Assessment Report for
Arizona, SPS 1

Visit date: March 3, 2004

List of Tables

List of Figures

1 Executive Summary

A visit was made to the Arizona SPS-1 site on March 3, 2004 for the purpose of conducting an assessment of the WIM system located on US route 93 at milepost 52.62, 0.25 miles north of County Road 125.

This site is not recommended for a site validation.

The site is instrumented with PAT America weigh pad sensors and a PAT America DAW-100 controller. All of the WIM system components are in working order.

Sufficient data was collected to provide a Sheet 16 for classification verification at this site. There are 22-percent unclassified vehicles. This is above the percentage of 2% defined as the criteria for research data. Truck classes 5, 6 and 8 had an error rate exceeding 2% of matches.

There were no distresses observed that would influence truck motions significantly. However, the pavement condition exceeds the recommended WIM Index value of 0.789 m/km. A review of the profile data indicates that this WIM Index value was exceeded at 16 locations.

A review of the speed information collected on-site indicates that the range of truck speeds to be covered during an evaluation is 55 to 65 mph. The posted speed limit on this site is 65 mph.

This site has 7 years of classification data and 6 years of weight data. The site was calibrated on June 2, 2003 according to the December 2003 upload. **Due to the change in truck traffic on this route since September 11, 2001 (see additional information provided in Appendix A) if there is no validation information, it will not be possible to evaluate earlier data for research quality, as the populations are different. Based on available calibration information and review of the data submitted through the December 2003 upload, this site still needs 5 years of data to meet the need of 5 years of research quality data**.

2 Corrective Actions Recommended

It is recommended that telephone communications equipment be installed. It may be possible for the landline telephone services presently installed for use by a nearby weather station to be utilized.

Grinding of the pavement should be done to reduce the roughness.

The weight data for all the years needs to be validated before acceptance as research quality. If no validation data is available prior to September 11, 2001 it is not recommended that later validation information be used due to the change in the vehicle population.

The June 1999 weight data is inconsistent with the rest of the data and should be considered for omission from the database. The June 1994 GVW curve is unusual in comparison to other months (the Saturday of the week beginning the 8th appears to be the reason).

3 Equipment inspection and diagnostics

The site is instrumented with PAT America weigh pad weighing sensors, installed in a staggered configuration, 16 feet 4 inches apart. Six-foot by 6-foot loop sensors are installed directly preceding each weigh pad sensor. The first loop sensor is for vehicle presence detection, and the second is for back-up speed and spacing calculations should the vehicles' axles not trigger the second weigh pad. The WIM system utilizes a PAT America DAW-100 WIM Controller for signal processing, data storage, user interface and remote operation.

A complete electrical check of all support service components including the solar power equipment and telephone service was performed. **Presently installed cellular communications equipment is not working**. Nearby landline telephone service is available and working properly. All power support equipment is operating properly.

An electronic check of all WIM components was performed. The second loop indicated low resistance to ground, but is working properly at this time. Significant rainfall could cause the loop to quit working. This is not a problem that would significantly affect the accuracies of the WIM equipment, and replacement of this sensor is not required at this time. All other in-road sensors are working properly.

During speed and classification accuracy studies, it was discovered that certain types of vehicles containing long axle spacings were being split into two separate vehicles by the WIM system. Troubleshooting identified that the loop sensors sensitivity settings were too low, causing them to shut off before the vehicle had a chance to completely cross over both of the weigh pad sensors. An increase was made to the loops' delay period to ensure that they remained on until the vehicle completely crossed the WIM scale area. Afterward, the WIM controller appeared to be working properly.

A visual inspection of all system components, including in-road sensors, cabinet, pull boxes, service mast, solar panels and conduit as well as the telephone service components was conducted. All components are in excellent physical condition.

4 Classification Verification with test truck recommendations

The agency uses the FHWA 13-bin classification scheme with an agency specific definition for Class 14 that describes a 5-axle tractor-trailer combination. Its dimensions could be typified by dump trucks hauling trailers. In contrast the last axle on the Class 9 must be a tandem, tridem or split tandem.

A sample of 4 hours of data 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 zero-percent unknown vehicles and 22-percent unclassified vehicles. The unclassified vehicles are typically Recreational Vehicles (RVs) with trailers and pickups with trailers being classified as Class 8 or Class 15.

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

Table 1 Truck Misclassification Percentages for 040100 – 03-Mar-2004

Class	Percent Error	Class	Percent Error	Class	Percent Error
3	100				
4	100	5	53	6	38
7	N/A				
8	95	9	33	10	0
11	N/A	12	N/A	13	0

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

Table 2 Truck Classification Mean Differences for 040100 - 03-Mar-2004

Class	Mean Difference	Class	Mean Difference	Class	Mean Difference
3	-100.0				
4	0.0	5	-39.0	6	-38.0
7	N/A				
8	1800.0	9	0.0	10	0.0
11	N/A	12	N/A	13	0.0

These error rates are normalized to represent how many vehicles of the class are expected to be over or under-counted for every hundred of that class observed by the equipment. Thus a value of 0 means the class is identified correctly every time. A number between -1 and –100 indicates the 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 how many more vehicles are assigned to the class than the actual "hundred observed". Class marked 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 more are reported than are actually in the population. N/A means no vehicles of the class recorded by either the equipment or the observer.

A review of the site data collected on site indicated that Class 5 and Class 6 constitute at least 10 percent of the truck population. The percent of Class 9 might have significantly reduced due to most of the commercial truck traffic being diverted after September 11, 2001. Based on this information in addition to the air-suspension 3S2, the second vehicle used for evaluation should be a legally loaded Class 5.

5 Profile Evaluation

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

Profile data collected at the SPS WIM location by Nichols Consulting Engineers on February 11, 2004 has been processed through the LTPP SPS WIM Index software. This WIM scale is installed on a Portland cement concrete pavement. The results are shown in Table 3.

A total of 8 profiler passes have been conducted over the WIM site. Since the issuance of the LTPP directive on collection of longitudinal profile data for SPS WIM 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 done 4 passes at the center of the lane, 2 passes shifted to the left side of the lane, and 2 passes shifted to the right side of the lane. Shifts to the sides of the lanes have been made such that data are collected as close to the lane edges as was safely possible. For each profiler pass, profiles are recorded under the left wheel path (LWP), and the right wheel path (RWP).

Table 3 shows the computed index values for all 8 profiler passes for this WIM site. The average values over the passes at each path are also calculated when three or more passes are completed. These are shown in the right most column of the table. Values above the index limits are presented in italics.

Table 3 Long Range Index (LRI) and Short Range Index (SRI)

Profiler Passes			**Pass 1**	**Pass 2**	**Pass 3**	**Pass 4**	**Ave.**
Center	LWP	LRI (m/km)	0.770	0.742	0.767	0.776	**0.764**
		SRI (m/km)	0.372	0.387	0.460	0.442	**0.415**
	RWP	LRI (m/km)	*0.844*	*0.842*	*0.878*	*0.834*	***0.850***
		SRI (m/km)	*1.145*	*0.850*	*0.995*	*1.001*	***0.998***
Left Shift	LWP	LRI (m/km)	*0.905*	0.763			
		SRI (m/km)	0.651	0.578			
	RWP	LRI (m/km)	*0.812*	0.769			
		SRI (m/km)	0.604	0.449			
Right Shift	LWP	LRI (m/km)	*0.838*	0.765			
		SRI (m/km)	0.599	0.544			
	RWP	LRI (m/km)	*0.941*	*0.917*			
		SRI (m/km)	*1.030*	*1.021*			

There are 16 passes for which the WIM Index value of 0.789 m/km is exceeded as can be seen in the table above. When all values are less than 0.789 it is presumed unlikely that pavement roughness will significantly influence sensor output. Values above that level may or may not influence the reported weights and potentially vehicle spacings. Based on the profile data analysis, the Arizona SPS-1 WIM site does not meet the requirements for WIM site locations. The suggested alternative for pavement correction is grinding.

6 Distress survey and any applicable photos

The pavement appears to be in good condition with little distress. There was transverse cracking approximately 86 feet and 203 feet prior to the WIM scale area as shown in Figure 13-1 and Figure 13-2 respectively. These distresses do not appear to significantly affect the dynamics of the trucks as they pass over the WIM scales. Figure 13-3 shows the condition of the pavement in the downstream direction and Figure 13-4 shows in the condition of the pavement in the upstream direction.

7 Vehicle-pavement interaction discussion

A visual inspection of the pavement 425 feet in advance of the WIM area and 75 feet following the WIM area was conducted. No significant pavement distress that would affect the performance of the WIM scales was detected.

During a visual survey of the truck dynamics in the area of the WIM scales, no discernable horizontal or vertical truck movements could be detected as trucks were approaching or leaving the sensor area. Daylight could not be readily seen between the tires and any of the sensors indicating that the trucks are fully touching the sensors.

8 Speed data with speed range recommendations for evaluation

Based on the data collected on site the 15th and 85th percentile speeds for Class 9s are 55 and 65 mph respectively. The upper end of the range is the posted speed limit. This

range does not vary significantly for other truck classes. As a result the recommended speeds for test trucks in an evaluation are 55, 60 and 65 mph.

Measurements of speeds on-site indicated that the equipment is currently measuring speeds with no bias and an associated standard deviation of 0.6 mph.

The review of drive axle spacings for Class 9 vehicles indicates that this is not affecting the measurements of length and therefore vehicle classification.

9 Traffic Data review: Overall Quantity and Sufficiency

As of March 3, 2004 this site does not have at least 5 years of research quality data.

Research quality data is defined to be at least 210 days in a year of data of known calibration meeting LTPP's precision requirements. The precision requirements are shown in Table 4. A record of a calibration visit for June 2, 2003 was provided. Review of the data indicates that data for weight is available on the precision and bias of the weight data using a single truck. There is no information on classification errors.

