15670	14750 *	19530	-	76740
Average	10973[3]	15410	15785[3]	14750	19536[7]	-	76458[8]

* split based on Pass 1, 2

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 split 50:50	Axle C	Axle D split 50:50	Axle E	Axle F	GVW
1	10620	15080	15080	17150	17190	-	75.60
2	10620	15[illegible]0	15110	17170	17170	-	75.80
3							
Average	10620	15095	15095	17.80	17180		75170

Measured By Dean J. Wolf Verified By KMA/BKO

Sheet 20	* STATE_CODE 39
LTPP Traffic Data	*SPS PROJECT_ID 01 00
Speed and Classification Checks * 1 of* 2	* DATE 02/04/2004

Rev. 08/31/2001

South

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
55	5		56	4	58	9		58	9
56	5		54	5	55	9		54	9
57	9		57	9	61	9		60	9
55	9		53	9	61	9		60	9
59	9		59	9	58	9		56	9
56	9		54	9	59	9		57	9
56	9		56	9	52	9		53	9
53	9		53	9	54	9		54	9
59	9		58	9	55	5		54	5
56	9		56	9	56	9		58	9
59	9		58	9	56	9		57	9
51	9		52	9	59	9		58	9
54	8		55	8	62	9		61	9
55	9		54	9	58	9		56	9
54	9		54	9	58	9		56	9
58	10		58	10	56	6		59	6
59	9		58	9	54	9		55	9
59	9		59	9	55	9		56	9
55	9		54	9	54	8		54	8
53	9		52	9	55	9		54	9
60	6		59	6	58	9		58	9
55	9		55	9	56	9		54	9
59	9		57	9	56	9		54	9
60	9		59	9	58	9		56	9
56	9		57	9	56	4		55	4

Recorded by KMK Direction S Lane 1 Time from 4.30pm to

Sheet 20	* STATE_CODE 39
LTPP Traffic Data	*SPS PROJECT_ID 0100
Speed and Classification Checks * 2 of* 2	* DATE 02/04/2004

Rev. 08/31/2001

South

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
55	5		54	5	54	9		55	9
58	9		58	9	54	9		54	9
58	8		58	8	54	4		54	5
58	9		58	9	55	9		54	9
54	9		50	9	63	9		62	9
51	9		51	9	47	9		47	9
55	9		55	9	59	9		56	9
56	9		55	9	59	9		56	9
56	9		56	9	58	9		57	9
55	9		54	9	57	8		56	8
54	9		53	9	61	9		59	9
57	9		54	9	63	9		61	9
52	6		51	6	59	9		59	9
56	9		55	9	59	9		58	9
54	9		53	9	56	9		57	9
56	4		55	5 motor vehicle	55	9		52	9
58	9		56	9	51	9		52	9
55	9		57	9	59	9		59	9
59	9		58	9	59	9		56	9
55	9		55	9	55	9		55	9
55	9		53	9	52	9		53	9
52	9		53	9	56	5		58	5
59	9		57	9	60	8		57	8
56	5		54	5	60	9		61	9
54	9		54	9	56	9		55	9

Recorded by _____ Direction S Lane 1 Time from _____ to _____

truck 1 = 31,620/34.5 truck 2 = 48,280/35.8 truck 3 = 76,433/25.4 = 52,337

Sheet 21	* STATE_CODE 39
LTPP Traffic Data	*SPS PROJECT_ID 2100
WIM System Test Truck Records 1 of 6	* DATE 02/03/2004

