Validation Report

Michigan, SPS-1
Task Order 22, CLIN 2
October 2 to 3, 2007

# List of Tables

# List of Figures

# 1 Executive Summary

A visit was made to the Michigan 0100 on October 2 to 3, 2007 for the purposes of conducting a validation of the WIM system located on US Route 27 approximately 2.6 miles north of M-21. The SPS-1 is located in the righthand, southbound lane of a four-lane divided facility. The posted speed limit at this location is 60 mph for trucks. The LTPP lane is one of 4 lanes instrumented at this site. The validation procedures were in accordance with LTPP's SPS WIM Data Collection Guide dated August 21, 2001.

This is the third validation visit to this location. This is the original site location. It was installed in June 2005 by the agency.

**This site meets all LTPP precision requirements except speed. This is not considered sufficient to disqualify the site as having research quality data. The classification algorithm currently does not provide research quality classification information.**

The site is instrumented with quartz piezo sensors and DAW 190 electronics. It is installed in portland cement concrete, 400 feet long.

The validation used the following trucks:

1) 5-axle tractor-trailer with a tractor having an air suspension and a trailer with a standard rear tandem and an air suspension loaded to 75,700 lbs., the "golden" truck.
2) 5-axle tractor semi-trailer with a tractor having an air suspension and a trailer with a standard rear tandem and an air suspension loaded to 65,390 lbs., the "partial" truck.

The validation speeds ranged from 49 to 70 miles per hour. The agency had already identified that the 85$^{th}$ percentile speed for trucks was in excess to the posted speed limit of 60 mph for trucks. The Agency received approval from the Motor Carrier Enforcement Group to run the test trucks at speeds greater than the posted truck speed limit. The test trucks were not allowed to exceed the speeds being driven by the surrounding traffic. The pavement temperatures ranged from 62 to 86 degrees Fahrenheit. The desired speed range was achieved during this validation. The desired 30 degree Fahrenheit temperature range was not achieved.

**Table 1-1 Post-Validation results – 260100 – 03-Oct-2007**

| SPS-1, -2, -5, -6 and -8 | 95 %Confidence Limit of Error | Site Values | Pass/Fail |
|---|---|---|---|
| Steering axles | ±20 percent | 5.5 ± 7.0% | Pass |
| Tandem axles | ±15 percent | -1.5 ± 6.1% | Pass |
| GVW | ±10 percent | -0.5 ± 4.3% | Pass |
| **Speed** | **±1 mph [2 km/hr]** | **0.4 ± 1.2 mph** | **Fail** |
| Axle spacing | ± 0.5 ft [150mm] | 0.0 ± 0.1 ft | Pass |

*Prepared: djw* *Checked: bko*

The pavement condition appeared to be satisfactory for conducting a performance evaluation. There were no distresses observed that would influence truck motions significantly. A visual survey determined that there is no discernable bouncing or avoidance by trucks in the sensor area. There has been no profile information collected in the year prior to the validation so WIMIndex values could not be computed. When profile data becomes available an amended report will be submitted that includes WIMIndex values.

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

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

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

*Prepared: djw* *Checked: bko*

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

# 2 Corrective Actions Recommended

The pavement in the area of the trailing WIM sensor has developed a crack that runs laterally through the sensor installation and may have been the cause for the sensor's input cable to lose insulation resistance properties. The trailing sensor needs to be replaced.

There are no other corrective measures recommended for this site at this time under the assumption that LTPP will only recognize misclassification of heavy vehicles (FHWA Classes 6 and higher).

# 3 Post Calibration Analysis

This final analysis is based on test runs conducted Oct 3, 2007 during the morning and early afternoon hours at test site 260100 on US Route 27. This SPS-1 site is on the southbound, righthand of a four-lane divided facility. No auto-calibration was used during test runs. The two trucks used for the calibration and for the subsequent validation included:

1. 5-axle tractor-trailer with a tractor having an air suspension and trailer with a standard rear tandem and air suspension loaded to 75,700 lbs., the "golden" truck.
2. 5-axle tractor semi-trailer with a tractor having an air suspension and a trailer with a standard rear tandem and an air suspension loaded to 65,390 lbs., the "partial" truck.

Each truck made a total of 20 passes over the WIM scale at speeds ranging from approximately 49 to 70 miles per hour. The desired speed range was achieved during this validation. Pavement surface temperatures were recorded during the test runs ranging from about 62 to 86 degrees Fahrenheit. The desired 30 degree Fahrenheit temperature range was not achieved. The computed values of 95% confidence limits of each statistic for the total population are in Table 3-1.

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

**Table 3-1 Post-Validation Results – 260100 – 03-Oct-2007**

| SPS-1, -2, -5, -6 and -8 | 95 %Confidence Limit of Error | Site Values | Pass/Fail |
|---|---|---|---|
| Steering axles | ±20 percent | 5.5 ± 7% | Pass |
| Tandem axles | ±15 percent | -1.5 ± 6.1% | Pass |
| GVW | ±10 percent | -0.5 ± 4.3% | Pass |
| **Speed** | **±1 mph [2 km/hr]** | **0.4 ± 1.2 mph** | **Fail** |
| Axle spacing | ± 0.5 ft [150mm] | 0.0 ± 0.1 ft | Pass |

*Prepared: djw* *Checked: bko*

The test runs were conducted primarily during morning and early afternoon hours under mostly cloudy weather conditions, resulting in a limited range of pavement temperatures. The runs were also conducted at various speeds to determine the effects of these variables on the performance of the WIM scale. To investigate these effects, the data set was split into three speed groups and two temperature groups. The distribution of runs by speed and temperature is illustrated in Figure 3-1. The figure indicates that the desired distribution of speed and temperature combinations was not achieved for this set of validation runs because of the limited temperature range.

The three speed groups were divided as follows: Low speed – 49 to 55 mph, Medium speed – 56 to 62 mph and High speed – 63 + mph. The two temperature groups were created by splitting the runs between those at 62 to 73 degrees Fahrenheit for Low temperature and 74 to 86 degrees Fahrenheit for High temperature.

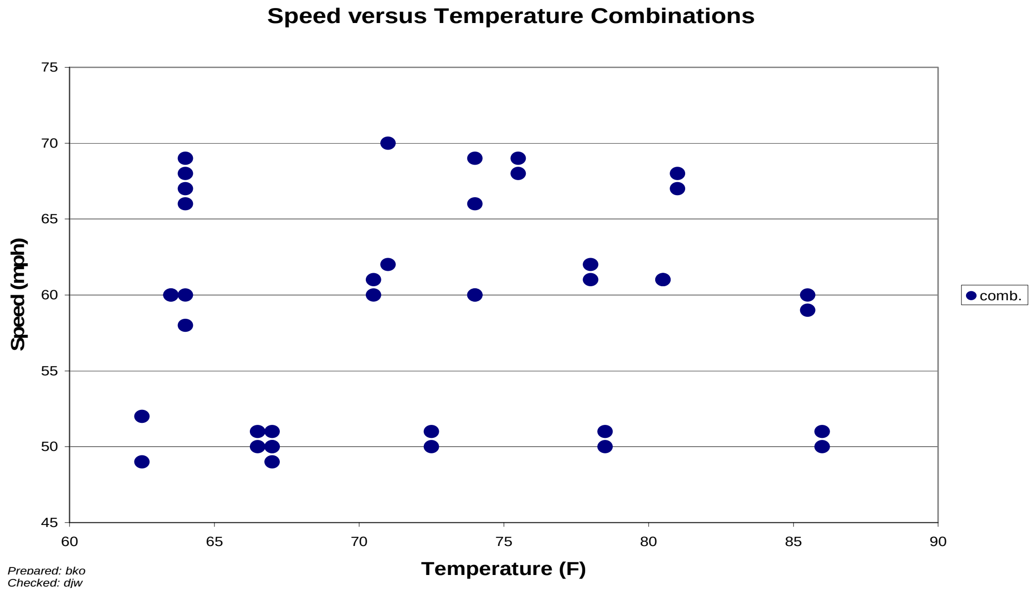


**Figure 3-1 Post-Validation Speed-Temperature Distribution – 260100 – 03-Oct-2007**

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

Figure 3-2 shows the GVW Percent Error vs. Speed graph for the population as a whole. From the figure, it can be seen that the GVW error estimate of the WIM equipment progresses from a slight underestimation at lower speeds toward a slight overestimation as speeds reach the higher end of the test range. The scatter of the percent error appears to be greater at the lower speeds.

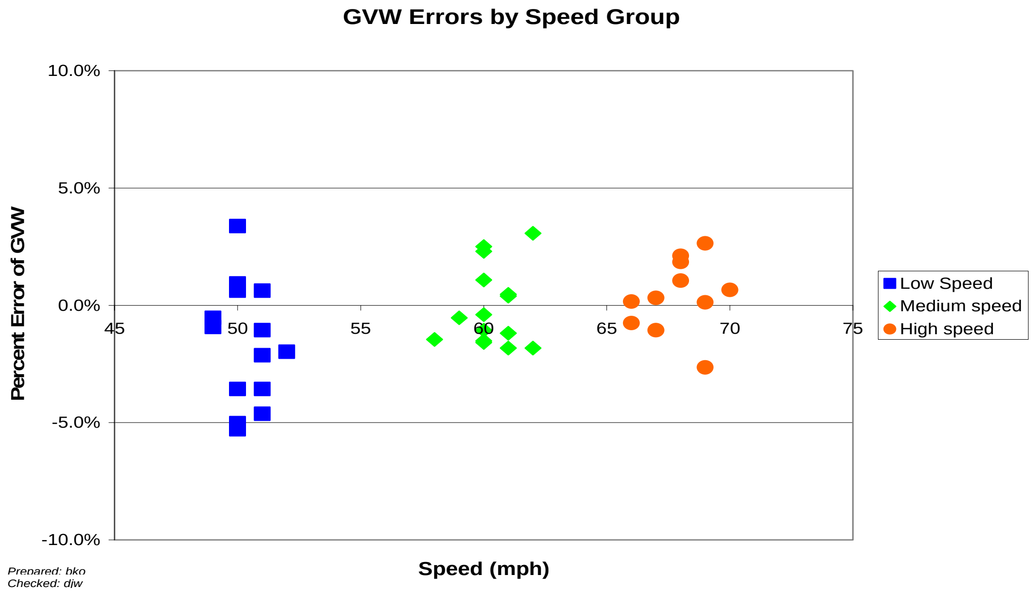


**Figure 3-2 Post-validation GVW Percent Error vs. Speed – 260100 – 03-Oct-2007**

Figure 3-3 shows the relationship between temperature and GVW percentage error. The graph illustrates that there does not appear to be a significant relationship between GVW error and pavement temperature although there is a tendency to underestimate at the lower temperatures.

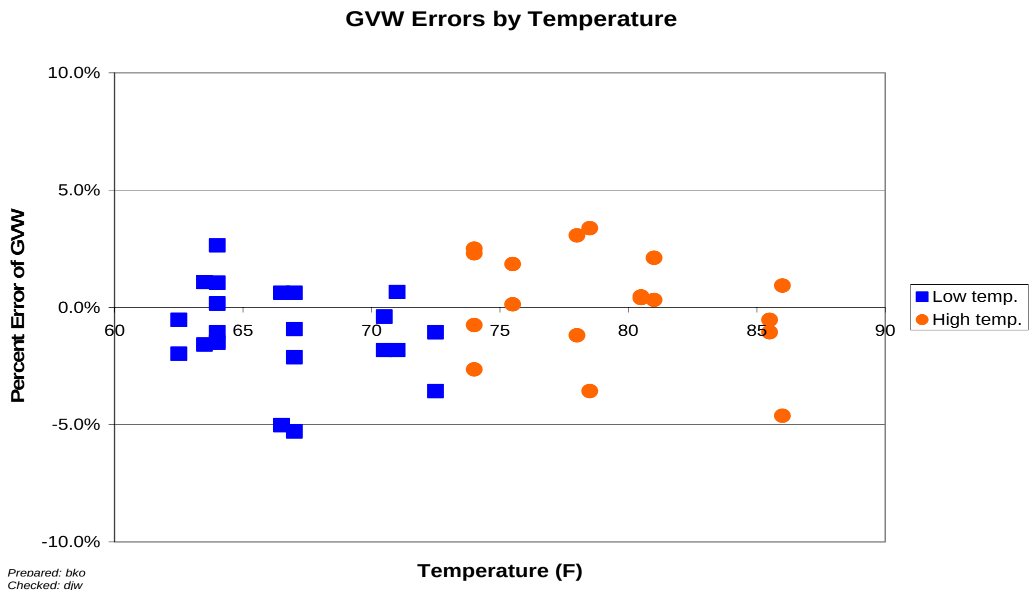


**Figure 3-3 Post-Validation GVW Percent Error vs. Temperature – 260100 – 03-Oct-2007**

Figure 3-4 shows the relationship between the drive tandem spacing errors in feet and speeds. This graph is used as a potential indicator of classification errors due to failure to correctly identify spacings on a vehicle. Since the most common reference value is the drive tandem on a Class 9 vehicle, this is the spacing evaluated and plotted for validations. Axle spacing errors appear to be consistent throughout the test truck speed range and are limited to maximums of about 0.1 feet. Vehicles speeds appear to have no effect on the error of measured axle spacing.

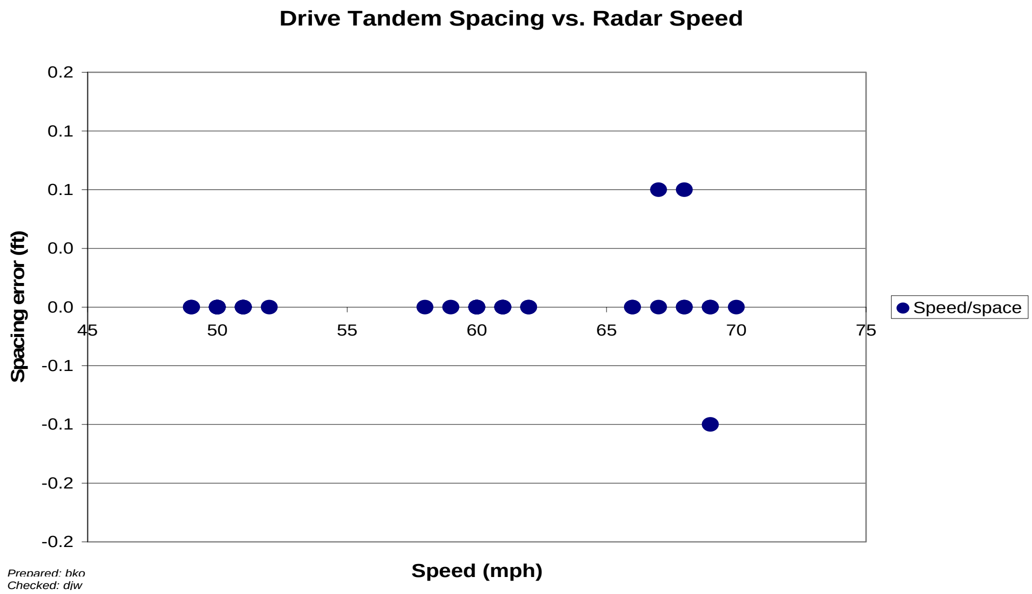


**Figure 3-4 Post-Validation Spacing vs. Speed – 260100 – 03-Oct-2007**

## *3.1 Temperature-based Analysis*

The two temperature groups were created by splitting the runs between those at 62 to 73 degrees Fahrenheit for Low temperature and 74 to 86 degrees Fahrenheit for High temperature.

**Table 3-2 Post-Validation Results by Temperature Bin – 260100 – 03-Oct-2007**

| Element | 95% Limit | Low Temperature 62 to 73 °F | High Temperature 74 to 86 °F |
|---|---|---|---|
| Steering axles | ±20 % | 5.2 ± 8.7% | 5.8 ± 5.0% |
| Tandem axles | ±15 % | -2.1 ± 5.2% | -0.7 ± 7.0% |
| GVW | ±10 % | -1.1 ± 4.0% | 0.2 ± 4.7% |
| Speed | ±1 mph | 0.5 ± 1.2 mph | 0.2 ± 1.2 mph |
| Axle spacing | ± 0.5 ft | 0.0 ± 0.1 ft | 0.0 ± 0.0 ft |

*Prepared: djw Checked: bko*

From Table 3-2, it appears that the mean error for steering axles is greater than the mean error for tandem and GVW weights at all temperatures. The equipment appears to estimate GVW and tandem axle weights with reasonable accuracy, with slight underestimation of both at the lower temperatures. The scatter for steering axle error is greater at the lower temperatures, while error scatter for tandem weights is greater at the higher temperatures. Scatter for GVW error appears to be consistent at all temperatures.

Figure 3-5 is the distribution of GVW Errors versus Temperature by Truck graph. The figure illustrates consistent GVW errors for both trucks over the observed temperature range.

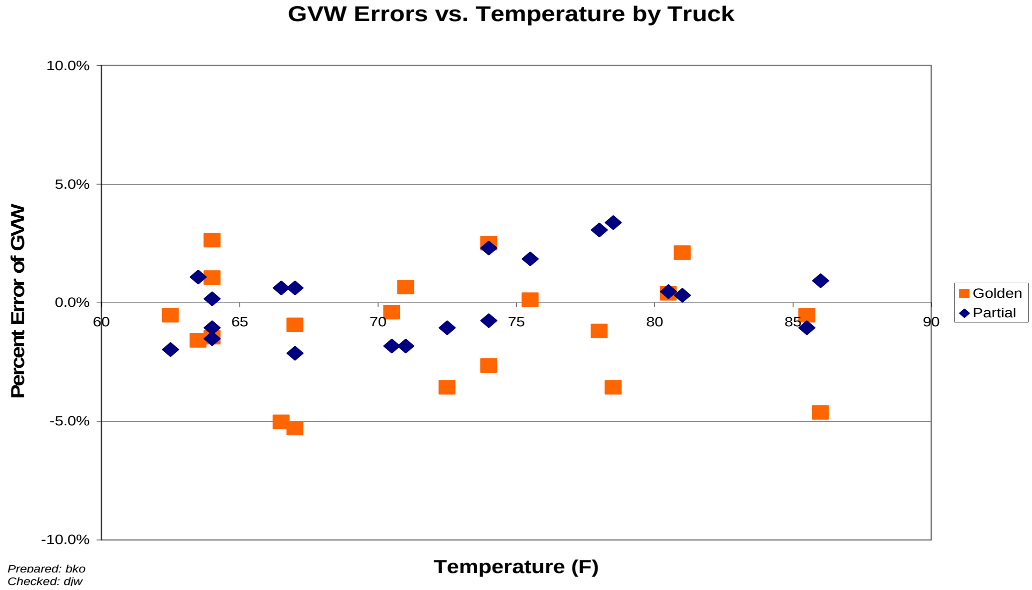


**Figure 3-5 Post-Validation GVW Percent Error vs. Temperature by Truck – 260100 – 03-Oct-2007**

Figure 3-6 shows the relationship between steering axle errors and temperature. This graph is included due to the frequent use of steering axle weights of Class 9 vehicles for calibration. This site does not use auto-calibration. The steering axles in this graph are associated only with Class 9 vehicles. Figure 3-6 shows how the WIM equipment overestimates the steering axle weights at all temperatures. Variability of the error is decreasing as the temperature increases. This may be a function of the number of observations rather than an actual temperature effect.

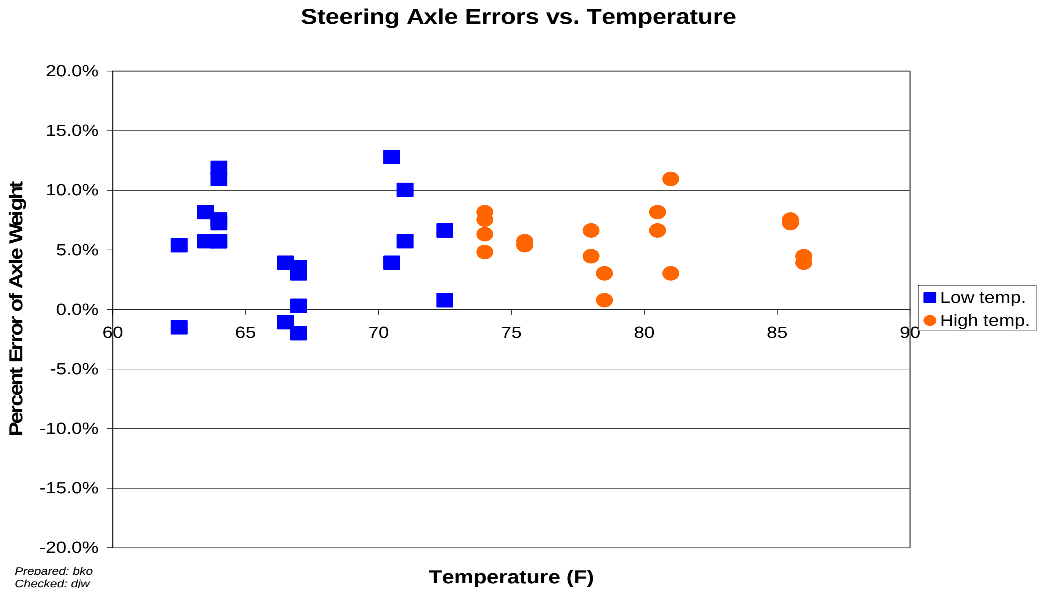


**Figure 3-6 Post-Validation Steering Axle Error vs. Temperature by Group – 260100 – 03-Oct-2007**

## *3.2 Speed-based Analysis*

The three speed groups were divided using 49 to 55 mph for Low speed, 56 to 62 mph for Medium speed and 63+ mph for High speed.