Table 4 Precision and Bias Requirements for Weight Data

Pooled Fund Site	95 Percent Confidence Limit of Error
Single Axles	± 20 percent
Axle groups	± 15 percent
Gross Vehicle Weight	± 10 percent
Vehicle Speed	±1 mph (2 kph)
Axle Spacing	± 0.5 ft (150 mm)

Data that has validation information available is 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 5. 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 all years but 1997 have a sufficient classification and 1994, 1995, 1996, 1998 have a sufficient weight quantity to be considered complete years of data. **Together with the previously gathered calibration information it can be seen that at least one additional year of research quality**

weight data and five years of research quality are needed to meet the goal of a minimum of 5 years of research weight data.

Table 5 Amount of Traffic Data Available

Year	Class Days	Months	Coverage	Weight Days	Months	Coverage
1994	352	12	Complete Week	354	12	Complete Week
1995	340	12	Complete Week	344	12	Complete Week
1996	345	12	Complete Week	341	12	Complete Week
1997	183	6	Complete Week	184	6	Complete Week
1998	331	11	Complete Week	294	12	Complete Week
1999	312	12	Complete Week	1	1	Sunday
2000	259	11	Complete Week	N/A	N/A	N/A

To evaluate the consistency of the existing data and determine its probable quality a series of reports and graphs have been generated. These include the SPS Summary report, vehicle distribution graphs, GVW distributions both over all years and by month within years, average daily steering axle weights for Class 9 vehicles, and ESAL graphs.

9.1 SPS Summary Report

The overall report is the SPS Summary Report. This report uses sets of benchmark data based on calibration information or consistent, rational data patterns. The report shows the trend in some basic statistics at the site over time. It provides a numeric equivalent to the graphs typically run for the comparison evaluation process. It includes the number of days of data and statistics associated with Class 9 vehicles. They include the average volumes, average ESALs, the average steering axle weight and mean loaded and unloaded weight on a monthly basis. Class Days and Percent Class 9s are generated from classification data submissions. All other values come from the weight data submissions. Counts derived from weight data are available for all months. Steering axle and weight statistics are only present when that data was loaded through LTPP's new traffic analysis software, since it is the only software that calculates them. The data is separated into blocks that depend on when the site was validated. Where there is no validation record an initial time point has been picked at which continuous data exists and that data is used as the basis for comparison. In this case with no 2003 data available, 1994 was used for comparisons. Excluded months have no data.

Table 6 SPS Summary Report

```
Arizona               0100

North      Lane 1

Comparison Date Weight -   08-January-1994        Classification -   08-January-1994
```

Month-Year	Class	Percent	Weight	Average	Avg.ESALs	Average	Mean	Mean

	Days	Class 9s	Days	No. Class 9s	Per Class 9	Class 9 Steering	Loaded Weight	Unloaded Weight
Comparison values		14.2		380	1.27	10,471	77,306	33,786
JAN 1994	22	14.1	24	368	1.27	10,517	77,331	33,947

Arizona 0100
North Lane 1

Comparison Date Weight - 08-January-1994 Classification - 08-January-1994

Month-Year	Class Days	Percent Class 9s	Weight Days	Average No. Class 9s	Avg.ESALs Per Class 9	Average Class 9 Steering	Mean Loaded Weight	Mean Unloaded Weight
Comparison values		14.2		380	1.27	10,471	77,306	33,786
FEB 1994	28	13.4	28	350	1.27	10,571	77,491	33,665
MAR 1994	31	11.1	31	355	1.42	10,808	80,287	30,659
APR 1994	29	12.0	29	403	1.46	10,798	80,598	33,119
MAY 1994	31	11.5	31	372	1.56	10,989	80,745	30,578
JUN 1994	30	12.2	30	431	1.43	10,813	81,188	33,152
JUL 1994	30	9.8	30	350	1.52	11,008	80,905	30,315
AUG 1994	31	11.6	31	377	1.45	10,994	80,791	33,582
SEP 1994	30	12.2	30	375	1.46	10,942	80,414	30,256
OCT 1994	31	13.2	31	397	1.39	10,798	78,031	33,546
NOV 1994	30	14.2	30	415	1.24	10,537	77,198	33,689
DEC 1994	29	13.4	29	392	1.28	10,555	77,077	33,902
JAN 1995	31	15.1	31	382	1.24	10,582	76,764	33,519
FEB 1995	23	14.3	27	394	1.33	10,735	77,477	33,659
MAR 1995	30	12.7	30	423	1.37	10,753	77,734	27,354
APR 1995	30	12.1	30	423	1.42	10,787	77,927	29,774
MAY 1995	31	11.7	31	412	1.45	10,821	78,239	29,673
JUN 1995	30	11.8	30	424	1.48	10,920	80,442	29,955
JUL 1995	31	10.4	31	384	1.46	10,961	80,503	33,577
AUG 1995	31	11.9	31	403	1.42	10,944	80,328	34,042
SEP 1995	25	12.3	25	395	1.33	10,854	77,969	33,817
OCT 1995	20	13.9	20	439	1.31	10,710	77,422	33,935
NOV 1995	30	14.3	30	436	1.26	10,672	77,177	33,936
DEC 1995	28	14.1	28	418	1.28	10,670	76,908	34,277
JAN 1996	31	15.9	31	465	1.30	10,719	76,986	33,914
FEB 1996	29	15.1	29	465	1.35	10,788	77,303	34,071
MAR 1996	25	13.2	25	473	1.37	10,796	77,423	33,729
APR 1996	30	13.2	30	471	1.42	10,862	77,804	33,926
MAY 1996	29	13.2	29	464	1.48	10,981	78,159	33,770
JUN 1996	24	12.5	24	450	1.44	11,027	78,231	33,715
JUL 1996	29	11.6	29	438	1.41	10,974	78,223	33,450
AUG 1996	29	12.5	29	449	1.35	10,940	77,947	33,705
SEP 1996	30	13.9	30	464	1.30	10,772	77,338	34,143
OCT 1996	31	15.1	31	464	1.21	10,610	76,746	34,242
NOV 1996	29	15.9	30	463	1.18	10,507	76,422	26,635
DEC 1996	29	13.7	29	448	1.14	10,467	74,202	26,630
JUL 1997	31	11.6	31	461	1.31	10,768	77,199	27,058
AUG 1997	31	12.0	31	462	1.27	10,744	77,027	26,876
SEP 1997	30	14.5	30	494	1.20	10,647	76,640	34,201
OCT 1997	30	14.9	31	501	1.15	10,518	74,336	33,997
NOV 1997	30	14.3	30	466	1.17	10,518	74,311	26,776
DEC 1997	31	14.8	31	482	1.11	10,389	73,873	33,670
JAN 1998	29	16.4	31	477	1.16	10,598	74,096	34,160
FEB 1998	28	16.2	28	516	1.16	10,609	74,084	34,079
MAR 1998	31	14.8	7	531	1.16	10,543	74,155	26,646
APR 1998	30	14.6	30	532	1.25	10,645	76,303	26,299
MAY 1998	31	13.7	31	510	1.28	10,747	76,536	26,680
JUN 1998	29	14.2	30	530	1.31	10,807	76,984	26,628

JUL 1998	31	13.2	31	513	1.30	10,794	77,064	26,909
AUG 1998	31	14.8	7	561	1.26	10,671	76,802	27,264
SEP 1998	30	15.6	30	484	1.15	10,602	76,280	27,131
OCT 1998	31	16.9	31	503	1.12	10,513	74,277	26,952
NOV 1998	30	16.6	7	573	1.10	10,443	74,098	33,862
DEC 1998			31	536	1.04	10,363	73,471	34,106
JAN 1999	31	18.3						
Arizona		0100						

North Lane 1

Comparison Date Weight - 08-January-1994 Classification - 08-January-1994

Month-Year	Class Days	Percent Class 9s	Weight Days	Average No. Class 9s	Avg.ESALs Per Class 9	Average Class 9 Steering	Mean Loaded Weight	Mean Unloaded Weight
Comparison values		14.2		380	1.27	10,471	77,306	33,786
FEB 1999	21	18.2						
MAR 1999	31	16.0						
APR 1999	30	15.7						
MAY 1999	8	13.6						
JUN 1999	29	15.2	1	186	1.37	10,900	76,867	27,623
JUL 1999	24	12.7						
AUG 1999	26	14.1						
SEP 1999	29	14.9						
OCT 1999	29	15.7						
NOV 1999	24	15.0						
DEC 1999	30	15.5						
JAN 2000	29	16.9						
FEB 2000	29	16.3						
MAR 2000	31	14.5						
APR 2000	29	14.7						
MAY 2000	31	14.1						
JUL 2000	22	13.9						
AUG 2000	16	15.0						
SEP 2000	30	14.7						
OCT 2000	23	15.9						
NOV 2000	11	17.3						
DEC 2000	8	9.0						

From Table 6 it appears that in the classification data the percent of Class 9s was essentially the same for all the years except in July 1994 and December 2000 where it is below 10 percent. From the available weight data it can be seen that the average daily number of Class 9s gradually increased from January 1994 until December 1998. However, in June 1999 the amount drastically reduced to a third of the past volumes. In the same month, the classification data did not show similar drastic reduction. The reason for this reduction in the data collected by the WIM is unknown at present. The average ESALs per Class 9 has a cyclical pattern for all the years. Data reflects it is increasing from winter to summer season and decreasing from summer to fall season. At the same time the average ESALs is decreasing over the years. This may be due to calibration drift, lighter trucks overall, or a greater proportion of unloaded trucks. Without calibration data, the cause cannot be determined. The average steering axle weights appear to be essentially constant for all the years. The mean loaded weight remained almost similar for the years of data collected. The mean unloaded weight remained almost similar for the years except from November 1996 to August 1997, November

1997, March to October 1998 and June 1999 where the mean unloaded weight was less than 28,000 lbs. The reason for this behavior is also unknown at present.

9.2 Vehicle Distribution

The vehicle distribution graphs indicate whether the fleet mix is stable over time and any day of week or seasonal patterns that may exist. The vehicle distribution graphs contain two types of comparisons, one between data types and one over time. The between types comparison is represented by the two columns for every time unit present. The column on the left labeled with a 4 is for classification data. The right hand column of the pair is for weight data. Whether or not the data is equivalent is perhaps more important than the variation over time.