Rev. 08/31/2001

South 353.1

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
39		2 DAVE	1	~~10:27~~ 10:19:42	6872	46	5480 / 4900	5480 / 4680	5620 / ~~5640~~ 4640	4940 / 4780	4800 / 5320		50640	18.2	4.4	35.7	3.9	+4.9
39		1 DON	1	~~10:37~~ 10:33:03	~~7470~~ 7096	45	4620 / 4460	[illegible] / 5200	[illegible] / [illegible]	2460 / [illegible]	3140 / 2720		34660	16.6	4.3	34.3	3.9	+9.6
39		2 DAVE	2	~~10:52~~ 10:48:05	~~7356~~ 7344	45	5660 / 4900	5500 / 4840	5860 / 4560	4980 / 4800	4940 / 5200		51240	18.8	4.3	35.4	3.9	+6.1
39		1 DON	2	~~10:54~~ 10:50:05	~~7392~~ 7380	44	4640 / 4600	3900 / 3180	4180 / 2700	2660 / 3120	3160 / 2920		35060	16.8	4.3	34.6	4.0	+10.9
39		2 DAVE	3	~~11:01~~ 10:58:02	~~7539~~ 7527	45	5540 / 4860	5440 / 4520	5640 / 4420	5100 / 4680	4820 / 5240		50260	17.9	4.3	35.2	3.9	+4.1
39	41	1 DON	3	~~11:03~~ 10:59:32	~~7571~~ 7559	45	4820 / 4580	3720 / 3140	4220 / 2860	2720 / 3060	3200 / 2900		35220	16.8	4.3	34.8	4.0	+11.4
39		2 DAVE	4	~~11:11~~ 11:08:09	~~7734~~ 7722	45	5560 / 4960	5180 / 4680	5440 / 4520	5000 / 4820	4980 / 5140		50780	17.9	4.3	35.9	4.0	+5.2
39		1 DON	4	~~11:13~~ 11:09:09	~~7750~~ 7738	44	4780 / 4960	3760 / 2900	3940 / 2760	2800 / 2680	2960 / 2640		34180	16.7	4.3	34.8	4.0	+8.1

Recorded by KMA / DJW Checked by KMA

truck 1 avg = 34,729/35.2 truck 2 AVG = 50,333/35.8 truck 3 avg = 74,943/25.4

Sheet 21	* STATE_CODE 39
LTPP Traffic Data	*SPS PROJECT_ID 0100
WIM System Test Truck Records 2 of 6	* DATE 02/03/2004

Rev. 08/31/2001

SOUTH

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
39	46	2	5	~~11:23~~ 11:19:09	~~7937~~ 7925	51	5230 4860	5580 4360	5800 4700	4940 4700	4860 ~~4960~~ 5000		50480	18.3	~~34.3~~ 4.3	~~36.2~~ 36.2	3.9	+4.6
35.5		3	1	~~11:25~~ 11:21:59	~~7989~~ 7976	44	5320 4680	8060 7720	8700 7220	7410 6360	~~7480~~ 7480 ~~9025~~ 9020		74500	19.8	4.2	25.1	4.0	-2.6
35.5		1	5	~~11:27~~ 11:23:31	~~8013~~ 8000	45	~~4640~~ 4640 4560	3930 3140	4120 2580	2660 2360	3100 2480		34400	16.8	4.3	34.4	4.0	+8.8
35.5	47	2	6	~~11:36~~ 11:32:09	~~8157~~ 8144	50	5690 4680	5760 4260	~~5960~~ 5860 4560	5020 4500	5000 4740		50060	~~18.0~~ 18.0	4.3	36.0	3.9	+3.7
35.5	40	3	2	~~11:40~~ 11:36:21	~~8264~~ 8236	44	5340 4860	8120 7660	8420 7420	7600 8430	7600 9080		74580	20.0	4.2	25.3	4.0	-2.4
37.0	43	1	6	~~11:41~~ 11:37:27	~~8271~~ 8258	48	~~4440~~ 4740 ~~4500~~ 4580	3960 3060	4220 ~~2440~~ 2940	~~2530~~ 2580 2660	2960 2460		34160	16.8	4.4	34.7	4.0	+8.0
37.0		2	7	~~11:51~~ 11:48:01	~~8463~~ 8455	50	5320 4920	5320 5040	5600 4600	4620 4920	4680 5360		49960	18.2	4.4	36.3	3.9	+3.5
37.0		3	3	~~11:53~~ 11:49:29	~~8497~~ 8484	49	5900 4880	7860 7740	8600 7640	7960 8420	7840 9280		75620	19.9	4.2	25.6	3.9	-1.0