**Table 3-3 Post-Validation Results by Speed Bin – 260100 – 03-Oct-2007**

| Element | 95% Limit | Low Speed 49 to 55 mph | Medium Speed 56 to 62 mph | High Speed 63+ mph |
|---|---|---|---|---|
| Steering axles | ±20 % | 2.2 ± 5.8% | 7.4 ± 5.2% | 7.1 ± 5.8% |
| Tandem axles | ±15 % | -2.4 ± 7.3% | -1.3 ± 5.7% | -0.6 ± 5.3% |
| GVW | ±10 % | -1.7 ± 5.5% | -0.1 ± 3.6% | 0.4 ± 3.4% |
| Speed | ±1 mph | 0.4 ± 1.1 mph | 0.2 ± 1.2 mph | 0.5 ± 1.5 mph |
| Axle spacing | ± 0.5 ft | 0.0 ± 0 ft | 0.0 ± 0.0 ft | 0.0 ± 0.1 ft |

*Prepared: djw* *Checked: bko*

From Table 3-3, it appears that the mean error for steering axle weights is generally greater than the mean error for tandem axle weights and GVW at all speeds. For steering axle weights, the equipment overestimates at all speeds, with greater overestimation at the medium and high speeds. Scatter for steering axle weights appears to be consistent throughout the entire speed range. Tandem and GVW weights are generally underestimated, with scatter of the error greater at the lower speeds than the medium and high speeds.

Figure 3-7 illustrates the tendency of the WIM equipment to underestimate GVW for the Golden truck (squares) at the lower speeds, and report fairly consistent GVW weights for the Partial truck (diamonds) at all speeds. The underestimation of GVW for the Golden truck creates a greater scatter in error at the lower speeds for the truck population as a whole. Individually the scatter in errors for the two trucks at the lower speed appears similar. This subset of speed data is collected below the 15th percentile speed for trucks.

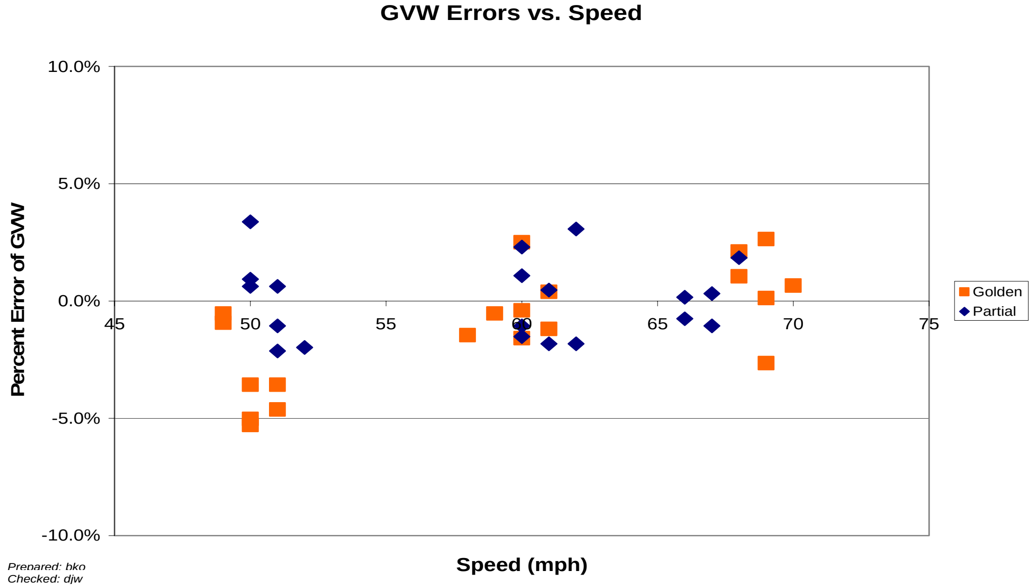


**Figure 3-7 Post-Validation GVW Percent Error vs. Speed by Truck – 260100 – 03-Oct-2007**

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

Figure 3-8 shows how the WIM equipment generally overestimates the steering axle weights, with greater overestimation at the medium and high speeds. Variability of the error is generally constant throughout the entire speed range.

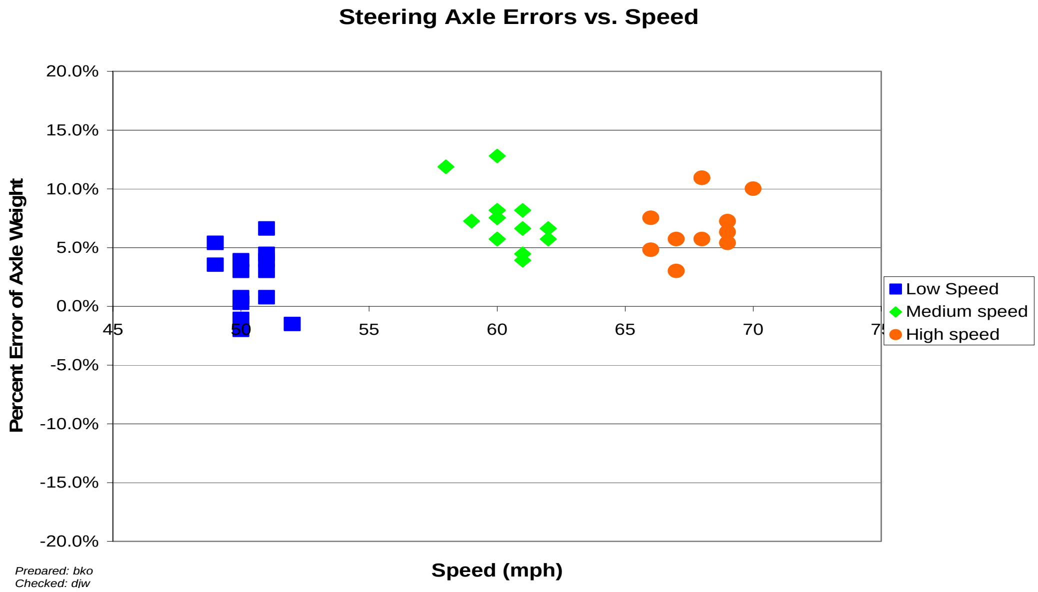


**Figure 3-8 Post-Validation Steering Axle Percent Error vs. Speed by Group – 260100 – 03-Oct-2007**

### *3.3 Classification Validation*

The agency uses a variant of the FHWA 13-bin classification scheme. Classification 15 has been added to record the number of unclassified vehicles. The classification scheme is known to have difficulties in differentiating between some Class 10s and 13s and in identifying school buses.

The agency has elected not to make additional modifications to its classification scheme to address these issues as there is no unique non-visual way to improve the scheme for the problem vehicles.

The classification validation is intended to find gross errors in vehicle classification, not to validate the installed algorithm. A sample of 100 trucks was collected at the site. Video was taken at the site to provide ground truth for the evaluation. Based on a 100 percent sample it was determined that there are 0 percent unknown vehicles and 0 percent unclassified vehicles.

The second check is the ability of the algorithm to correctly distinguish between truck classes with no more than 2% errors in such classifications.

Table 3-4 has the classification error rates by class. The overall misclassification rate is 6.8%.

**Table 3-4 Truck Misclassification Percentages for 260100 – 03-Oct-2007**

| Class | Percent Error | Class | Percent Error | Class | Percent Error |
|---|---|---|---|---|---|
| 4 | 50 | 5 | 4.2 | 6 | 14.3 |
| 7 | N/A | | | | |
| 8 | 0 | 9 | 1.9 | 10 | 25 |
| 11 | N/A | 12 | N/A | 13 | 16.7 |

*Prepared: djw Checked: bko*

The misclassification percentage is computed as the probability that a pair containing the Class of interest does NOT include a match. Thus if there are eight pairs of observations with at least one Class 9 and only six of them are matches, the error rate is 25 percent. The percent error and the mean differences reported below do not represent the same statistic. It is possible to have error rates greater than 0 with a mean difference of zero.

**Table 3-5 Truck Classification Mean Differences for 260100 – 03-Oct-2007**

| Class | Mean Difference | Class | Mean Difference | Class | Mean Difference |
|---|---|---|---|---|---|
| 4 | -50 | 5 | 4 | 6 | - 14 |
| 7 | N/A | | | | |
| 8 | 0 | 9 | 2 | 10 | - 25 |
| 11 | N/A | 12 | N/A | 13 | 20 |

*Prepared: djw Checked: bko*

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

The error in Class 9 vehicles is the result of a pickup and trailer combination that is visually a Class 5 (single unit vehicle with light trailer) having the correct dimensions and apparently sufficient weight to be considered a Class 9. The Class 10 error is a single vehicle that was identified as a Class 13. The Class 4 errors are school buses identified as Class 5s.

### *3.4 Evaluation by ASTM E-1318 Criteria*

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

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

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

*Prepared: djw Checked: bko*

# 4 Pavement Discussion

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

## *4.1 Profile Analysis*

Although there has been no profile data collected in the year prior to this validation profile data was collected within a year of the previous validation. When new profile data becomes available a profile analysis will be done and an amended report submitted.

The WIM site is a section of pavement that is 305 meters long with the WIM scale located at 274.5 meters from the beginning of the test section. An ICC profiler was used to collect longitudinal profiles of the test section with a sampling interval of 25 millimeters.

Profile data collected at the SPS WIM location by Stantec Consultants on June 2, 2006 were processed through the LTPP SPS WIM Index software, version 1.1. While the profile files indicate that this WIM scale is installed on a flexible pavement, a review of the photos and on-site confirmation show that the pavement type around on this section is rigid.

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

The SPS WIM Index software, version 1.0 was developed with four different indices: LRI, SRI, Peak LRI and Peak SRI. The LRI incorporates the pavement profile starting 25.8 m prior to the scale and ending 3.2 m after the scale in the direction of travel. The SRI incorporates a shorter section of pavement profile beginning 2.74 m prior to the WIM scale and ending 0.46 m after the scale. The LRI and SRI are the index values for the actual location of the WIM scale. Peak LRI is the highest value of LRI, within 30 m prior to the scale. Peak SRI indicates the highest value of SRI that is located between

2.45 m prior to the scale and 1.5 m after the scale. Also, a range for each of the indices was developed to provide the smoothness criteria. The ranges are shown in Table 4-1. When all of the values are below the lower thresholds, it is presumed unlikely that pavement smoothness will significantly influence sensor output. When one or more values exceed an upper threshold there is a reasonable expectation that the pavement smoothness will influence the outcome of the validation. When all values are below the upper threshold but not all below the lower threshold, the pavement smoothness may or may not influence the validation outcome.

**Table 4-1 Thresholds for WIM Index Values**

| Index | Lower Threshold (m/km) | Upper Threshold (m/km) |
|---|---|---|
| LRI | 0.50 | 2.1 |
| SRI | 0.50 | 2.1 |
| Peak LRI | 0.50 | 2.1 |
| Peak SRI | 0.75 | 2.9 |

*Prepared: djw* *Checked: bko*

Table 4-2 shows the computed index values for all 11 profiler passes for this WIM site. The average values over the passes in each path were also calculated when three or more passes were completed. These are shown in the right most column of the table. Values above the upper index limits are presented in bold while values below the lower index limits are presented in italics.

From Table 4-2 it can be seen that most of the indices computed from the profiles are between the upper and lower threshold values. These results indicate that the pavement smoothness may or may not influence the sensor output. However, since the validation of the equipment was successful, no pavement remediation is recommended at this time.

**Table 4-2 WIM Index Values - 260100 –02-Jun-2006**

| Profiler Passes | | | Pass 1 | Pass 2 | Pass 3 | Pass 4 | Pass 5 | Ave. |
|---|---|---|---|---|---|---|---|---|
| Center | LWP | LRI (m/km) | 0.544 | 0.562 | 0.600 | 0.582 | 0.565 | 0.571 |
| | | SRI (m/km) | 0.630 | *0.482* | 0.635 | 0.648 | 0.594 | 0.598 |
| | | Peak LRI (m/km) | 0.686 | 0.744 | 0.791 | 0.741 | 0.752 | 0.743 |
| | | Peak SRI (m/km) | *0.674* | *0.639* | *0.691* | *0.658* | *0.647* | *0.662* |
| | RWP | LRI (m/km) | 0.809 | 0.741 | 0.771 | 0.805 | 0.820 | 0.789 |
| | | SRI (m/km) | 1.123 | 0.973 | 1.226 | 1.286 | 1.316 | 1.185 |
| | | Peak LRI (m/km) | 0.895 | 0.871 | 0.946 | 0.954 | 0.916 | 0.916 |
| | | Peak SRI (m/km) | 1.180 | 1.112 | 1.311 | 1.367 | 1.363 | 1.267 |
| Left Shift | LWP | LRI (m/km) | 0.612 | 0.578 | 0.597 | | | 0.596 |
| | | SRI (m/km) | 0.554 | 0.538 | 0.619 | | | 0.570 |
| | | Peak LRI (m/km) | 0.672 | 0.640 | 0.727 | | | 0.680 |
| | | Peak SRI (m/km) | 0.789 | 0.791 | *0.689* | | | 0.756 |
| | RWP | LRI (m/km) | 0.771 | 0.761 | 0.795 | | | 0.776 |
| | | SRI (m/km) | 1.044 | 0.959 | 1.360 | | | 1.121 |
| | | Peak LRI (m/km) | 1.182 | 1.196 | 0.957 | | | 1.112 |

| **Profiler Passes** | | | **Pass 1** | **Pass 2** | **Pass 3** | **Pass 4** | **Pass 5** | **Ave.** |
|---|---|---|---|---|---|---|---|---|
| | | Peak SRI (m/km) | 1.295 | 1.301 | 1.507 | | | 1.368 |
| Right Shift | LWP | LRI (m/km) | 0.672 | 0.682 | 0.612 | | | 0.655 |
| | | SRI (m/km) | 0.839 | 0.824 | 0.617 | | | 0.760 |
| | | Peak LRI (m/km) | 0.807 | 0.916 | 0.853 | | | 0.859 |
| | | Peak SRI (m/km) | 0.911 | 0.951 | *0.713* | | | 0.858 |
| | RWP | LRI (m/km) | 0.854 | 0.903 | 0.779 | | | 0.845 |
| | | SRI (m/km) | 1.217 | 1.305 | 1.266 | | | 1.263 |
| | | Peak LRI (m/km) | 0.977 | 1.009 | 0.937 | | | 0.974 |
| | | Peak SRI (m/km) | 1.313 | 1.379 | 1.285 | | | 1.326 |

*Prepared: djw* *Checked: bko*

### *4.2 Distress Survey and Any Applicable Photos*

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

A lateral crack in the area of the trailing WIM sensor appears to have diminished the lead-in cable's insulation resistance properties. This is shown in Figure 4-1

**Figure 4-1 Trailing Sensor Crack – 260100 – 02-Oct-2007**

### *4.3 Vehicle-pavement Interaction Discussion*

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

# 5 Equipment Discussion

The traffic monitoring equipment at this location includes quartz piezo sensors and DAW 190. These sensors are installed ten feet apart in a staggered configuration in a portland cement concrete pavement.

There were no changes in basic equipment operating condition since the validation on July 11, 2006.

## *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. Although it appears to be working normally, insulation resistance measurements of the trailing WIM sensor indicated that it is operating outside of the manufacturer's minimum standard for insulation resistance. All other sensors and system components were found to be within operating parameters.

## *5.2 Calibration Process*

The equipment required one-iteration of the calibration process between the initial 40 runs and the final 40 runs.

### *5.2.1 Calibration Iteration 1*

For this equipment, there are 4 primary calibration factors. The overall sensitivity factor is increased to account for underestimation of all weights at all speeds and is decreased to compensate for overestimation of all weights at all speeds.

The three speed point factors are increased or decreased to compensate for underestimation or overestimation of weights at the lower, medium and high speed ranges.

For this site, the starting factors were:

Overall sensitivity: 820
Speed compensation factor 1: 1000
Speed compensation factor 2: 1014
Speed compensation factor 3: 1044

The results of the pre-validation test runs indicated that the equipment was generally underestimating all weights by approximately 10%, with additional underestimation at the medium and high speeds of approximately 3% and 2% respectively.

As a result, the primary factors were adjusted to compensate for these underestimations and the following factors were installed:

Overall sensitivity: 900
Speed compensation factor 1: 1000
Speed compensation factor 2: 1050

Speed compensation factor 3: 1071

The agency made the same calculations and selected the new factors which they input into the controller.

The results of the 12 calibration verification runs are shown in Table 5-1. No further calibrations were deemed necessary. A final 28 test runs were conducted to complete the post-validation series of 40 runs.

**Table 5-1 Calibration Iteration 1 Results – 260100 – 03-Oct-2007 (09:09 AM)**

| SPS-1, -2, -5, -6 and -8 | 95 %Confidence Limit of Error | Site Values | Pass/Fail |
|---|---|---|---|
| Steering axles | +20 percent | 4.2 ± 8.7% | Pass |
| Tandem axles | +15 percent | -1.8 ± 5.5% | Pass |
| GVW | +10 percent | -1.0 ± 4.3% | Pass |
| **Speed** | **+1 mph** | **0.6 ± 1.1 mph** | **Fail** |
| Axle spacing | + 0.5 ft | 0.0 ± 0.1 ft | Pass |

*Prepared: djw* *Checked: bko*

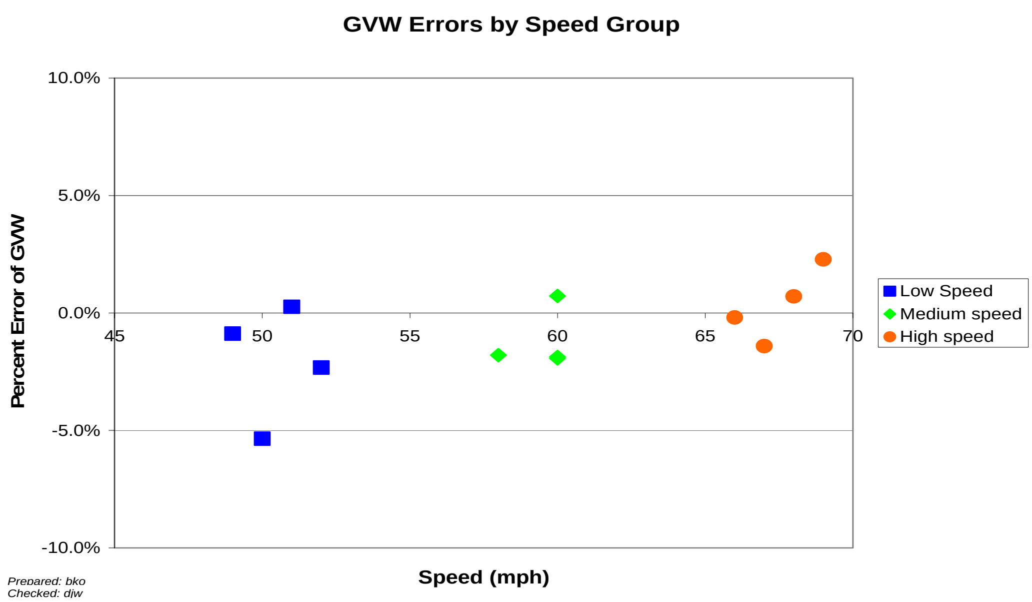


**Figure 5-1 Calibration Iteration 1 GVW Percent Error vs. Speed Group – 260100 – 03-Oct-2007 (09:09 AM)**

## *5.3 Summary of Traffic Sheet 16s*

This site has validation information from previous visits as well as the current one in the tables below.
Table 5-2 has the information for TRF_CALIBRATION_AVC for Sheet 16s submitted prior to this validation as well as the information for the current visit.

**Table 5-2 Classification Validation History – 260100 – 03-Oct-2007**

| Date | Method | Mean Difference | | | | Percent Unclassified |
|---|---|---|---|---|---|---|
| | | Class 9 | Class 8 | Class 13 | Other 2 | |
| 10/03/2007 | Manual | 2.0 | 0.0 | 20.0 | | 0.0 |
| 10/02/2007 | Manual | 0.0 | 0.0 | 100.0 | | 0.0 |
| 07/11/2006 | Manual | 0.0 | 0.0 | 0.0 | | 0.0 |
| 12/07/2005 | Manual | 0.0 | 0.0 | | | 0.0 |
| 12/06/2005 | Manual | 0.0 | 0.0 | | | 0.0 |

*Prepared: djw Checked: bko*

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

**Table 5-3 Weight Validation History – 260100 – 03-Oct-2007**

| Date | Method | Mean Error and (SD) | | |
|---|---|---|---|---|
| | | GVW | Single Axles | Tandem Axles |
| 10/03/2007 | Test Trucks | -0.5 (2.1) | 5.5 (3.5) | -1.5 (3.1) |
| 10/02/2007 | Test Trucks | -10.8 (2.1) | -7.3 (3.1) | -11.4 (3.4) |
| 07/11/2006 | Test Trucks | -0.6 (1.7) | 0.5 (4.7) | -1.2 (2.1) |
| 12/08/2005 | Test Trucks | -2.1 (3.4) | -4.2 (4.0) | -1.7 (4.3) |
| 12/07/2005 | Test Trucks | 19.8 (7.6) | 19.6 (3.6) | 19.7 (9.7) |

*Prepared: djw Checked: bko*

Differences in temperature ranges during separate validations typically result in increased weight errors. At this site, the weight errors increased 10% from the validation on 11 July even though temperatures were very similar for these two validations. The shift in reported weights by this equipment may be related to degradation of the trailing WIM sensor operation described in Section 5.1.

### *5.4 Projected Maintenance/Replacement Requirements*

Due to the diminished resistive properties of the trailing WIM sensor's lead-in cable, the sensor needs to be replaced.

