Appendix 2

Windshield Survey Summary and Photo Log

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MEMORANDUM

To: Tom Kahle
MDT Project Manager

From: Sarah Nicolai
DOWL HKM Project Manager

Date: May 4, 2011

Subject: Summary of Windshield Survey Conducted on April 15, 2011
Billings Area I-90 Corridor Planning Study

The following team members conducted a windshield survey of the study corridor on April 15, 2011:

Todd Cormier	DOWL HKM
Sarah Nicolai	DOWL HKM
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This summary describes potential constraints observed in the field during the survey, although it should not be considered a comprehensive account of all constraints within the corridor. Constraints are discussed progressing west to east from Segment 1 to Segment 8. Reference Post (RP) and Station (Sta.) locations are approximated. Potential constraints were visually inspected; no testing or detailed inspections were conducted.

Segment 1: Laurel Interchange to Mossmain Interchange

The Laurel Interchange eastbound on-ramp currently appears to have geometric deficiencies including tight horizontal curves, limited sight distance for merging, and lack of adequate acceleration distance. It was noted in the field that these issues could be resolved if a third lane was added to the outside of the Interstate, either as a dedicated lane or as a longer parallel acceleration lane.

The Laurel Interchange westbound off-ramp also appears to have geometric deficiencies related to lack of adequate deceleration distance to the off-ramp intersection with South 1st Avenue as well as tight horizontal curves. It was noted in the field that some of these issues could be addressed through the addition of a parallel exit lane or a 3rd lane transitioning to an exit lane at this location.

Culverts

- A 60-inch culvert servicing Italian Ditch is located at RP 434.0 (Sta. 25). The culvert extends through each set of Interstate lanes and the median. Widening to the inside of the Interstate would avoid the need to lengthen the culvert, although the culvert may need to be replaced due to its age and condition. (Photo 1 and 2).
- An inverted siphon is located at RP 435.7 (Sta. 140). The siphon extends through each set of Interstate lanes and the median. Widening would need to occur toward the inside in this location. (Photo 5).
- Canyon Creek Ditch is located at RP 436.9 (Sta.165).

Overhead Power Lines

- RP 434.5 (Sta. 35)
- RP 435.0 (Sta. 60)
- RP 435.5 (Sta. 70)
- RP 436.5 (Sta. 138)
- RP 436.8 (Sta. 150)

Bridges

- The Strauch Road Bridge crosses I-90 at RP 435.5 (Sta. 90). Based on field measurements, the median is 42 feet wide, with 21 feet from the center of the bridge pier to the eastbound edge of pavement and the westbound edge of pavement. It appears that the Interstate could be widened to the inside in this location. Vertical clearance was not measured. (Photos 3 and 4).

Emergency Vehicle Turnarounds

- RP 434.7 (Sta. 40)
- RP 437.0 (Sta. 162)

Segment 2: Mossmain Interchange to Shiloh Interchange

Culverts

- The Danford Drain is located at RP 440.78 (Sta.363). This culvert would need to be reconstructed or lengthened if an additional lane is added to the outside of the Interstate.

Overhead Power Lines

- RP 437.5 (Sta. 195)
- RP 437.6 (Sta. 209)
- RP 437.65 (Sta. 210)
- RP 439.0 (Sta. 285)
- RP 441.5 (Sta. 400)
- RP 442.0 (Sta. 418)
- RP 442.6 (Sta. 463)
- RP 443.0 (Sta. 480)

Bridges

- Two I-90 mainline bridges cross over the Mossmain Interchange crossroad at RP 437.5 (Sta. 190). It appears that the Interstate could be widened to the inside in this location with a reconstruction of the bridge structures.
- Two I-90 mainline bridges cross over BBWA Canal at RP 438.0 (Sta. 220).
- Two South 56th Street overpass bridges are located at RP 440.25 (Sta.335). The existing bridge structures would require reconstruction to add additional travel lanes.
- Two I-90 mainline bridges cross over 56th St. W at RP 443.0 (Sta. 337).
- The Autumn Lane Bridge crosses over the I-90 mainline at RP 442.7 (Sta. 465). Distance to median piers and vertical clearance was not measured. (Photos 6 and 7).
- Two I-90 mainline bridges cross over Canyon Creek at RP 442.8 (Sta. 470). It appears that the Interstate could be widened to the inside in this location with a reconstruction of the bridge structures (Photos 8 and 9).

