



INTERNATIONAL ROAD DYNAMICS INC.

LTPP SPS PHASE II

WEIGH-IN-MOTION SITE ACCEPTABILITY ASSESSMENT REPORT II

MARYLAND SPS-5
LTPP ID 240500
SEPTEMBER 30, 2005
CLIN 1001 TASK ORDER 6



CONTRACT NO. DTFH61-05-D-00001



LONG TERM
pavement
PERFORMANCE

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1.0 EXECUTIVE SUMMARY

The proposed Maryland SPS-5 WIM site was visited on September 15th and a site acceptability assessment was performed. The site is located on US15 at Mile Post 4.7 near the town of Frederick. It is proposed to install a Weigh-in-Motion (WIM) system for the northbound lane between existing SPS-5 pavement test sections 240559 and 240561. Based upon our site evaluation criteria, our discussions with the State, and lane closure considerations, it is recommended that this site be accepted and instrumented with Bending Plate technology.

The site is located on a straightaway with no curves immediately before or after the WIM location and the grade is relatively flat. Vehicles track smoothly through this area at speeds between 55 and 65 MPH. Traffic flow is medium to heavy on this two lane, two direction roadway.

The existing roadway pavement at this location consists of 11 inches of Asphalt Concrete (AC). The State has installed a blanket ground 400 foot Portland Cement Concrete (PCC) slab to accommodate the WIM system's in-pavement sensors. Both the approach and departure pavement and the PCC slab are in good condition with no noticeable distress conditions. Additional grinding has been performed to improve the smoothness of the PCC slab on August 29, 2005.

AC power and telephone service is available at the existing controller cabinet located approximately 450 feet from the proposed WIM controller cabinet location. The State has extended these services from this existing cabinet to the proposed WIM cabinet location.

2.0 EXISTING ROADWAY

Visual on-site observation of the existing roadway and traffic operating characteristics were performed and recorded. This included taking roadside measurements, digital photography, and driving over the roadway to evaluate conditions at the proposed location.

2.1 PAVEMENT AND GEOMETRICS

The northbound lane is 12 feet wide with a 10 foot wide outside shoulder. The horizontal alignment is tangent with minimal grade (positive 0.62%).

In regard to cross slope, the northbound lane is crowned at the lane line with the southbound lane, each lane sloping 1.6% away from the lane line.

2.2 PCC WIM SLAB

A 400 foot non-reinforced plain PCC jointed slab has been installed to accommodate the WIM system's in-pavement sensors. The slab thickness is 11 inches and the transverse joints are on nominal 15 foot centers. These joints are dowelled. The shoulder has not been disturbed and remains AC.

2.3 OBSERVED TRAFFIC OPERATING CHARACTERISTICS

The medium to heavy traffic flow exhibited good lane discipline, staying well within the lane and shoulder line markings. Traffic is free flowing at all times at speeds between 55 and 65 MPH (posted speed limit is 55 MPH for all vehicles). Although tailgating can occasionally occur, this can be accommodated by adjustments in the system's software. There are no signals or merging in the WIM site vicinity. Trucks are "cruising" through the site at constant speeds. The only on/off locations between the WIM site and the SPS sites exist at the Basford and Whiten Road exits. It should be noted that these exits are residential roadways and will not accept heavy truck traffic.

3.0 SITE CONFORMANCE TO EVALUATION CRITERIA

A number of site parameters were evaluated at the proposed WIM location to confirm site acceptability. These site parameters included items such as pavement, traffic patterns, availability of power and telephone, and logistics. These parameters were rated as either "Pass", "Requires Attention", or "To Be Performed". At the end of this section, recommendations on site acceptance and/or corrective action are noted.

3.1 PAVEMENT TYPE AND CONDITION- PASS

The 400 foot PCC slab installed in October 2004 specifically for the WIM system sensors appears to be structurally sound with no evidence of distress conditions. It is recommended that the WIM system scales be installed approximately 90 feet from the end of the PCC slab.

The AC approach and departure pavements appear to be in fair condition, although there is cracking and spalling in and around the slab location. Since the proposed WIM will be located approximately 90 feet from the back end of the slab, this should not be an issue as it relates to WIM performance.

3.2 OBSERVED PAVEMENT SMOOTHNESS- PASS

The AC approach and departure pavements, as well as the blanket ground PCC slab look much improved when compared to our initial site assessment in February 22-24, 2005. Additional grinding has been performed to improve the smoothness of the PCC slab on August 29, 2005. The ride through this area is now smooth and observations of trucks approaching and passing through the proposed scale location show minimal suspension and body motion dynamics.

3.3 ANALYSIS OF PAVEMENT PROFILE DATA- PASS

Profiling was performed by Stantec on September 21, 2005 and provided to IRD on September 22, 2005. The analysis of pavement profile data indicated that the computed WIM indices were in between the lower and upper threshold values. When considering the observed pavement smoothness, our findings reinforce that the site is sufficiently smooth to provide research quality WIM data and the construction of the slab is anticipated to retain this level of smoothness exceeding 5 years.

3.4 ROADWAY GEOMETRICS- PASS

The grade is minimal and the lane in which the sensors are to be installed is 12 feet wide. The pavement cross slope is adequate for proper roadway drainage. The adjacent lane's having an opposite cross slope poses no problem.

3.5 TRAFFIC OPERATING CHARACTERISTICS- PASS

The general traffic pattern is free flowing with good lane discipline. There are no interchanges or signals affecting traffic flow. The truck traffic is cruising through the site and staying within the lane lines.

3.6 TRUCK TRAFFIC COMPARISON BETWEEN WIM AND TEST SITE- PASS

There are exit/entrance locations between the WIM site and the SPS-5 pavement test sections, however, these are access routes for residential roadways and pose no risk of diversion for truck traffic.

3.7 POTENTIAL WIM INTERFERENCE SOURCES- PASS

The nearest source of any potential interference (overhead power lines) is 450 feet upstream of the proposed WIM system location.

3.8 ACCESS TO POWER AND PHONE SERVICES- PASS

The State will run AC power and telephone service to the proposed WIM controller cabinet location from the existing ATR # 68 controller cabinet.

3.9 EQUIPMENT INSTALLATION CAPABILITY- PASS

There is an adequate location for the WIM controller cabinet behind the guard rail by the existing junction box that will be used by the State for supply of AC power and telephone services. There is good visibility from this location of the sensors and approaching vehicles. There is adequate room adjacent to the cabinet location for service facilities. Roadway and overall site drainage is adequate. There is no foreseen potential for ponding or flooding at the cabinet and pullboxes and there is adequate topography for scale pit drainage. There is the ability to provide safe clearance in the work zone from live traffic during installation of the WIM system.

3.10 POTENTIAL TRAFFIC CONTROL / WORK ZONE SAFETY ISSUES- PASS

The traffic control should go smoothly, given the good approaching sight distance and the lack of nearby intersections or interchanges. Lane closures will need to be performed either at night or on weekends due to the high volume of traffic on the roadway during the day and flagmen will be needed for the required one lane reversible traffic control. No other work zone safety issues are foreseen at this rural site.

3.11 CALIBRATIONS AND EVALUATIONS USING TEST TRUCKS- PASS

The nearest usable NB truck turnaround location is the Whiten Road Exit, a distance of 0.8 miles from the WIM site. The nearest usable SB turnaround location is the Basford Road Exit, a distance of 1.2 miles from the WIM site.

The test truck round trip circuit route is approximately 5 miles. In that Basford and Whiten Exits are residential roadways, the best way to route test vehicles into the Basford and Whiten Exits and back onto the roadway will need to be determined. Due to potential constraints, the estimated lap time is 20 minutes.

3.12 TRUCK CIRCUIT MAP - PASS

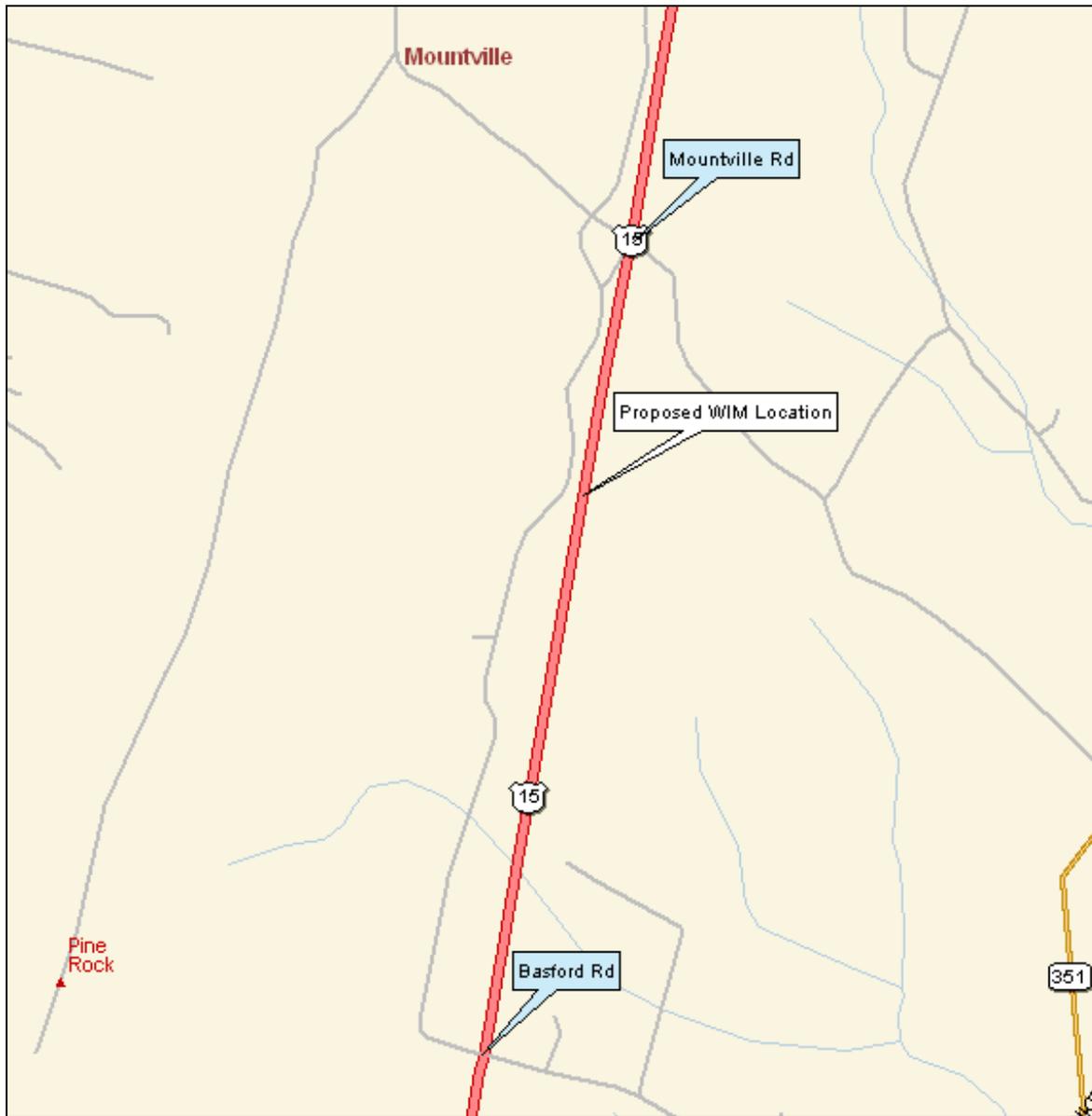


Figure 1: Truck Circuit Map

3.13 RECOMMENDATIONS ON SITE ACCEPTANCE / CORRECTIVE ACTIONS

The State has run AC power and telephone service to the proposed WIM controller cabinet location from the existing ATR # 68 controller cabinet.