Figure 14-1 shows a typical by week pattern for heavy truck classification data. The individual weeks show essentially the same heavy truck mix. Every vehicle in Classes 6 through 13 that constitutes at least 10 percent of the population is expected to stay within plus or minus 5 percent of the value observed during the two weeks following validation. This range is shown by the darker band inside the lighter band to the right of the weekly data. Weeks that go outside more than plus or minus 10 percent of the expected value will fall above or below the light gray areas of the band. These are weeks that should have been subjected to additional scrutiny prior to accepting the data as reasonable.

For this site, the fleet mix was essentially similar. A typical graph for this period is shown in Figure 14-1. There was no significant difference in the mix stability graphed for the weight data as shown in Figure 14-2.

Figure 14-3 shows the typical pattern for vehicle distribution by month by year for the data collected from the classifier versus the data collected by the WIM equipment. From the figure it appears that the WIM equipment is collecting data slightly less than the classifier. However, from Figure 14-4 it is seen that the data collected by WIM equipment is not the same as the classifier. The major difference in volume is the presences of Class 15s and 16s in the classification data. This suggests that the classification equipment reports all vehicles but the weight records contain only valid vehicles.

9.3 GVW Distributions for Class 9s

The Class 9 GVW graph is a generally accepted way to evaluate loading data reported at a site. A typical graph has two peaks, one between 28,000 and 36,000 pounds and the other between 72,000 and 80,000 pounds. The first is the unloaded peak. The second, the loaded peak, reflects the legal weight limit for a 5-axle tractor-trailer vehicle on the interstate highway system. Additionally, it is expected that less than 3 percent of the trucks will be excessively light (less than 12,000 pounds) and less than 5 percent will be significantly overweight (in excess of 96,000 pounds). Data that falls outside of the expected conditions needs a record of validation to verify that the pattern is in fact correct

for the location. Data meeting the expected patterns is not automatically considered to be of research quality, merely rational as bias in scale measurements may shift the peaks in the data from their true values.

The overall assessment of loading patterns is done using a Class 9 GVW graph by year over the available years. In Figure 14-5 the typical pattern is shown in the gray line with Xs. From Figure 14-5 and Figure 14-6 it may appear that the unloaded peaks from 1994 to1998 are slightly different whereas the loaded peaks are essentially the same. For 1999 the trend was significantly different. The most probable reason being there is only one day of weight data in 1999.

To investigate any seasonal variations the Class 9 GVW distributions are graphed by month by year. As shown in Figure 14-7 the percent of peak-unloaded weights are almost similar for all the months. The percent of peak-loaded weights are essentially the same for all the months. The trend for rest of the year is similar to the trend in January to March.

9.4 Axle Distributions

Axle distribution graphs were not needed for this site since the GVW graphs were available for all years.

9.5 ESALs per year

Average ESALs for Class 9 vehicles are a very crude method of identifying loading shifts. Figure 14-8 shows the average Class 9 ESALs per month for this location. To remove the influence of changing pavement structure all ESAL values have been computed with and SN = 5 and a p_t of 2.5. Average ESALs per Class 9 are not used as an indicator of research quality data. As seen in the figure the average ESALs per Class 9 has a cyclical pattern. At the same time the average ESAL value is decreasing over the years. The reason for this behavior might be that the loads of the Class 9s have been shifting over the years or the calibration of the equipment is changing. Calibration information would be needed to indicate which.

9.6 Average Daily Steering Axle Weight

A frequently used statistic for checking scale calibration and doing auto-calibration of WIM equipment is the weight of the front axle. This value is site specific and should be relatively constant particularly for loaded Class 9s (vehicles in excess of 60,000 lbs.). Typically when auto calibration is used this value either cycles repeatedly or with very large truck volumes results in an essentially straight line for the mean. As shown in Figure 14-9 the average steering axle weights are essentially the same for the year 1994. The trend is similar for the rest of the years.

10 Updated handout guide and Sheet 17

A copy of the post visit handout has been included following page 22. It includes a current Sheet 17 with all applicable maps and photographs. The only significant change from the pre-visit handout is the correction for the information for the FHWA Division Office Liaison contact, which was incorrect in the pre-visit information provided.

11 Updated Sheet 18

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

12 Traffic Sheet 16(s) (Classification Verification only)

Sufficient classification information was collected between 10:20 a.m. and 2:10 p.m. on March 3, 2004 to complete a Sheet 16. A copy is attached at the very end of the report.

13 Distress Photographs

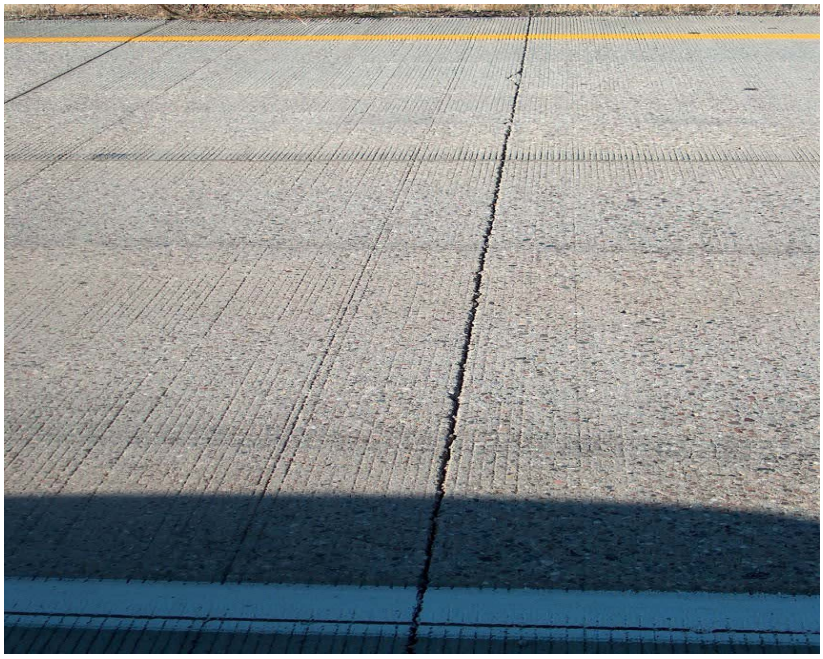


Figure 13-1 Transverse Cracking 86 feet prior to WIM Scale (Distress Photo 1)

Figure 13-2 Transverse Cracking 203 feet prior to WIM Scale (Distress Photo 2)

Figure 13-3 Pavement Condition in Downstream Direction (Distress Photo 3)

Figure 13-4 Pavement Condition in Upstream Direction (Distress Photo 4)

14 Traffic Graphs

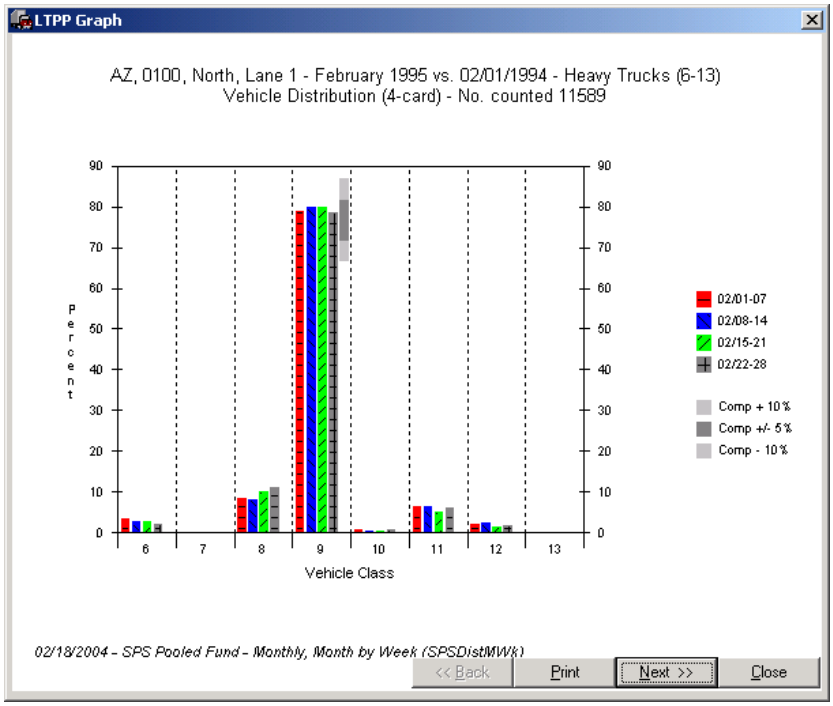


Figure 14-1 Typical Heavy Truck Distribution Pattern for Classification Data for 040100