Adjacent Road

- South 72nd Street West located at RP 437.79 (Sta. 205) could possibly be in conflict with new I-90 foreslopes. This location may possibly require a barrier for safe roadway separation.

Weigh Station

- Adding travel lanes to I-90 would require pavement modification for both weigh stations located at RP 438.92 (Sta. 265).

Emergency Vehicle Turnarounds

- RP 439.5 (Sta. 302)
- RP 442.2 (Sta. 443)

Segment 3: Shiloh Interchange to West Billings Interchange

Overhead Power Lines

- RP 445.1 (Sta. 595)

Overhead Signs

- Eastbound Lane RP 445.7 (Sta. 614). The sign bridge structure would require reconstruction if widening occurred at this location.

Bridges

- The Shiloh Interchange crossroad crosses over the I-90 mainline at RP 443.4 (Sta. 508). It appears that the Interstate could be widened to the inside in this location.
- Two I-90 mainline bridges cross over Hogan's Slough at RP 445.5 (Sta. 610). Based on field measurements, the median is 42 feet wide. The bridge would need to be reconstructed to accommodate a third lane in each direction on the I-90 mainline. This location is constrained by the frontage road south of the eastbound lanes. (Photos 10 through 12).

Emergency Vehicle Turnarounds

- RP 445.3 (Sta. 605)

Segment 4: West Billings Interchange to South Billings Boulevard Interchange

Overhead Power Lines

- RP 446.3 (Sta. 656)

Overhead Signs

- Eastbound and westbound sign at RP 446.4 (Sta. 661). The sign bridge structure would require reconstruction if widening occurred at this location.
- Eastbound and westbound sign at RP 446.7 (Sta. 685). The sign bridge structure would require reconstruction if widening occurred at this location.

Bridges

- Two West Billings Interchange bridges cross over an access road at RP 446.0 (Sta. 636). The bridge structures would require reconstruction if widening occurred at this location.
- Two West Billings Interchange bridges cross over an access road at RP 446.2 (Sta. 647). The bridge structures would require reconstruction if widening occurred at this location.

Segment 5: South Billings Boulevard Interchange to S. 27th Street Interchange

Culverts

- Two 60-inch culverts servicing Suburban Ditch are located at RP 448.4 (Sta. 770). The culverts extend through each set of Interstate lanes and the median. These culverts would need to be reconstructed or lengthened if an additional lane is added to the outside of the Interstate. (Photos 15 and 16).
- Eagle Ditch is located at RP 448.6 (Sta. 771). This culvert would need to be reconstructed or lengthened if an additional lane is added to the outside of the Interstate.
- Grey Eagle Ditch is located at RP 449.0 (Sta. 772). This culvert would need to be reconstructed or lengthened if an additional lane is added to the outside of the Interstate.

Overhead Power Lines

- RP 447.7 (Sta. 729)
- RP 448.1 (Sta. 752)
- RP 448.5 (Sta. 769)
- RP 449.0 (Sta. 797)
- RP 449.3 (Sta. 815)

Bridges

- The South Billings Boulevard Bridge crosses over the I-90 mainline at RP 447.2 (Sta. 715). Based on field measurements, the median is 42 feet wide, with 21 feet from the center of the bridge pier to the eastbound edge of pavement and the westbound edge of pavement. It appears that the Interstate could be widened to the inside in this location. Vertical clearance was not measured. (Photos 13 and 14).
- The Sugar Avenue Bridge crosses over the I-90 mainline at RP 449.3 (Sta. 814). Support piers for this structure are currently located directly adjacent to the shoulders of each set of lanes, precluding the ability to add lanes at this location. The bridge would need to be rebuilt to accommodate a third lane in each direction on the I-90 mainline. (Photos 17 through 19).