# 6 Pre-Validation Analysis

This pre-validation analysis is based on test runs conducted Oct 2, 2007 during the morning and early afternoon hours at test site 260100 on US Route 27. This SPS-1 site is installed on the southbound, righthand lane of a four-lane divided facility. No auto-calibration was used during test runs. The two trucks used for initial validation included:

1. 5-axle tractor semi-trailer combination with a tractor having an air suspension and trailer with standard rear tandem and an air suspension loaded to 75,510 lbs.
2. 5-axle tractor semi-trailer with a tractor having an air suspension and a trailer with a standard rear tandem and an air suspension loaded to 64,820 lbs., the partial truck.

For the initial validation, each truck made a total of 20 passes over the WIM scale at speeds ranging from approximately 49 to 68 miles per hour. The desired speed range was achieved during this validation. Pavement surface temperatures were recorded during the test runs ranging from about 63 to 97 degrees Fahrenheit. The desired 30 degree Fahrenheit temperature range was also achieved. The computed values of 95% confidence limits of each statistic for the total population are in Table 6-1.

As shown in Table 6-1, the site did not meet LTPP performance criteria for research quality data for GVW or Tandem axle weight or speed.

**Table 6-1 Pre-Validation Results – 260100 – 02-Oct-2007**

| **SPS-1, -2, -5, -6 and -8** | **95 %Confidence Limit of Error** | **Site Values** | **Pass/Fail** |
|---|---|---|---|
| Steering axles | ±20 percent | -7.3 ± 6.2% | Pass |
| **Tandem axles** | **±15 percent** | **-11.4 ± 6.7%** | **Fail** |
| **GVW** | **±10 percent** | **-10.8 ± 4.3%** | **Fail** |
| **Speed** | **±1 mph [2 km/hr]** | **0.1 ± 1.5 mph** | **Fail** |
| Axle spacing | ± 0.5 ft [150mm] | 0.0 ± 0.1 ft | Pass |

*Prepared: djw* *Checked: bko*

The test runs were conducted primarily during the morning and early afternoon hours under cloudy weather conditions, resulting in a limited range of pavement temperatures. The runs were also conducted at various speeds to determine the effects of these variables on the performance of the WIM scale. To investigate these effects, the dataset was split into three speed groups and two temperature groups. The distribution of runs within these groupings is illustrated in Figure 6-1. The figure indicates that the desired distribution of speed and temperature combinations was achieved for this set of validation runs. There were insufficient data points in the upper end of the range to justify splitting the data into three groups. A third group would have had less than the minimum eight points considered necessary for this project.

The three speed groups were divided into 49 to 55 mph for Low speed, 56 to 62 mph for Medium speed and 63+ mph for High speed. The two temperature groups were created by splitting the runs between those at 63 to 75 degrees Fahrenheit for Low temperature and 76 to 97 degrees Fahrenheit for High temperature.

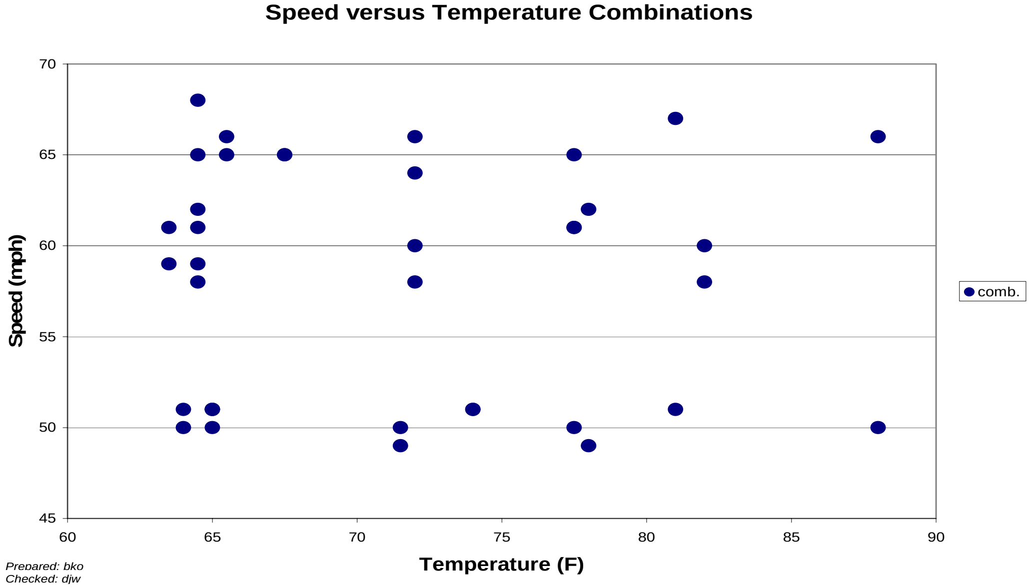


**Figure 6-1 Pre-Validation Speed-Temperature Distribution – 260100 – 02-Oct-2007**

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

Figure 6-2 shows the GVW Percent Error vs. Speed graph for the population as a whole. From the figure, it can be seen that the equipment underestimates GVW at all speeds. The scatter of the percent error appears to be consistent over the entire speed range.

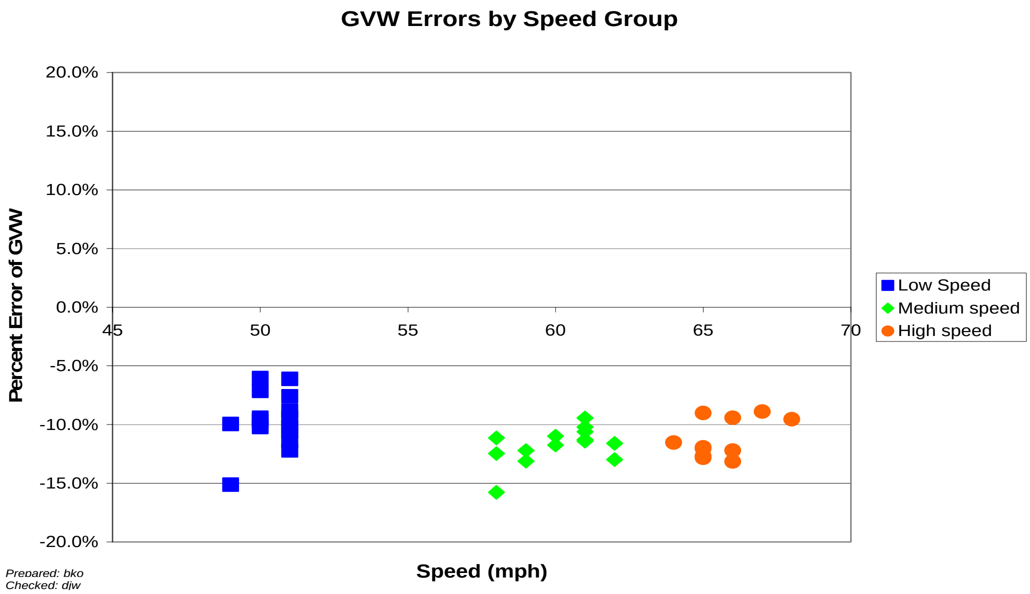


**Figure 6-2 Pre-validation GVW Percent Error vs. Speed – 260100 – 02-Oct-2007**

Figure 6-3 shows the relationship between temperature and GVW percentage error. The graph illustrates that there does not appear to be a relationship between GVW error and pavement temperature in the observed range.

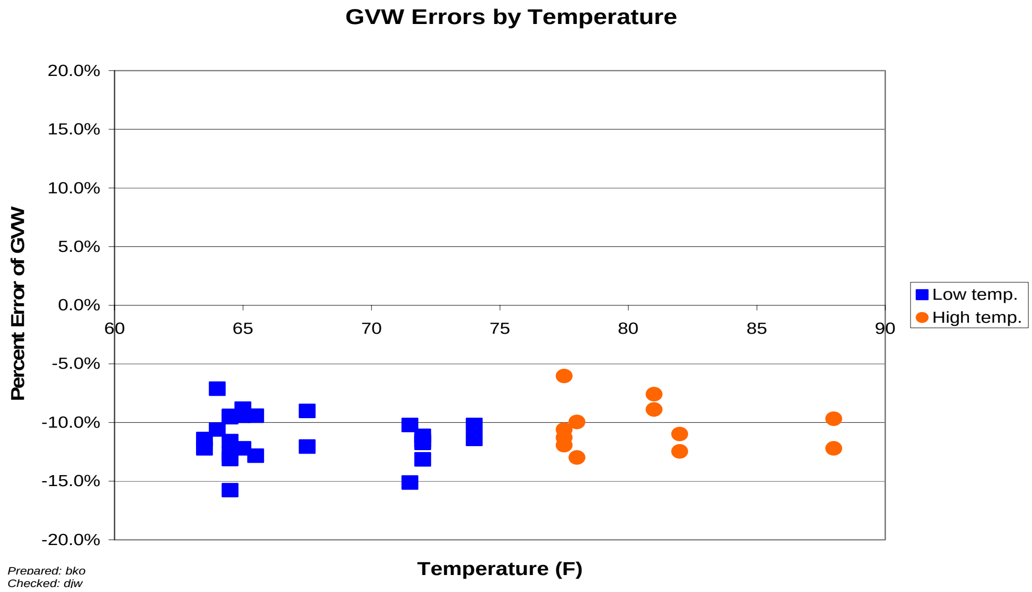


**Figure 6-3 Pre-Validation GVW Percent Error vs. Temperature – 260100 – 02-Oct-2007**

Figure 6-4 shows the relationship between the drive tandem spacing errors in feet and speeds. This graph is used as a potential indicator of classification errors due to failure to correctly identify spacings on a vehicle. Since the most common reference value is the drive tandem on a Class 9 vehicle, this is the spacing evaluated and plotted for validations. Axle spacing errors appear to be consistent throughout the test truck speed range and are limited to maximums of about 0.1 feet.

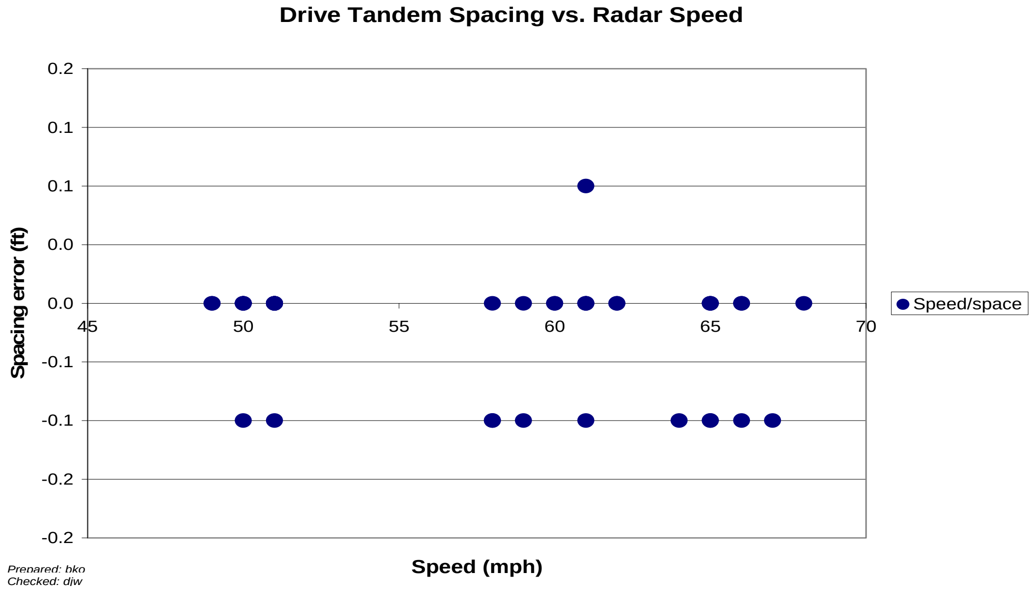


**Figure 6-4 Pre-Validation Spacing vs. Speed - 260100 – 02-Oct-2007**

## *6.1 Temperature-based Analysis*

The two temperature groups were created by splitting the runs between those at 63 to 75 degrees Fahrenheit for Low temperature and 76 to 97 degrees Fahrenheit for High temperature. There were insufficient data points at the high end of the range to support dividing the data by temperature into three sets covering approximately the same number of degrees and similar numbers of data points.

**Table 6-2 Pre-Validation Results by Temperature Bin – 260100 – 02-Oct-2007**

| Element | 95% Limit | Low Temperature 63 to 75 °F | High Temperature 76 to 97 °F |
|---|---|---|---|
| Steering axles | ±20 % | -8.3 ± 6.6% | -5.6 ± 4.0% |
| Tandem axles | ±15 % | -11.7 ± 6.6% | -10.9 ± 7.2% |
| GVW | ±10 % | -11.2 ± 4.1% | -10.1 ± 4.8% |
| Speed | ±1 mph | 0.2 ± 1.7 mph | 0.0 ± 1.2 mph |
| Axle spacing | ± 0.5 ft | 0.0 ± 0.1 ft | 0.0 ± 0.1 ft |

*Prepared: djw* *Checked: bko*

From Table 6-2, it appears that the equipment significantly underestimates all weights at all temperatures. For GVW, scatter in error appears to be consistent at all temperatures. For steering axle weight error, the scatter is greater at the lower temperatures, while the Tandem weight scatter is greater at the higher temperatures.

Figure 6-5 shows the distribution of GVW Errors versus Temperature by Truck. The figure illustrates the tendency of the WIM equipment to report consistent underestimates of GVW weights for both trucks over the entire temperature range.

Consistency of the scatter over the observed range cannot be addressed due to the limited number of observations at High temperature for this validation.

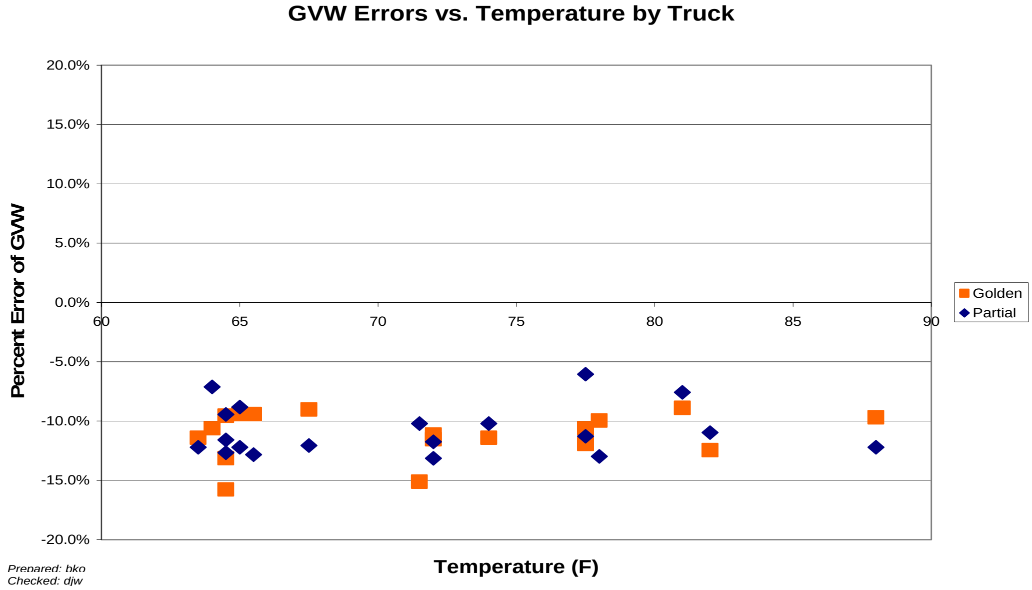


**Figure 6-5 Pre-Validation GVW Percent Error vs. Temperature by Truck – 260100 – 02-Oct-2007**

Figure 6-6 shows the relationship between steering axle errors and temperature. This graph is included due to the frequent use of steering axle weights of Class 9 vehicles for auto-calibration. This site does not use auto-calibration. The steering axles in this graph are associated only with Class 9 vehicles. Figure 6-6 shows how the WIM equipment generally underestimates the steering axle weights. Variability of the error is greater at the lower temperatures.

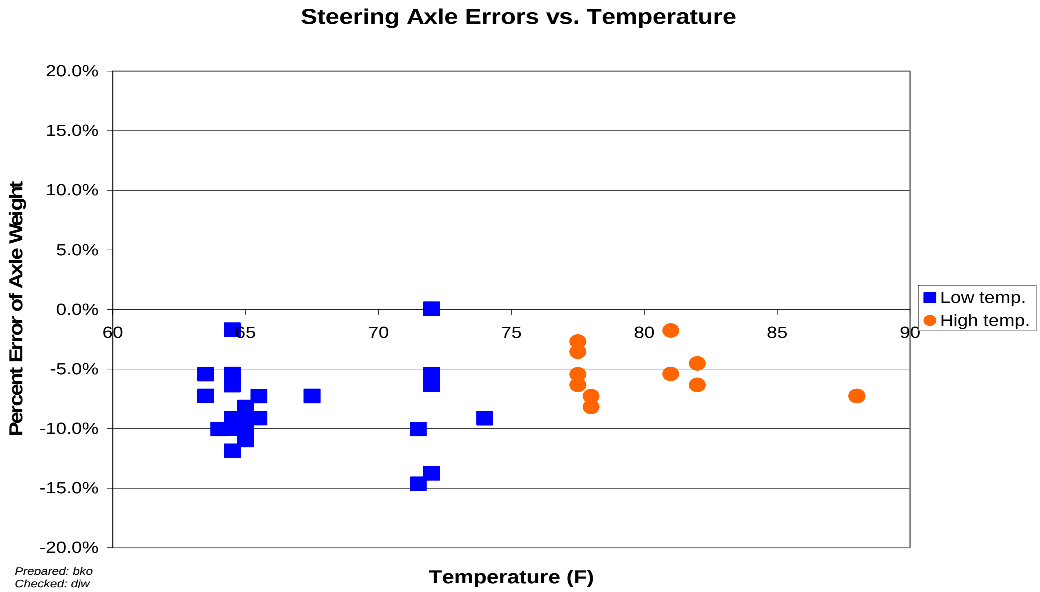


**Figure 6-6 Pre-Validation Steering Axle Error vs. Temperature by Group – 260100 – 02-Oct-2007**

## *6.2 Speed-based Analysis*

The speed groups were divided as follows: Low speed – 49 to 55 mph, Medium speed – 56 to 62 mph and High speed – 63+ mph.

**Table 6-3 Pre-Validation Results by Speed Bin – 260100 – 02-Oct-2007**

| Element | 95% Limit | Low Speed 49 to 55 mph | Medium Speed 56 to 62 mph | High Speed 63+ mph |
|---|---|---|---|---|
| Steering axles | ±20 % | -8.9 ± 4.9% | -6.2 ± 5.5% | -6.5 ± 8.6% |
| Tandem axles | ±15 % | -9.8 ± 6.7% | -12.9 ± 5.9% | -11.7 ± 6.6% |
| GVW | ±10 % | -9.6 ± 5.1% | -11.8 ± 3.3% | -11.2 ± 3.7% |
| Speed | ±1 mph | 0.1 ± 1.4 mph | -0.2 ± 1.5 mph | 0.5 ± 1.8 mph |
| Axle spacing | ± 0.5 ft | 0.0 ± 0.1 ft | 0.0 ± 0.1 ft | 0.0 ± 0.1 ft |

*Prepared: djw* *Checked: bko*

From Table 6-3, it appears that the mean error for steering axles is less than the mean error for tandem axles and GVW at all speeds. Steering axle underestimation is greater at the lower speeds. Tandem axle weight and GVW underestimations are greater at the medium and high speeds. The scatter for steering axle error is greater at the higher speeds. The scatter for GVW is greater at the lower speeds.

Figure 6-7 illustrates the tendency of the WIM equipment to underestimate GVW for both trucks at all speeds. The variability in error appears to be slightly greater at the lower speeds.

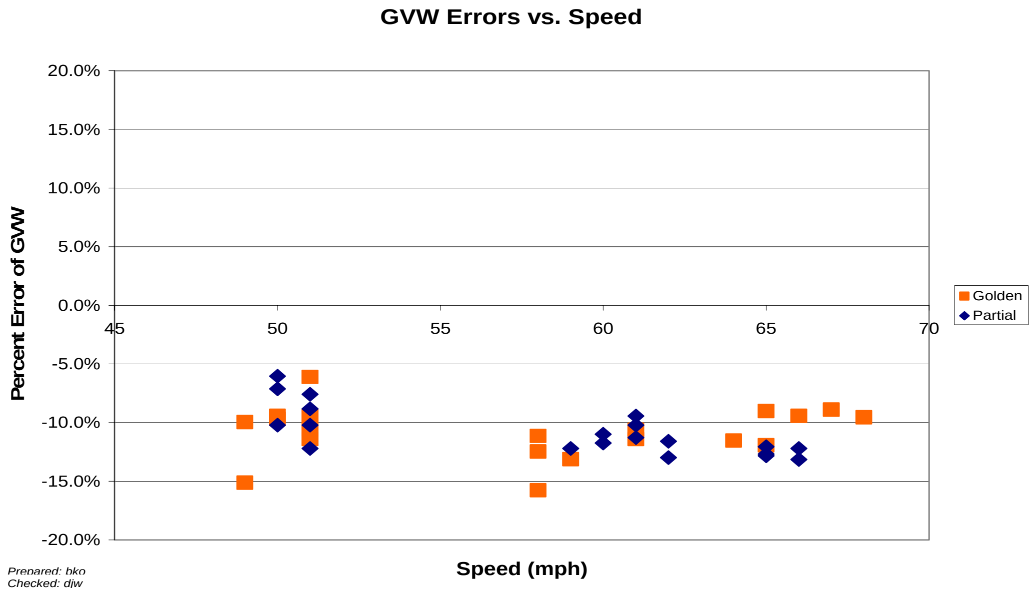


**Figure 6-7 Pre-Validation GVW Percent Error vs. Speed Group - 260100 –02-Oct-2007**

Figure 6-8 shows the relation between steering axle errors and speed. This graph is included due to the frequent use of steering axle weights of Class 9 vehicles for calibration. This site does not use auto-calibration. The steering axles in this graph are associated only with Class 9 vehicles. Figure 6-8 shows how the WIM equipment generally underestimates the steering axle weights. Variability of the error appears to increase as speed increases.