The State has also performed additional grinding to ensure a smooth approach in advance and immediately following the proposed WIM System.

No further corrective action is required to this site location at this time. This site is acceptable for the installation of the proposed WIM System.

4.0 TRAFFIC DATA REVIEW

Vehicle distributions of all trucks (FHWA Class 4 and higher) - 12.96%

Vehicle distributions for heavy trucks (FHWA Class 6 and higher) – 7.68%

Volume of trucks comprising of 10 % or more of truck population

Class 4 vehicles – 10.7%

Class 5 vehicles – 29.9%

Class 9 vehicles – 44.5%

Volume of trucks comprising 10 % or more of heavy truck population

Class 8 vehicles – 16.1%

Class 9 vehicles – 75.0%

The data as noted has been collected by Maryland State Highway Administration as supplied from the ATR # 68 Permanent Piezo Weigh-in-Motion System. The State has been collecting data through their continuous classification program at this location for quite some time.

The 2004 Traffic Volumes provided by ATR # 68 indicate the ADT to be 15,380.

5.0 PAVEMENT EVALUATION

In determining WIM site acceptability, the pavement was evaluated by the team. This is the second evaluation of the WIM site. Various data was collected and analyzed. The data included: geometric information provided by the State, visual surface condition data, and profile data collected by the NRSC.

5.1 GEOMETRIC INFORMATION

The SPS-5 is a flexible pavement study. As part of the WIM installation, the State has installed approximately 400 ft of PCC pavement to accommodate the system. There will be approximately 313 ft of PCC prior to the WIM and 90 ft of PCC after the WIM. The pavement has a thickness of 11 in with joint spacing of 15 ft.

Lane width of the SPS-5 and PCC pavement is 12 ft. The shoulders are AC throughout the pavement study and are 10 ft in width.

The PCC pavement is relatively straight with little horizontal curvature. There are no curves immediately before or after the WIM. The grade is relatively flat throughout the project area. A grade of 0.62% was reported by the State.

The cross slope was reported to be 1.6% by the State. The drainage was reported to be adequate.

5.2 SURFACE CONDITION

IRD performed a site evaluation on September 15, 2005. Pictures were taken to document the surface condition and are presented in Appendix D. The site evaluation observed the range of pavement from 900 ft prior to the WIM to 100 ft after the WIM. The PCC pavement is located within this observed area.

5.2.1 PCC PAVEMENT

The PCC pavement was constructed October, 2004. It was reported by the State that additional grinding was performed August 29, 2005 on the PCC using a 36 in wide blanket grinder.

5.2.2 AC PAVEMENT UPSTREAM OF WIM

The AC pavement upstream of the WIM is approximately 13 years old. There was some distress observed on the upstream pavement. Longitudinal cracking along the pavement edge and the construction joint along the centerline was observed.

5.2.3 AC PAVEMENT DOWNSTREAM OF WIM

The AC pavement downstream of the WIM is approximately 13 years old. There was some distress observed on the downstream pavement. The AC pavement starts approximately 90 ft after the proposed WIM. Longitudinal cracking along the pavement edge and construction joint along the centerline was observed. There may be some raveling in the center of the travel lane.

5.2.4 SHOULDER CONDITION

The shoulders are AC throughout the study area. The shoulder adjacent to the PCC pavement is approximately 13 years old. The drop off from the pavement edge to the right of way (ground) is variable. The condition of the pavement edge and shoulder joint is poor in several areas. Cracking (i.e., longitudinally along pavement edge and transversely from pavement edge to right of way) and deterioration of the AC is evident in many of the pictures shown in Appendix D.

5.3 SURFACE PROFILE

Profile data was collected by the NRSC on September 21, 2005 with the LTPP Profiler. The LTPP Profiler is manufactured by ICC and is a Class I Profiler as described in ASTM E950. The profile runs were performed on 1033 ft (315 m) of pavement. Five profile runs were performed along the center of the lane (i.e., along the usual wheel paths). Three profile runs were performed on the left side (i.e., inner edge of lane) and right side (i.e., close to shoulder) of the lane. The PCC pavement is located at approximately 515 ft to 915 ft (157 m to 279 m). The proposed WIM will be located at approximately 825 ft (252 m). The profile data was analyzed with ProVAL and LTPP WIM Index Software to evaluate the pavement smoothness at the site.

5.3.1 PROFILING CONDITIONS

Table 1 presents the profile runs used in the analysis. The profile runs were collected in the morning under partly cloudy skies. The air temperature was reported as 28°C (82°F). This information was reviewed to assess temporal or temperature related variables. In the case of PCC pavements, it is well documented that curling and warping can occur. Because of the short profiling time and no reported change in temperature, the profile data should not have differences due to weather.

Table 1. Profile Runs Used in Analysis.

Filename*	Date	Time	Location	Cloud Conditions	Air Temperature (°C)
24050CB1	9/21/2005	3:23 PM	Center	Clear	28.3
24050CB2	9/21/2005	3:29 PM	Center	Clear	28.3
24050CB3	9/21/2005	3:33 PM	Center	Clear	28.3
24050CB4	9/21/2005	3:46 PM	Center	Clear	28.3
24050CB5	9/21/2005	3:51 PM	Center	Clear	28.3
24050LB1	9/21/2005	3:57 PM	Left	Clear	28.3
24050LB2	9/21/2005	4:02 PM	Left	Clear	28.3
24050LB3	9/21/2005	4:07 PM	Left	Clear	28.3
24050RB1	9/21/2005	4:12 PM	Right	Clear	28.3
24050RB2	9/21/2005	4:17 PM	Right	Clear	28.3
24050RB3	9/21/2005	4:24 PM	Right	Clear	28.3

*Converted to ERD format by NRSC.

5.3.2 PROFILE OBSERVATIONS

The profile runs were visually compared using ProVAL. The profile runs were compared with one another at each sensor position (i.e., left and right wheel path). Figures 2-5 present profile runs along the center of the lane. The red vertical lines represent the start and end of the PCC pavement.

The following observations can be made:

- The profile runs showed good agreement for each sensor position.
- Features such as peaks and valleys correspond well with each other.
- Within the data set, the PCC pavement is located between 157 m and 279 m.
- In the AC pavement, there are transverse cracks present, which are shown as sharp downward spikes.
- In the PCC pavement, there are either transverse cracks or joints present, which are shown as sharp downward spikes.
- AC and PCC pavement joints are noticeable. Roughness of joints can cause variations in profile as seen in Figures 4-5.

Figures 6 and 7 present profile runs from along the center of the lane versus the left and right edge. These figures show the transverse variation within the wheel path. There is little variation along most of the profile. However, there is still a noticeable variation at the upstream and downstream PCC joints. From the site visit pictures, the interface between the AC / PCC at 157 and 279 m have sealant and no visible pavement distress is present.