- The South 27th Street Interchange Bridge crosses over the I-90 mainline at RP 450.1 (Sta. 855). Based on field measurements, the median is 39 feet wide, with 20 feet from the center of the bridge pier to the eastbound edge of pavement and 19 feet from the center of the bridge pier to the westbound edge of pavement. It appears that the Interstate could be widened to the inside in this location. Vertical clearance was not measured. (Photos 20 through 22).

Emergency Vehicle Turnarounds

- RP 448.0 (Sta. 743)
- RP 449.5 (Sta. 825)

Segment 6: S. 27th Street Interchange to Lockwood Interchange

Overhead Power Lines

- RP 450.2 (Sta. 865)
- RP 450.8 (Sta. 890)
- RP 451.1 (Sta. 908)
- RP 451.3 (Sta. 915)
- RP 451.6 (Sta. 932)
- RP 452.7 (Sta. 997)

Bridges

- Two I-90 mainline bridges cross over the railroad at RP 450.5 (Sta. 878). The bridges would need to be reconstructed to accommodate a third lane in each direction on the I-90 mainline. (Photos 23 and 24).
- Two I-90 mainline bridges cross over the Yellowstone River at RP 452.0 (Sta. 955). The bridges would need to be reconstructed to accommodate a third lane in each direction on the I-90 mainline. (Photo 26).
- The bridge for Old US 87 at the Lockwood Interchange crosses over the I-90 mainline at RP 450.1 (Sta. 1000). Based on field measurements, the median is 42 feet wide, with 21 feet from the center of the bridge pier to the eastbound edge of pavement and the westbound edge of pavement. It appears that the Interstate could be widened to the inside in this location. (Photos 27 through 29).

Utility Lines

- A gas transmission line runs under the I-90 mainline at RP 452.0 (Sta. 890). (Photo 25).
- Several additional underground petroleum or gas line markers were identified adjacent to or crossing the Interstate within this segment.

Emergency Vehicle Turnarounds

- RP 451.3 (Sta. 920)

Segment 7: Lockwood Interchange to Johnson Interchange

Culverts

- The Lockwood Ditch culvert runs underneath the I-90 mainline at RP 452.37 (Sta. 975).
- Two 60-inch culverts servicing the Lockwood Ditch run underneath the I-90 mainline at RP 453.0 (Sta. 1035). The culverts extend through each set of Interstate lanes and the median. These culverts would need to be reconstructed or lengthened if an additional lane is added to the outside of the Interstate. If widening occurred to the inside of the Interstate, the culverts may need to be replaced due to their age and condition. (Photos 30 and 31).
- Two 60-inch culverts servicing Dry Creek runs underneath the I-90 mainline at RP 454.7 (Sta. 1110). The culverts extend through each set of Interstate lanes and the median. These culverts would need to be reconstructed or lengthened if an additional lane is added to the outside of the Interstate. If widening occurred to the inside of the Interstate, the culverts may need to be replaced due to their age and condition. (Photos 32 through 35).

Overhead Power Lines

- RP 453.2 (Sta. 1021)
- RP 453.8 (Sta. 1051)
- RP 454.0 (Sta. 1061)
- RP 454.7 (Sta. 1092)

Emergency Vehicle Turnarounds

- RP 453.5 (Sta. 1035)

Right-of-Way Constraints

- Potential right-of-way constraints are located just east and west of RP 451.0 (Sta. 910) on the north and south sides of I-90. The Conoco oil refinery and the rail spur line are located to the north and a coal fire plant and city park are located to the south.