Recorded by KMA/DTO Checked by KCK

Sheet 21	* STATE_CODE 39
LTPP Traffic Data	*SPS PROJECT_ID 0100
WIM System Test Truck Records 3 of 6	* DATE 02/03/2004

Rev. 08/31/2001

SOUTH

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
37		1	7	~~11:59~~ 11:50:35	~~8512~~ 8499	50	4820 4660	4000 3000	4300 3080	2460 3300	3120 2940		35680	17.1	4.4	35.2	3.9	+12.8
37		2	8	~~12:00~~ 12:02:04	~~8705~~ 8691	49	5580 4860	5600 ~~5660~~ 4640	5820 ~~4520~~ 4500	4880 ~~4860~~ ~~4860~~ 4860	4980 ~~5480~~ 5280		51000	17.6	4.3	35.4	3.9	+5.6
37		3	4	~~12:07~~ 12:03:22	~~8735~~ 8721	48	5420 4720	7820 8060	8520 7800	7960 8520	7660 9380		75860	19.9	4.2	25.5	3.9	-.8
37		1	8	~~12:09~~ 12:05:29	~~8777~~ 8763	46	4780 4700	3880 2940	4100 3020	2720 2620	2880 ~~2880~~ 2720		34360	16.7	4.3	34.5	3.9	+8.7
37		2	9	~~12:20~~ 12:16:45	~~8980~~ 8966	50	5480 5000	5440 4660	5580 4620	4960 4640	5000 4980		50360	18.0	4.4	35.7	3.9	+4.3
37		3	5	~~12:23~~ 12:19:14	~~9025~~ 9011	49	5420 4880	7820 7940	8420 7900	7920 8440	7580 9160		75480	20.1	4.3	~~25.9~~ 25.6	3.9	-1.3
37		1	9	~~12:26~~ 12:21:50	~~9083~~ 9069	49	4900 ~~4640~~ 4640	3580 2920	4000 3020	2560 3120	2900 2900		34940	16.9	4.3	35.1	4.0	+10.5

Recorded by KMA / DJW Checked by KMA

Sheet 21	* STATE_CODE 39
LTPP Traffic Data	*SPS PROJECT_ID 01 00
WIM System Test Truck Records 4 of 6	* DATE 02/03/2004

Rev. 08/31/2001

South

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
30		2	10	~~1:15~~ 13:12:09	~~10059~~ 10044	49	5380 / 4840	5640 / 4350	5940 / 4600	4940 / 4660	4860 / 4900	–	50,140	18.1	4.4	35.6	3.9	+3.9
30	47	3	6	~~1:18~~ 13:13:52	~~10101~~ 10092	54	5540 / 4860	7720 / 7640	8060 / 7480	7740 / 8420	7920 / 9040	–	74,420	20.2	4.3	25.3	3.9	−2.7
30		1	10	~~1:21~~ 13:17:01	~~10178~~ 10163	47	4880 / 4670	4270 / 3060	4080 / 3500	2600 / 2780	3420 / 2180		35,340	17.0	4.4	34.8	4.0	+11.8
29.5	47	2	11	~~1:35~~ 13:31:41	~~10491~~ 10476	49	5620 / 4660	5280 / 4400	5870 / 4500	4880 / 4460	4940 / 4960		49,660	18.0	4.3	35.7	3.9	+2.9
29.5	48	3	7	13:33:58 ~~1:37~~	10513 ~~10528~~	53	5560 / 4940	7980 / 7720	8340 / 7280	7840 / 8660	7900 / 9040		75,480	20.0	4.2	25.5	4.0	−1.7
29.5	49	1	11	13:35:57 ~~1:39~~	10543 ~~10558~~	48	4660 / 4640	4040 / 2800	4260 / 2900	2820 / 3040	3420 / 2540		35,480	16.9	4.4	34.5	3.9	+10.9
29.0		2	12	13:47:20 ~~1:51~~	10799 ~~10815~~	55	5400 / 5060	5780 / 4360	5660 / 4480	4900 / 4760	5020 / 4900		50,320	18.1	4.3	36.0	4.0	+4.2
29.0		3	8	13:49:38 ~~1:53~~	10840 ~~10856~~	52	5540 / 4600	7940 / 7560	8500 / 7600	7800 / 8200	7780 / 8960		74,420	20.1	4.3	25.6	4.0	−2.2