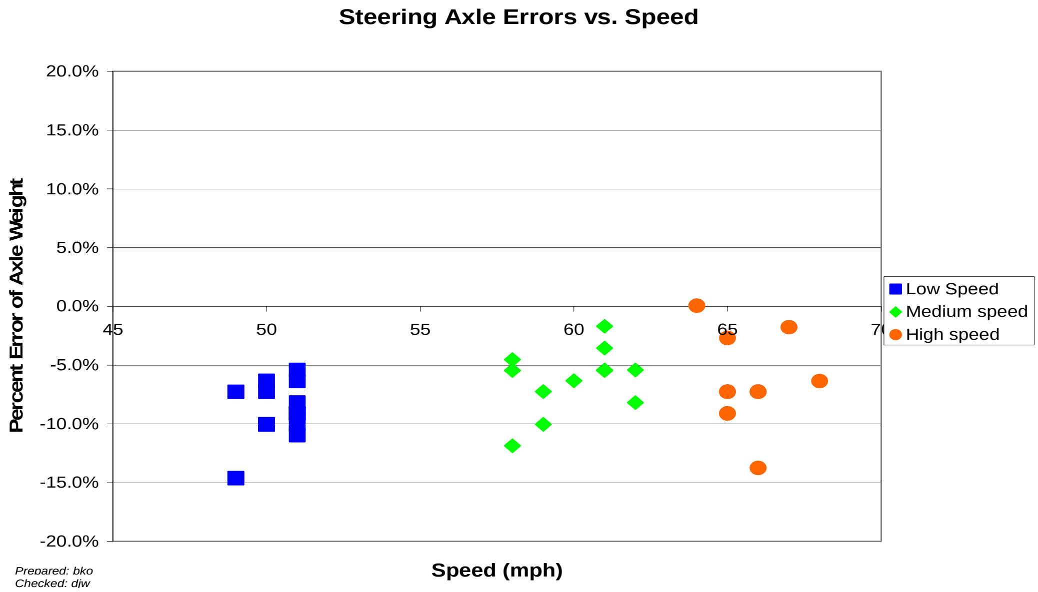


**Figure 6-8 Pre-Validation Steering Axle Percent Error vs. Speed Group - 260100 – 02-Oct-2007**

## *6.3 Classification Validation*

The agency uses a variant of the FHWA 13-bin classification scheme. Classification 15 has been added to record the number of unclassified vehicles. The classification scheme is known to have difficulties in differentiating between some Class 10s and 13s and in identifying school buses. The agency has elected not to make additional modifications to its classification scheme to address these issues as there is no unique non-visual way to improve the scheme for the problem vehicles.

The classification validation is intended to find gross errors in vehicle classification, not to validate the installed algorithm. A sample of 100 trucks was collected at the site. The classification identification is to identify gross errors in classification, not validate the classification algorithm. Video was taken at the site to provide ground truth for the evaluation. Based on a 100 percent sample it was determined that there are 0 percent unknown vehicles and 1.9 percent unclassified vehicles.

The second check is the ability of the algorithm to correctly distinguish between truck classes with no more than 2% errors in such classifications. Table 6-4 has the classification error rates by class. The overall misclassification rate is 9.8 percent.

**Table 6-4 Truck Misclassification Percentages for 260100 – 02-Oct-2007**

| Class | Percent Error | Class | Percent Error | Class | Percent Error |
|---|---|---|---|---|---|
| 4 | 100 | 5 | 17 | 6 | 0 |
| 7 | 100 | | | | |
| 8 | 0 | 9 | 0.0 | 10 | 13 |
| 11 | N/A | 12 | N/A | 13 | N/A |

*Prepared: djw* *Checked: bko*

The misclassification percentage is computed as the probability that a pair containing the class of interest does NOT include a match. Thus if there are eight pairs of observations with at least one Class 9 and only six of them are matches, the error rate is 25 percent. The percent error and the mean differences reported below do not represent the same statistic. It is possible to have error rates greater than 0 with a mean difference of zero.

**Table 6-5 Truck Classification Mean Differences for 260100 – 02-Oct-2007**

| Class | Mean Difference | Class | Mean Difference | Class | Mean Difference |
|---|---|---|---|---|---|
| 4 | -100 | 5 | 10 | 6 | 0 |
| 7 | -100 | | | | |
| 8 | 0 | 9 | 0.0 | 10 | -13 |
| 11 | N/A | 12 | N/A | 13 | N/A |

*Prepared: djw Checked: bko*

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

The Class 4 errors are school buses identified as Class 5s. The Class 7 error is a crane that the equipment counted different numbers of axles on each loop. This is the unclassified vehicle. The Class 10 error is a single vehicle.

### *6.4 Evaluation by ASTM E-1318 Criteria*

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

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

| Characteristic | Limits for Allowable Error | Percent within Allowable Error | Pass/Fail |
|---|---|---|---|
| Single Axles | ± 20% | 100% | Pass |
| **Axle Groups** | **± 15%** | **83.8%** | **Fail** |
| **GVW** | **± 10%** | **35%** | **Fail** |

*Prepared: djw Checked: bko*

## *6.5 Prior Validations*

The last validation for this site was done July 11, 2006. It was the second validation of the site. The site was producing research quality data. Figure 6-9 shows the GVW Percent Error vs. Speed for the post validation runs. The site was validated with two trucks. The "Golden" truck was loaded to 77,180 lbs. The "partial" truck, which had air suspension on both tandems, was loaded to 65,340 lbs.

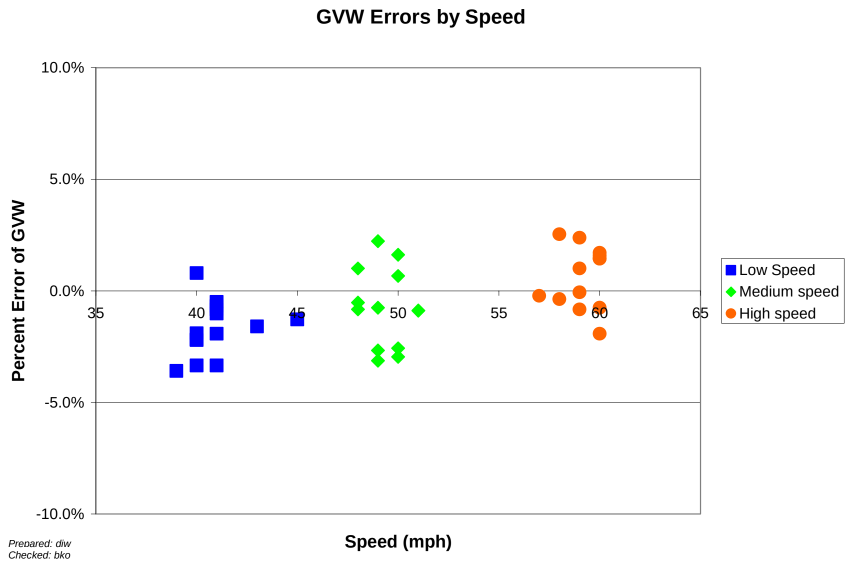


**Figure 6-9 Last Validation GVW Percent Error vs. Speed – 260100 – 11-Jul-2006**

Table 6-7 shows the overall results from the last validation. The site was slightly underestimating GVW and tandem axle weights. It was overestimating steering axle weights. Single axle weight errors were calculated because the Partial truck had a split tandem on the trailer. The end conditions from the prior validation are similar to those for the end conditions of the current validation.

**Table 6-7 Last Validation Final Results – 260100 – 11-Jul-2006**

| SPS-1, -2, -5, -6 and -8 | 95 %Confidence Limit of Error | Site Values | Pass/Fail |
|---|---|---|---|
| Steering axles | ±20 percent | 3.5 ± 6.7% | Pass |
| Single axles | ±20 percent | 0.5 ± 9.4% | Pass |
| Tandem axles | ±15 percent | -1.2 ± 4.1% | Pass |
| Gross vehicle weights | ±10 percent | -0.6 ± 3.5% | Pass |
| **Speed** | **±1 mph [2 km/hr]** | **0.3 ± 1.4 mph** | **Fail** |
| Axle spacing | ± 0.5 ft [150 mm] | 0.0 ± 0.0 ft | Pass |

*Prepared: djw* *Checked: bko*

Due to the limited range of temperatures during the period of testing, the site could not be evaluated for temperature effects. Only four points were observed at the lower end of the range (79-90) from the full range of 79 to 96. Through this validation, the equipment has been observed at temperature from 1 to 96 degrees Fahrenheit.

Table 6-8 has the results of the prior post validation by speed groups. The tendency to have decreasing errors with increasing temperatures is observed here. The last validation was conducted with speeds limited by the truck speed limit.

**Table 6-8 Last Validation Results by Speed Bin – 260100 – 11-Jul-2006**

| Element | 95% Limit | Low Speed 39 to 45 mph | Medium Speed 46 to 51 mph | High Speed 52+ mph |
|---|---|---|---|---|
| Steering axles | ±20 % | 2.2 ± 7.4% | 2.8 ± 4.7% | 5.7 ± 7.1% |
| Single axles | ±20 % | -1.2 ± 10.1% | 1.0 ± 7.9% | 1.6 ± 10.3% |
| Tandem axles | ±15 % | -1.9 ± 3.5% | -1.6 ± 4.3% | 0.1 ± 4.1% |
| GVW | ±10 % | -1.7 ± 2.7% | -0.7 ± 3.8% | 0.6 ± 3.0% |
| Speed | ±1 mph | 0.1 ± 1.9 mph | 0.4 ± 1.4 mph | 0.0 ± 0.1 mph |
| Axle spacing | ± 0.5 ft | 0.0 ± 0.0 ft | 0.0 ± 0.0 ft | 0.0 ± 0.1 ft |

*Prepared: djw Checked: bko*

# 7 Data Availability and Quality

As of October 2, 2007 this site does not have at least 5 years of research quality data. Research quality data is defined to be at least 210 days in a year of data of known calibration meeting LTPP's precision requirements.

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

The amount and coverage for the site is shown in Table 7-1. The value for months is a measure of the seasonal variation in the data. The indicator of coverage indicates whether day of week variation has been accounted for on an annual basis. As can be seen from the table, between 1996 and 2006 all years but 1996, 1998 and 1999 for classification and 1996,1999 and 2002 for weight have a sufficient quantity of data to be considered complete years of data. **With only the 2006 validation information available for these years it can be seen that at least four additional years of research quality data are needed to meet the goal of a minimum of 5 years of research weight data. Since the site was installed in June 2005, analysis of data from prior years for consideration as research quality data will require validation information for that installation.** With the observed failure condition at the beginning of this validation and the agency's intent not to replace the sensor until Spring 2008, it is unlikely that 2007 will qualify as a year of research quality data.

**Table 7-1 Amount of Traffic Data Available 260100 – 02-Oct-2007**

| Year | Classification Days | Months | Coverage | Weight Days | Months | Coverage |
|---|---|---|---|---|---|---|
| 1996 | 176 | 7 | Full week | 191 | 7 | Full week |
| 1997 | 339 | 12 | Full week | 322 | 11 | Full week |
| 1998 | 1 | 1 | Weekday(s) | 356 | 12 | Full week |
| 1999 | 127 | 6 | Full week | 136 | 6 | Full week |
| 2000 | 309 | 11 | Full week | 309 | 12 | Full week |
| 2001 | 345 | 12 | Full week | 341 | 12 | Full week |
| 2002 | 345 | 12 | Full week | 353 | 12 | Full week |
| 2003 | 300 | 10 | Full week | 298 | 10 | Full week |
| 2004 | 280 | 11 | Full week | 323 | 11 | Full week |
| 2005 | 333 | 12 | Full week | 340 | 12 | Full week |
| 2006 | 316 | 12 | Full week | 357 | 12 | Full week |
| 2007 | 135 | 5 | Full week | 144 | 5 | Full week |

*Prepared: djw Checked: bko*

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

Class 5s and Class 9s constitute more than 10 percent of the truck population. Based on the data collected from the end of the last calibration iteration the following are the expected values for these populations. The precise values to be used in data review will need to be determined by the RSC on receipt of the first 14 days of data after the successful validation. For sites that do not meet LTPP precision requirements, this period may still be used as a starting point from which to track scale changes.

Table 7-2 is generated with a column for every vehicle class 4 or higher that represents 10 percent or more of the truck (class 4-20) population. In creating Table 7-2 the following definitions are used:

- Class 9 overweights are defined as the percentage of vehicles greater than 88,000 pounds
- Class 9 underweights are defined as the percentage of vehicles less than 20,000 pounds.
- Class 9 unloaded peak is the bin less than 44,000 pounds with the greatest percentage of trucks.
- Class 9 loaded peak is the bin 60,000 pounds or larger with the greatest percentage of trucks.
- For all other trucks the typical axle configuration is used to determine the maximum allowable weight based on 18,000 pounds for single axles and 34,000 pounds for tandem axles. A ten percent cushion above that maximum is used to set the overweight threshold.

- For all other trucks in the absence of site specific information the computation of under weights assumes the power unit weighs 10,000 pounds and each axle on a trailer 5,000 pounds. Ninety percent of the total for the unloaded configuration is the value below which a truck is considered under weight.
- For all trucks other than class 9s that have a bi-modal distribution the unloaded peak is defined to be in a bin less than or equal to half of the allowable maximum weight.
- For all trucks other than class 9s that have a bi-modal distribution the loaded peak is defined to be in a bin greater than or equal to half of the allowable maximum weight.

There may be more than one bin identified for the unloaded or loaded peak due to the small sample size collected after validation. Where only one peak exists, the peak rather than a loaded or unloaded peak is identified. This may happen with single unit trucks. It is not expected to occur with combination vehicles.

**Table 7-2 GVW Characteristics of Major sub-groups of Trucks – 260100 – 03-Oct-2007**

| Characteristic | Class 5 | Class 9 |
|---|---|---|
| Percentage Overweights | 0.0% | 0.7% |
| Percentage Underweights | 1.3% | 0.0% |
| Unloaded Peak | | 36,000 lbs |
| Loaded Peak | | 84,000 lbs |
| Peak | 12,000 lbs | |

*Prepared: djw Checked: bko*

The expected percentage of unclassified vehicles among the truck population is 7.5%. This is based on the percentage of unclassified vehicles in the post-validation data download.

The graphical screening comparison figures are found in Figure 7-2 through Figure 7-4. These are based on data collected immediately after the validation and may not be wholly representative of the population at the site. They should however provide a sense of the statistics expected when SPS comparison data is computed for the post-validation Sheet 16.

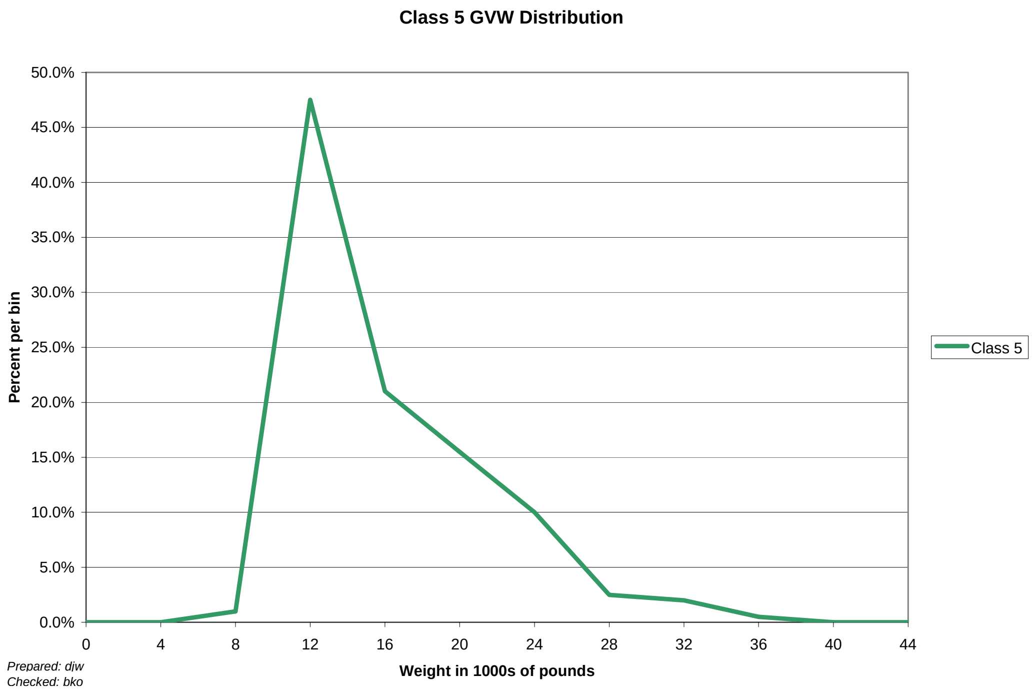


**Figure 7-1 Expected GVW Distribution Class 5 – 260100 – 03-Oct-2007**

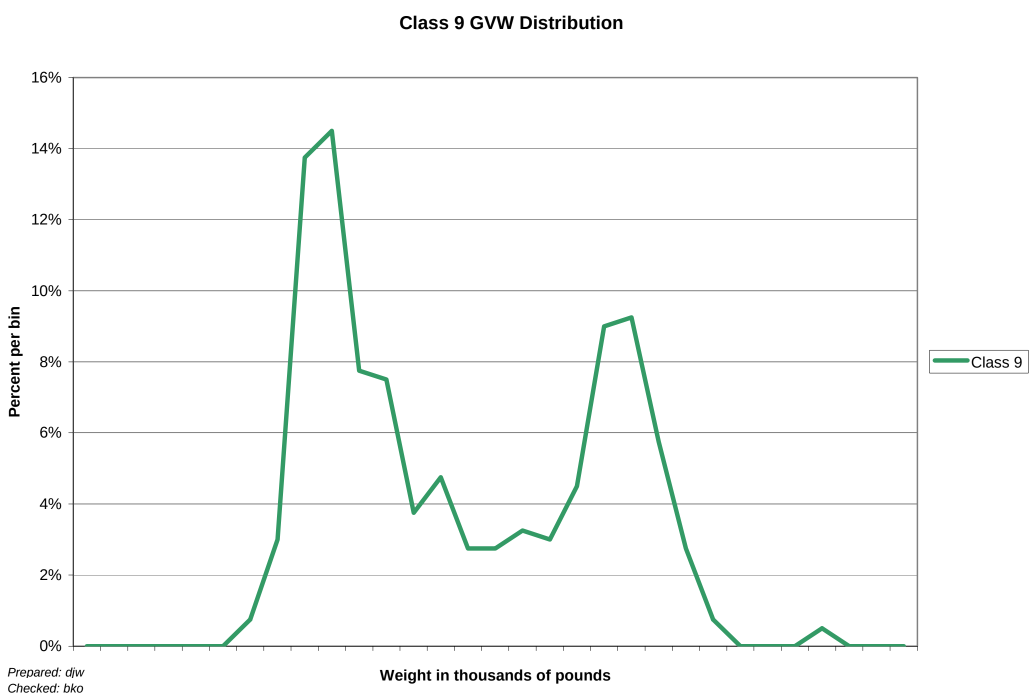


**Figure 7-2 Expected GVW Distribution Class 9 – 260100 – 03-Oct-2007**

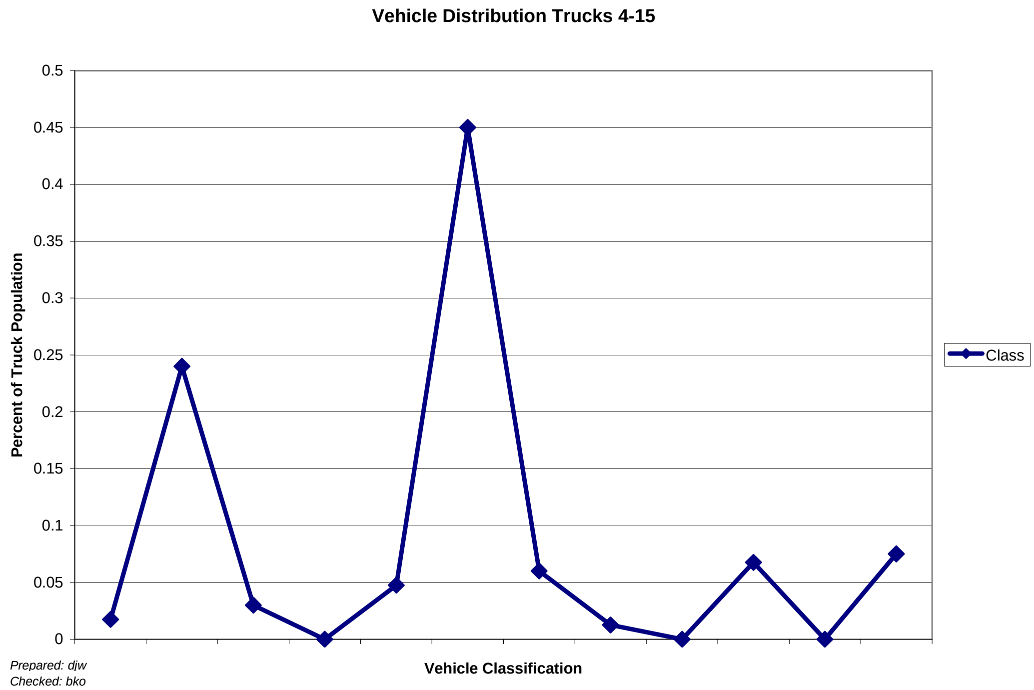


**Figure 7-3 Expected Vehicle Distribution – 260100 – 03-Oct-2007**

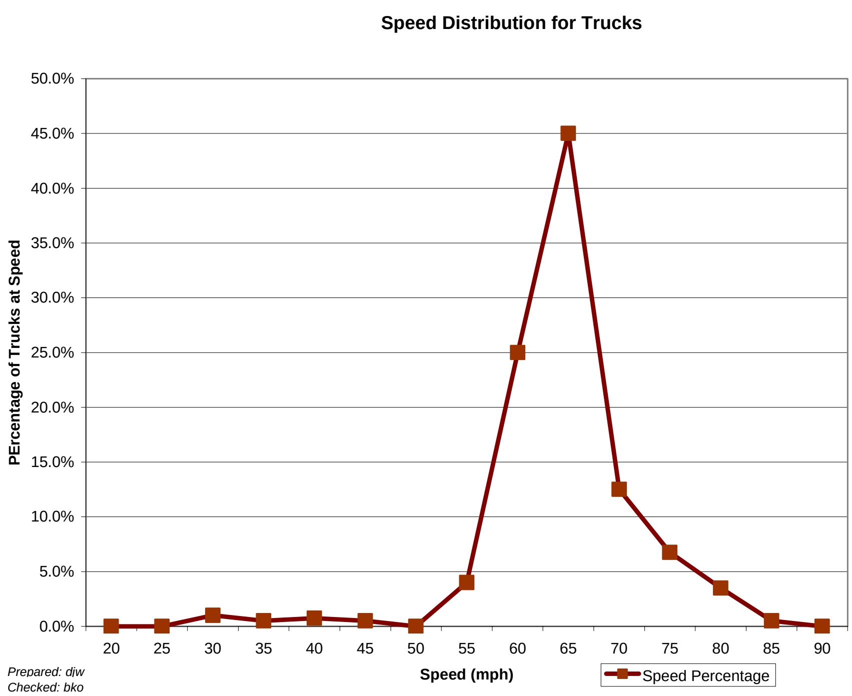


**Figure 7-4 Expected Speed Distribution – 260100 – 03-Oct-2007**

# 8 Data Sheets

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

Sheet 19 – Truck 1 – 3S2 loaded air suspension (2 pages)
Sheet 19 – Truck 1a – 3S2 loaded air suspension (2 pages)
Sheet 19 – Truck 2 – 3S2 loaded air suspension (3 pages)

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

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

Calibration Iteration 1 Worksheets – (1 page)

Test Truck Photographs (9 pages)

Michigan Classification Scheme (1 page)

Final System Parameters (1 page)

# 9 Updated Handout Guide and Sheet 17

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

# 10 Updated Sheet 18

A current Sheet 18 indicating the contacts, conditions for assessments and evaluations has been attached following the updated handout guide.