Segment 8: Johnson Interchange to Pinehills Interchange

Culverts

- Two 60-inch culverts run underneath the I-90 mainline at RP 455.3 (Sta. 1125). The culverts extend through each set of Interstate lanes and the median. These culverts would need to be reconstructed or lengthened if an additional lane is added to the outside of the Interstate. If widening occurred to the inside of the Interstate, the culverts may need to be replaced due to their age and condition. (Photo 36 and 37).

Overhead Power Lines

- RP 456.0 (Sta. 1166)

Overhead Signs

- Eastbound lane, RP 455.6 (Sta. 1130). The sign bridge structure would require reconstruction if widening occurred at this location. (Photo 38).
- Eastbound and westbound lane, RP 455.7 (Sta. 1160). The sign bridge structure would require reconstruction if widening occurred at this location.

Bridges

- Two I-90 mainline bridges cross over Johnson Lane at RP 455.3 (Sta. 1130). The bridges would need to be reconstructed to accommodate a third lane in each direction on the I-90 mainline. (Photo 39).

Emergency Vehicle Turnarounds

- RP 455.5 (Sta. 1155)

Billings Area
I-90 Corridor Planning Study

WINDSHIELD SURVEY PHOTO LOG

April 15, 2011

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The photos contained within this photo log illustrate potential constraints observed in the field during a windshield survey conducted on April 15, 2011. Photos are numbered in chronological order progressing west to east from Segment 1 to Segment 8. Reference Post (RP) and Station (Sta.) locations are approximated. This photo log does not provide a comprehensive account of all constraints within the corridor. Potential constraints were visually inspected; no testing or detailed inspections were conducted.

Segment 1

Photo 1. South of I-90 mainline just east of Laurel Interchange looking southeast at Italian Ditch. RP 434.3 (Sta. 25).

Photo 2. South of I-90 mainline just east of the Laurel Interchange looking northwest at 60-inch culvert servicing Italian Ditch. The culvert extends through each set of Interstate lanes and the median. Widening to the inside would avoid the need to lengthen the culvert, although the culvert may need to be replaced due to its age and condition. RP 434.3 (Sta. 25).

Photo 3. North side of I-90 mainline, west of Strauch Road looking southeast. Based on field measurements, the median is 42 feet wide, with 21 feet from the center of the bridge pier to the eastbound edge of pavement and the westbound edge of pavement. It appears that the Interstate could be widened to the inside in this location. Vertical clearance was not measured. RP 435.5 (Sta. 90).

Photo 4. North side of I-90 mainline, west of Strauch Road looking northeast. Based on field measurements, the median is 42 feet wide, with 21 feet from the center of the bridge pier to the eastbound edge of pavement and westbound edge of pavement. It appears that the Interstate could be widened to the inside in this location. Vertical clearance was not measured. RP 435.5 (Sta. 90).

Photo 5. North side of I-90 mainline looking southwest at an inverted siphon. The siphon extends through each set of Interstate lanes and the median. Widening would need to occur toward the inside in this location. RP 435.7 (Sta. 140).

Segment 2

Photo 6. Looking south at Autumn Lane bridge over I-90 mainline. Distance to median piers and vertical clearance was not measured. RP 442.7 (Sta. 465).

Photo 7. Looking up and north at Autumn Lane bridge over I-90 mainline. Beams show signs of deterioration. Distance to median piers and vertical clearance was not measured. RP 442.7 (Sta. 465).

Photo 8. North of I-90 mainline, looking southeast at two bridges over Canyon Creek. It appears that the Interstate could be widened to the inside in this location with a reconstruction of the bridge structures. RP 442.8 (Sta. 470).

Photo 9. North of I-90 mainline, looking south at two bridges over Canyon Creek. It appears that the Interstate could be widened to the inside in this location with a reconstruction of the bridge structures. RP 442.8 (Sta. 470).