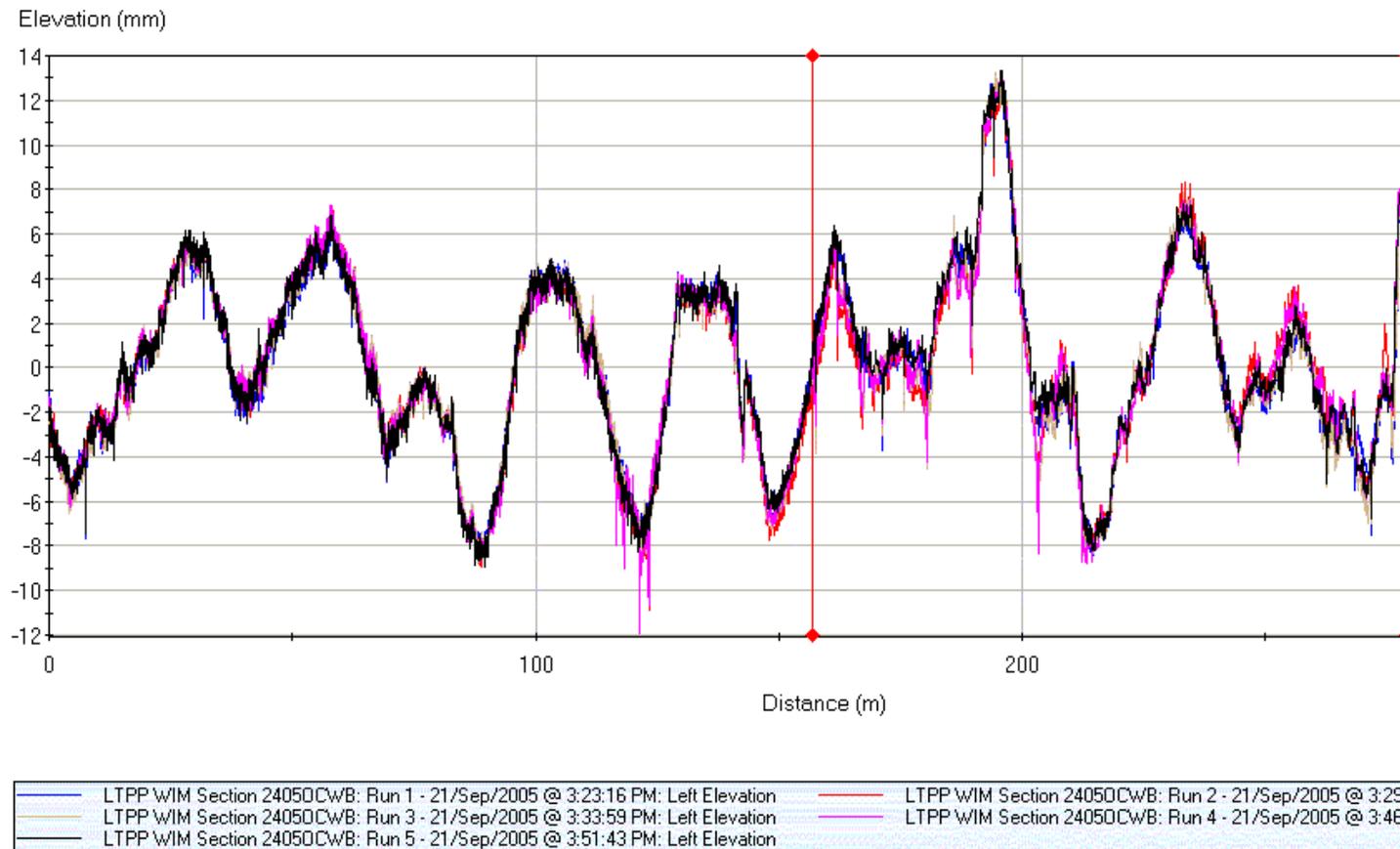


Figure 2. Left Wheel Path Along Center of the Lane.

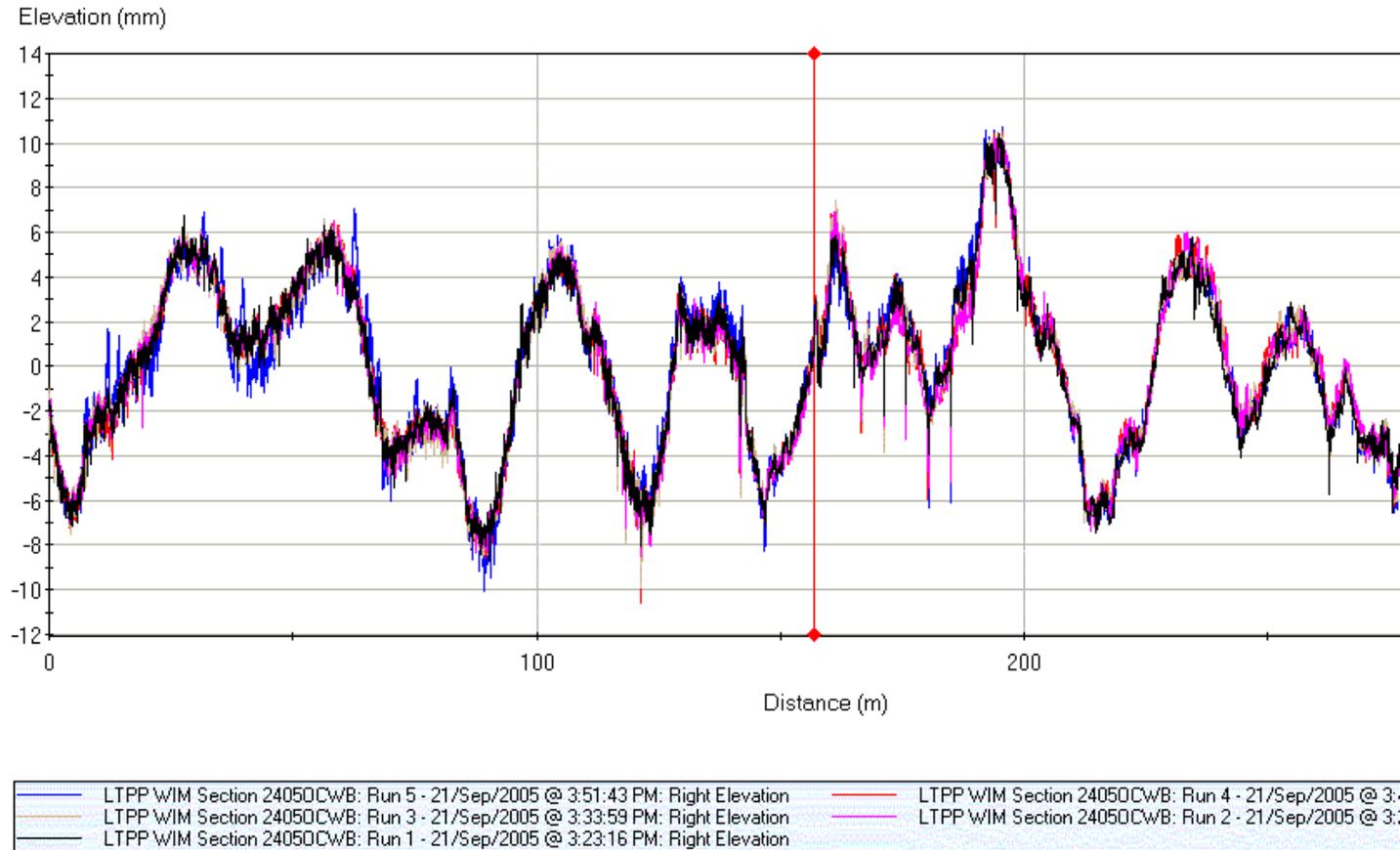


Figure 3. Right Wheel Path Along Center of the Lane.

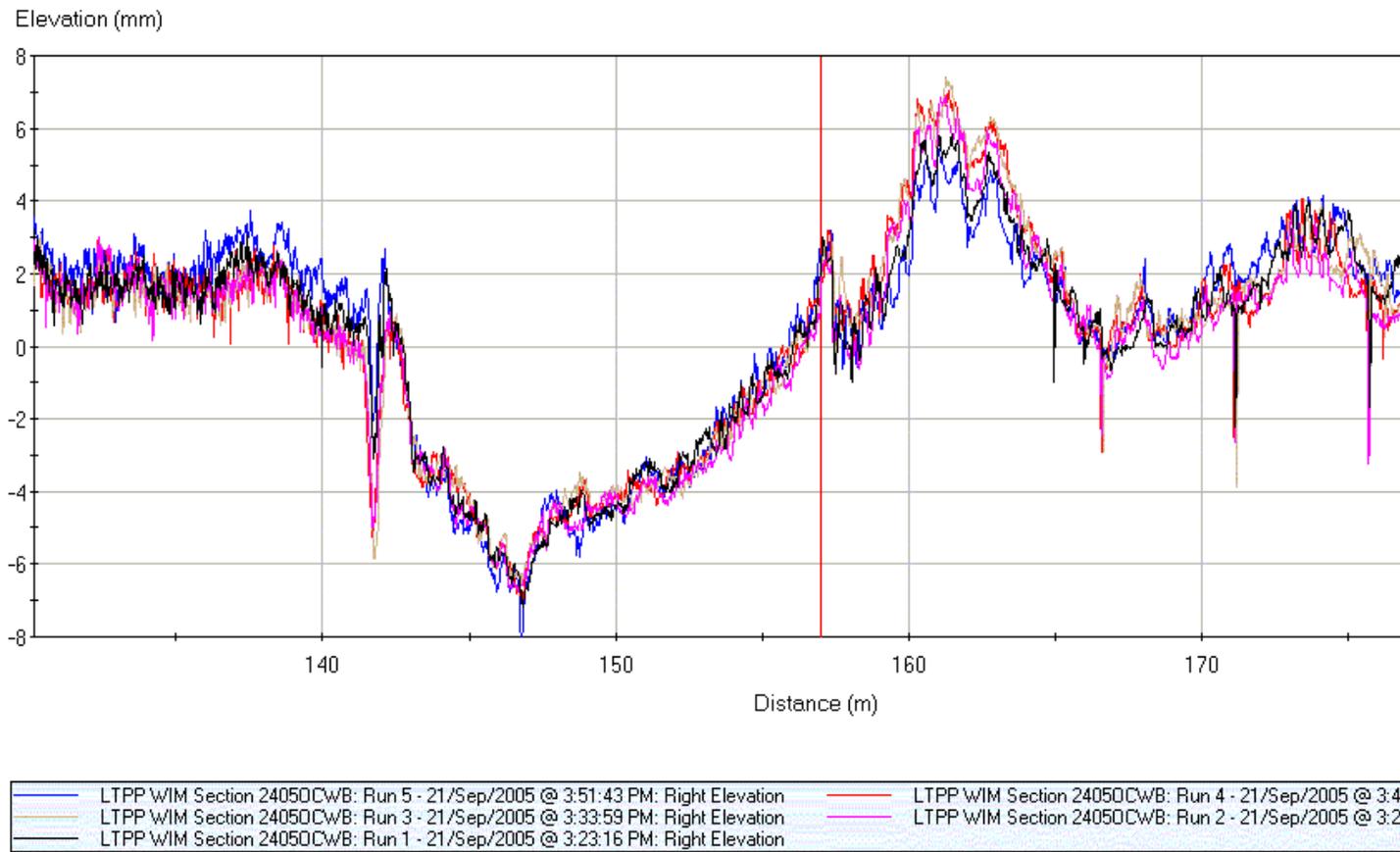


Figure 4. Right Wheel Path along Center of the Lane at Upstream PCC Pavement Joint



Figure 5. Right Wheel Path along Center of the Lane at Downstream PCC Pavement Jo