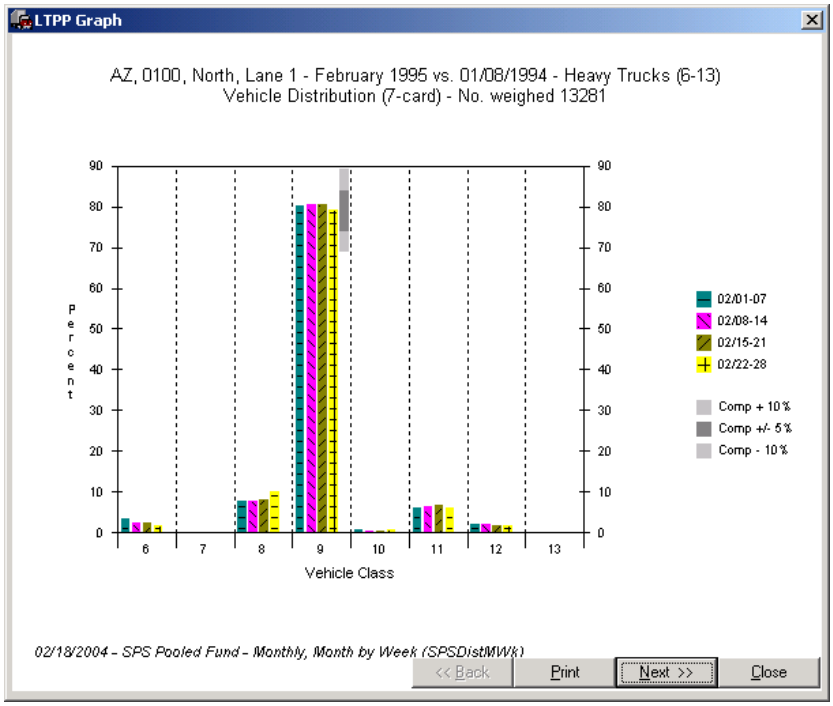


Figure 14-2 Typical Heavy Truck Distribution Pattern for Weight Data for 040100

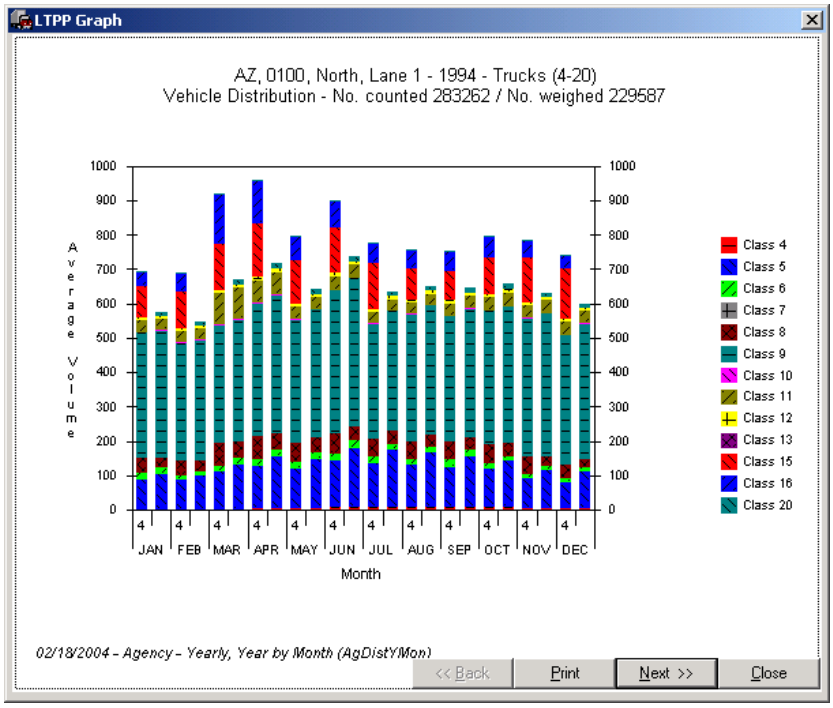


Figure 14-3 Vehicle Distribution by Month for the Year 1994 for 040100

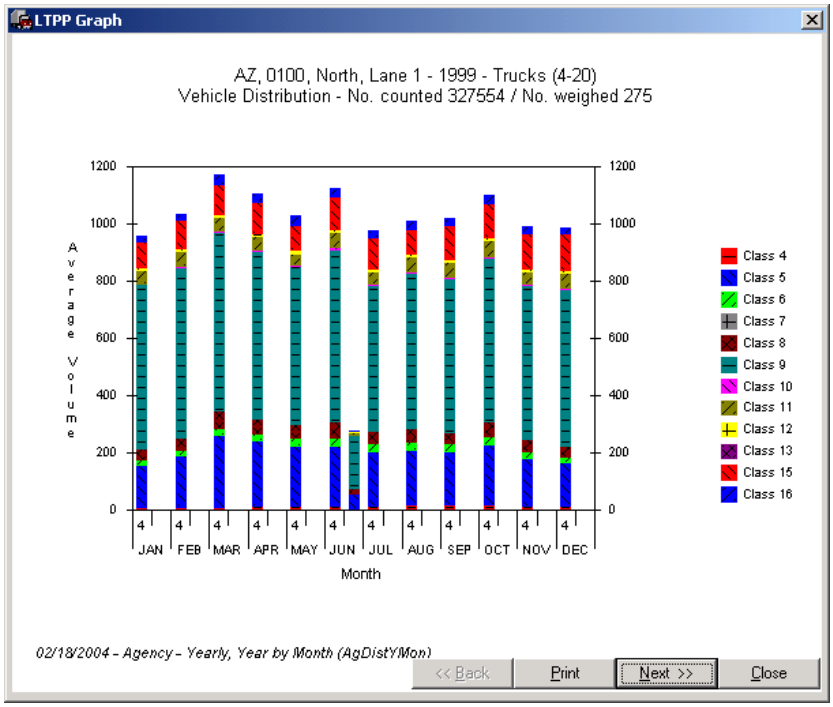


Figure 14-4 Vehicle Distribution by Month for the Year 1999 for 040100

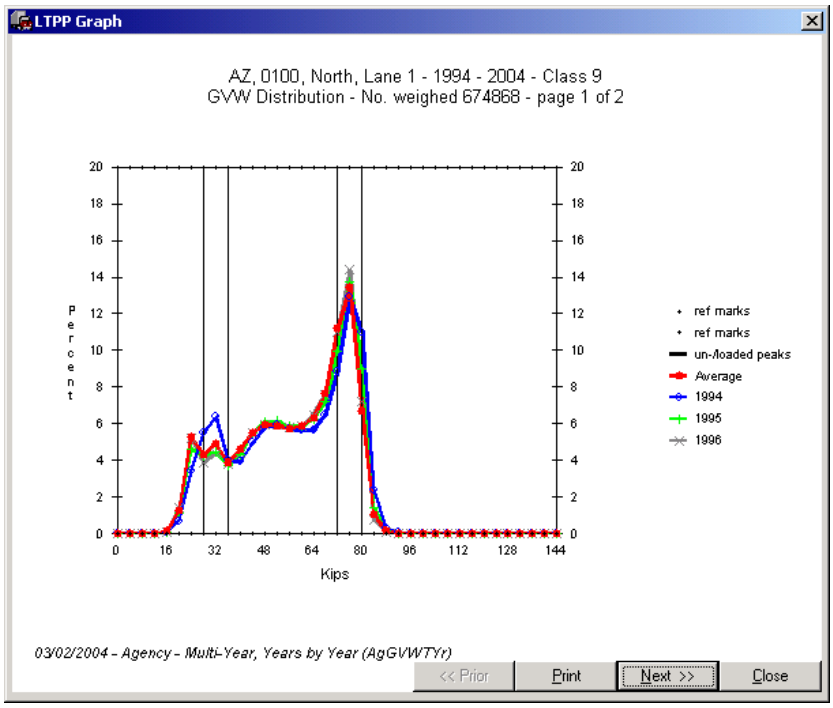


Figure 14-5 Class 9 GVW Distribution – 1994 to 1996 for 040100

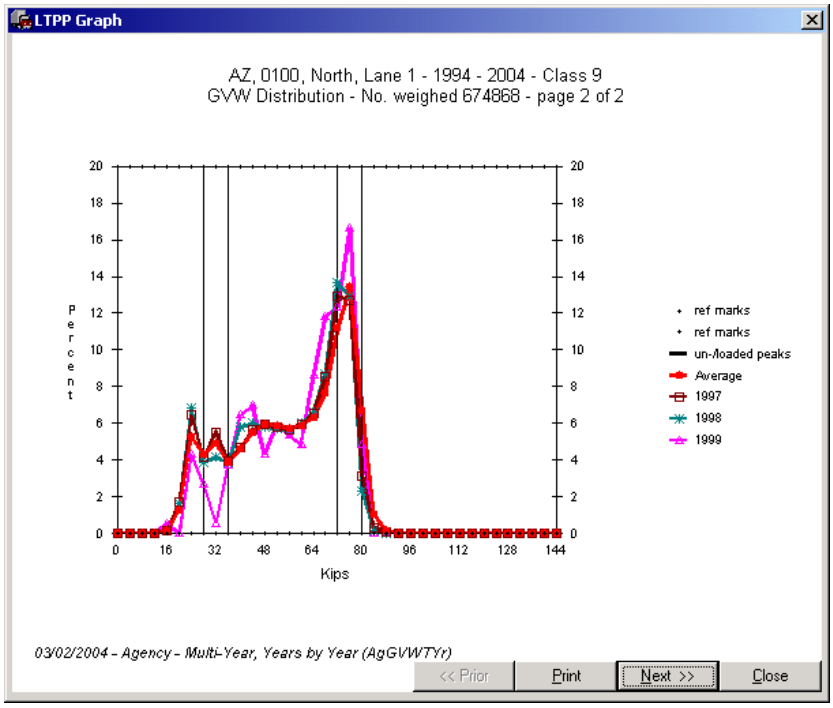


Figure 14-6 Class 9 GVW Distribution – 1997 to 1999 for 040100

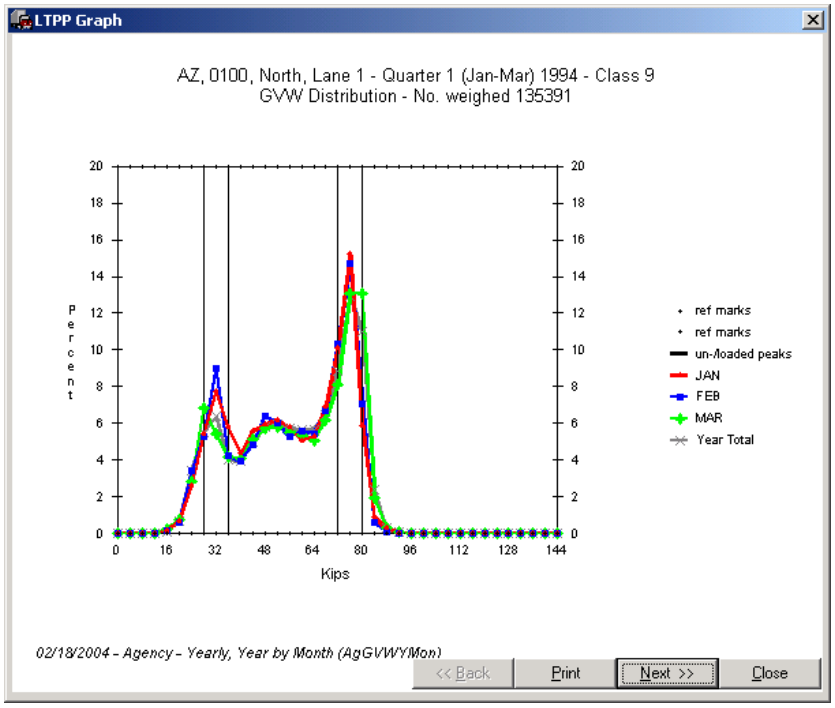


Figure 14-7 Class 9 GVW Distribution – Jan 1994 to Mar 1994 for 040100

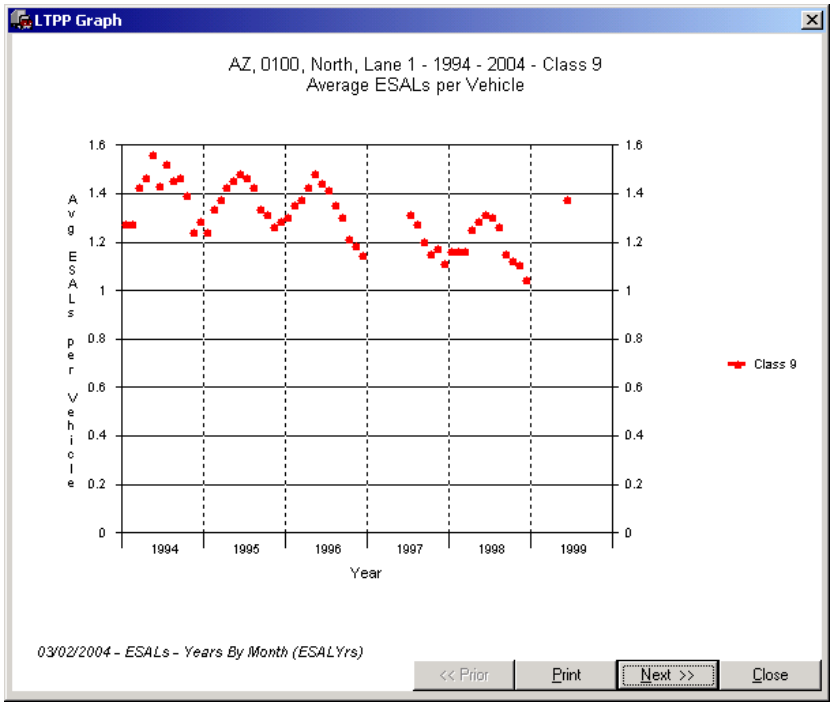


Figure 14-8 Average Class 9 ESALs for site from 1994 to 1999 for 040100

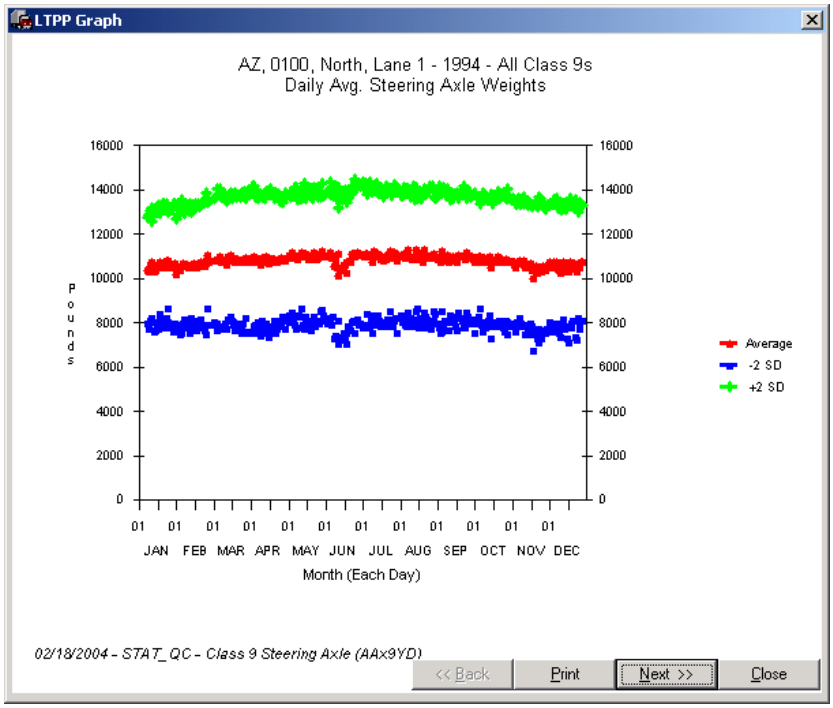


Figure 14-9 Average Daily Class 9 Steering Axle Weight - 1994 for 040100

15 Appendix A

Hoover Dam and surrounding highways have been closed indefinitely to commercial vehicle traffic, according to a report issued by the Federal Motor Carrier Safety Administration (FMCSA). The agency indicated in an e-mail that FBI sources indicated the action was precautionary, and not in response to any direct threat.

According to a report on the *Las Vegas Review Journal* web site, Hoover Dam is open to passenger cars only. The visitors' center and parking areas remain closed, the web site said.

US Route 93 runs over Hoover Dam, which is on the Nevada-Arizona border. It is 30 miles southeast of Las Vegas NV.

Since 9/11/01, the road across the Hoover Dam has been closed to commercial trucking and over 2,100 trucks per day are now detoured to other highways. Commercial truck traffic must now route through Laughlin, an additional 23 miles or I-40 an additional 70 miles, adding dozens of travel miles to each trip. This creates a negative financial impact of $30 