Segment 3

Photo 10. North side of I-90 mainline, looking northeast at two I-90 mainline bridges over Hogan's Slough. Based on field measurements, the median is 42 feet wide. The bridges would need to be reconstructed to accommodate a third lane in each direction on the I-90 mainline. This location is constrained by the frontage road south of the eastbound lanes. RP 445.5 (Sta. 610).

Photo 11. South side of I-90 mainline, looking southwest at bridges over Hogan's Slough. Based on field measurements, the median is 42 feet wide. The bridges would need to be reconstructed to accommodate a third lane in each direction on the I-90 mainline. This location is constrained by the frontage road south of the eastbound lanes. RP 445.5 (Sta. 610).

Photo 12. North side of I-90 mainline, looking north at two 60-inch culverts at Hogan's Slough. RP 445.5 (Sta. 610).

Segment 5

Photo 13. West of South Billings Boulevard bridge over I-90 mainline looking northeast. Based on field measurements, the median is 42 feet wide, with 21 feet from the center of the bridge pier to the eastbound edge of pavement and the westbound edge of pavement. It appears that the Interstate could be widened to the inside in this location. Vertical clearance was not measured. RP 447.2 (Sta. 715).

Photo 14. West of South Billings Boulevard bridge over I-90 mainline looking southeast. Based on field measurements, the median is 42 feet wide, with 21 feet from the center of the bridge pier to the eastbound edge of pavement and the westbound edge of pavement. It appears that the Interstate could be widened to the inside in this location. Vertical clearance was not measured. RP 447.2 (Sta. 715).

Photo 15. North side of I-90 mainline on Washington Street looking northwest at Suburban Ditch. RP 448.4 (Sta. 770).

Photo 16. North side of I-90 mainline on Washington Street looking southwest at two 60-inch culverts servicing Suburban Ditch. The culverts extend through each set of Interstate lanes and the median. These culverts would need to be reconstructed or lengthened if an additional lane is added to the outside of the Interstate. RP 448.4 (Sta. 770).

Photo 17. Looking northeast at the Sugar Avenue Bridge over the I-90 mainline. Support piers for this structure are currently located directly adjacent to the shoulders of each set of lanes, precluding the ability to add lanes to the I-90 mainline at this location. The bridge would need to be rebuilt to accommodate a third lane in each direction on the I-90 mainline. RP 449.3 (Sta. 814).

Photo 18. Looking east at the Sugar Avenue Bridge over the I-90 mainline. Support piers for this structure are currently located directly adjacent to the shoulders of each set of lanes, precluding the ability to add lanes to the I-90 mainline at this location. The bridge would need to be rebuilt to accommodate a third lane in each direction on the I-90 mainline. RP 449.3 (Sta. 814).

Photo 19. Looking east at the Sugar Avenue Bridge over the I-90 mainline. Support piers for this structure are currently located directly adjacent to the shoulders of each set of lanes, precluding the ability to add lanes to the I-90 mainline at this location. The bridge would need to be rebuilt to accommodate a third lane in each direction on the I-90 mainline. RP 449.3 (Sta. 814).

Photo 20. Looking east at the South 27th Street Interchange Bridge. Based on field measurements, the median is 39 feet wide, with 20 feet from the center of the bridge pier to the eastbound edge of pavement and 19 feet from the center of the bridge pier to the westbound edge of pavement. It appears that the Interstate could be widened to the inside in this location. Vertical clearance was not measured. RP 450.1 (Sta. 855).

Photo 21. Looking east at the South 27th Street Interchange Bridge over I-90 mainline. Based on field measurements, the median is 39 feet wide, with 20 feet from the center of the bridge pier to the eastbound edge of pavement and 19 feet from the center of the bridge pier to the westbound edge of pavement. It appears that the Interstate could be widened to the inside in this location. Vertical clearance was not measured. RP 450.1 (Sta. 855).