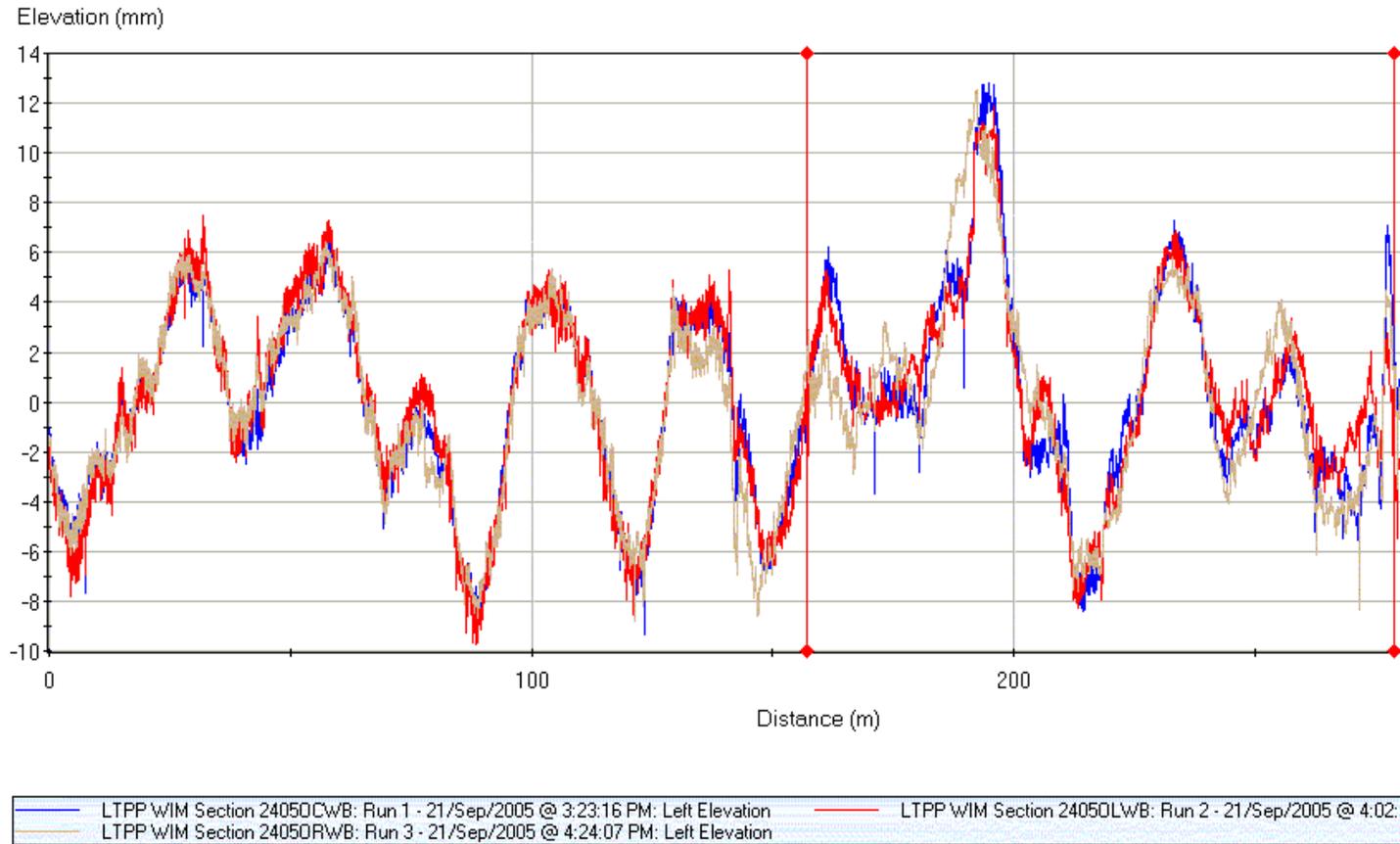


Figure 6. Left Wheel Path Comparison.

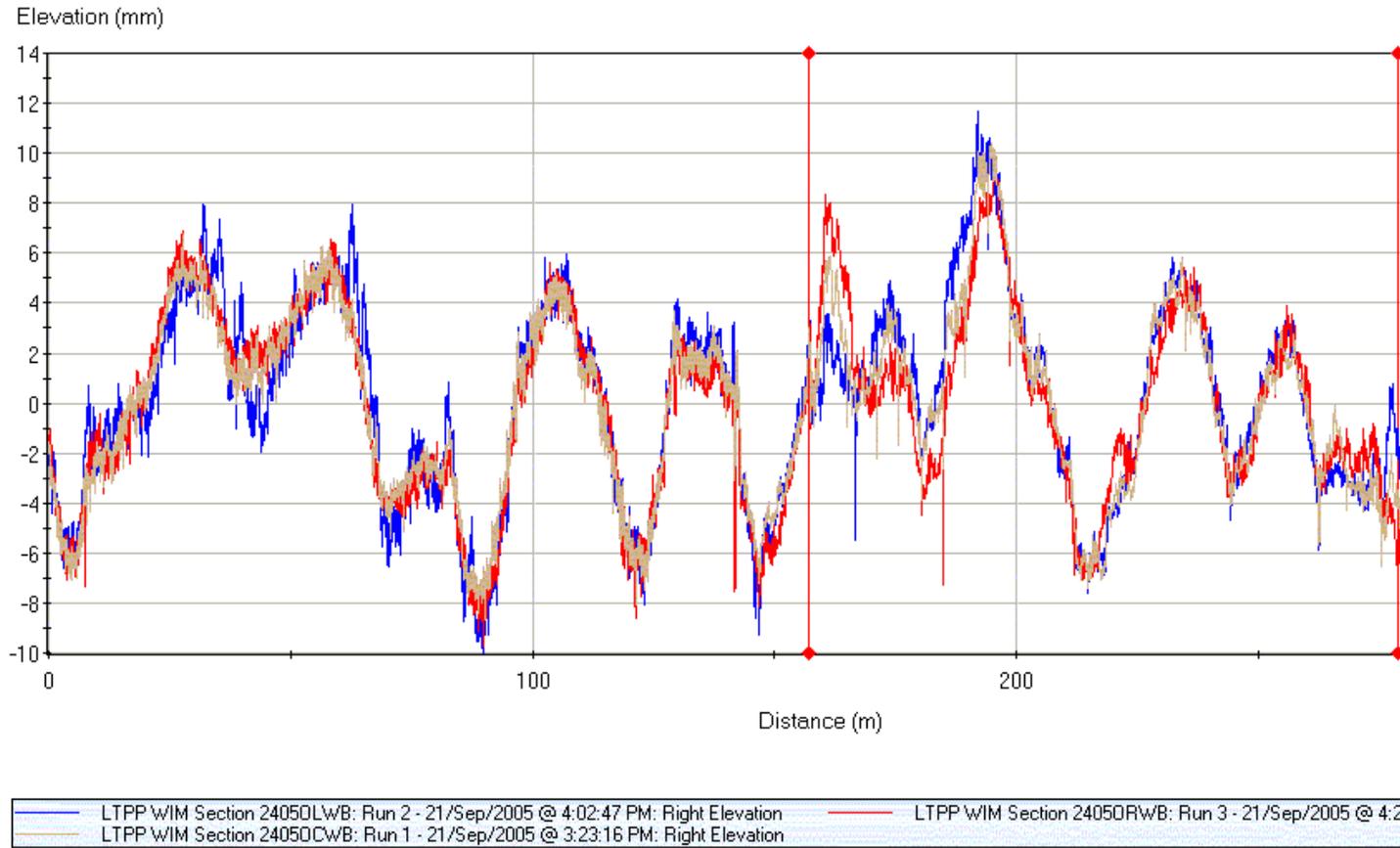


Figure 7. Right Wheel Path Comparison.

5.3.3 PROFILE RIDE STATISTICS

As part of the analysis, the profile runs were divided into 10 m segments and ride statistics were generated using ProVAL. Table 2 presents the average of each data set (i.e., center lane, left edge and right edge) as well as the standard deviation between the averages. IRI values over 2.00 m/km and standard deviations greater than 0.50 m/km have been depicted in red font. Heavy black border lines indicate edge of PCC pavement and heavy green border lines indicate proposed location of the WIM. Several observations can be made from Table 2. The right wheel path is more variable than the left wheel path. Higher IRI values occur at the AC / PCC pavement joints.

Table 2. Summary of Profile Ride Statistics.

Interval (m)	Center Lane Average		Left Edge Average		Right Edge Average		Left Stdev (m/km)	Right Stdev (m/km)
	Left	Right	Left	Right	Left	Right		
	IRI (m/km)	IRI (m/km)	IRI (m/km)	IRI (m/km)	IRI (m/km)	IRI (m/km)		
0.0000 to 9.9750	0.89	1.16	1.01	1.70	0.97	1.30	0.06	0.28
10.0000 to 19.9750	0.96	1.30	1.17	1.42	1.09	0.94	0.11	0.25
20.0000 to 29.9750	0.69	0.76	0.70	1.15	0.86	0.79	0.10	0.22
30.0000 to 39.9750	0.75	1.25	1.31	2.45	0.83	0.53	0.31	0.97
40.0000 to 49.9750	0.95	0.95	1.75	1.67	1.20	0.69	0.41	0.51
50.0000 to 59.9750	0.87	0.61	0.83	1.07	0.70	0.63	0.09	0.26
60.0000 to 69.9750	0.69	1.31	0.69	2.44	1.03	0.56	0.20	0.95
70.0000 to 79.9750	0.88	0.91	0.85	1.40	1.42	0.70	0.32	0.36
80.0000 to 89.9750	1.19	1.23	1.45	2.58	1.38	0.96	0.13	0.87
90.0000 to 99.9750	0.96	0.99	1.09	1.32	1.08	1.06	0.07	0.17
100.0000 to 109.9750	0.64	0.69	0.84	0.91	0.89	0.45	0.13	0.23
110.0000 to 119.9750	1.11	0.84	0.99	0.85	1.09	0.74	0.06	0.06
120.0000 to 129.9750	1.15	1.07	0.84	1.03	1.00	1.09	0.16	0.03
130.0000 to 139.9750	1.04	1.13	1.07	1.57	1.42	1.00	0.21	0.30
140.0000 to 149.9750	1.73	2.03	1.74	1.69	2.37	2.42	0.37	0.37
150.0000 to 159.9750	0.72	1.15	0.78	1.56	0.94	1.12	0.12	0.24
160.0000 to 169.9750	1.58	1.71	1.14	1.84	1.46	1.83	0.23	0.07
170.0000 to 179.9750	1.13	1.29	0.98	1.37	1.38	1.37	0.21	0.05
180.0000 to 189.9750	1.45	1.43	1.14	1.75	1.41	1.23	0.17	0.27
190.0000 to 199.9750	1.96	1.31	1.87	1.36	1.14	1.19	0.45	0.09
200.0000 to 209.9750	1.85	1.43	1.89	1.55	1.25	1.17	0.36	0.20
210.0000 to 219.9750	1.94	1.32	1.57	1.46	1.44	0.90	0.26	0.29
220.0000 to 229.9750	1.01	0.87	0.93	1.04	0.83	1.40	0.09	0.27
230.0000 to 239.9750	0.89	1.07	0.77	0.89	0.87	0.73	0.07	0.17
240.0000 to 249.9750	1.17	1.01	1.15	1.10	0.98	1.21	0.11	0.10
250.0000 to 259.9750	0.96	1.04	0.82	1.18	1.00	1.03	0.09	0.08
260.0000 to 269.9750	1.87	1.24	1.18	1.21	1.19	1.26	0.40	0.03
270.0000 to 279.9750	3.17	1.25	2.87	1.70	2.70	1.34	0.24	0.24
280.0000 to 289.9750	1.12	1.61	1.30	1.55	1.12	0.96	0.10	0.36
290.0000 to 299.9750	1.07	1.06	1.05	1.20	1.13	0.93	0.04	0.14
300.0000 to 309.9750	0.88	1.47	1.37	2.35	1.02	1.95	0.25	0.44
310.0000 to 315.0000	1.15	1.25	0.89	2.05	0.97	1.28	0.13	0.45
Average 0 to 315	1.20	1.18	1.19	1.51	1.19	1.09	0.01	0.22