million per year, based on only the additional mileage, which is ultimately passed on to the consumer. The detours currently being used by commercial trucks are not designed to handle this traffic volume and weight. The Hoover Dam crossing is the only major highway in the nation with ongoing restrictions as a result of the terrorist attack.

POST VISIT HANDOUT GUIDE FOR SPS WIM FIELD ASSESSMENT

STATE: Arizona

SHRP ID: 0100

Figures

1. General Information

SITE ID: *040100*

LOCATION: *U.S. 93 North at M.P. 52.62*

VISIT DATE: *March 3, 2004*

VISIT TYPE: *Assessment*

2. Contact Information

POINTS OF CONTACT:

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

Highway Agency: *Dr. Estomih Kombe, 602-712-3135, ekombe@dot.state.az.us*

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

FHWA Division Office Liaison: *Alan Hansen, 602-379-3645 x 108, Alan.Hansen@fhwa.dot.gov*

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

3. Agenda

BRIEFING DATE: *Held March 5, 2004, 9:00 a.m. in the office of Dr. Kombe, 2739 E. Washington Street, Phoenix, AZ, 85034 - Contact Number 602-712-3135*

ON SITE PERIOD: *March 3, 2004*

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

4. Site Location/ Directions

NEAREST AIRPORT: *McCarran International Airport, Las Vegas, Nevada*

DIRECTIONS TO THE SITE: *0.25 miles North of County Route 125*

MEETING LOCATION: *On site at 8:00 a.m.*

WIM SITE LOCATION: *U.S. 93 North at M.P. 52.62 (Latitude: 35^0 24.004' and Longitude: -114^0 15.671')*

WIM SITE LOCATION MAP:*See Figure 4.1*

Figure 4.1: Site 040100 in Arizona

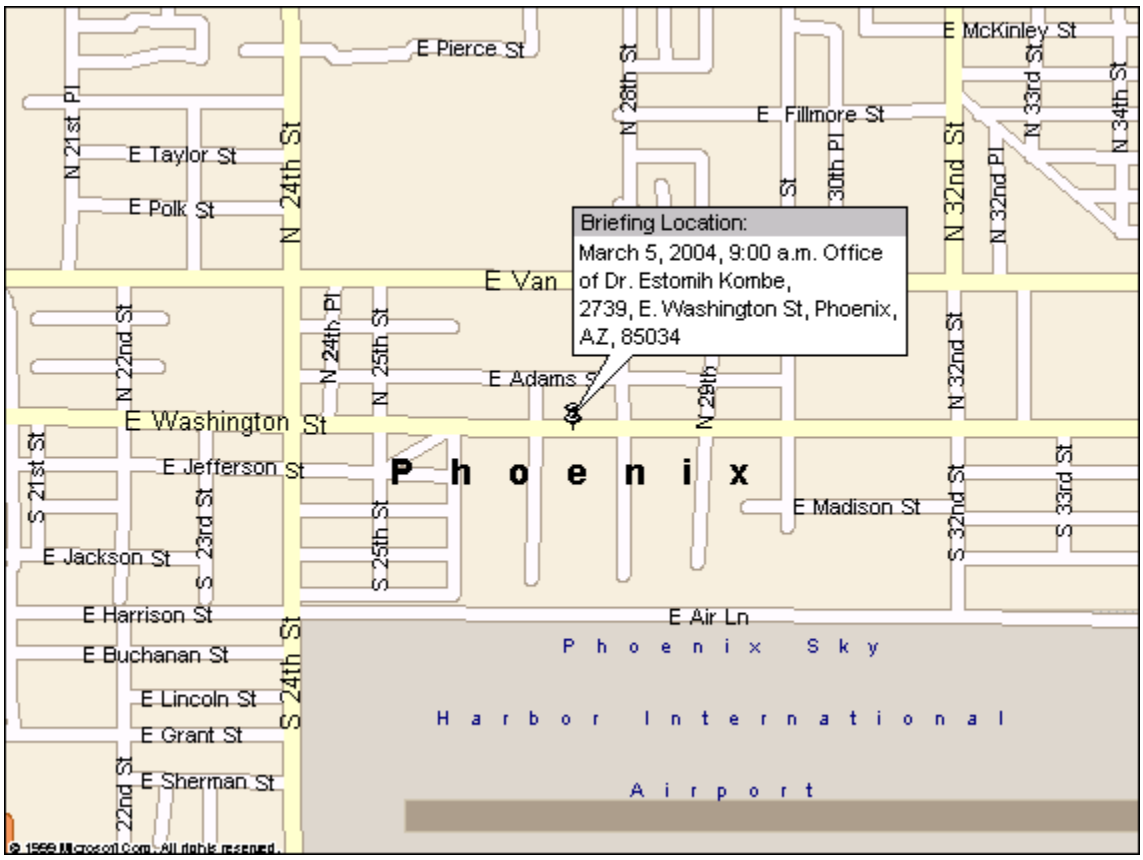


Figure 4.2: Briefing Location of 040100 in Arizona

5. Truck Route Information

ROUTE RESTRICTIONS: *None.*

SCALE LOCATION: *TA Kingman, Kingman, AZ, I-40, exit 48,Latitude: 35.19088, Longitude: -114.0705,Tim Curry - proprietor, Phone No: 928-753-7600, 24 hrs, $8.00 per run.*