# 11 Traffic Sheet 16(s)

Sheet 16s for the pre-validation and post-validation conditions are attached following the current Sheet 18 information at the very end of the report.

# POST-VISIT HANDOUT GUIDE FOR SPS WIM FIELD VALIDATION

## STATE: Michigan

## SHRP ID: 0100

Figures



Photos

## 1. General Information

SITE ID: *260100*

LOCATION: *US Route 27 South, approximately 2.36 miles north of M-21.*

VISIT DATE: *October 2, 2007*

VISIT TYPE: *Validation*

## 2. Contact Information

POINTS OF CONTACT:

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

**Highway Agency:** *Tom Hynes, 517-322-5711, hynest@michigan.gov*

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

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

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

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

## 3. Agenda

BRIEFING DATE: *No briefing requested for this visit*

ON SITE PERIOD: *October 2, 2007, beginning at 9:00am*

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

## 4. Site Location/ Directions

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

DIRECTIONS TO THE SITE: *Located on US Route 27, approximately 2.36 miles north of M-21.*

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

WIM SITE LOCATION: *US 27 South (Latitude: 43.0239$^0$ and Longitude: -84.5435$^0$)*

WIM SITE LOCATION MAP:

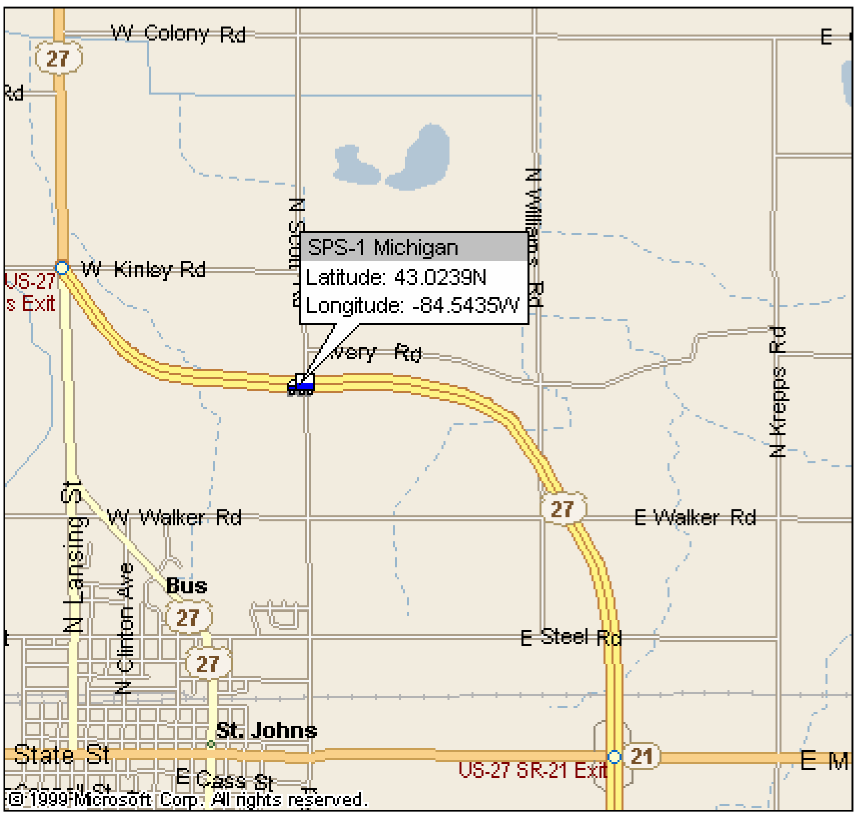


**Figure 4-1 - Site Location for SPS-1 in Michigan**

## 5. Truck Route Information

ROUTE RESTRICTIONS: *None.*

SCALE LOCATION: *See Figure 5-1.*

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

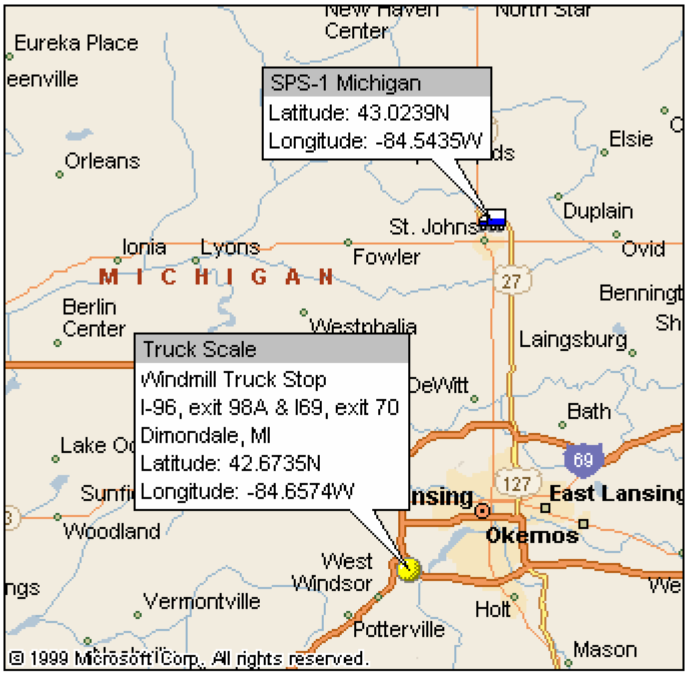


**Figure 5-1 - Truck Scale Location for Michigan SPS-1**

TRUCK ROUTE: *See Figure 5-2.*

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

*Southbound to M-21 Exit – 2.36 miles.*

*Total distance = 6.72 miles*
*Total time = 10 minutes*

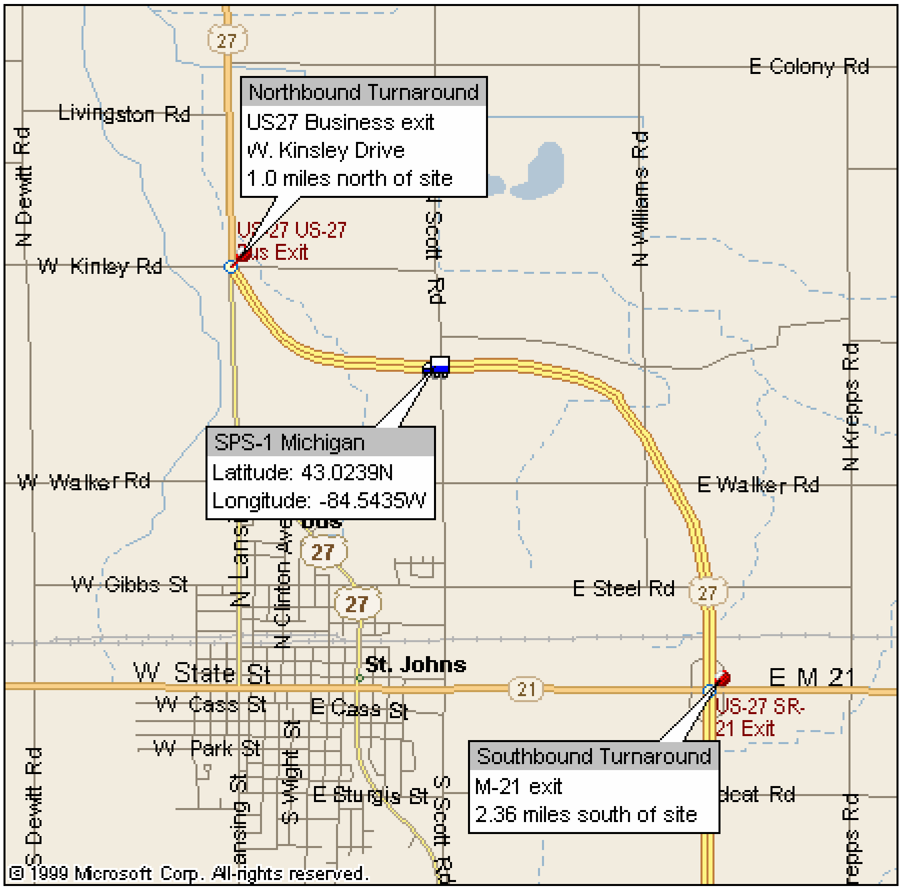


**Figure 5-2 - Truck Route for SPS-1 in Michigan**

## 6. Sheet 17 – Michigan (260100)

1.* ROUTE ___US 27_______MILEPOST _unk_ LTPP DIRECTION - N S E W

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

3.* LANE CONFIGURATION
Lanes in LTPP direction __2__ Lane width _1_2__ ft

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

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

Shoulder width __1_1___ ft

4.* PAVEMENT TYPE ____Portland Concrete Cement___

5.* PAVEMENT SURFACE CONDITION – Distress Survey
Date __10/2/2007____ Photo Filename __26_0100_Upstream_10_02_07.jpg_________
Date __10/2/2007____ Photo Filename __26_0100_Downstream_10_02_07.jpg_______
Date ______________________Distress Photo Filename _________________

6. * SENSOR SEQUENCE
______quartz piezo – loop – quartz piezo______________________________

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

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

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

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

10. * CABINET LOCATION

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

Distance from edge of traveled lane _5_1__ ft

Distance from system __4_7_ __ ft

TYPE _____M_____________________

CABINET ACCESS controlled by LTPP / STATE / JOINT ?

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

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

11. * POWER

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

Service provider _____________________ Phone number _______________

12. * TELEPHONE

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

Service provider __Verizon____________ Phone Number _______________

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

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

15. PHOTOS FILENAME

| | |
|---|---|
| Power source | 26_0100_Power_Service_Box_10_02_07.jpg |
| Phone source | 26_0100_Telephone_Service_Box_10_02_07.jpg |
| Cabinet exterior | 26_0100_Cabinet_Exterior_10_02_07.jpg |
| Cabinet interior | 26_0100_Cabinet_Interior_10_02_07.jpg |
| Weight sensors | 26_0100_Leading_WIM_Sensor_10_02_07.jpg |
| | 26_0100_Trailing_WIM_Sensor_10_02_07.jpg |
| Other sensors | 26_0100_Loop_Sensor_10_02_07.jpg |

Description ___Loops_____________________________________________

Downstream direction at sensors on LTPP lane

__26_0100_Downstream_10_02_07.jpg _____________________

Upstream direction at sensors on LTPP lane

_26_0100_Upstream_10_02_07.jpg _________________________

COMMENTS

GPS Coordinates: Latitude: 43.029$^0$ and Longitude: -84.5435$^0$

Amenities in St. John's – gas, food, Wal-Mart – located south 2 miles off of M-21 exit, right approximately 2 miles.

Hotels in Dewitt, approximately 17 miles from site.

COMPLETED BY __Dean J. Wof

PHONE _301-210-5105______ DATE COMPLETED ___9_ /_2_4_ / _2_0_0_7_

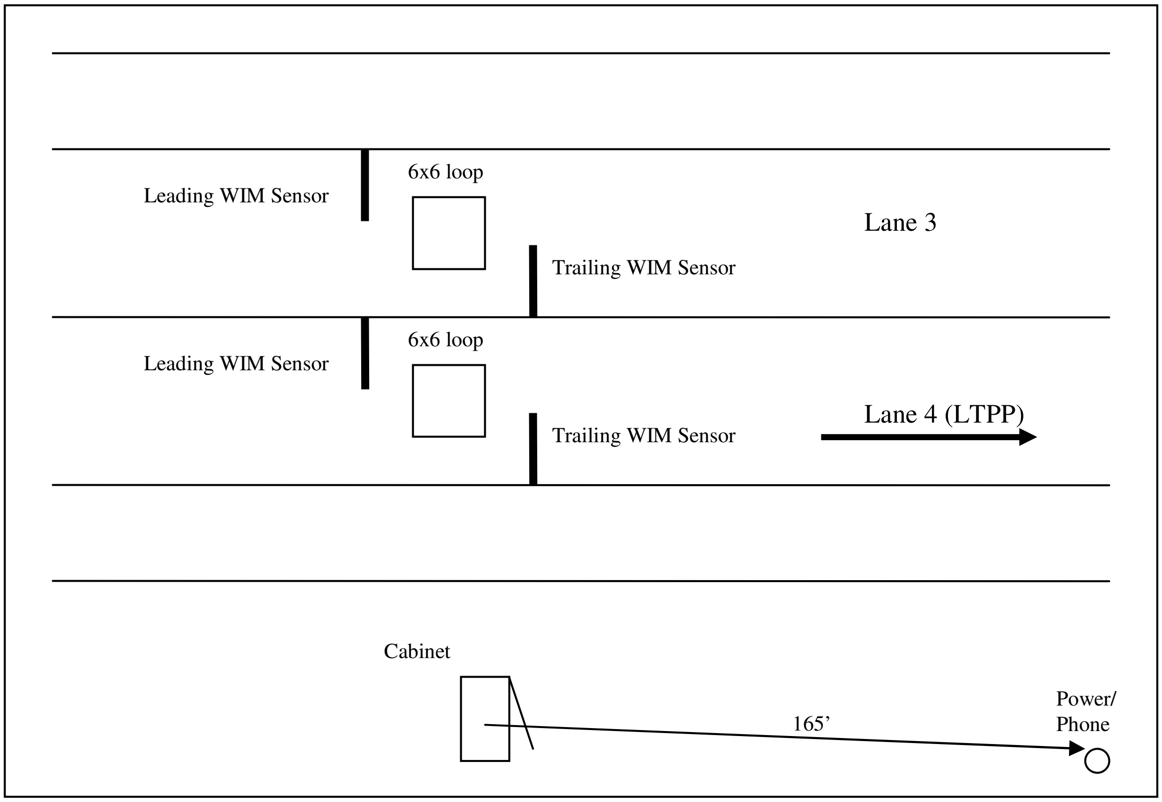


**Figure 6-1 - Sketch of equipment layout**


**Figure 6-2 - Site Map 260100**

**Photo 1 26_0100_Upstream_10_02_07.jpg**

**Photo 2 26_0100_Downstream_10_02_07.jpg**

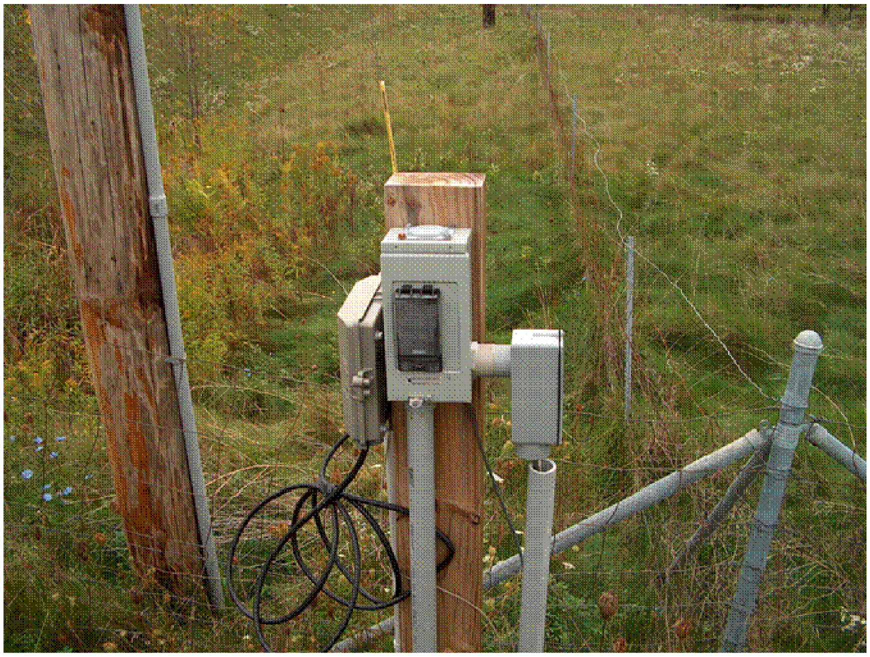

**Photo 3 26_0100_Power_Service_Box_10_02_07.jpg**

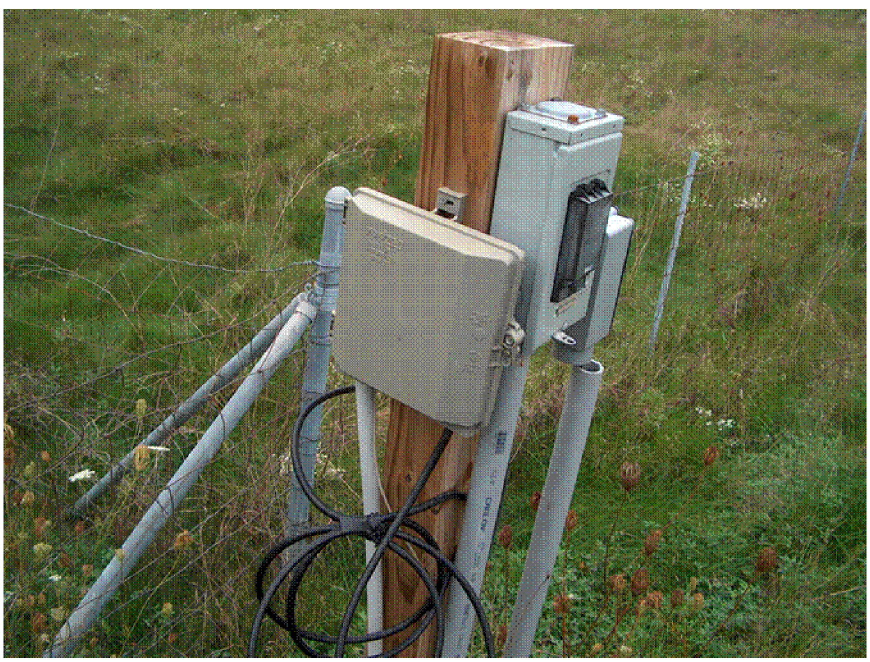

**Photo 4 26_0100_Telephone_Service_Box_10_02_07.jpg**

**Photo 5 26_0100_Cabinet_Exterior_10_02_07 011.jpg**

**Photo 6 26_0100_Cabinet_Interior_10_02_07.jpg**

**Photo 7 26_0100_Leading_WIM_Sensor_10_02_07.jpg**

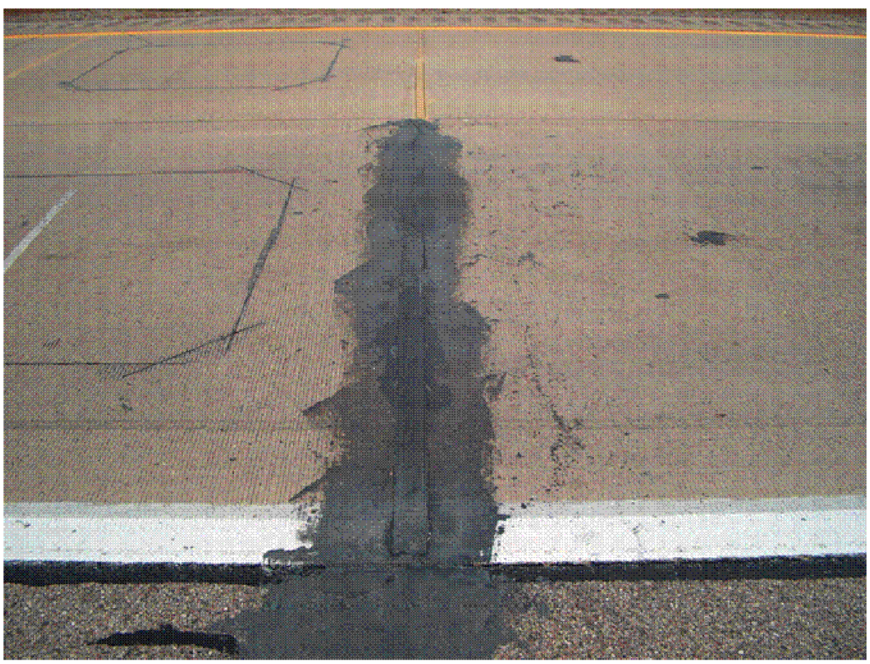

**Photo 8 26_0100_Trailing_WIM_Sensor_10_02_07.jpg**

**Photo 9 26_0100_WIM_site_10_02_07.jpg**

**Photo 10 26_0100_Loop_Sensor_10_02_07.jpg**

| SHEET 18 | STATE CODE [ _2_6_ ] |
|---|---|
| LTPP MONITORED TRAFFIC DATA | SPS PROJECT ID [ _0_1_0_0_ ] |
| WIM SITE COORDINATION | DATE: (mm/dd/yyyy) _1_0_ / _0_3_ / _2_0 _0_7_ |