5.3.4 LOCALIZED ROUGHNESS ANALYSIS

The profile runs were further analyzed using the localized roughness module in ProVAL. It is based on the Texas Department of Transportation (TXDOT) Specification, Tex-1001-S. The specification computes an average of each elevation point (i.e., average of left and right wheel paths together). Next, a 25 ft moving average filter is applied. The difference between the average wheel path profile and the 25 ft moving average filtered profile is computed. If the deviation is greater than 0.15 in, it is considered an area of localized roughness. Positive deviations are considered bumps and negative deviations are considered dips.

The parameters of the localized roughness module were modified to be consistent with ASTM 1318-02, where the deviation is 0.125 in (3 mm) over a 20 ft (6 m) interval. Figure 8 presents the locations that can be considered localized roughness from the profile data. The heavy black lines represent the PCC pavement edge and the heavy green line represents the proposed location of the WIM. As can be seen from the figure, there are many small areas of localized roughness around the AC / PCC interfaces. There are also a couple of areas located at 166 m and 185 m, which are within the PCC pavement.

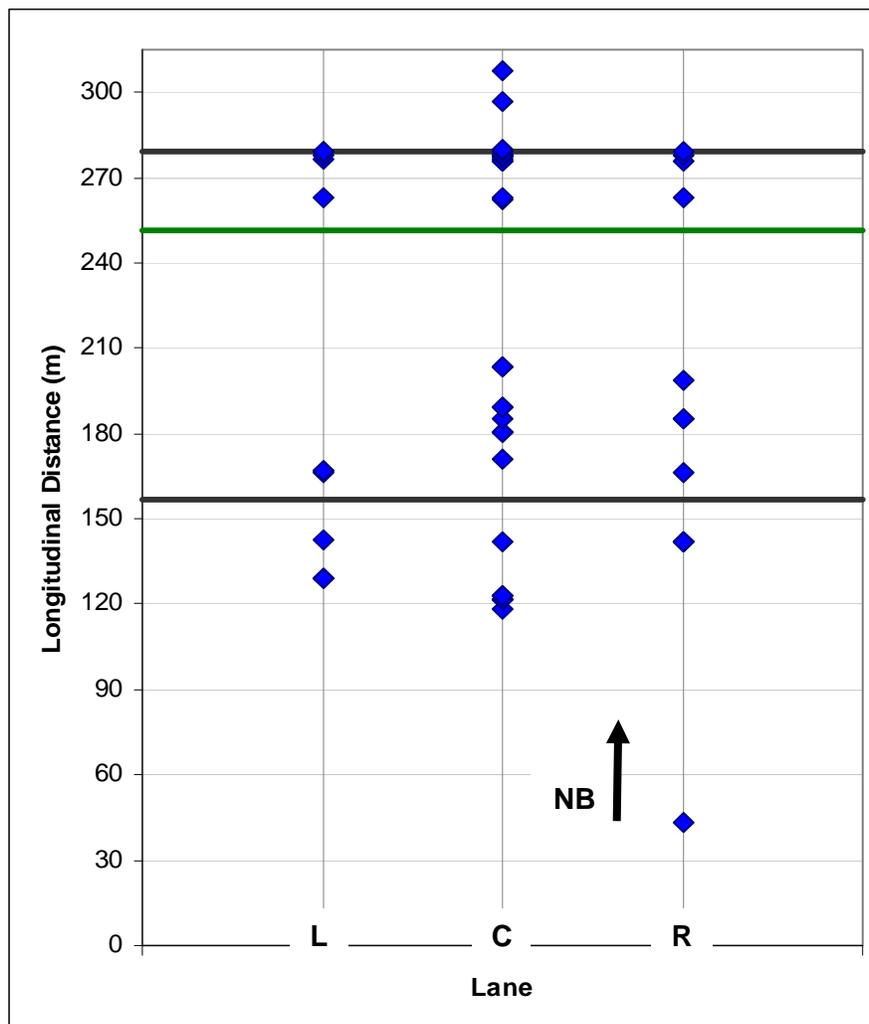


Figure 8. Localized Roughness Locations.

5.3.5 LTPP WIM INDEX ANALYSIS

The profile runs were further analyzed using the LTPP WIM Index Software developed by the LTPP Technical Support Services Contractor (TSSC). The software computes two indices called the Long Range Index (LRI) and the Short Range Index (SRI). These indices are based on research conducted by the University of Michigan Transportation Research Institute (UMTRI).

The LRI represents the vertical deviations of the pavement surface from a horizontal reference within a range of pavement from 25.8 m preceding a WIM scale to 3.2 m beyond it. This characterizes the “background” roughness for a relatively long distance leading up to the scale and a short distance beyond it. A Peak LRI is also computed by the software and compares against the LRI thresholds.

The SRI represents the vertical deviations of the pavement surface from a horizontal reference within a range of pavement from 2.8 m preceding a WIM scale to 0.5 m beyond it. It characterizes the roughness directly at the scale. The very presence of a WIM scale will often create localized roughness within the pavement in its vicinity. Because of this case, a Peak SRI threshold value was established.

Threshold values were developed as part of the research to describe the anticipated performance of a WIM site. The lower threshold values are those below in which a WIM site is very likely to produce an acceptable level of weighing error. The upper threshold values of these indices are those above which a site is very likely to produce an unacceptable level of weighing error. Values which fall between the upper and lower thresholds indicate the pavement condition may or may not cause dynamic loading in the trucks traversing the site sufficiently large enough to cause inaccurate weight measurements.

Table 3 presents the roughness index thresholds for a Type 1 WIM. The SPS-5 profile runs were compared to these thresholds to evaluate the proposed WIM's accuracy.

Table 3. Roughness Index Thresholds.

WIM Index	Lower Threshold (m/km)	Upper Threshold (m/km)
Long Range Index (LRI)	0.5	2.1
Short Range Index (SRI)	0.5	2.1
Peak Short Range Index	0.75	2.9

The *Site Evaluation* option of the software was used to compute the desired indices. The default settings were used with a WIM location of 251.6 m. Tables 4-6 present the index values that were calculated and their comparison with the lower and upper threshold values. Red values would indicate a value above the upper threshold, blue values would indicate below the lower threshold and orange values would be in between.

Table 5. Comparison of WIM Index Thresholds for Left Edge Data Set.

Computed WIM Index

	24050LB1		24050LB2		24050LB3	
WIM Index	LWP (m/km)	RWP (m/km)	LWP (m/km)	RWP (m/km)	LWP (m/km)	RWP (m/km)
LRI	0.893	0.810	0.863	0.856	0.813	0.890
Peak LRI	1.233	1.019	1.131	0.950	1.141	1.052
SRI	0.795	0.505	0.787	0.431	0.821	0.394
Peak SRI	0.959	0.632	0.955	0.622	0.888	0.547

Comparison of WIM Index Versus WIM Index Thresholds

	24050LB1		24050LB2		24050LB3	
WIM Index	LWP	RWP	LWP	RWP	LWP	RWP
LRI	Between	Between	Between	Between	Between	Between
Peak LRI	Between	Between	Between	Between	Between	Between
SRI	Between	Between	Between	Below	Between	Below
Peak SRI	Between	Below	Between	Below	Between	Below

Table 6. Comparison of WIM Index Thresholds for Right Edge Data Set.

Computed WIM Index

	24050RB1		24050RB2		24050RB3	
WIM Index	LWP (m/km)	RWP (m/km)	LWP (m/km)	RWP (m/km)	LWP (m/km)	RWP (m/km)
LRI	0.754	1.076	0.734	1.069	0.774	0.920
Peak LRI	0.968	1.092	0.927	1.117	1.007	1.012
SRI	0.557	0.720	0.479	0.553	0.513	0.725
Peak SRI	0.639	0.797	0.613	0.921	0.543	0.935

Comparison of WIM Index Versus WIM Index Thresholds

	24050RB1		24050RB2		24050RB3	
WIM Index	LWP	RWP	LWP	RWP	LWP	RWP
LRI	Between	Between	Between	Between	Between	Between
Peak LRI	Between	Between	Between	Between	Between	Between
SRI	Between	Between	Below	Between	Between	Between
Peak SRI	Below	Between	Below	Between	Below	Between

In almost all cases, the computed indices were in between the lower and upper threshold values. This indicates the pavement may or may not cause dynamic loading in the trucks traversing the site sufficiently large enough to cause inaccurate weight measurements. The *Site Evaluation* option assumed the WIM is already installed. In this case, there is only a proposed location. These values will likely change once the proposed WIM is installed.

Another option in the WIM Index Software is *Location Selection*. This option computes the profiles of LRI and SRI values along the entire profiled pavement so that the location most suitable for the WIM can be identified. Generally, the LRI profiles were between the lower and upper threshold values. Figure 9 presents a LRI plot for profile run 1 on the left edge of pavement. This is a typical plot for all profile runs. The blue vertical line represents the proposed WIM location.