TRUCK ROUTE:

- *Northbound to crossover (1.17 miles)*
- *Southbound to crossover (1.945 miles)*
- *Total turnaround length is 3.115 miles*

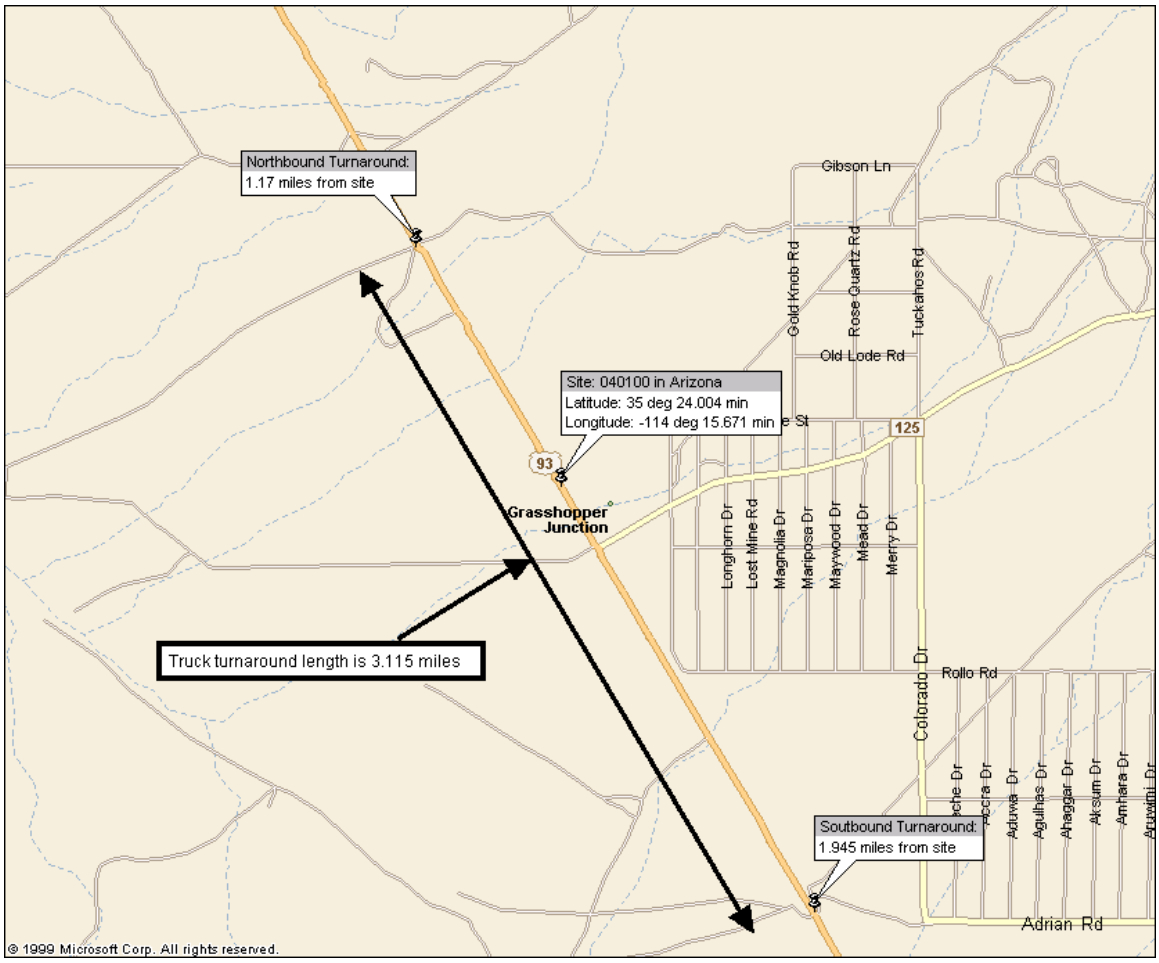


Figure 5.1: Truck Route at 040100 in Arizona

6. Sheet 17 – Arizona (040100)

1.* ROUTE ___US 93_____MILEPOST ___52.62__LTPP DIRECTION - N S E W

2.* WIM SITE DESCRIPTION - Grade ___<_1____ % Sag vertical Y / N
Nearest SPS section upstream of the site _0_4_0 1_6_0_ ___ ___
Distance from sensor to nearest upstream SPS Section ___ ___ 43.75___ ___ ft

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

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

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

Shoulder width ___ _8__ ft

4.* PAVEMENT TYPE _____Portland Cement Concrete_____

5.* PAVEMENT SURFACE CONDITION – Distress Survey
Date _____03-03-04_____Distress Photo Filename
__Distress_1_TO_4_04_24A_0100_03_03_04.JPG_____
Date _____03-03-04_____Distress Photo Filename
_Distress_2_TO_4_04_24A_0100_03_03_04.JPG_____
Date _____03-03-04_____Distress Photo Filename
__Downstream_TO_4_04_24A_0100_03_03_04.JPG_____

6. * SENSOR SEQUENCE _____Loop – Bending Plate – Loop – Bending Plate ___

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 ___ __4_. _0__ in
Clearance/access to flush fines from under system Y / N

10. * CABINET LOCATION

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

Distance from edge of traveled lane _69.5_ __ ft

Distance from system __ _77.5_ __ ft

TYPE ____M_____

CABINET ACCESS controlled by LTPP / (STATE) / JOINT?

Contact - name and phone number __Estomih Kombe (602) 712-3135 __

Alternate - name and phone number_ Nate Woolfenden – (602) 954-0257

11. * POWER

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

Service provider _____ Phone number _____

12. * TELEPHONE

Distance to cabinet from drop ___ ___ __1_ ft Overhead / under ground / cell?

Service provider _____ Phone Number_____

13.* SYSTEM (software & version no.)- DAW 100 Version 8.54_____

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

14. * TEST TRUCK TURNAROUND time __10__ minutes DISTANCE __6.230_ mi.