Rev. 05/25/04

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

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

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

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

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

   c. Maintenance –
      □ Contract with purchase – Expiration Date _______
      □ Separate contract LTPP – Expiration Date _______
      □ Separate contract State – Expiration Date _______
      X State personnel

   d. Calibration –
      □ Vendor
      □ State
      X LTPP

   e. Manuals and software control –
      X State
      □ LTPP

   f. Power –
      i. Type –
         □ Overhead
         X Underground
         □ Solar
      ii. Payment –
         X State
         □ LTPP
         □ N/A

g. Communication –
  i. Type –
    X Landline
    □ Cellular
    □ Other
  ii. Payment –
    X State
    □ LTPP
    □ N/A

3. PAVEMENT –
  a. Type –
    X Portland Concrete Cement
    □ Asphalt Concrete

  b. Allowable rehabilitation activities –
    □ Always new
    □ Replacement as needed
    □ Grinding and maintenance as needed
    X Maintenance only
    □ No remediation

  c. Profiling Site Markings –
    □ Permanent
    X Temporary

4. ON SITE ACTIVITIES –
  a. WIM Validation Check - advance notice required ___2___ □ days X weeks

  b. Notice for straightedge and grinding check - ___2___ □ days X weeks
    i. On site lead –
      X State
      □ LTPP

    ii. Accept grinding –
      X State
      □ LTPP

  c. Authorization to calibrate site –
      □ State only
      X LTPP

  d. Calibration Routine –
      X LTPP – X Semi-annually □ Annually
      □ State per LTPP protocol – □ Semi-annually □ Annually
      □ State other – ___________________________

e. Test Vehicles
   i. Trucks –
      1st – Air suspension 3S2 ☐ State X LTPP
      2nd – __3S2__________ ☐ State X LTPP
      3rd – ________________ ☐ State ☐ LTPP
      4th – ________________ ☐ State ☐ LTPP
   ii. Loads – ☐ State X LTPP
   iii. Drivers – ☐ State X LTPP

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

______________________________________________________________________

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

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

i. Traffic Control Required – ☐Yes X No

j. Enforcement Coordination Required – ☐Yes X No

5. SITE SPECIFIC CONDITIONS –
   a. Funds and accountability – ________________________________________
   b. Reports – ________________________________________________________
   c. Other – _________________________________________________________
   d. Special Conditions – ______________________________________________

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

      Name: __Jim Kramer_____________ Phone: _517-322-1736____

      Agency: ___Michigan DOT__________________________

b. Maintenance (equipment) –

Name: __Jim Kramer____________ Phone: _517-322-1736____

Agency: ___Michigan DOT___________________________

c. Data Processing and Pre-Visit Data –

Name: __Jim Kramer____________ Phone: _517-322-1736____

Agency: ___Michigan DOT___________________________

d. Construction schedule and verification –

Name: _________________________ Phone: __________________

Agency: ____________________________________________

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

Name: ___Brian Hitchcock_______ Phone: _517-521-2124____

Agency: ___MBH Trucking LLC______________________

f. Traffic Control –

Name: _________________________ Phone: __________________

Agency: ____________________________________________

g. Enforcement Coordination –

Name: _________________________ Phone: __________________

Agency: ____________________________________________

h. Nearest Static Scale

Name:_Don's Windmill Truck Stop_ Location: _I-96 Exit 98A, I-69 Exit 70__

Phone: __517-646-6752__________________________________

| SHEET 16<br>LTPP MONITORED TRAFFIC DATA<br>SITE CALIBRATION SUMMARY | *STATE ASSIGNED ID [ __ __317 __ __ ]<br>*STATE CODE [ 26 ]<br>*SHRP SECTION ID [ 0100] |
|---|---|

SITE CALIBRATION INFORMATION

1. * DATE OF CALIBRATION (MONTH/DAY/YEAR) [ 10/2/2007]

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

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

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

5. EQUIPMENT MANUFACTURER ___IRD/ PAT Traffic___

WIM SYSTEM CALIBRATION SPECIFICS**

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

___ NUMBER OF TRUCKS COMPARED __ 2 __ NUMBER OF TEST TRUCKS USED

__ 20 __ PASSES PER TRUCK

| | TRUCK | TYPE | SUSPENSION |
|---|---|---|---|
| TYPE PER FHWA 13 BIN SYSTEM | 1 | 9 | 1 |
| SUSPENSION: 1 - AIR; 2 - LEAF SPRING | 2 | 9 | 1 |
| 3 - OTHER (DESCRIBE) | 3 | | |

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

| | | | |
|---|---|---|---|
| DYNAMIC AND STATIC GVW | -10.8 | STANDARD DEVIATION | 2.1 |
| DYNAMIC AND STATIC SINGLE AXLES | -7.3 | STANDARD DEVIATION | 3.1 |
| DYNAMIC AND STATIC DOUBLE AXLES | -11.4 | STANDARD DEVIATION | 3.4 |

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

9. DEFINE THE SPEED RANGES USED (MPH) ______ _50_ __60__ __70_ ____ __ __ ______ ______

10. CALIBRATION FACTOR (AT EXPECTED FREE FLOW SPEED) ___1044___

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

CLASSIFIER TEST SPECIFICS***

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

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

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

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

| SHEET 16<br>LTPP MONITORED TRAFFIC DATA<br>SITE CALIBRATION SUMMARY | *STATE ASSIGNED ID [ __ __317 __ __ ]<br>*STATE CODE [ 26 ]<br>*SHRP SECTION ID [ 0100] |
|---|---|

SITE CALIBRATION INFORMATION

1. * DATE OF CALIBRATION (MONTH/DAY/YEAR) [ 10/3/2007]

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

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

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

5. EQUIPMENT MANUFACTURER ___IRD/ PAT Traffic___

WIM SYSTEM CALIBRATION SPECIFICS**

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

___ NUMBER OF TRUCKS COMPARED __2__ NUMBER OF TEST TRUCKS USED

__20__ PASSES PER TRUCK

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

| TRUCK | TYPE | SUSPENSION |
|---|---|---|
| 1 | 9 | 1 |
| 2 | 9 | 1 |
| 3 | | |

7. SUMMARY CALIBRATION RESULTS (EXPRESSED AS A PERCENT)
MEAN DIFFERENCE BETWEEN ---
DYNAMIC AND STATIC GVW ___-0.5 STANDARD DEVIATION ___2.1
DYNAMIC AND STATIC SINGLE AXLES ___5.5 STANDARD DEVIATION ___3.5
DYNAMIC AND STATIC DOUBLE AXLES ___-1.5 STANDARD DEVIATION ___3.1

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

9. DEFINE THE SPEED RANGES USED (MPH) ______ _50_ __60__ __70_ ______ ______ ______
______ ______ ______ ______ ______ ______ ______ ______ ______ ______

10. CALIBRATION FACTOR (AT EXPECTED FREE FLOW SPEED) ___1071___

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

CLASSIFIER TEST SPECIFICS***

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

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

14. MEAN DIFFERENCE IN VOLUMES BY VEHICLES CLASSIFICATION:
*** FHWA CLASS 9 ____ 2.0 FHWA CLASS ___ ____ ____ ____
*** FHWA CLASS 8 ____ 0.0 FHWA CLASS ___ ____ ____ ____
FHWA CLASS ___ ____ ____ ____
FHWA CLASS ___ ____ ____ ____
*** PERCENT "UNCLASSIFIED" VEHICLES: ____ 0.0

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

# APPENDIX A

| Sheet 19 | * STATE_CODE 26 |
|---|---|
| LTPP Traffic Data | * SPS PROJECT ID 0100 |
| *CALIBRATION TEST TRUCK # 1 | * DATE 10/2/2007 |

Rev. 08/31/01

TRUCK 16
TRAILER V12

PART I.

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

**AXLES** - units - lbs / 100s lbs / kg

**GEOMETRY**

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

9. a) * Make: PETERBILT b) * Model: ______

10.* Trailer Load Distribution Description:

PALLETIZED BAGS OF FERTILIZER LOADED EVENLY ALONG TRAILER

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

b). Trailer Tare Weight (units): ______

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

A to B 19.4 B to C 4.5 C to D 32.3

D to E 4.1 E to F ______

Wheelbase (measured A to last) ______ Computed ______

13. *Kingpin Offset From Axle B (units) + 2.0 (______)

( + is to the rear)

**SUSPENSION**

| Axle | 14. Tire Size | 15.* Suspension Description (leaf, air, no. of leaves, taper or flat leaf, etc.) |
|---|---|---|
| A | 11R22.5 | 2 FULL LEAF |
| B | 11R22.5 | AIR |
| C | 11R22.5 | AIR |
| D | 75R24.5 | AIR |
| E | 75R24.5 | AIR |
| F | | |

| Sheet 19 | * STATE_CODE 26 |
|---|---|
| LTPP Traffic Data | * SPS PROJECT ID 0100 |
| *CALIBRATION TEST TRUCK # 1 | * DATE 10/2/2007 |

Rev. 08/31/01

PART II

Day 1

vehicle refueled at 10:10 and 21.6gal 2150016

*b) Average Pre-Test Loaded weight 75007

*c) Post Test Loaded Weight 76020

*d) Difference Post Test – Pre-test +1013

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

| Pass | Axle A | Axle B | Axle C | Axle D | Axle E | Axle F | GVW |
|---|---|---|---|---|---|---|---|
| 1 | 10680 | 13800 | 13800 | 18340 | 18340 | | 74960 |
| 2 | 10680 | 13830 | 13830 | 18340 | 18340 | | 75020 |
| 3 | 10680 | 13860 | 13860 | 18320 | 18320 | | 75040 |
| Average | 10680 | 13830 | 13830 | 18333 | 18333 | | 75007 |

Table 6. Raw data – Axle scales –

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

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

| Pass | Axle A | Axle B | Axle C | Axle D | Axle E | Axle F | GVW |
|---|---|---|---|---|---|---|---|
| 1 | 11140 | 14090 | 14090 | 18350 | 18350 | | 76020 |
| 2 | 11100 | 14140 | 14140 | 18320 | 18320 | | 76020 |
| 3 | 11080 | 14150 | 14150 | 18320 | 18320 | | 76020 |
| Average | 11107 | 14127 | 14127 | 18330 | 18330 | | 76020 |

Measured By DAW Verified By Bno Weight date 10/2/2007

| Sheet 19 | * STATE_CODE | 26 |
|---|---|---|
| LTPP Traffic Data | * SPS PROJECT ID | 0100 |
| *CALIBRATION TEST TRUCK # 1a | * DATE | 10/03/07 |

Rev. 08/31/2001

truck 43
trailer V12

PART I.

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

**AXLES** - units - lbs / 100s lbs / kg

**GEOMETRY**

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

9. a) * Make: PETERBILT b) * Model: ____________

10.* Trailer Load Distribution Description:

PALLETIZED FERTILIZER BAGS LOADED EVENLY ALONG TRAILER

11. a) Tractor Tare Weight (units): ____________
b). Trailer Tare Weight (units): ____________

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

A to B 18.6 B to C 4.3 C to D 32.1

D to E 4.1 E to F ____________

Wheelbase (measured A to last) ____________ Computed ____________

13. *Kingpin Offset From Axle B (units) +2.0' (____________)
(+ is to the rear)

**SUSPENSION**

| Axle | 14. Tire Size | 15.* Suspension Description (leaf, air, no. of leaves, taper or flat leaf, etc.) |
|---|---|---|
| A | 11R22.5 | 2 FULL LEAF |
| B | 11R22.5 | AIR |
| C | 11R22.5 | AIR |
| D | 75R24.5 | AIR |
| E | 75R24.5 | AIR |
| F | | |

| Sheet 19 | * STATE_CODE 26 |
|---|---|
| LTPP Traffic Data | * SPS PROJECT ID 0100 |
| *CALIBRATION TEST TRUCK # 1 | * DATE 10/2/2007 |

Rev. 08/31/01

Day 2

7.2 *b) Average Pre-Test Loaded weight 75967

*c) Post Test Loaded Weight ~~75440~~ 75440

*d) Difference Post Test – Pre-test -527

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

| Pass | Axle A | Axle B | Axle C | Axle D | Axle E | Axle F | GVW |
|---|---|---|---|---|---|---|---|
| 1 | 10840 | 14290 | 14290 | 18260 | 18260 | | 75940 |
| 2 | 11140 | 14040 | 14040 | 18360 | 18360 | | 75940 |
| 3 | 11000 | 14180 | 14180 | 18330 | 18330 | | 76020 |
| Average | 10993 | 14170 | 14170 | 18317 | 18317 | | 75967 |

Table 6.2. Raw data – Axle scales –

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

Table 7.2 Raw data – Axle scales – post-test

| Pass | Axle A | Axle B | Axle C | Axle D | Axle E | Axle F | GVW |
|---|---|---|---|---|---|---|---|
| 1 | 10640 | 14110 | 14110 | 18290 | 18290 | | 75440 |
| 2 | | | | | | | |
| 3 | | | | | | | |
| Average | 10640 | 14110 | 14110 | 18290 | 18290 | | 75440 |

Measured By DW Verified By [illegible] Weight date 10/3/07

| Sheet 19 | * STATE_CODE 26 |
|---|---|
| LTPP Traffic Data | * SPS PROJECT ID 0100 |
| *CALIBRATION TEST TRUCK # 2 | * DATE 10/2/2007 |

Rev. 08/31/01

PART I.

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

**AXLES** - units - lbs / 100s lbs / kg

TRUCK 30

TRAILER V10

**GEOMETRY**

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

9. a) * Make: PETERBILT b) * Model: ____

10.* Trailer Load Distribution Description:

PALLETIZED BAGS OF FERTILIZER LOADED EVENLY ALONG TRAILER

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

b). Trailer Tare Weight (units): ____

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

A to B 17.4 B to C 4.3 C to D 32.4

D to E 4.1 E to F ____

Wheelbase (measured A to last) ____ Computed ____

13. *Kingpin Offset From Axle B (units) + 2.2 (____)__

( + is to the rear)

**SUSPENSION**

| Axle | 14. Tire Size | 15.* Suspension Description (leaf, air, no. of leaves, taper or flat leaf, etc.) |
|---|---|---|
| A | 75R24.5 | 2 FULL LEAF |
| B | 75R24.5 | AIR |
| C | 75R24.5 | AIR |
| D | 75R24.5 | AIR |
| E | 75R24.5 | AIR |
| F | | |

| Sheet 19 | * STATE_CODE 26 |
|---|---|
| LTPP Traffic Data | * SPS PROJECT ID 0100 |
| *CALIBRATION TEST TRUCK # 2 | * DATE 10/2/2007 |

Rev. 08/31/01

PART II

Day 1

*b) Average Pre-Test Loaded weight ~~64920~~ 64950 bko
*c) Post Test Loaded Weight 64660
*d) Difference Post Test – Pre-test - 320

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

| Pass | Axle A | Axle B | Axle C | Axle D | Axle E | Axle F | GVW |
|---|---|---|---|---|---|---|---|
| 1 | 10860 | 12210 | 12210 | 14860 | 14860 | | 65000 |
| 2 | 10820 | 12230 | 12230 | 14860 | 14860 | | 65000 |
| 3 | 10800 | 12220 | 12220 | 14850 | 14850 | | 64940 |
| Average | ~~10767~~ 10827 bko | 12220 | 12220 | 14857 | 14857 | | ~~64920~~ 64950 bko |

Table 6. Raw data – Axle scales – post test

| Pass | Axle A | Axle B | Axle C | Axle D | Axle E | Axle F | GVW |
|---|---|---|---|---|---|---|---|
| 1 | 10740 | ~~2420~~ 12100 | 12100 | 14860 | 14860 | | 64660 |
| 2 | | | | | | | |
| 3 | | | | | | | |
| Average | 10740 | 12100 | 12100 | 14860 | 14860 | | 64660 |

Table 7. Raw data – Axle scales – ~~post-test~~ wrong truck

| Pass | Axle A | Axle B | Axle C | Axle D | Axle E | Axle F | GVW |
|---|---|---|---|---|---|---|---|
| 1 | ~~11140~~ | ~~14090~~ | ~~14090~~ | ~~18350~~ | ~~18350~~ | | ~~76020~~ |
| 2 | ~~11100~~ | ~~14140~~ | ~~14140~~ | ~~18320~~ | ~~18320~~ | | ~~76020~~ |
| 3 | ~~11080~~ | ~~14150~~ | ~~14150~~ | ~~18320~~ | ~~18320~~ | | ~~76020~~ |
| Average | ~~11107~~ | ~~14127~~ | ~~14127~~ | ~~18330~~ | ~~18330~~ | | ~~76020~~ |

wrong truck bko

Measured By bko Verified By ________________ Weight date 10/2/2007

| | |
|---|---|
| Sheet 19 | * STATE_CODE 26 |
| LTPP Traffic Data | * SPS PROJECT ID 0100 |
| *CALIBRATION TEST TRUCK # 2 | * DATE 10/2/2007 |

Rev. 08/31/01

Day 2

7.2 *b) Average Pre-Test Loaded weight 65627
*c) Post Test Loaded Weight 65160
*d) Difference Post Test – Pre-test -467

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

| Pass | Axle A | Axle B | Axle C | Axle D | Axle E | Axle F | GVW |
|---|---|---|---|---|---|---|---|
| 1 | 11280 | 12310 | 12310 | 14870 | 14870 | | 65640 |
| 2 | 11300 | 12270 | 12270 | 14900 | 14900 | | 65640 |
| 3 | 11120 | 12390 | 12390 | 14850 | 14850 | | 65600 |
| Average | 11233 | 12323 | 12323 | 14873 | 14873 | | 65627 |

Table 6.2. Raw data – Axle scales –

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

Table 7.2 Raw data – Axle scales – post-test

| Pass | Axle A | Axle B | Axle C | Axle D | Axle E | Axle F | GVW |
|---|---|---|---|---|---|---|---|
| 1 | ~~10614~~ 10900 | 12300 | 12300 | 14830 | 14830 | | 65160 |
| 2 | | | | | | | |
| 3 | | | | | | | |
| Average | 10900 | 12300 | 12300 | 14830 | 14830 | | 65160 |

Measured By DJW Verified By KWD Weight date 10/3/07

| Sheet 20 | * STATE_CODE 26 |
|---|---|
| LTPP Traffic Data | *SPS PROJECT_ID 0100 |
| Speed and Classification Checks * 1 of* 2 | * DATE 10 / 02 / 2007 |

Rev. 08/31/2001

| WIM speed | WIM class | WIM Record | Obs. Speed | Obs Class | WIM speed | WIM class | WIM Record | Obs. Speed | Obs Class |
|---|---|---|---|---|---|---|---|---|---|
| 63 | 9 | 7351 | 62 | 9 | 60 | 5 | 9677 | 61 | 5 |
| ~~60~~ | no record | ~~no Rcd~~ | ~~60~~ | ~~9~~ | 60 | 9 | 9679 | 60 | 9 |
| 61 | 12 | 7534 | 61 | 12 | 57 | 9 | 9686 | 60 | 9 |
| 61 | 9 | 7549 | 61 | 9 | 57 | 9 | 9714 | 58 | 9 |
| | | ~~7566~~ | | | 57 | 9 | 9725 | 59 | 9 |
| 57 | 9 | 9372 | 57 | 9 | 60 | 9 | 9727 | 61 | 9 |
| 54 | 13 | 9304 | 54 | 13 | 57 | 5 | 9738 | 58 | 5 |
| 58 | 9 | 9480 | 58 | 9 | 66 | 5 | 9773 | 66 | 5 |
| 62 | 9 | 9414 | 63 | 9 | 59 | 9 | 9794 | 60 | 9 |
| 55 | 9 | 9460 | 54 | 9 | 63 | 5 | 9815 | 64 | 5 |
| 62 | 8 | 9473 | 63 | 8 | 62 | 9 | 9839 | 63 | 9 |
| 59 | 9 | 9481 | 61 | 9 | 56 | 5 | 9851 | 54 | 5 |
| 59 | 9 | 9501 | 59 | 9 | 58 | 9 | 9869 | 60 | 9 |
| 58 | 9 | 9504 ~~9501~~ | 58 | 9 | 62 | 5 | 9873 | 62 | 5 |
| 60 | 9 | 9507 | 61 | 9 | 59 | 9 | 9887 | 60 | 9 |
| 64 | 9 | 9512 | 65 | 9 | 58 | 9 | 9890 | 59 | 9 |
| 73 | 5 | 9519 | 73 | 5 | 61 | 9 | 9895 | 60 | 9 |
| 61 | 9 | 9536 | 62 | 9 | 65 | 15 | 9946 | 63 | 5 pickup & trailer |
| 56 | 9 | 9558 | 56 | 9 | 62 | 10 | 9947 | 63 | 10 |
| 68 | 9 | 9562 | 69 | 9 | 68 | 9 | 9963 | 68 | 9 |
| 57 | 9 | 9581 | 58 | 9 | 69 | 5 | 10031 | 70 | 5 |
| 60 | 13 | 9586 | 60 | 10 Darle vell | 58 | 9 | 10069 | 57 | 9 |
| 60 | 9 | 9612 | 59 | 9 | 60 | 9 | 10077 | 62 | 9 |
| 66 | 5 | 9645 | 68 | 5 | 62 | 6 | 10079 | 63 | 6 |
| 59 | 9 | 9659 | 60 | 9 | 65 | 9 | 10091 | 66 | 9 |