Figure 10 presents the SRI plot for profile run 3 on the right edge of pavement. This is a typical plot for all profile runs. The blue vertical line represents the proposed WIM location.

The downstream edge of the PCC pavement is very noticeable for all data sets and should be avoided. The SRI values are above the upper threshold of 2.1 m/km. Although a higher SRI is expected at the interface, the SRI is sometimes even surpassing the Peak SRI upper threshold of 2.9 m/km. This analysis shows that there is no one location that will be below the lower threshold for LRI and SRI.

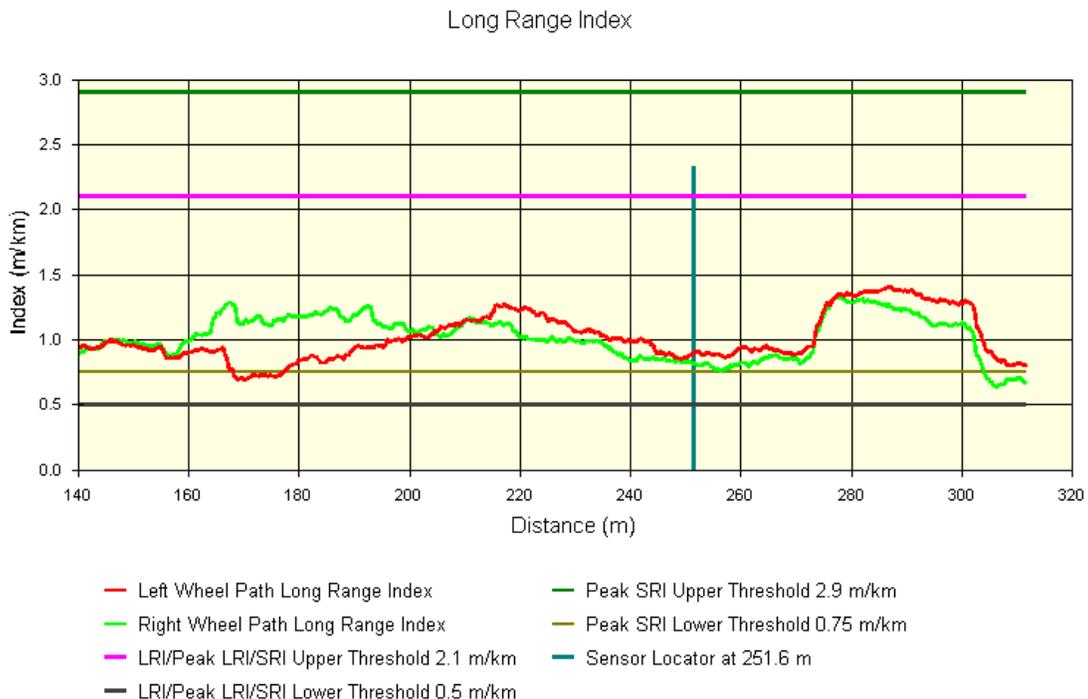


Figure 9. Typical LRI Plot.

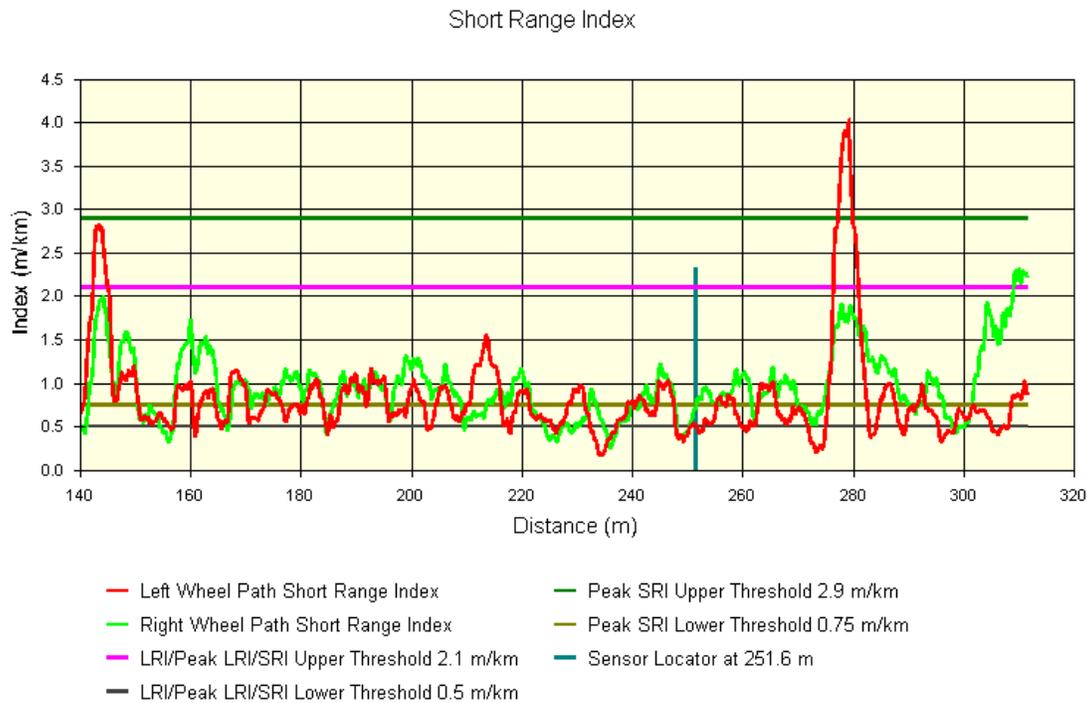


Figure 10. Typical SRI Plot.

5.4 COMPARISON OF INITIAL & CURRENT PROFILES

The team evaluated the changes in profile from the initial visit of April 26, 2005 and September 21, 2005 visit. Figure 11 presents the right wheel path profiles taken from the center data set. The red line is from the initial visit and the blue line is from this visit. The red vertical lines show the limits of the PCC slab and the blue vertical line shows the proposed WIM location.

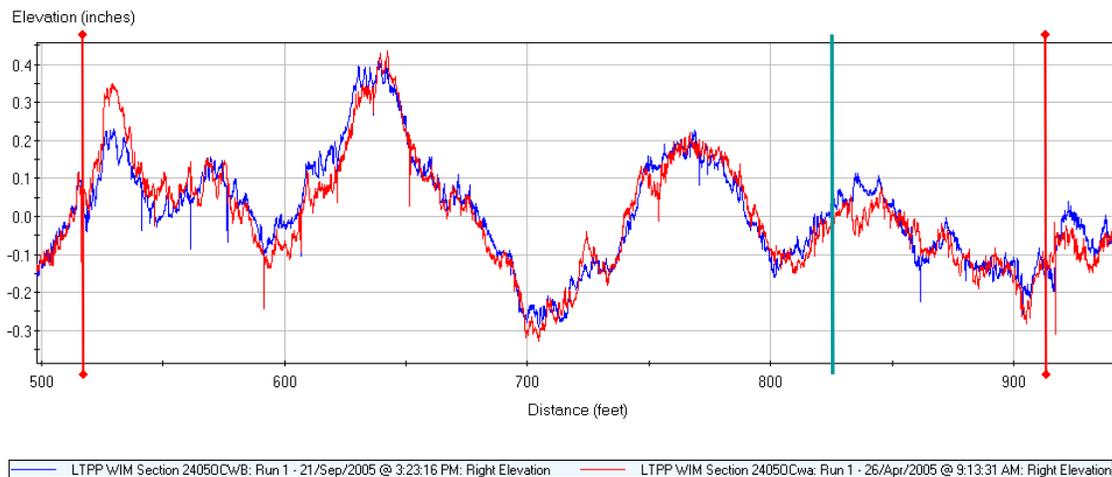


Figure 11. Right Wheel Path Comparison from Initial and Current Visit.

5.5 RESULTS DISCUSSION

The results of the pavement evaluation were based on the geometrics of the pavement, photographs of the pavement surface condition and analysis of the profile data.

The geometric information indicated that a PCC pavement had been constructed at a quality location near the MD SPS-5. There is very little horizontal curvature, grade or cross slope.

The surface condition evaluation showed that the AC / PCC interface at 157 m and 279 m have been sealed. However, the longitudinal AC / PCC joints are in poor condition. Sealant is no longer adhering to pavement interfaces and the AC pavement is deteriorating (i.e., fraying along the edge with a mean width between 6-19 mm). There was some distress observed on the upstream and downstream AC pavement.

The profile data was analyzed with ProVAL and LTPP WIM Index Software to evaluate the pavement smoothness at the site. The profile runs showed good agreement for each sensor position with features such as peaks and valleys corresponding well with each other. The following analysis comments can be made:

- Higher IRI values occurred at the AC / PCC joints.
- Localized roughness is located at the AC / PCC joints.
- Additional localized roughness was observed at 166 m and 185 m, which is within the PCC pavement.
- The computed WIM indices were in between the lower and upper threshold values.
- Using the *Location Selection* option of the WIM Index Software, the LRI and SRI profiles were generally between the lower and upper threshold values.