Recorded by KMA/DJW Checked by KMA

Sheet 21	* STATE_CODE 39
LTPP Traffic Data	*SPS PROJECT_ID 01 00
WIM System Test Truck Records 5 of 6	* DATE 02/03/2004

Rev. 08/31/2001

South

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
29.0	56	1	12	13:51:29 ~~1:55~~	10877 ~~10893~~	59	4860 4660	4060 2740	4140 2840	2320 2820	2980 2320		33740	17.2	4.5	36.1	4.1	+6.7
29.0	53	2	13	14:05:13 ~~2:09~~	~~11192~~ 11176	55	5580 4980	5760 4340	5740 4220	4840 4480	5160 4720		49820	18.1	4.4	36.2	4.0	+3.2
29.0		3	9	~~2:13~~ 14:09:38	11282 ~~11298~~	52	5300 5280	7840 7680	8160 7480	7660 8660	7420 9800		74720	19.8	4.2	25.1	3.9	-2.3
25.0	55	1	13	14:12:28 ~~2:16~~	~~11369~~ 11353	59	4640 4800	3860 3400	4060 3180	2340 3200	3140 2840		[illegible]	[illegible]	[illegible]	[illegible]	3.9	+11.5
28.0	52	2	14	14:23:27 ~~2:27~~	11569 ~~11585~~	54	5460 5160	5660 4620	5500 4580	4840 4840	5040 5020		50660	17.9	4.3	35.4	3.9	+4.9
~~28.0~~		3	10															
28.0	53	1	14	14:27:12 ~~2:31~~	11661 ~~11677~~	63	4900 4820	4060 3140	4180 2740	2820 2440	3040 2320		34460	17.2	4.5	38.8	4.1	+9.0
29.0	52	2	15	14:39:04 ~~2:42~~	11931 ~~11947~~	54	5440 4820	5320 4460	5640 4460	4640 4660	4980 4780		49620	17.9	4.3	35.8	3.9	+2.8

Recorded by KMA / OTW Checked by KMA

Sheet 21	* STATE_CODE 39
LTPP Traffic Data	*SPS PROJECT_ID 0100
WIM System Test Truck Records 6 of 6	* DATE 02/03/2001

Rev. 08/31/2001

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
29.0	59	3	10	14:43:09 ~~2:47~~	12014 ~~12030~~	53	5360 [illegible]	7560 7730	8140 7520	7670 8460	7440 9570		74360	20.0	4.2	25.3	[illegible]	-2.7
29.0	59	1	15	14:44:30 ~~2:48~~	12052 ~~12068~~	63	4960 4680	4180 2760	4180 2880	2980 2360	3360 2060		34400	17.5	4.5	36.2	4.0	+8.8

Recorded by KMA/DJW Checked by KMA

Sheet 21	* STATE_CODE 39
LTPP Traffic Data	*SPS PROJECT_ID 0100
WIM System Test Truck Records 1 of 2	* DATE 02/04/2004