Photo 22. Looking east at the South 27th Street Interchange Bridge over I-90 mainline. Based on field measurements, the median is 39 feet wide, with 20 feet from the center of the bridge pier to the eastbound edge of pavement and 19 feet from the center of the bridge pier to the westbound edge of pavement. It appears that the Interstate could be widened to the inside in this location. Vertical clearance was not measured. RP 450.1 (Sta. 855).

Segment 6

Photo 23. Looking southwest at two I-90 mainline bridges over railroad. The bridges would need to be reconstructed to accommodate a third lane in each direction on the I-90 mainline. RP 450.5 (Sta. 878).

Photo 24. Looking west at two I-90 mainline bridges over railroad. The bridges would need to be reconstructed to accommodate a third lane in each direction on the I-90 mainline. RP 450.5 (Sta. 878).

Photo 25. On frontage road looking north at gas transmission line running underneath the I-90 mainline. RP 452.0 (Sta. 890).

Photo 26. Standing on Charlene Street, looking northeast at two I-90 mainline bridges crossing the Yellowstone River. A pedestrian facility runs underneath the bridges. The bridges would need to be reconstructed to accommodate a third lane in each direction on the I-90 mainline. RP 452.0 (Sta. 955).

Photo 27. Looking northeast at the bridge for Old US 87 at the Lockwood Interchange crossing over the I-90 mainline. Based on field measurements, the median is 42 feet wide, with 21 feet from the center of the bridge pier to the eastbound edge of pavement and the westbound edge of pavement. It appears that the Interstate could be widened to the inside in this location. Vertical clearance was not measured. RP 450.1 (Sta. 1000).

Photo 28. Looking northeast at the bridge for Old US 87 at the Lockwood Interchange crossing over the I-90 mainline. Based on field measurements, the median is 42 feet wide, with 21 feet from the center of the bridge pier to the eastbound edge of pavement and the westbound edge of pavement. It appears that the Interstate could be widened to the inside in this location. Vertical clearance was not measured. RP 450.1(Sta. 1000).

Photo 29. Looking northeast at the bridge for Old US 87 at the Lockwood Interchange crossing over the I-90 mainline. Based on field measurements, the median is 42 feet wide, with 21 feet from the center of the bridge pier to the eastbound edge of pavement and the westbound edge of pavement. It appears that the Interstate could be widened to the inside in this location. Vertical clearance was not measured. RP 450.1 (Sta. 1000).

Segment 7

Photo 30. South side of I-90 mainline looking northeast at two 60-inch culverts servicing the Lockwood Ditch running underneath the I-90 mainline. The culverts extend through each set of Interstate lanes and the median. These culverts would need to be reconstructed or lengthened if an additional lane is added to the outside of the Interstate. If widening occurred to the inside of the Interstate, the culverts may need to be replaced due to their age and condition. RP 453.0 (Sta.1035).

Photo 31. Standing in I-90 median looking north at grate leading to two 60-inch culverts servicing the Lockwood Ditch. RP 453.0 (Sta. 1035).

Photo 32. South side of I-90 mainline looking northeast at two 60-inch culverts servicing Dry Creek running underneath the I-90 mainline. The culverts extend through each set of Interstate lanes and the median. These culverts would need to be reconstructed or lengthened if an additional lane is added to the outside of the Interstate. If widening occurred to the inside of the Interstate, the culverts may need to be replaced due to their age and condition. RP 454.7 (Sta. 1110).

Photo 33. Standing in I-90 median, grate leading to two 60-inch culverts servicing Dry Creek. RP 454.7 (Sta. 1110).

Photo 34. North side of I-90 mainline, looking at grate draining to two 60-inch culverts servicing Dry Creek. RP 454.7 (Sta. 1110).