6.0 PROPOSED WIM SITE- INFORMATION

6.1 LOCATION – US15 MP 4.7



Figure 12: Map of US15 WIM Site

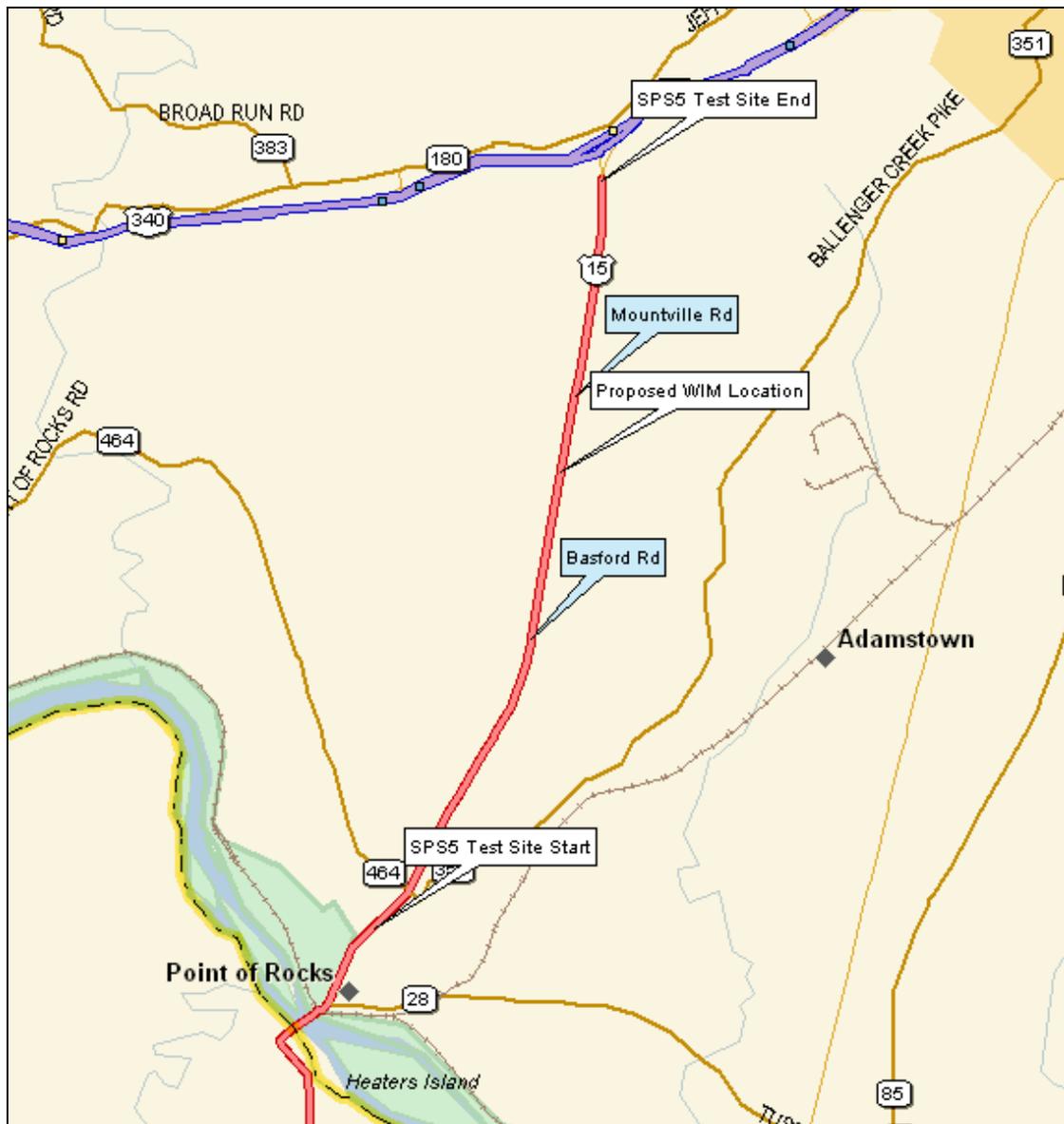


Figure 13: Map of US15 WIM Site at Milepost 4.7

The LTPP SPS-5 test sections, approximately 60 miles from Baltimore, are located in the northbound lane of US15 between mileposts 1 and 8, just north of the Potomac River.

The proposed site for the WIM system installation is located at milepost 4.7, 0.5 miles north of test section 240559 and immediately South of test section 240561 in the SPS-5 experiment, with scales to be installed in the northbound lane. The controller cabinet and power utility pole from the existing ATR # 68 PEEK Piezo Weigh-in-Motion traffic data collection system is located approximately 400 feet upstream of this location behind the southbound guardrail.

7.0 RECOMMENDED WIM TECHNOLOGY

Based upon the site conditions and discussions with the State, the Bending Plate technology is recommended for use at this site. It will fit the performance expectations of the State, and accommodate installation and future maintenance so as to minimize lane closures and provide the highest degree of reliability.

Both Kistler and Single Load Cell were ruled out due to lane closure/serviceability constraints on this busy two lane, two direction roadway.

7.1 RECOMMENDED LOCATION FOR THE WIM SYSTEM SENSORS

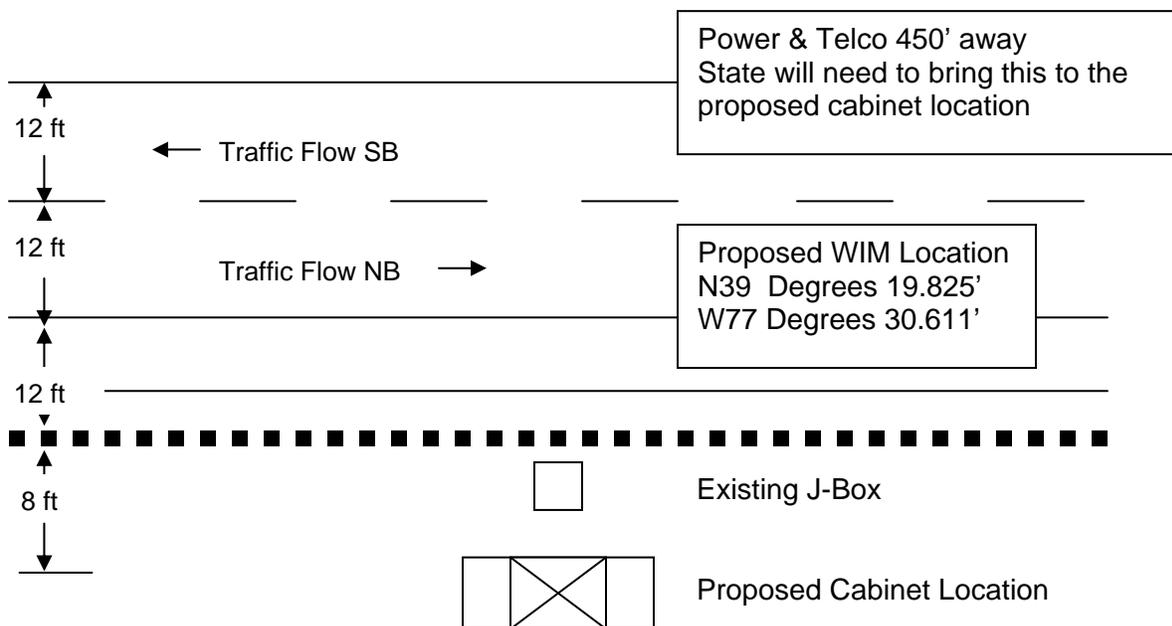


Figure 14: Proposed WIM Site Layout

A.0 COORDINATION DETAILS

Task Order #6, which authorized the CLIN 1001 “Determine Acceptability of Proposed Site” for the Maryland SPS-5 Site (LTPP ID 240500), was issued on September 14, 2005. This Site Acceptability Assessment was a follow up to our original assessment dated February 22-24, 2005 at which time corrective actions were identified.

Contacts were initially made with interested parties as follows:

- Contracting Officer’s Technical Representative (COTR)
 - Debbie Walker – FHWA-LTPP ph: 202-493-3068
- State Highway Agency (SHA)
 - Al Blazucki – SHA/OOTS ph: 410-321-3118
- LTPP Regional Support Contractor (RSC)
 - Basel Abukhater – RSC/Stantec ph: 716-632-0804
- FHWA Division Office
 - Jitesh Parikh – FHWA Div Rep ph: 410-779-7136

The original “Pre-Visit Handout Guide” (Appendix A) was distributed on February 18, 2005, to the following individuals:

- Al Blazucki
- Debbie Walker
- Basel Abukhater

The site was originally visited on February 22nd through 24th, 2005, by Roy Czinku (IRD). Roy Czinku, Debbie Walker, Chris Strain (SHA), and Michael Moravec (FHWA) were all on-site February 23 to confirm location and availability of the AC Power and existing conduit between the existing ATR # 68 controller cabinet and the proposed WIM cabinet location.

Upon completion of the corrective actions identified during the February 22nd through 24th assessment, a follow-up evaluation was performed on September 15, 2005 by Roy Czinku and Bruce Myers (IRD).

The initial briefing session was held at 9:00 AM on February 23rd, 2005, at the State Highway Agency’s District 7 Office, located approximately ½ mile South of I-270 Exit 31 on Maryland Route 85. A complete list of all attendees is attached (Appendix F.0 Sign In Sheet – Site Acceptability Briefing Session).

All other communications after this date was performed via email and telephone.



INTERNATIONAL ROAD DYNAMICS INC.

LTPP SPS PHASE II

WEIGH-IN-MOTION SITE ACCEPTABILITY PRE-VISIT HANDOUT GUIDE

MARYLAND SPS-5
LTPP ID 240500

Date: February 18, 2005



CONTRACT NO. DTFH61-05-D-00001



LONG TERM
pavement
PERFORMANCE

B.0 PRE-VISIT HANDOUT GUIDE

B.1 SCHEDULE

- a. Briefing session
 - i. Meeting is scheduled for 9:00 a.m. February 23, 2005 at the District 7 Office in Frederick (Located approximately ½ mile South of I-270 Exit 31 on Maryland Route 85).
- b. Site visit
 - i. February 22, 2005 thru February 24, 2005

B.2 BRIEFING SESSION FEBRUARY 23, 2005, POINTS OF CONTACT, PHONE No.s

- c. Contracting Officer's Technical Representative (COTR)
 - i. Debbie Walker – FHWA-LTPP ph: 202-493-3068
- d. State Highway Agency (SHA)
 - i. Al Blazucki – SHA/OOTS ph: 410-321-3118
- e. LTPP Regional Support Contractor (RSC)
 - i. Basel Abukhater – RSC/Stantec ph: 716-632-0804
- f. FHWA Division Office
 - i. Jetesh Parikh – FHWA Div Rep ph: 410-779-7136

B.3 INFORMATION REQUESTS

- g. From COTR
 - i. FHWA Division contact person
 - ii. New pavement profile from RSC if recent profile data unavailable
- h. From RSC
 - i. SHA contact person
 - ii. SPS roadway section layouts (plan view and/or stationing or mileposts)
 - iii. Recent pavement profile data
- i. From SHA
 - i. As-built info on roadway at proposed site
 - 1. Pavement cross section and structural section
 - 2. Alignment and grade
 - 3. Any utilities located in WIM install work area
 - ii. Location and general availability of power and phone services, service providers, service provider contacts and phone numbers (may be beneficial if power and phone utility reps be requested to participate in briefing session and/or site visit)
 - iii. Will SHA agree to extend power and phone services from existing available access points to demarcation points near planned controller cabinet location?
 - iv. If existing roadway pavement is AC or inadequate PCC will SHA consider replacement with 400' PCC slab if recommended per site assessment?
 - v. What permits will be needed to install equipment and what are procedures and time frames for obtainment
 - vi. Required cabinet clear zone from edge of traveled way

-
- vii. If no detour routing available at proposed site (or three or more adjacent lanes), will SHA permit shifting inside lane traffic partially onto inside shoulder to provide safe clearance during installation in outside lane?
 - viii. Historic truck traffic data

B.4 SITE LOCATION INFORMATION

- j. Proposed WIM site
 - i. US15 Mile Post 4.7 Northbound Lane
- k. Briefing session location
 - i. District 7 Office approximately ½ mile South of I-270 Exit 31 on Maryland Route 85
- l. Nearest major airport
 - i. Baltimore Washington International Airport



INTERNATIONAL ROAD DYNAMICS INC.