Rev. 08/31/2001

Iteration - 1 South

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
22	47	2	1	10:04:28 ~~10:08~~	~~7094~~ 7083	49	5280 5120	4980 5100	5680 4940	4460 4820	4440 5280		50100	17.8	4.3	34.7	3.8	+3.8
22	49	3	1	10:06:24 ~~10:10~~	~~7144~~ 7133	50	5220 5060	7700 7640	8160 7460	7740 8260	7500 9180		74420	19.7	4.2	25.5	3.9	-2.2
22		1	1	10:07:43 ~~10:11~~	~~7179~~ 7168	50	4780 4620	[illegible] 2920	4060 3100	2760 3120	2980 3160		35460	17.1	4.4	34.9	3.9	[illegible]
24	49	2	2	10:17:34 ~~10:21~~	7335 ~~7346~~	50	5180 4920	5400 4620	5380 4600	4500 5020	4440 5400		49460	17.9	4.3	35.2	3.8	
24	49	3	2	10:19:26 ~~10:23~~	7375 ~~7386~~	50	5060 5180	7540 7720	8260 7380	8040 8580	7480 9360		74600	17.7	4.2	25.4	3.9	
24	48	1	2	10:20:18 ~~10:24~~	7390 ~~7401~~	49	4760 4840	3700 3340	3940 3280	3320 2620	2820 3220		35780	16.7	4.3	34.1	3.7	
24	49	2	3	10:29:23 ~~10:33~~	~~7571~~ 7560	49	4980 4900	5240 4440	5340 5060	4620 5060	4500 5360		49620	17.8	4.3	34.8	3.8	
24	49	3	3	10:31:19 ~~10:35~~	~~7599~~ 7588	51	5040 4980	7640 7740	8320 7620	8000 8520	7640 9120		74600	19.8	4.2	25.4	3.9	

Recorded by KMA

Checked by KMA/DJW

Sheet 21	* STATE_CODE 39
LTPP Traffic Data	*SPS PROJECT_ID 0100
WIM System Test Truck Records 2 of 2	* DATE 02/04/2004

Rev. 08/31/2001

Iteration #1 South

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
24	47	1	3	10:32:15 ~~10:36~~	7602 ~~7613~~	49	4700 4800	3720 3220	4160 3120	2460 3020	2740 2900		34840	16.7	4.3	34.0	3.8	
		2	4															
24	48	3	4	10:42:34 ~~10:46~~	7805 ~~7816~~	50	5160 5260	7660 7660	8140 7520	7860 8220	7520 7360		74300	19.6	4.2	25.4	3.9	
24	49	1	4	10:43:32 ~~10:47~~	~~7832~~ 7821	49	4840 5100	3740 3420	3840 3160	3260 3000	3020 2540		36920	16.6	4.3	34.2	2.9	
													35750 49727 74830	+13.1 +3.0 -2.6	+4.5			

Recorded by KMA Checked by KMA/DJW

Sheet 21	* STATE_CODE 39
LTPP Traffic Data	*SPS PROJECT_ID 0100
WIM System Test Truck Records 1 of 2 4	* DATE 02/04/2004

Rev. 08/31/2001

Location #2 South 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
34		2	1	~~12:25~~ 12:22:14	~~9637~~ 9626	49	4860 4760	5120 4800	5080 4780	4430 4960	4500 5480		48820	17.6	4.3	34.8	3.8	
34		2	2	~~12:36~~ 12:33:41	~~9868~~ 9857	50	5200 4880	5240 4540	5160 4520	4500 4760	4420 5360		48520	18.0	4.3	35.4	3.8	
34		3	1	~~10:39~~ 12:35:52	~~9920~~ 9908	50	4880 4920	7440 7620	7280 7560	7760 8040	7180 9040		72120	15.6	4.2	25.1	3.9	
34		1	1	12:37:07 ~~12:40~~	~~9942~~ 9930	49	4560 4860	3600 3340	3840 3120	3120 2200	2600 2800		34040	16.6	4.3	34.2	3.6	
~~36~~		~~2~~	~~3~~															
36	49	3	2	12:49:06 ~~12:52~~	~~10228~~ 10216	50	5000 4900	7340 7540	7800 7320	7560 8400	7240 9060		72160	19.6	4.1	25.3	3.9	
36	50	1	2	12:50:04 ~~12:53~~	10247 ~~10259~~	49	4600 4200	3560 3080	3800 3080	2440 2700	2620 2910		32340	16.7	4.3	34.1	3.9	
37	49	2	3	12:58:15 ~~1:01:00~~	10423 ~~10435~~	49	5060 5240	5280 4480	5080 4980	4580 4860	4500 5460		49320	17.7	4.2	34.9	~~3.9~~ 3.8	

Recorded by KMA Checked by KMA/RTW

Sheet 21	* STATE_CODE 39
LTPP Traffic Data	*SPS PROJECT_ID 01 [illegible]
WIM System Test Truck Records 2 of ~~2~~ 4	* DATE 02/24/2004