Recorded by BWOstrom - J Kramer Direction S Lane 4 Time from ~~12:40~~ 14:40 to 16:15

6420070022_SPSWIM_TO_22_26_2.96_0100_Pre-Validation_Sheet_20.doc

| Sheet 20 | * STATE_CODE 26 |
| --- | --- |
| LTPP Traffic Data | *SPS PROJECT_ID 0100 |
| Speed and Classification Checks * 2 of* 2 | * DATE 10 / 02 / 2007 |

Rev. 08/31/2001

| WIM speed | WIM class | WIM Record | Obs. Speed | Obs Class | WIM speed | WIM class | WIM Record | Obs. Speed | Obs Class |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 65 | 9 | 10104 | 65 | 9 | 63 | 9 | 10454 | 64 | 9 |
| 65 | 10 | 10134 | 65 | 10 | 59 | 5 | 10494 | 60 | 5 |
| 64 | 9 | 10136 | 64 | 9 | 59 | 9 | 10502 | 60 | 9 |
| 62 | 8 | 10143 | 62 | 8 | 23 ? | 15 | 10522 | 60 | 7 |
| 63 | 9 | 10166 | 64 | 9 | 53 | ~~8~~ 10 | 10525 | 60 | 10 |
| 60 | 9 | 10182 | 60 | 9 | 62 | 9 | 10534 | 64 | 9 |
| 71 | 5 | 10204 | 71 | 5 | 55 | 9 | 10570 | 55 | 9 |
| 62 | 8 | 10225 | 62 | 8 | 61 | 5 | 10589 | 61 | 4 |
| 63 | 9 | 10235 | 63 | 9 | 62 | 9 | 10600 | | 9 |
| 62 | 9 | 10248 | 62 | 9 | 68 | 5 | 10614 | 68 | 5 |
| 62 | 9 | 10262 | 62 | 9 | 58 | 5 | 10631 | 61 | 5 |
| 58 | 9 | 10264 | 62 | 9 | 56 | 5 | 10656 | 58 | 5 |
| 68 | 5 | 10301 | 68 | 5 | 57 | 10 | 10664 | 59 | 10 |
| 61 | 9 | 10307 | 61 | 9 | 60 | 5 | 10675 | 61 | 5 |
| 61 | 9 | 10313 | 62 | 9 | 63 | 9 | 10752 | 65 | 9 |
| 65 | 9 | 10340 | 65 | 9 | 60 | 9 | 10755 | 63 | 9 |
| 59 | 9 | 10343 | 60 | 9 | 63 | 10 | 10778 | 63 | 10 |
| 64 | 9 | 10359 | 64 | 9 | 57 | 5 | 10820 | 58 | 5 |
| 56 | 9 | 10377 | 56 | 9 | 61 | 5 | 10868 | 61 | 4 |
| 60 | 9 | 10379 | 61 | 9 | 58 | 10 | 10890 | 58 | 10 |
| 59 | 9 | 10416 | 61 | 9 | 63 | 5 | 10897 | 63 | 4 |
| 61 | 9 | 10417 | 62 | 9 | 64 | 5 | 10938 | 64 | 5 |
| 57 | 10 | 10428 | 57 | 10 | 56 | 12 | 10957 | 56 | 12 |
| 64 | 5 | 10434 | 65 | 5 | 61 | 9 | 10981 | 61 | 9 |
| 65 | 5 | 10446 | 65 | 5 | 54 | 9 | 10997 | 54 | 9 |

cramer very large tires

Recorded by J Kramer Direction S Lane 4 Time from 14:40 to 16:15

5/4 problems length or weight based

| Sheet 20 | * STATE_CODE 26 |
|---|---|
| LTPP Traffic Data | *SPS PROJECT_ID 0100 |
| Speed and Classification Checks * 2 of* 2 | * DATE 10 / 03 / 2007 |

Rev. 08/31/2001

| WIM speed | WIM class | WIM Record | Obs. Speed | Obs Class | WIM speed | WIM class | WIM Record | Obs. Speed | Obs Class |
|---|---|---|---|---|---|---|---|---|---|
| 68 | 9 | 10641 | 70 | 9 | 63 | 9 | 11078 | 64 | 9 |
| 70 | 4 | 10692 | 70 | 4 | 62 | 10 | 11098 | 63 | 10 |
| 63 | 9 | 10703 | 63 | 9 | 64 | 9 | 11114 | 64 | 9 |
| 64 | 9 | 10714 | 64 | 9 | 63 | 8 | 11118 | 63 | 8 |
| 59 | 9 | 10727 | 60 | 9 | 62 | 9 | 11120 | 63 | 9 |
| 64 | 13 | 10730 | 65 | 13 | 67 | 9 | 11225 | 67 | 9 |
| 60 | 9 | 10744 | 60 | 9 | 58 | 6 | 11252 | 59 | 6 |
| 59 | 9 | 10759 | 59 | 9 | 59 | 6 | 11287 | 59 | 6 |
| 59 | 8 | 10782 | 58 | 8 | 56 | 5 | 11300 | 57 | 5 |
| 67 | 5 | 10795 | 67 | 5 | 62 | 10 | 11312 | 62 | 10 |
| 61 | 9 | 10827 | 62 | 9 | 62 | 9 | 11352 | 63 | 9 |
| 59 | 13 | 10845 | 58 | 10 | 59 | 9 | 11359 | 60 | 9 |
| 63 | 13 | 10868 | 63 | 13 | 60 | 9 | 11367 | 61 | 9 |
| 59 | 6 | 10883 | 59 | 6 | 66 | 9 | 11371 | 66 | 9 |
| 59 | 5 | 10884 | 59 | 5 | 59 | 9 | 11413 | 60 | 9 |
| 70 | 5 | 10918 | 70 | 5 | 61 | 5 | 11415 | 62 | 5 |
| 61 | 9 | 10951 | 62 | 9 | 59 | 9 | 11425 | 60 | 9 |
| 71 | 5 | 10960 | 71 | 5 | 60 | 5 | 11438 | 61 | 5 |
| 69 | 5 | 10965 | 69 | 5 | 54 | 9 | 11474 | 56 | 9 |
| 70 | 5 | 10981 | 70 | 5 | 61 | 9 | 11513 | 62 | 9 |
| 57 | 9 | 11026 | 57 | 9 | 59 | 5 | 11517 | 60 | 5 |
| 61 | 9 | 11036 | 61 | 9 | 60 | 5 | 11536 | 61 | 5 |
| 63 | 9 | 11059 | 63 | 9 | 63 | 5 | 11569 | 62 | 5 |
| 62 | 9 | 11068 | 63 | 9 | 63 | 5 | 11582 | 63 | 5 |
| 63 | 6 | 11073 | 65 | 6 | 62 | 9 | 11589 | 62 | 9 |

Recorded by JK Direction S Lane 4 Time from 7:35 to 4:14

| Sheet 20 | * STATE_CODE 26 |
|---|---|
| LTPP Traffic Data | *SPS PROJECT_ID 0100 |
| Speed and Classification Checks * 1 of* 2 | * DATE 10 / 03 / 2007 |

Rev. 08/31/2001

| WIM speed | WIM class | WIM Record | Obs. Speed | Obs Class | WIM speed | WIM class | WIM Record | Obs. Speed | Obs Class |
|---|---|---|---|---|---|---|---|---|---|
| 63 | 9 | 9750 | 63 | 9 | 58 | 9 | 10253 | 59 | 9 |
| 63 | 9 | 9780 | 63 | 9 | 59 | 5 | 10294 | 59 | 4 |
| 62 | 9 | 9781 | 63 | 9 | 61 | 9 | 10315 | 62 | 9 |
| 65 | 9 | 9790 | 66 | 9 | 63 | 5 | 10320 | 62 | 5 |
| 72 | 5 | 9792 | 72 | 5 | 60 | 9 | 10322 | 63 | 9 |
| 61 | 13 | 9919 | 63 | 13 | 59 | 5 | 10328 | 59 | 5 |
| 58 | 9 | 9926 | 59 | 9 | 58 | 9 | 10333 | 58 | 9 |
| 59 | 10 | 9929 | 59 | 10 | 56 | 9 | 10401 | 57 | 9 |
| 65 | 9 | 9946 | 65 | 9 | 58 | 9 | 10416 | 57 | 9 |
| 63 | 9 | 9947 | 63 | 9 | 65 | 9 | 10421 | 65 | 9 |
| 65 | 5 | 9976 | 65 | 5 | 49 | 5 | 10458 | 48 | 5 |
| 58 | 8 | 10002 | 60 | 8 | 60 | 9 | 10462 | 61 | 9 |
| 57 | 9 | 10038 | 57 | 9 | 68 | 5 | 10470 | 68 | 5 |
| 59 | 9 | 10037 | 59 | 9 | 63 | 9 | 10515 | 63 | 9 |
| 61 | 8 | 10046 | 61 | 8 | 57 | 10 | 10534 | 58 | 10 |
| 59 | 10 | 10079 | 59 | 10 | 66 | 6 | 10552 | 66 | 6 |
| 60 | 13 | 10092 | 60 | 13 | 63 | 5 | 10556 | 63 | 5 |
| 63 | 10 | 10109 | 62 | 10 | 54 | 9 | 10562 | 54 | 9 |
| 61 | 9 | 10112 | 63 | 9 | 63 | 5 | 10568 | 63 | 5 |
| 54 | 9 | 10118 | 54 | 9 | 61 | 9 | 10573 | 61 | 9 |
| 59 | 13 | 10151 | 59 | 13 | 60 | 5 | 10576 | 60 | 5 |
| 67 | 9 | 10169 | 68 | 9 | 58 | 9 | 10584 | 61 | 9 |
| 56 | 9 | 10188 | 55 | 9 | 61 | 9 | 10598 | 61 | 9 |
| 58 | 10 | 10224 | 58 | 10 | 59 | 6 | 10621 | 59 | 6 |
| 62 | 9 | 10241 | 61 | 9 | 58 | 5 | 10636 | 59 | 5 |

Recorded by JK Direction S Lane 4 Time from 2:35 to 4:14

| Sheet 21 | * STATE_CODE 26 |
|---|---|
| LTPP Traffic Data | *SPS PROJECT_ID 0100 |
| WIM System Test Truck Records 1 of | * DATE 10/ 02 /2007 |

Rev. 08/31/2001

| Pvmt temp | Radar Speed | Truck | Pass | Time | Record No. | WIM Speed | Axle A weight. | Axle B weight. | Axle C weight. | Axle D weight. | Axle E weight. | Axle F weight | GVW | A-B space | B-C space | C-D space | D-E space | E-F space |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 64 | 50 | 2 | 1 | 9:41 | 4339 | 51 | 9.7 | 11.6 | 10.7 | 13.6 | 14.6 | | 60.2 | 17.4 | 4.3 | 32.3 | 4.0 | |
| 64 | 51 | 1 | 1 | 9:42 | 4368 | 50 | 9.9 | 13.0 | 11.8 | 16.8 | 15.9 | | 67.5 | 19.3 | 4.4 | 31.9 | 4.1 | |
| 63.5 | 59 | 2 | 2 | 9:53 | 4521 | 58 | 10.0 | 11.4 | 10.6 | 13.0 | 11.9 | | 56.9 | 17.4 | 4.3 | 32.3 | 4.0 | |
| 63.5 | 61 | 1 | 2 | 9:54 | 4536 | 59 | 10.3 | 11.9 | 11.8 | 16.4 | 16.5 | | 66.9 | 19.4 | 4.5 | 32.0 | 4.0 | |
| 64.5 | 65 | 2 | 3 | 10:04 | 4671 | 65 | 9.8 | 10.8 | 11.1 | 12.3 | 12.6 | | 56.6 | 17.4 | 4.3 | 32.3 | 4.0 | |
| 64.5 | 68 | 1 | 3 | 10:05 | 4682 | 68 | 10.2 | 13.3 | 12.6 | 16.2 | 16.0 | | 68.3 | 19.3 | 4.5 | 31.9 | 4.0 | |
| 65 | 51 | 2 | 4 | 10:14 | 4842 | 52 | 9.9 | 10.9 | 11.1 | 13.6 | 13.7 | | 59.1 | ~~9.9~~ 17.5 | 4.3 | 32.4 | 4.0 | |
| 65 | 51 | 1 | 4 | 10:15 | 4853 | 51 | 9.9 | 13.2 | 11.7 | 17.3 | 16.3 | | 68.4 | 19.4 | 4.5 | 32.0 | 4.0 | |
| 64.5 | 62 | 2 | 5 | 10:26 | 5006 | 62 | 10.2 | 11.1 | 10.7 | 12.5 | 12.8 | | 57.3 | 17.4 | 4.3 | 32.3 | 4.0 | |
| 64.5 | 59 | 1 | 5 | 10:27 | 5012 | 59 | 9.8 | 12.6 | 12.0 | 16.0 | 15.2 | | 65.6 | 19.4 | 4.4 | 32.1 | 4.0 | |
| 65.5 | 65 | 2 | 6 | 10:36 | 5178 | 66 | 9.8 | 10.9 | 10.8 | 12.6 | 12.4 | | 56.5 | 17.5 | 4.3 | 32.4 | 4.0 | |
| 65.5 | 66 | 1 | 6 | 10:37 | 5181 | 68 | 10.1 | 13.6 | 12.7 | 15.9 | 16.1 | | 68.4 | 19.4 | 4.4 | 32.0 | 4.0 | |
| 65.0 | 51 | 2 | 7 | 10:57 | 5482 | 51 | 9.6 | 10.7 | 10.5 | 12.8 | 13.3 | | 56.9 | 17.4 | 4.3 | 32.2 | 4.0 | |
| 65.0 | 50 | 1 | 7 | 10:57 | 5485 | 50 | 9.3 | 13.6 | 12.1 | 16.7 | 16.2 | | 68.4 | 19.3 | 4.5 | 32.0 | 4.0 | |
| 64.5 | 61 | 2 | 8 | 11:08 | 5654 | 61 | 10.6 | 10.6 | 10.1 | 13.5 | 13.9 | | 58.7 | 17.5 | 4.4 | 32.4 | 4.1 | |
| 64.5 | 58 | 1 | 8 | 11:09 | 5671 | 58 | 9.6 | 11.3 | 11.8 | 15.2 | 15.7 | | 63.6 | 19.3 | 4.5 | 32.0 | 4.0 | |

Recorded by Djw　　　　Checked by ____________

| Sheet 21 | * STATE_CODE 26 |
|---|---|
| LTPP Traffic Data | *SPS PROJECT_ID 0100 |
| WIM System Test Truck Records 2 of 3 | * DATE 10 / 0 2 / 2007 |

Rev. 08/31/2001

| Pvmt temp | Radar Speed | Truck | Pass | Time | Record No. | WIM Speed | Axle A weight. | Axle B weight. | Axle C weight. | Axle D weight. | Axle E weight. | Axle F weight | GVW | A-B space | B-C space | C-D space | D-E space | E-F space |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 67.5 | 65 | 2 | 9 | 11:19 | 5810 | 66 | 10.0 | 10.4 | 11.3 | 12.7 | 12.4 | | ~~7~~ 57.0 | 17.5 | 4.3 | 32.4 | 4.0 | |
| 67.5 | 65 | 1 | 9 | 11:19 | 5821 | 64 | 10.1 | 13.8 | 12.3 | 16.4 | 16.1 | | 68.7 | 19.4 | 4.4 | 32.0 | 4.0 | |
| 71.5 | 50 | 2 | 10 | 11:32 | 6032 | 50 | 9.7 | 10.6 | 10.8 | 14.1 | 13.0 | | 58.2 | 17.4 | 4.3 | 32.3 | 4.0 | |
| 71.5 | 49 | 1 | 10 | 11:33 | 6043 | 50 | 9.3 | 10.8 | 12.1 | 16.0 | 15.9 | | 64.1 | 19.4 | 4.5 | 31.9 | 4.0 | |
| 72 | 60 | 2 | 11 | 12:58 | 7444 | 60 | 10.1 | 10.1 | 10.4 | 13.0 | 13.6 | | 57.2 | 17.4 | 4.3 | 32.3 | 4.0 | |
| 72 | 58 | 1 | 11 | 12:58 | 7449 | 58 | 10.3 | 12.3 | 12.2 | 16.2 | 16.1 | | 67.1 | 19.3 | 4.4 | 31.9 | 4.0 | |
| 72 | 66 | 2 | 12 | 13:09 | 7626 | 67 | 9.3 | 11.4 | 10.8 | 12.6 | 12.3 | | 56.3 | 17.5 | 4.3 | 32.3 | 4.0 | |
| 72 | 64 | 1 | 12 | 13:09 | 7639 | 64 | 10.9 | 12.4 | 12.0 | 15.8 | 15.8 | | 66.8 | 19.3 | 4.4 | 31.9 | 4.0 | |
| 74 | 51 | 2 | 13 | 13:19 | 7779 | 51 | 9.8 | 11.3 | 10.7 | 12.8 | 13.8 | | 58.2 | 17.5 | 4.3 | 32.4 | 4.0 | |
| 74 | 51 | 1 | 13 | 13:19 | 7782 | 52 | 9.9 | 14.1 | 12.3 | 15.4 | 15.2 | | 66.9 | 19.4 | 4.5 | 31.9 | 4.0 | |
| 82 | 60 | 2 | 14 | 13:29 | 7935 | 61 | 10.1 | 10.9 | 11.3 | 12.5 | 12.8 | | 57.7 | 17.4 | 4.3 | 32.3 | 4.0 | |
| 82 | 58 | 1 | 14 | 13:30 | 7951 | 58 | 10.4 | 10.3 | 12.9 | 16.5 | 16.0 | | 66.1 | 19.4 | 4.4 | 32.0 | 4.0 | |
| 78 | 62 | 2 | 15 | 13:40 | 8121 | 62 | 9.9 | 10.5 | 10.6 | 12.8 | 12.6 | | 56.4 | 17.4 | 4.3 | 32.2 | 4.0 | |
| 78 | 49 | 1 | 15 | 13:40 | 8129 | 49 | 10.1 | 12.8 | 12.2 | 16.7 | 16.2 | | 68.0 | 19.4 | 4.5 | 31.9 | 4.0 | |
| 77.5 | 50 | 2 | 16 | 13:51 | 8313 | 50 | 10.1 | 10.8 | 10.6 | 14.3 | 14.5 | | 60.9 | 17.5 | 4.3 | 32.3 | 4.1 | |
| 77.5 | 61 | 1 | 16 | 13:52 | 8332 | 60 | 10.3 | 13.4 | 12.7 | 16.0 | 15.0 | | 67.5 | 19.4 | 4.4 | 31.9 | 4.0 | |

Recorded by DJW Checked by ____________

| Sheet 21 | * STATE_CODE 26 |
| --- | --- |
| LTPP Traffic Data | *SPS PROJECT_ID 0100 |
| WIM System Test Truck Records 3 of 3 | * DATE 10 / 02 / 2007 |

Rev. 08/31/2001

| Pvmt temp | Radar Speed | Truck | Pass | Time | Record No. | WIM Speed | Axle A weight. | Axle B weight. | Axle C weight. | Axle D weight. | Axle E weight. | Axle F weight | GVW | A-B space | B-C space | C-D space | D-E space | E-F space |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 77.5 | 61 | 2 | 17 | 14:03 | 8522 | 61 | 10.4 | 10.4 | 10.5 | 13.2 | 13.0 | | 57.5 | 17.5 | 4.3 | 32.3 | 4.0 | |
| 77.5 | 65 | 1 | 17 | 14:04 | 8526 | 65 | 10.6 | 11.9 | 12.7 | 16.0 | 15.4 | | 66.5 | 19.5 | 4.4 | 31.9 | 4.0 | |
| 88 | 66 | 2 | 18 | 14:13 | 8681 | 67 | 10.0 | 10.7 | 10.9 | 12.7 | 12.7 | | 56.9 | 17.5 | 4.3 | 32.2 | 4.0 | |
| 88 | 50 | 1 | 18 | 14:13 | 8686 | 50 | 10.1 | 12.6 | 13.0 | 16.2 | 16.3 | | 68.2 | 19.4 | 4.4 | 32.0 | 4.0 | |
| 81 | 51 | 2 | 19 | 14:24 | 8855 | 51 | 10.2 | 10.8 | 10.8 | 13.6 | 14.5 | | 59.9 | 17.5 | 4.3 | 32.3 | 4.0 | |
| 81 | 67 | 1 | 19 | 14:25 | 8869 | 67 | 10.7 | 13.5 | 12.6 | 16.3 | 15.7 | | 68.8 | 19.4 | 4.4 | 31.9 | 4.0 | |
| 96.5 | 61 | 2 | 20 | 14:41 | 9152 | 61 | 10.2 | 10.7 | 10.6 | 13.2 | 13.5 | | 58.2 | 17.4 | 4.3 | 32.2 | 4.0 | |
| 96.5 | 51 | 1 | 20 | 14:41 | 9155 | 50 | 10.2 | 14.1 | 12.6 | 17.0 | 17.1 | | 70.9 | 19.3 | 4.5 | 31.9 | 4.0 | |