15. PHOTOS FILENAME

Power source _Solar_Panel_TO_4_04_24A_0100_03_03_04.JPG___

Phone source _Phone_TO_4_04_24A_0100_03_03_04.JPG___

Cabinet exterior _Cabinet Exterior_TO_4_04_24A_0100_03_03_04.JPG____

Cabinet interior _Cabinet Interior_TO_4_04_24A_0100_03_03_04.JPG _____

Weight sensors _ First_Weight_Sensor_TO_4_04_24A_0100_03_03_04.JPG __

Classification sensors _ Second_Weight_Sensor_TO_4_04_24A_0100_03_03_04.JPG

Other sensors _____

Description _____

Downstream direction at sensors on LTPP lane _

Downstream_TO_4_04_24A_0100_03_03_04.JPG _____

Upstream direction at sensors on LTPP lane _

Upstream_TO_4_04_24A_0100_03_03_04.JPG _____

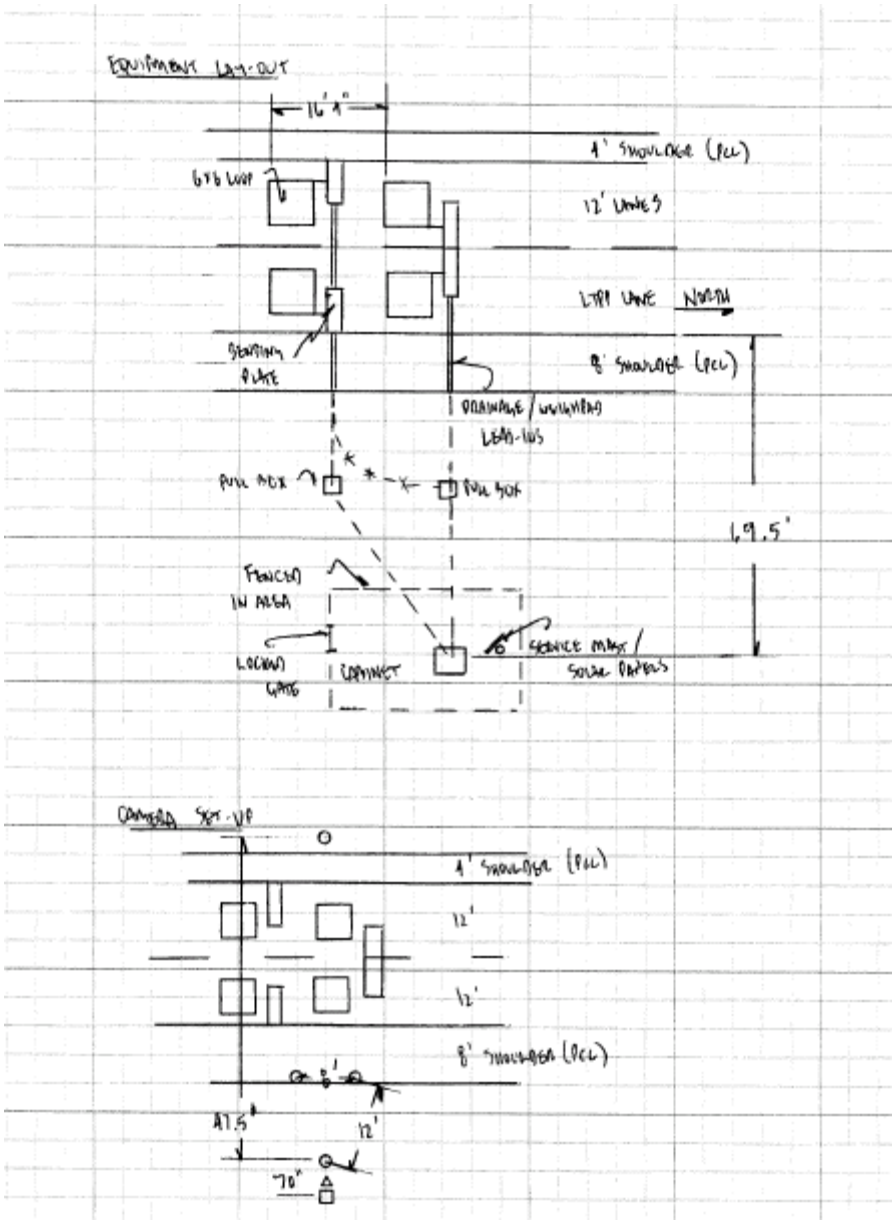
COMMENTS

_____
_____GPS Coordinates: Latitude: 35^0 24.004' and Longitude: -114^0 15.671'_____
_____
_____Drainage Conduit could not be located_____
_____
_____Closest Amenities: Kingman – 18 miles south of site_____
_____Various restaurants, hotels, gas etc._____
_____Telephone service is available but is being used by the weather station installed near the WIM cabinet_____
_____
_____
_____ Test Truck Recommendations:_____
_____Types of Trucks: One Class 9 and One Class 5 _____
Truck 1: Class 9, 72,000 to 80,000 lb legal limit on gross and axles, air suspension;
____Truck 2: Class 5, Fully loaded to legal limit_____
_____
_____Expected Speeds: 55, 60 and 65 mph_____
_____
_____
_____
_____
_____

COMPLETED BY _____Dean J. Wolf_____

PHONE __301-210-5105___ DATE COMPLETED _0_ _3_ /_0_ _3_ / _2_ _0_ _0_ _4_

Sketch of equipment layout



Site Map

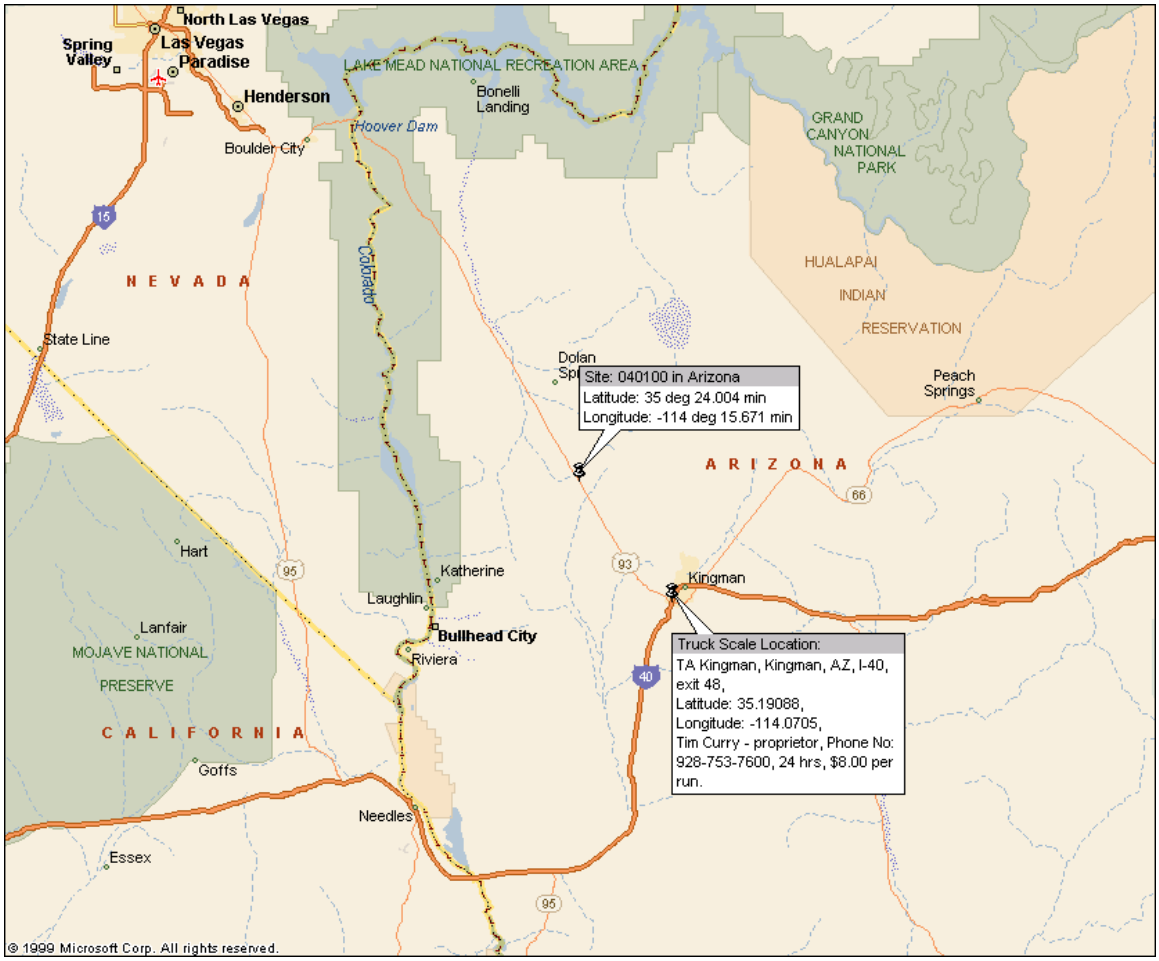
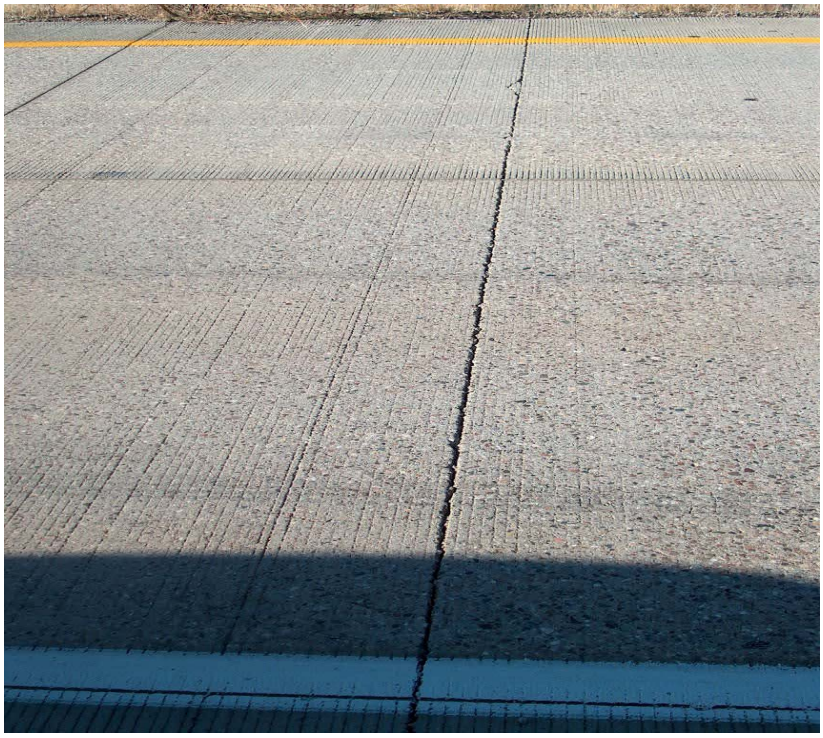
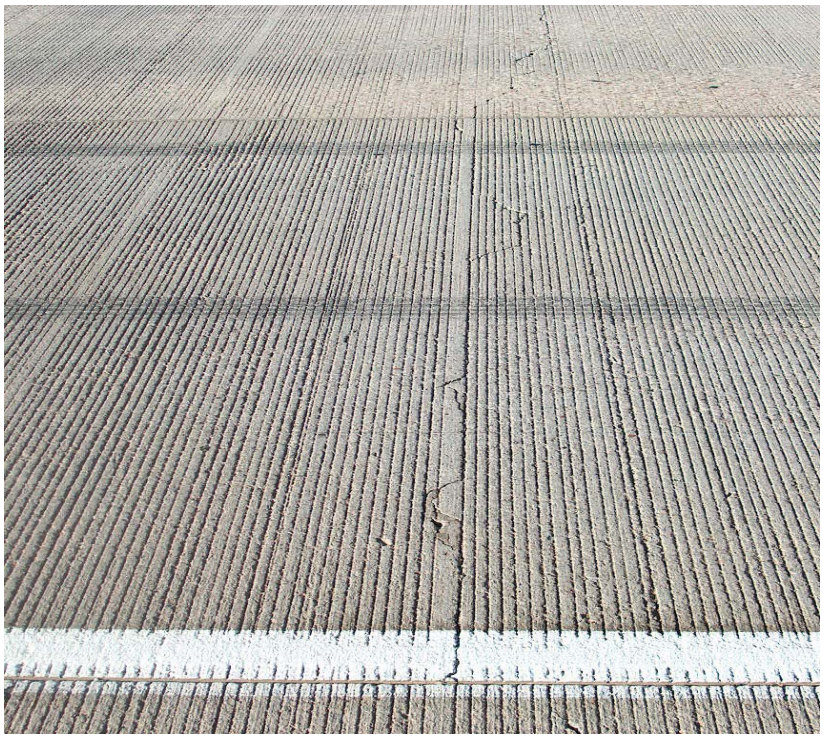


Figure 6.1: Site Map at 040100 in Arizona.