Rev. 08/31/2001

Iteration #2 South

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
39	48	3	3	13:00:33 ~~1:33:00~~	~~10476~~ 10463	50	4880 4940	7220 7580	7510 7440	7520 8040	7320 9020		73200	19.5	4.1	25.0	3.9	
37	49	1	3	13:03:09 ~~1:06:00~~	10520 ~~10553~~	48	4600 4960	3660 3220	3980 2780	3440 3320	[illegible] 3040		35[illegible]	16.5	4.3	33.7	3.8	
36	47	2	4	13:12:00 ~~1:15:00~~	~~10734~~ 10721	50	5020 5080	5040 4620	5220 4620	4500 4740	4500 5360		48,600	18.10	4.3	35.5	3.8	
36	48	3	4	13:14:33 ~~1:17:00~~	10778 ~~10791~~	50	4960 4860	7400 7540	7960 7320	7780 8260	7760 9160		72440	19.7	4.2	25.1	3.9	
36	48	1	4	13:16:21 ~~1:19:00~~	10814 ~~10827~~	49	4720 4920	3600 3220	3600 3200	3100 3000	3040 3240		35640	16.4	4.3	33.5	3.8	
36	48	2	5	13:43:10 ~~1:46:00~~	11475 ~~11469~~	49	4920 4960	5280 4480	5160 4560	4580 4960	4440 5320		48600	17.7	4.3	35.5	3.8	
36		3	5	13:47:59 ~~1:51:00~~	11566 ~~11580~~	50	4980 4940	7420 7420	8040 7040	7940 8020	7520 8800		72120	19.7	4.2	25.3	3.9	
36		1	5	13:45:07 ~~1:52:00~~	~~11602~~ 11588	49	4620 4680	3480 3360	3820 3060	2920 3120	2820 3140		35020	16.5	4.3	33.7	3.8	

Recorded by KMA Checked by KMA/DSW

Sheet 21	* STATE_CODE 39
LTPP Traffic Data	*SPS PROJECT_ID 0100
WIM System Test Truck Records 3 of 4	* DATE 02/04/2004

Rev. 08/31/2001

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
36	43	2	6	13:59:43 ~~2:05~~	11838 ~~11852~~	45	4980 4980	4680 [illegible]	5140 4600	4160 4740	4200 5420		46,000	17.8	4.3	35.1	3.9	
36	44	3	6	14:01:56 ~~2:05~~	11875 ~~11889~~	47	4760 4840	7340 7620	8200 7260	[illegible] [illegible]	7180 [illegible]		71900	19.6	4.2	35.1	3.9	
36	42	1	6	14:03:09 ~~2:06~~	11907 ~~11921~~	44	4540 4420	3600 [illegible]	4020 2960	2480 3160	2880 2920		33980	16.7	4.3	34.7	3.9	
36	44	2	7	14:11:56 ~~2:15~~	12093 ~~12107~~	45	5040 4830	5160 4400	5220 4340	4560 4780	4460 5200		47980	17.9	4.2	34.9	3.9	
36	45	3	7	14:14:03 ~~2:17~~	12146 ~~12160~~	47	4800 4680	7480 7520	8160 7300	7500 8120	7480 8960		71940	19.5	4.2	24.7	3.9	
36	43	1	7	14:15:00 ~~2:18~~	12166 ~~12180~~	44	4480 4740	3360 3320	3800 3820	2680 2940	2760 3120		34040	16.4	4.2	34.1	3.9	
36	44	2	8	14:24:05 ~~2:27~~	12411 ~~12425~~	46	4860 [illegible]	5020 4660	5080 4740	4680 4800	4420 5200		48160	17.8	4.3	35.2	3.8	
36	44	3	8	14:25:06 ~~2:28~~	12426 ~~12440~~	47	4840 4660	[illegible] 7540	7840 7300	[illegible] [illegible]	7360 9030		71440	19.7	4.2	25.3	3.9	
36	43	1	8	14:26:10 ~~2:29~~	12450 ~~12464~~	44	4400 4640	3600 3200	3760 [illegible]	2320 3140	2860 2720		33360	16.5	4.3	34.1	3.8	
36	43	2	9	14:35:21 ~~2:38~~	12678 ~~12692~~	45	4960 5220	4820 4740	4300 5240	4760 4560	5340 4440		48280	17.7	4.3	34.9	3.9	60.6
36	46	3	9	14:35:41 ~~2:39~~	12686 ~~12700~~	48	4780 4880	7620 [illegible]	8080 7960	7980 7980	7280 8920		72320	19.7	4.2	25.0	3.9	
36		1	9	14:37:48 ~~2:41~~	12737 ~~12751~~	44	4620 4800	3480 3240	3820 2860	2980 2720	2860 3160		34480	16.5	4.2	34.1	3.9	
36	49	2	10	14:45:45 ~~2:49~~	12953 ~~12967~~	54	5040 4860	4780 4860	5200 4660	4260 4880	4620 4880		48040	17.8	4.2	34.9	3.8	60.7
36	5[illegible]	3	10	14:46:41 ~~2:49~~	12964 ~~12978~~	56	5080 5320	[illegible] 7560	[illegible] 7580	7660 8480	7240 9280		72720	19.7	4.2	25.0	3.9	
36	52	1	10	14:47:52 ~~2:51~~	12999 ~~13013~~	52	4600 4840	3500 3300	2660 2280	2240 3260	2780 2860		34320	16.7	4.3	34.1	3.8	
36	55	2	11	~~2:58~~	~~13200~~	54	4900 5020	4840 5040	5240 4720	4300 5000	4540 4960		48560	17.8	4.2	35.0	3.9	