LTPP SPS PHASE II

WEIGH-IN-MOTION SITE ACCEPTABILITY

SITE VISIT EVALUATION FORM

MARYLAND SPS-5 LTPP ID 240500

Date of Site Visit: September 15, 2005



CONTRACT NO. DTFH61-05-D-00001



LONG TERM
pavement
PERFORMANCE

C.0 SITE EVALUATION FORM

- Site Evaluation Forms
- Graph paper and note paper
- Clipboard
- Pens & pencils
- Small stapler
- Digital camera, with PC cable
- GPS receiver
- Notebook PC
- Calculator
- Cell phone
- Site Pre-visit Handout Guide
- Metal tape measure (25 ft.)
- Measuring wheel (ft.) and/or 100 ft. rag tape
- Folding rule (6 foot)
- Hand level
- Small torpedo level
- Keel markers
- Spray can white paint
- String Line
- Line Level
- Hammer and Concrete Nails
- _____

Request furnish on-site by Highway Agency:

- Spray can white paint
- Lath, 4 ft.
- Hammer
- Misc. small tools
- Keys for known Agency service cabinets
Note: Key for existing cabinet is a standard Type II

Proper attire for field work and expected weather:

- Durable shoes
- Cold weather layering
- Rain gear
- _____

Safety equipment per State Highway Agency requirements:

- Hard hat
- Safety vest – type Hi-Vis Safety Yellow
- Other required equipment _____

C.1 PROPOSED WIM LOCATION

Proposed WIM Site Location – 2 Lane Roadway (1 lane each Direction)

Route US 15 Mile Post 4.7 Direction NB Lane Outside

Proximity to applicable SPS test section The proposed WIM Site is 3573 feet Downstream from the start of SPS Test Section 240559 and 167 feet upstream from the start of SPS Test Section 240561

C.1.1 EXISTING ROADWAY AT PROPOSED WIM SITE

Type Pavement Asphalt Lane Width 12 feet Thickness 11 inches

Observed Structural Soundness Moderate

Observed Smoothness Moderate

Outside NB Shoulder Type Asphalt Width 10 feet

Outside NB Shoulder Condition Moderate

Outside SB Shoulder Type Asphalt Width 10 feet

Outside SB Shoulder Condition Moderate

C.1.2 PAVEMENT 325' PRIOR AND 75' FOLLOWING WIM SCALE LOCATION

Type Rigid Structural Soundness Good Smoothness Good

Thickness 11inches Jointed or Continuous Jointed Concrete (15 ft joints) dowelled

Notes/Comments on Pavement

The State has installed a 400 foot Portland Cement Concrete Slab to accommodate the WIM System and performed additional grinding August 29, 2005 using a 36 inch wide blanket grinder. The AC approach and departure pavements, as well as the blanket ground PCC slab, look much improved when compared to our initial site assessment in February 22-24, 2005.

C.1.3 ROADWAY GEOMETRICS

Horizontal Alignment Straightaway Grade Minimal Grade(0.62%)

Cross-slope Approximately 2% (1.6%) Lane width 12 feet

C.1.4 OBSERVED TRAFFIC OPERATING CHARACTERISTICS

Passing, merging, not following lane lines? Good Lane Discipline, Some Passing

Stop and go traffic, congestion periods? Free Flowing at all Times

Traffic signals or interchanges affecting traffic flow? No Signals or Merging

Other adverse traffic flow conditions? None, Traffic Flow is Medium/Heavy

Truck traffic at "cruising" speed and no lugging? No Lugging, Smooth Flow

Truck traffic staying within lane lines? Yes, Trucks Track within Lane Lines

Observed truck suspension or body motion dynamics? Minimal

Truck traffic composition same at WIM site and SPS site? Yes

Truck traffic on/off locations between WIM site and SPS site? Two Exits (Basford Rd & Whiten Rd) between Test Site and WIM Location. (note: these are residential roadways that will not accept heavy truck traffic)

Notes/Comments on Geometrics and/or Traffic Operating Characteristics

The site is located on a straightaway with no curves immediately before or after the WIM location. The grade is relatively flat throughout the area with no significant grade. Vehicles track smoothly through this area at speeds between 55 and 65 MPH (posted speed is 55 MPH). There is very good lane discipline at this site, although it should be noted that there is occasional passing in this area. Traffic flows medium to heavy on this two lane, two direction roadway. Please note, tailgating of vehicles can occur at times on this roadway.

C.1.5 ACCESS TO UTILITY SERVICES

Potential source(s) for power Existing WIM Cabinet c/w AC Power is approximately 450 feet from proposed WIM location. This service has been extended from existing WIM to proposed WIM location.

Potential source(s) for telephone Existing WIM Cabinet c/w Telco is approximately 450 feet from proposed WIM location. This service has been extended from existing WIM to proposed WIM location.

C.1.6 EQUIPMENT INSTALLATION CAPABILITY

Adequate location for controller cabinet? Yes, behind Guard Rail

Distance from edge of traveled way to cabinet 20 feet Off Roadway

Visibility from cabinet of sensors and approaching vehicles? Very Good

Adequate location for service facilities? Existing, State extend to new WIM

Adequate drainage for scale pits? Yes

Adequate roadway and overall site drainage? Yes

Potential for ponding or flooding at cabinet or pullboxes? No

Potential for traffic control problems during installation? Possibly

Ability to provide safe clearance in work zone from live traffic via:

- OK from State Agency to use opposite shoulder for traffic shift
- OK from State Agency to use 1 Lane Reversible Traffic Control

Notes/Comments on Equipment Installation Capability

The State has already extended the existing power and telephone from the existing WIM Location to the new WIM location. We will need to work together on best way to perform lane closure in this area.

C.1.7 POTENTIAL WIM SENSOR/EQUIPMENT INTERFERENCE SOURCES

Overhead power lines? 450 ft upstream of WIM Adjacent railroad? None

C.1.8 CONDITIONS FOR USE OF TEST TRUCKS FOR CALIBRATION AND EVALUATIONS

Direction NB - Nearest usable truck turnaround location:

Whiten Rd, Maryland Distance from WIM 0.8 Miles

Direction SB - Nearest usable truck turnaround location:

Basford Rd, Maryland Distance from WIM 1.2 Miles

Circuit travel distance 5 Miles Estimated lap time 20 Minutes

Potential circuit route restrictions? Residential Area is part of Truck Loop

Identification and location of certified static scales:

Name LaFarge Frederick Quarry Contact Ben Tyeryar

Address 1000 Block East South Street, Frederick MD 21701

Phone 301-694-4820 Hours 6:00 a.m. to 4:00 p.m. Mon-Fri

Cost per initial weighing None Cost per additional weighing None.

Notes/Comments on Test Truck Circuit and Static Weighing Facility

Ben will be able to assist us with Calibration Vehicles. He Assisted MDDOT in the past and will not charge for initial or additional weighing provided we use one of the trucking firms recommended by LaFarge. He can provide us a load of Rock for no charge provided it is returned after testing is complete

D.0 SHEET 17

Sheet 17	*STATE_CODE	LTPP
LTPP Traffic Data	*SPS PROJECT ID	240500
WIM SITE INVENTORY	*SPS WIM ID	SPS-5

1.* ROUTE MILEPOST LTPP DIRECTION - N S E W

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

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

4.* PAVEMENT TYPE

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

Form completed by Date

E.0 PHOTOGRAPHS

E.1.1 SPS TEST SECTION MARKER



E.1.2 GENERAL SITE VIEW OF THE CONCRETE SLAB



E.1.3 GENERAL SITE VIEW OF THE CONCRETE SLAB FROM SHOULDER



E.1.4 DOWNSTREAM VIEW OF ROADWAY AND TRAILING EDGE OF SLAB



E.1.5 UPSTREAM VIEW OF ROADWAY AND LEADING EDGE OF SLAB



E.1.6 SLAB JOINT DETAIL



E.1.7 RECOMMENDED SCALE LOCATION



E.1.8 RECOMMENDED CABINET LOCATION



E.1.9 POWER SERVICE



E.1.10 EXISTING TELEPHONE SERVICE



E.1.11 EXISTING WIM CABINET



E.1.12 ROADWAY DRAINAGE



E.1.13 SLAB ANOMOLY (LOW SPOT)



F.0 SIGN IN SHEET – SITE ACCEPTABILITY BRIEFING SESSION

Name / Title	Email Address	Telephone #
David James – SHA	djames@sha.state.md.us	301-624-8204
Debbie Walker – FHWA-LTPP	deborah.walker@fhwa.dot.gov	202-493-3068
Roy Czinku - IRD	roy.czinku@irdinc.com	306-653-6627
Chris Strain – SHA/OOTS	cstrain@sha.state.md.us	410-787-5857
Al Blazucki – SHA/OMT	ablazucki@sha.state.md.us	410-321-3118
Barry Catterton – SHA/OMT	bcatterton@sha.state.md.us	410-321-4102
Karl Hess – SHA/HISD	khess@sha.state.md.us	410-545-5523
Barry Balzanna – SHA/HISD-TMS	bbalzanna@sha.state.md.us	410-545-5509
Michael Moravec – FHWA/RC-LTTP	mike.moravec@fhwa.dot.gov	410-962-5623
William McNeil – SHA/OOTS	wmcneil@sha.state.md.us	410-787-7601

NB