Distress_1_TO_4_04_24A_0100_03_03_04.JPG



Distress_2_TO_4_04_24A_0100_03_03_04.JPG

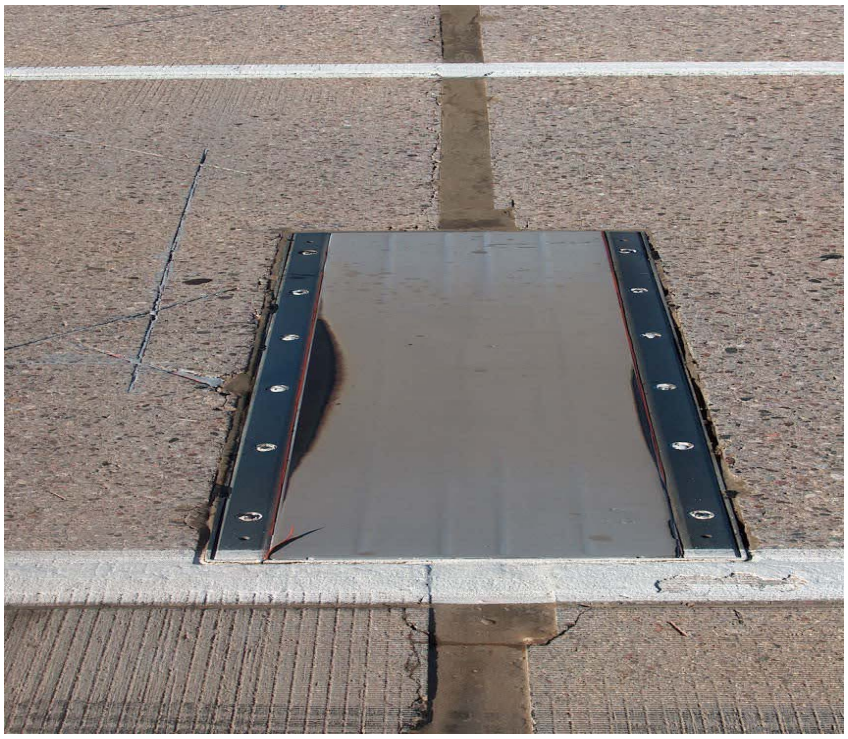
Downstream_TO_4_04_24A_0100_03_03_04.JPG

Solar_Panel_TO_4_04_24A_0100_03_03_04.JPG

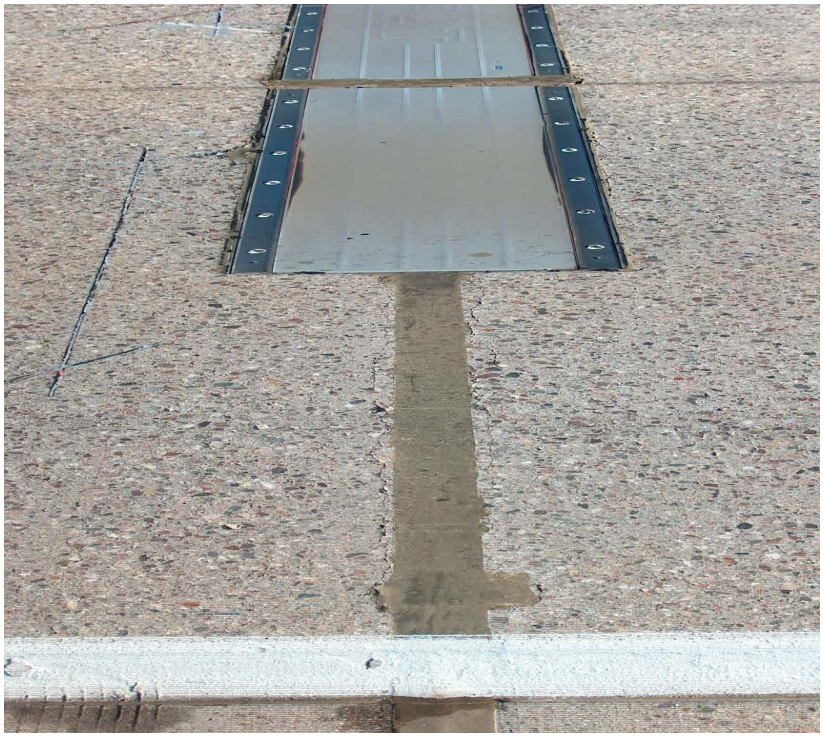
Phone_TO_4_04_24A_0100_03_03_04.JPG

Cabinet_Exterior_TO_4_04_24A_0100_03_03_04.JPG

Cabinet_Interior_TO_4_04_24A_0100_03_03_04.JPG



First_Weight_Sensor_TO_4_04_24A_0100_03_03_04.JPG



Second_Weight_Sensor_TO_4_04_24A_0100_03_03_04.JPG

Downstream_TO_4_04_24A_0100_03_03_04.JPG

Upstream_TO_4_04_24A_0100_03_03_04.JPG

WIM SITE COORDINATION

SPS Project_ID 0_ 1_ 0_ 0_

1. Equipment –
   - Maintenance – contract with purchase / separate contract LTPP / separate contract State / state personnel
     Contact: __Estomih Kombe (602) 712-3135_____

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

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

   - Calibration – Vendor / State / LTPP

   - Manuals and software – State / LTPP

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

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

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

2. Site visits – Evaluation

   - WIM Validation Check - advance notice required _7__ days / weeks

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

     Drivers State / LTPP
     Contact _____

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

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

WIM SITE COORDINATION SPS Project_ID 0_ 1_ 0_ 0_

- Pre-visit data
  - Classification and speed: Contact __ Estomih Kombe (602) 712-3135_____
  --Typical operating conditions (congestion, high truck volumes)
  Contact ____ Estomih Kombe (602) 712-3135_____
  -- Equipment operational status: Contact - Estomih Kombe (602) 712-3135

- Access to cabinet
  State only / Joint / LTPP Key / Combination Fenced in Areas

- State personnel required on site Y / N
Contact information ____ Estomih Kombe (602) 712-3135_____

- Enforcement Coordination required: Y / N
Contact information _____

- Traffic Control Required: Y/ N
Contact information _____

- Maximum number of personnel on site __5___
  Invitees _____

- Authorization to calibrate site -- State only / LTPP

- Special conditions _____

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

4. Site visits – Validation

- WIM Validation Check - advance notice required __7_ days / weeks
  LTPP Semi-annually / Sate per LTPP protocol semi-annually / State other Annually

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

  Drivers State / LTPP

WIM SITE COORDINATION SPS Project_ID 0_ 1_ 0_ 0_

Contact _____

Contractors with prior successful experience in WIM calibration in state:
_____PAT/IRD_____

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

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

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

- State personnel required on site Y / N
Contact information ___ Estomih Kombe (602) 712-3135_____

- Enforcement Coordination required: Y / N
Contact information _____

- Traffic Control Required: Y/ N
Contact information _____

- Authorization to calibrate site -- State only / LTPP

- Special conditions _____

5. Site visit – Construction

Construction schedule and verification – Contact ___ Estomih Kombe (602) 712-3135;
District Maintenance Office, Kingman (928) 681-6010__

- Notice for straightedge and grinding check - ___2___ days / weeks

On site lead to direct / accept grinding – State / LTPP
District Maintenance Office, Kingman (928) 681-6010

- WIM Calibration - advance notice required __7___ days / weeks
  Number of lanes -- ___4___
  LTPP / State per LTPP protocol / State Other _____

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

WIM SITE COORDINATION SPS Project_ID 0_ 1_ 0_ 0_

Drivers State / LTPP

Contractors with prior successful experience in WIM calibration in state:
_____PAT/IRD_____

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

- Pre-visit data
  – Classification and speed: Contact ___ Estomih Kombe (602) 712-3135___
  -- Equipment operational status: Contact _ Estomih Kombe (602) 712-3135____

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

- State personnel required on site Y / N
  Contact information _____ Estomih Kombe (602) 712-3135_____

- Enforcement Coordination required: Y / N
  Contact information _ District Maintenance Office, Kingman (928) 681-6010___

- Traffic Control Required: Y/ N
  Contact information _ District Maintenance Office, Kingman (928) 681-6010___

- Authorization to calibrate site -- State only / LTPP

- Special conditions _____

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

SHEET 16 **LTPP MONITORED TRAFFIC DATA** **SITE CALIBRATION SUMMARY**	*STATE ASSIGNED ID [_0_ _5_ _2_ _5_] *STATE CODE [_0_ _4_] *SHRP SECTION ID [0__ _1_ _0_ _0_]

SITE CALIBRATION INFORMATION

1. * DATE OF CALIBRATION (MONTH/DAY/YEAR) [_0_ _3_ / _0_ _3_ / _2_ _0_ _0_ _4_]

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

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

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

5. EQUIPMENT MANUFACTURER _____PAT DAW _____

WIM SYSTEM CALIBRATION SPECIFICS**

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

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

   __ __ __ PASSES PER TRUCK

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

7. SUMMARY CALIBRATION RESULTS (EXPRESSED AS A PERCENT)
   MEAN DIFFERENCE BETWEEN ---
   DYNAMIC AND STATIC GVW ___ ___ ___ . __ STANDARD DEVIATION __ __ . __
   DYNAMIC AND STATIC SINGLE AXLES ___ ___ ___ . __ STANDARD DEVIATION __ __ . __
   DYNAMIC AND STATIC DOUBLE AXLES ___ ___ ___ . __ STANDARD DEVIATION __ __ . __

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

9. DEFINE THE SPEED RANGES USED (MPH) _____ _____ _____ _____ _____ _____ _____ _____
   _____ _____ _____ _____ _____ _____ _____ _____ _____ _____

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

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

CLASSIFIER TEST SPECIFICS***

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

13. METHOD TO DETERMINE LENGTH OF COUNT ____ TIME _81___ NUMBER OF TRUCKS

14. MEAN DIFFERENCE IN VOLUMES BY VEHICLES CLASSIFICATION:

*** FHWA CLASS 9 ___0_ ____	FHWA CLASS __3__	____ _100___ ____ ____
*** FHWA CLASS 8 ___1800_ ____ ____	FHWA CLASS __5__	____ _-39___ ____ ____
	FHWA CLASS __6__	____ _-38___ ____ ____
	FHWA CLASS ____	____ ____ ____ ____

   *** PERCENT "UNCLASSIFIED" VEHICLES: ____ _22_____

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