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Geotechnical Design Memorandum

F.A.I. Route 74
Section 81-1-2
Rock Island County
Job No. P-92-032-01
Contract No. 64C08
PTB No. N/A
Retaining Wall IL-RW13
Structure Number 081-6020

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1. Project Description

This memorandum provides additional geotechnical recommendations for the proposed Retaining Wall IL-RW13, which is part of the Central Section of the I-74 over the Mississippi River Project.

This memorandum was prepared to address changes to the overall project staging that have occurred since the Structure Geotechnical Report (SGR) was prepared. This memorandum supplements the SGR prepared by Hanson Professional Services Inc. in May 2011. Geotechnical evaluations and design recommendations in the SGR still should be considered valid, except as specifically referenced herein.

2. Proposed Structure

The proposed wall will now be constructed in two stages instead of three. The stage line will be located in the current I-74 median. The east side (WB I-74) will be constructed first and then the west side (EB I-74) will be constructed in the following year. The bridges above will follow the same sequence.

An MSE wingwall will be added in the median under the EB approach slab parapet. This wingwall will replace a portion of IL-RW12, which will now be a soldier pile and lagging wall beginning at the south end of the approach slab. A soldier pile and lagging wall would have been difficult to construct over the reinforced soil mass of the MSE wall. A wingwall using precast panels with the minimum reinforced soil mass width is preferred for cost and ease of construction. The proposed wingwall will have a total height, measured from top of leveling pad to top of pavement, of approximately 9.8 to 10.0 feet. At this height, a typical MSE wall section would have an equivalent uniform bearing pressure of 1,900 to 2,000 psf.

3. Geotechnical Evaluations

The revised construction staging changes the locations of the temporary structures, but otherwise does not affect the geotechnical recommendations for the structure.

The new MSE median wingwall will bear on the reinforced soil mass of the proposed abutment wall near the abutment or on the reinforced soil mass of the temporary MSE wall towards the end of the approach slab. The allowable bearing capacity varies depending on the height of the lower wall's reinforced soil mass and on the ground improvement below. The allowable bearing capacity at the base of the MSE wingwall would never be less than the 4,000 psf allowable bearing capacity of the native soil. The proposed median wingwall would meet the Standard Specifications for Highway Bridges (AASHTO) requirements for bearing pressure and sliding stability along its entire length.

4. Design Recommendations

When designing for the external stability of the MSE wingwall, it should be assumed that the reinforced soil mass will be composed of a granular select backfill and the fill behind the reinforced soil mass will be embankment material as defined by the IDOT Standard Specifications for Road and Bridge Construction (IDOT Standard Specifications). Both materials should be assumed to have a total unit weight of 125 pcf. The active earth pressure coefficient of the embankment fill could vary greatly depending on the actual material used, but should be assumed to be 0.36 for design. Near the wall corners, where the backfill will be the select material placed behind the abutment wall, an active earth pressure coefficient of 0.28 may be used.

Along the median wingwall, the MSE wall should be proportioned for an allowable bearing capacity of 4,000 psf. Sliding stability should be checked against a nominal drained sliding resistance of 0.53 times the effective vertical stress. A conventional precast panel MSE wall is feasible. The theoretical top of leveling pad or base of

reinforced soil mass may be located at the minimum embedment required by IDOT (3'-6" below finished grade). The minimum length to height ratio specified by AASHTO (0.70) will be acceptable for the entire median wingwall.

5. Construction Considerations

The construction of MSE walls and aggregate column ground improvement are not covered by the IDOT Standard Specifications. Guide Bridge Special Provisions No. 38, Mechanically Stabilized Earth Retaining Walls (Revised: July 26, 2013), and No. 71, Aggregate Column Ground Improvement (Revised: October 15, 2011), should be included in the construction documents. These special provisions require that the contractor take responsibility for the final design of much of the structure.

The first stage of construction will require top-down shoring for a near-vertical cut in the I-74 median. The height of this shoring exceeds the maximum values in the Bridge Manual's Design Guide 3.13.1 – Temporary Sheet Piling Design. The existing retaining wall between the bridge abutments will have a significant impact on the design of the shoring. A contractor-designed temporary wall is recommended. Guide Bridge Special Provision No. 44, Temporary Soil Retention System (Revised: May 11, 2009), should be included in the construction documents.

The first stage will also require a temporary vertical face along the side of the reinforced soil mass, perpendicular to the front face of the permanent wall. This vertical face should not be formed by placing the select backfill against the temporary soil retention system. This would inhibit compaction of the select backfill and obstruct removal of the temporary soil retention system. A temporary, wire-faced MSE wall is recommended along the stage line. Guide Bridge Special Provision No. 57, Temporary Mechanically Stabilized Earth Retaining Walls (Revised: July 26, 2013), should be included in the construction documents.

The most recent versions of IDOT Guide Bridge Special Provisions No. 38 and No. 57 reference only the AASHTO LRFD Bridge Specifications for design of MSE walls. The previous versions should be used for this project, since the current wall design and plan details use the AASHTO Standard Specifications for Highway Bridges.

References

Hanson Professional Services Inc. (2011, May). Structure Geotechnical Report, Retaining Wall IL-RW13, Structure No. 081-6020.

Illinois Department of Transportation (2012). *Standard Specifications for Road and Bridge Construction*.