14:55:32 13186

Recorded by KMA/DJW

Checked by KMA/DJW

Sheet 21	* STATE_CODE 39
LTPP Traffic Data	*SPS PROJECT_ID 0100
WIM System Test Truck Records 4 of 4	* DATE 02/04/2004

Rev. 08/31/2001

South

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
36	55	3	11	14:57:07 ~~3:00.00~~	13230 ~~13244~~	56	5100 5200	7340 7560	7420 7100	7840 8000	7320 9120		72020	19.7	4.2	25.2	4.0	
35	54	1	11	14:57:44 ~~3:00.00~~	13239 ~~13253~~	58	4620 5020	3680 2920	4060 2900	3160 2960	2920 3520		35840	16.9	4.4	35.2	3.9	
35	57	2	12	15:06:15 ~~3:09~~	13458 ~~13472~~	54	4920 4960	5180 4760	5100 4640	4440 4920	4580 4940		48440	17.9	4.2	35.0	3.9	
35	53	3	12	15:07:34 ~~3:10~~	13492 ~~13506~~	56	5000 5100	7640 7040	9300 7480	8220 7740	8980 7340		71840	19.6	4.2	25.1	3.9	
35	55	1	12	15:08:15 ~~3:11~~	13513 ~~13527~~	55	4460 4800	3480 3400	3620 3120	2460 2660	2480 2720		33200	16.5	4.3	34.1	3.8	
35	54	2	13	15:16:12 ~~3:19~~	13755 ~~13769~~	54	5040 5020	5120 4700	5440 4500	4340 4720	4540 4800		48220	17.8	4.2	35.3	3.9	
35	55	3	13	15:17:36 ~~3:20~~	13790 ~~13804~~	56	5100 5000	7200 7680	7560 7460	7560 8360	7480 9140		72540	19.9	4.2	25.1	3.9	
35	55	1	13	15:18:11 ~~3:21~~	13802 ~~13816~~	55	4600 4820	3460 3160	3780 3180	2240 2300	2760 3080		34380	16.5	4.3	33.8	3.8	
35	53	2	14	15:25:16 ~~3:28~~	13986 ~~14000~~	53	5060 4920	4840 4580	4840 4380	4220 4960	4540 4860		47160	17.5	4.1	34.3	3.8	

Recorded by KMA

Checked by KMA/DJW