Recorded by DAW

Checked by

| Sheet 21 | * STATE_CODE 26 |
|---|---|
| LTPP Traffic Data | *SPS PROJECT_ID 0100 |
| WIM System Test Truck Records 1 of 1 | * DATE 10/03/2007 |

Rev. 08/31/2001

| Pvmt temp | Radar Speed | Truck | Pass | Time | Record No. | WIM Speed | Axle A weight. | Axle B weight. | Axle C weight. | Axle D weight. | Axle E weight. | Axle F weight | GVW | A-B space | B-C space | C-D space | D-E space | E-F space |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 62.5 | 52 | 2 | ~~X~~ 1 | 9:09 | 4014 | 52 | 10.9 | 12.5 | 12.0 | 14.7 | 14.0 | | 64.1 | 17.4 | 4.3 | 32.3 | 4.1 | |
| 62.5 | 49 | 1 | 1 | 9:10 | 4017 | 49 | 11.4 | 14.0 | 13.0 | 18.7 | 18.2 | | 75.3 | 18.6 | 4.3 | 32.0 | 4.0 | |
| 63.5 | 60 | 2 | 2 | 9:20 | 4169 | 60 | 11.7 | 12.1 | 12.1 | 14.7 | 15.6 | | 66.1 | 17.5 | 4.3 | 32.4 | 4.0 | |
| 63.5 | 60 | 1 | 2 | 9:20 | 4170 | 60 | 11.7 | 14.4 | 14.0 | 17.3 | 17.1 | | 74.5 | 18.6 | 4.3 | 32.0 | 4.0 | |
| 64 | 67 | 2 | 3 | 9:29 | 4324 | 67 | 11.7 | 12.8 | 11.3 | 14.3 | 14.7 | | 64.7 | 17.5 | 4.4 | 32.3 | 4.0 | |
| 64 | 69 | 1 | 3 | 9:30 | 4330 | 70 | 11.6 | 14.8 | 14.1 | 18.7 | 18.6 | | 77.7 | 18.8 | 4.3 | 32.1 | 4.1 | |
| 66.5 | 51 | 2 | 4 | 9:39 | 4479 | 52 | 11.5 | 12.6 | 12.1 | 15.1 | 14.5 | | 65.8 | 17.5 | 4.3 | 32.3 | 4.1 | |
| 66.5 | 50 | 1 | 4 | 9:39 | 4482 | 51 | 10.7 | 13.6 | 13.2 | 17.7 | 16.7 | | 71.9 | 18.7 | 4.3 | 32.0 | 4.1 | |
| 64 | 60 | 2 | 5 | 9:49 | 4615 | 61 | 11.7 | 12.2 | 12.1 | 14.1 | 14.3 | | 64.4 | 17.4 | 4.3 | 32.2 | 4.0 | |
| 64 | 58 | 1 | 5 | 9:50 | 4631 | 59 | 12.1 | 13.8 | 13.7 | 18.1 | 16.9 | | 74.6 | 18.6 | 4.3 | 31.9 | 4.0 | |
| 64 | 66 | 2 | 6 | 10:00 | 4780 | 67 | 11.9 | 11.9 | 12.4 ~~14.5~~ | 14.5 ~~14.~~ | 14.8 | | 65.5 | 17.4 | 4.3 | 32.2 | 4.0 | |
| 64 | 68 | 1 | 6 | 10:00 | 4784 | 69 | 12.0 | 14.9 | 14.3 | 18.0 | 17.4 | | 76.5 | 18.6 | 4.4 | 32.0 | 4.0 | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |

Recorded by DJW  Checked by ____________

| Sheet 21 | * STATE_CODE 26 |
|---|---|
| LTPP Traffic Data | *SPS PROJECT_ID 0100 |
| WIM System Test Truck Records 1 of 2 | * DATE 10/ 03 /2007 |

Rev. 08/31/2001

| Pvmt temp | Radar Speed | Truck | Pass | Time | Record No. | WIM Speed | Axle A weight. | Axle B weight. | Axle C weight. | Axle D weight. | Axle E weight. | Axle F weight | GVW | A-B space | B-C space | C-D space | D-E space | E-F space |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 67 | 50 | 2 | 7 | 10:11 | 4937 | 51 | 11.1 | 12.4 | 12.3 | 15.2 | 14.8 | | 65.8 | 17.4 | 4.3 | 32.3 | 4.1 | |
| 67 | 49 | 1 | 7 | 10:14 | 4985 | 49 | 11.2 | 14.1 | 13.5 | 18.3 | 18.2 | | 75.0 | 18.6 | 4.3 | 32.0 | 4.0 | |
| 70.5 | 61 | 2 | 8 | 10:23 | 5121 | 60 | 11.5 | 12.2 | 11.4 | 14.7 | 14.5 | | 64.2 | 17.4 | 4.3 | 32.2 | 4.1 | |
| 70.5 | 60 | 1 | 8 | 10:24 | 5140 | 60 | 12.2 | 14.3 | 14.2 | 17.6 | 17.2 | | 75.4 | 18.6 | 4.3 | 31.9 | 4.0 | |
| 71 | 62 | 2 | 9 | 10:34 | 5306 | 63 | 11.7 | 12.0 | 12.1 | 14.4 | 14.0 | | 64.2 | 17.5 | 4.3 | 32.3 | 4.0 | |
| 71 | 70 | 1 | 9 | 10:34 | 5309 | 70 | 11.9 | 14.1 | 13.9 | 18.3 | 18.1 | | 76.2 | 18.6 | 4.3 | 32.0 | 4.0 | |
| 67 | 51 | 2 | 10 | 10:45 | 5490 | 51 | 11.4 | 11.5 | 12.0 | 14.8 | 14.4 | | 64.0 | 17.4 | 4.3 | 32.3 | 4.1 | |
| 67 | 50 | 1 | 10 | 10:46 | 5494 | 51 | 10.6 | 13.3 | 13.2 | 17.5 | 17.1 | | 71.7 | 18.6 | 4.3 | 31.9 | 4.0 | |
| 80.5 | 61 | 2 | 11 | 10:56 | 5651 | 61 | 11.8 | 12.6 | 11.9 | 14.6 | 14.7 | | 65.7 | 17.4 | 4.3 | 32.3 | 4.0 | |
| 80.5 | 61 | 1 | 11 | 10:56 | 5660 | 61 | 11.7 | 14.6 | 14.3 | 17.9 | 17.5 | | 76.0 | 18.6 | 4.3 | 31.9 | 4.0 | |
| 74 | 66 | 2 | 12 | 11:06 | 5811 | 67 | 11.6 | 11.8 | 12.3 | 14.7 | 14.5 | | 64.9 | 17.5 | 4.3 | 32.4 | 4.0 | |
| 74 | 69 | 1 | 12 | 11:07 | 5817 | 69 | 11.5 | 14.0 | 13.7 | 17.5 | 17.1 | | 73.7 | 18.5 | 4.2 | 31.9 | 4.0 | |
| 72.5 | 51 | 2 | 13 | 11:16 | 5965 | 52 | 11.8 | 11.9 | 11.3 | 14.4 | 15.4 | | 64.7 | 17.5 | 4.3 | 32.3 | 4.0 | |
| 72.5 | 50 | 1 | 13 | 11:17 | 5976 | 50 | 10.9 | 13.9 | 13.8 | 17.3 | 17.1 | | 73.0 | 18.6 | 4.3 | 31.9 | 4.0 | |
| 74 | 60 | 2 | 14 | 11:33 | 6229 | 60 | 11.9 | 11.5 | 12.7 | 15.1 | 15.7 | | 66.9 | 17.5 | 4.3 | 32.4 | 4.1 | |
| 74 | 60 | 1 | 14 | 11:33 | 6231 | 61 | 11.7 | 14.3 | 14.1 | 19.1 | 18.5 | | 77.6 | 18.7 | 4.3 | 32.2 | 4.0 | |

Recorded by DJW

Checked by ______



includes cal 1 sheet for 1st 12

| Sheet 21 | * STATE_CODE 26 |
|---|---|
| LTPP Traffic Data | *SPS PROJECT_ID 0100 |
| WIM System Test Truck Records 2 of 2 | * DATE 10 / 03 / 2007 |

Rev. 08/31/2001

| Pvmt temp | Radar Speed | Truck | Pass | Time | Record No. | WIM Speed | Axle A weight. | Axle B weight. | Axle C weight. | Axle D weight. | Axle E weight. | Axle F weight | GVW | A-B space | B-C space | C-D space | D-E space | E-F space |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 85.5 | 60 | 2 | 15 | 12:37 | 7234 | 60 | 11.9 | 12.3 | 12.2 | 14.3 | 14.1 | | 64.7 | 17.3 | 4.3 | 32.2 | 4.0 | |
| 85.5 | 59 | 1 | 15 | 12:38 | 7255 | 59 | 11.6 | 14.5 | 14.0 | 17.4 | 17.7 | | 75.3 | 18.6 | 4.3 | 31.9 | 4.0 | |
| 81 | 67 | 2 | 16 | 12:48 | 7409 | 68 | 11.4 | 13.1 | 12.5 | 14.1 | 14.5 | | 65.6 | 17.4 | 4.3 | 32.2 | 4.0 | |
| 81 | 68 | 1 | 16 | 12:49 | 7426 | 68 | 12.0 | 14.4 | 14.6 | 18.0 | 18.3 | | 77.3 | 18.6 | 4.3 | 31.9 | 4.0 | |
| 78.5 | 50 | 2 | 17 | 12:58 | 7592 | 50 | 11.4 | 11.9 | 11.8 | 15.6 | 16.9 | | 67.6 | 17.5 | 4.3 | 32.3 | 4.0 | |
| 78.5 | 51 | 1 | 17 | 12:59 | 7603 | 51 | 10.9 | 14.2 | 13.0 | 17.8 | 17.2 | | 73.0 | 18.5 | 4.3 | 31.9 | 4.0 | |
| 78 | 62 | 2 | 18 | 13:09 | 7769 | 62 | 11.8 | 13.2 | 12.6 | 14.5 | 15.3 | | 67.4 | 17.5 | 4.3 | 32.4 | 4.0 | |
| 78 | 61 | 1 | 18 | 13:10 | 7788 | 61 | 11.3 | 14.2 | 14.0 | 17.9 | 17.5 | | 74.8 | 18.6 | 4.3 | 31.9 | 4.0 | |
| 75.5 | 68 | 2 | 19 | 13:19 | 7937 | 69 | 11.7 | 12.6 | 12.9 | 14.2 | 15.2 | | 66.6 | 17.5 | 4.3 | 32.3 | 4.0 | |
| 75.5 | 69 | 1 | 19 | 13:21 | 7977 | 68 | 11.4 | 14.7 | 13.8 | 18.0 | 17.9 | | 75.8 | 18.6 | 4.3 | 32.0 | 4.0 | |
| 86 | 50 | 2 | 20 | 13:29 | 8110 | 51 | 11.5 | 11.9 | 11.9 | 14.7 | 16.0 | | 66.0 | 17.4 | 4.3 | 32.2 | 4.0 | |
| 86 | 51 | 1 | 20 | 13:31 | 8161 | 51 | 11.3 | 13.6 | 13.3 | 16.9 | 17.2 | | 72.2 | 18.6 | 4.3 | 31.9 | 4.0 | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |

Recorded by DJW

Checked by ____________

## Calibration Worksheet

**Site: 260100**

Calibration Iteration 1 Date 10/3/07

**Beginning factors:**

| Speed Point (mph) | Name | Value |
|---|---|---|
| Overall | overall | 820 |
| Front Axle | front axle | 1039 |
| 1 – ( 50 ) | cf 1 | 1000 |
| 2 – ( 60 ) | 2 | 1014 |
| 3 – ( 70 ) | 3 | 1044 |
| 4 – ( ) | piezo 1 | 960 |
| 5 – ( ) | piezo 2 | 1040 |

**Errors:**

| | Speed Point 1 | Speed Point 2 | Speed Point 3 | Speed Point 4 | Speed Point 5 |
|---|---|---|---|---|---|
| F/A | -8.9 | -6.2 | -6.5 | | |
| Tandem | -9.8 | -12.9 | -11.7 | | |
| GVW | -9.6 | -11.8 | -11.2 | | |

**Adjustments:**

| | Raise | Lower | Percentage |
|---|---|---|---|
| Overall | ☒ | ☐ | 9.8 |
| Front Axle | ☐ | ☐ | |
| Speed Point 1 | ~~☒~~ | ☐ | ~~9.0 %~~ ~~10.6 %~~ |
| Speed Point 2 | ☒ | ☐ | ~~9.1 %~~ ~~13.5 %~~ 3.6 % |
| Speed Point 3 | ☒ | ☐ | ~~8.1 %~~ ~~12.2 %~~ 2.6 % |
| Speed Point 4 | ☐ | ☐ | |
| Speed Point 5 | ☐ | ☐ | |

**End factors:**

| Speed Point (mph) | Name | Value |
|---|---|---|
| Overall | overall | ~~820~~ 900 |
| Front Axle | front axle | 1039 |
| 1 – ( 50 ) | cf 1 | ~~1106~~ 1000 |
| 2 – ( 60 ) | 2 | ~~1150~~ 1050 |
| 3 – ( 70 ) | 3 | ~~1171~~ 1071 |
| 4 – ( ) | piezo 1 | 960 |
| 5 – ( ) | 2 | 1040 |

# TEST VEHICLE PHOTOGRAPHS FOR SPS WIM VALIDATION

**October 2-3, 2007**

**STATE: Michigan**

**SHRP ID: 0100**

**Photo 1 - Truck_1_Tractor_ 26_0100_10_02_07.JPG**


**Photo 2 - Truck_1_Trailer_1_26_0100_10_02_07.JPG**

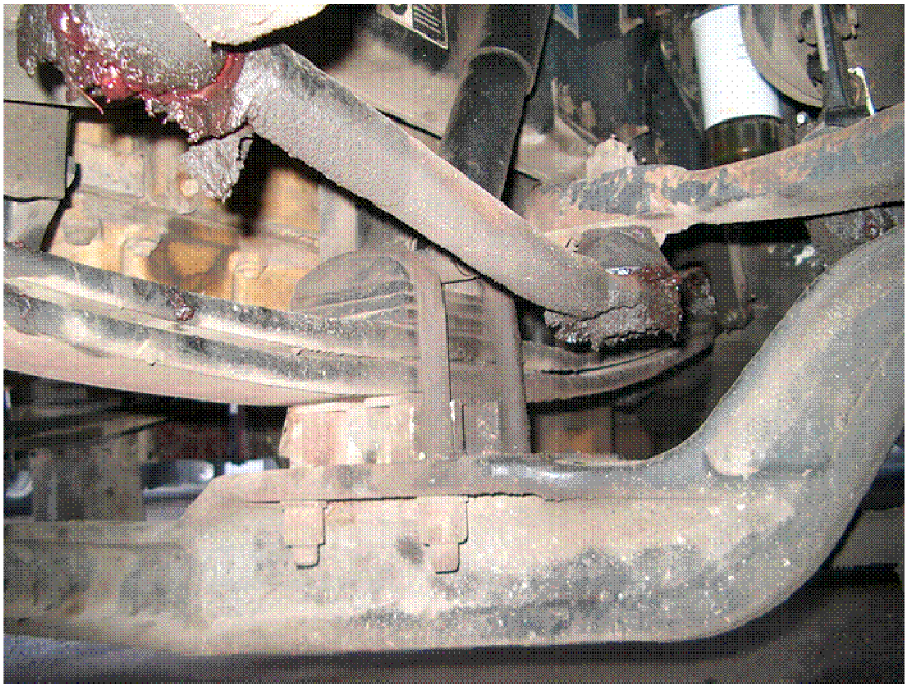

**Photo 3 - Truck_1_Suspension_1_26_0100_10_02_07.JPG**

**Photo 4 - Truck_1_Suspension_2_26_0100_10_02_07.JPG**


**Photo 5 - Truck_1_Suspension_3_26_0100_10_02_07.JPG**


**Photo 6 - Truck_2_Tractor_26_0100_10_02_07.JPG**


**Photo 7 - Truck_2_Trailer_26_0100_10_02_07.JPG**

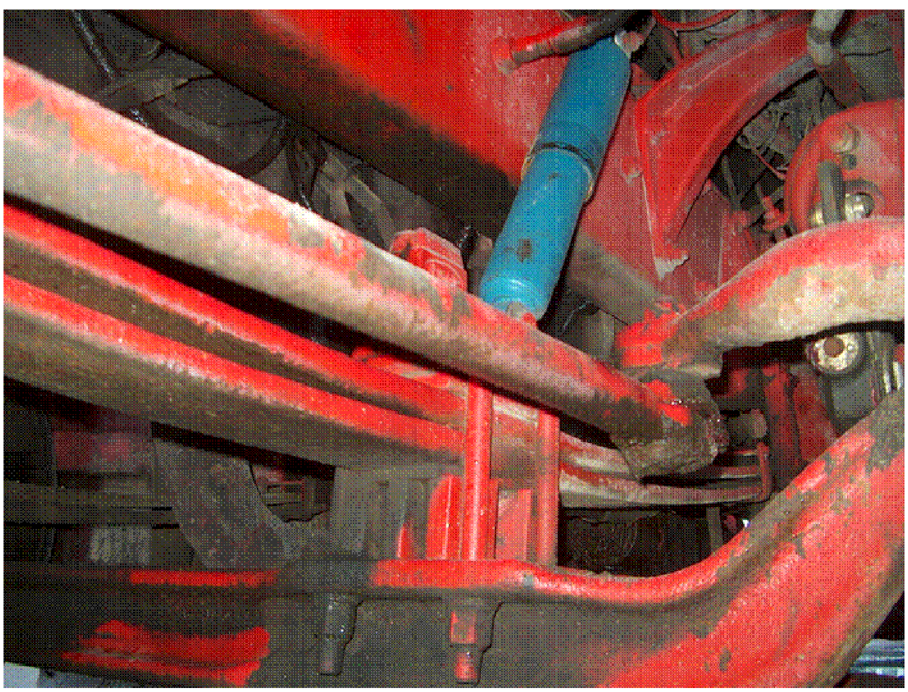

**Photo 8 - Truck_2_Suspension_1_26_0100_10_02_07.JPG**

**Photo 9 - Truck_2_Suspension_2_26_0100_10_02_07.JPG**

**Photo 10 - Truck_2_Suspension_3_26_0100_10_02_07.JPG**

**Photo 11 - Truck_1a_Tractor_ 26_0100_10_03_07.JPG**


**Photo 12 - Truck_1a_Trailer_1_26_0100_10_03_07.JPG**

**Photo 13 - Truck_1a_Suspension_1_26_0100_10_03_07.JPG**

**Photo 14 - Truck_1a_Suspension_2_26_0100_10_03_07.JPG**

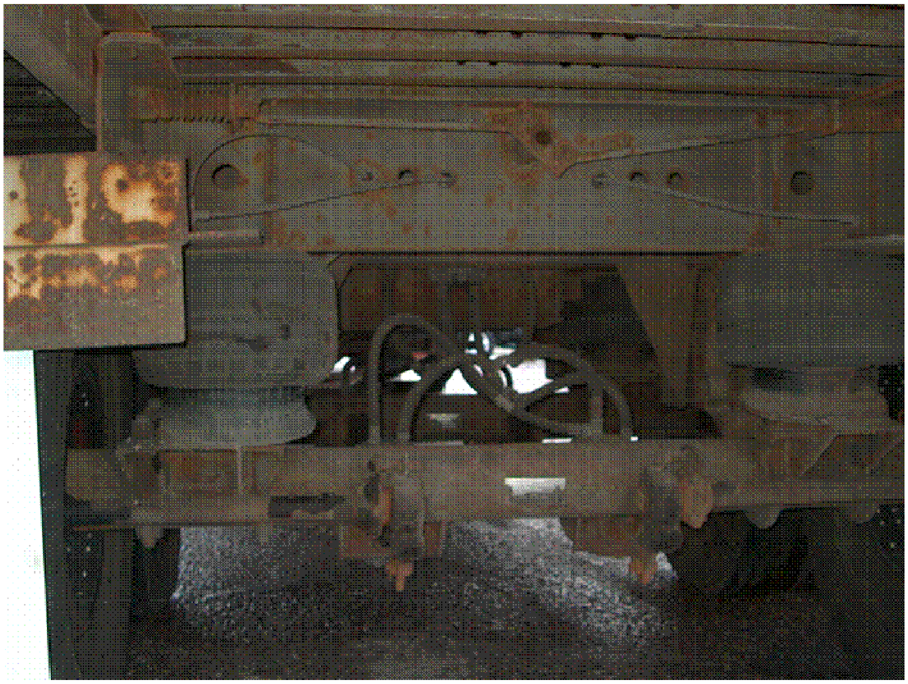

**Photo 15 - Truck_1a_Suspension_3_26_0100_10_03_07.JPG**

# Michigan Dept of Transportation Classification and Weight Parameters for WIM

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

System Operating Parameters

Michigan SPS-1 (Lane 4)

| Validation Visit | October 2, 2007 | July 11, 2006 |
|---|---|---|
| Factor | | |
| Overall | 900 | 820 |
| Front axle | 1039 | 1039 |
| Bin 1 (50 mph) | 1000 | 1106 |
| Bin 2 (60 mph) | 1050 | 1150 |
| Bin 3 (70 mph) | 1071 | 1171 |
| Piezo 1 | 960 | 960 |
| Piezo 2 | 1040 | 1040 |