Photo 35. North side of I-90 mainline, looking southwest at two 60-inch culverts servicing Dry Creek running underneath the I-90 mainline. The culverts extend through each set of Interstate lanes and the median. These culverts would need to be reconstructed or lengthened if an additional lane is added to the outside of the Interstate. If widening occurred to the inside of the Interstate, the culverts may need to be replaced due to their age and condition. RP 454.7 (Sta. 1110).

Segment 8

Photo 36. Southwest side of I-90 Johnson Lane Interchange looking south at two 60-inch culverts running underneath the I-90 mainline. The culverts extend through each set of Interstate lanes and the median. These culverts would need to be reconstructed or lengthened if an additional lane is added to the outside of the Interstate. If widening occurred to the inside of the Interstate, the culverts may need to be replaced due to their age and condition. RP 455.3 (Sta. 1125).

Photo 37. Southwest side of I-90 Johnson Lane Interchange looking north from two 60-inch culverts running underneath the I-90 mainline. RP 455.3 (Sta. 1125).

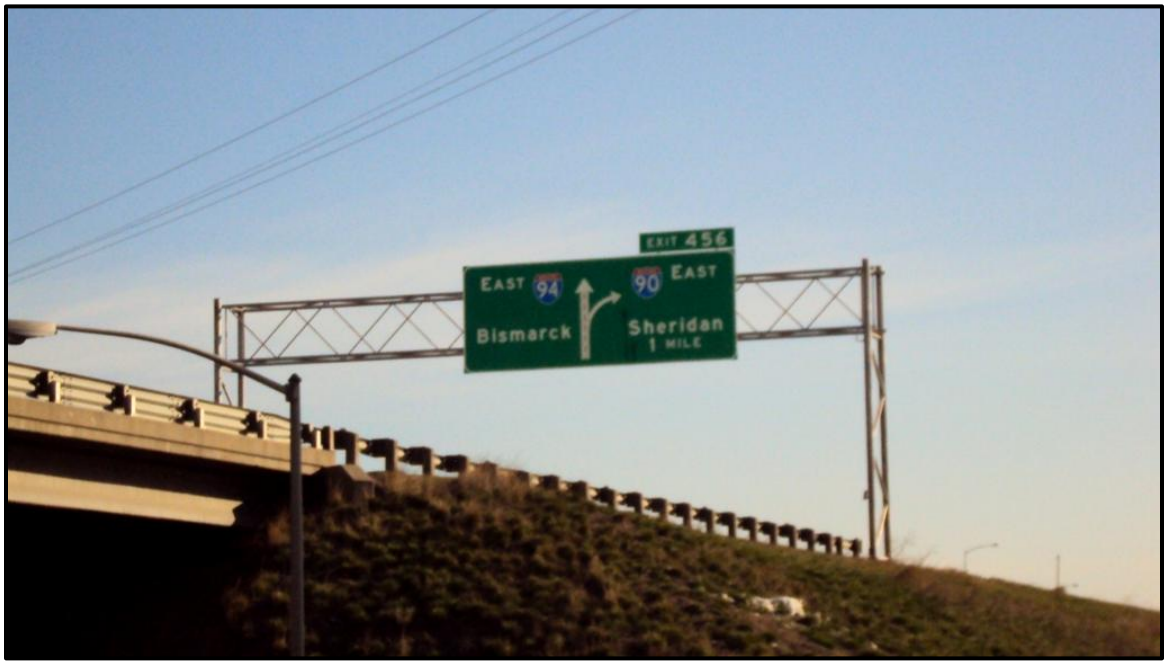

Photo 38. South side of I-90 mainline at Johnson Lane Interchange looking northeast at overhead road sign on eastbound lane. The sign bridge structure would require reconstruction if widening occurred at this location. RP 455.6 (Sta. 1130).

Photo 39. South side of I-90 mainline looking north at two I-90 bridges over Johnson Lane. The bridges would need to be reconstructed to accommodate a third lane in each direction on the I-90 mainline. RP 455.3 (Sta. 1130).