



March 9, 2006

TO: D. Yankauskas/G. Golphenee
Northwest Region, MS NB 82-77

FROM: *JA*
T. M. Allen/M. A. Frye
E&EP Geotechnical Division, 47365

SUBJECT: SR-20, MP 44.75 vic., XL0832
Quiet Cove Road Vic. to SR 20 Spur
Meadow Creek Bridge Approach Walls
Geotechnical Recommendations

Introduction

This memorandum presents geotechnical recommendations for the four approach walls at the proposed Meadow Creek Bridge associated with the subject project. This project involves safety improvements to SR 20 from south of Meadow Creek Bridge to Sharpes Corner. The improvements involve alignment and profile changes, construction of left-turn channelization, lane and shoulder widening, and closure of several intersections. As part of a new alignment, a new bridge will be constructed over Meadow Creek.

Meadow Creek currently passes under SR 20 in a 4-foot diameter culvert. The culvert will be removed, and an open channel constructed to convey Meadow Creek under a new, single-span bridge. Four retaining walls will be constructed at each corner of the bridge to provide a transition from the approach fills to the bridge curtain walls.

Retaining Wall Descriptions

Each of the four retaining walls at the corners of the Meadow Creek Bridge will transition from a maximum height of approximately 10 feet at the connection to the bridge curtain wall to zero height over a horizontal distance of less than 24 feet. The walls will support the traveled lanes and shoulders of SR 20 and will likely have a traffic barrier at the top of the wall.

Subsurface Conditions

Soils at the site consist of loose fill overlying very dense glacial deposits. A detailed description of subsurface conditions is available in our November 8, 2005 geotechnical report titled *Quiet Cove Road Vic. To SR 20 Spur Meadow Creek Bridge*. Bridge layout sheets, subsurface profiles, and boring logs are available in our earlier report.

Groundwater is not expected to be encountered during construction of these walls.

Geotechnical Recommendations

We have evaluated allowable bearing capacity, settlement, and global stability for several wall types. Based on site conditions and wall geometry, we recommend structural earth

walls be used due to their ability to tolerate moderate amounts of settlement. We estimate up to 2 inches of settlement could occur during and immediately after construction. We anticipate less than half an inch of long term settlement. A Type 1 permanent geosynthetic wall as shown in Standard Plan D-3 may be used for these walls. Additionally, pre-approved, proprietary structural earth walls are also suitable. We have evaluated overall stability for SE walls; overturning, sliding, and bearing capacity will be evaluated by the manufacturer's designer. Design parameters for inclusion in General Special Provision, titled *Structural Earth Walls*, (GSP 13030201.FB6), are provided as follows:

<u>Soil Parameters</u>	<u>Wall Backfill</u>	<u>Retained Soil</u>	<u>Foundation Soil</u>
Unit Weight (pcf)	125	125	125
Friction Angle (deg)	36	36	30
Cohesion (psf)	0	0	0

<u>Foundation Soil</u>	<u>AASHTO Load Group I</u>	<u>AASHTO Load Group VII</u>
Allowable Bearing Capacity (tsf)	3.5	5.25
Acceleration Coefficient (g)	0	0.27

A traffic surcharge of 250 psf should be added when designing the walls.

The SE wall system should meet the following requirements.

1. The wall should be placed on a level (in direction perpendicular to the wall face) and firm foundation. Walls can be allowed to slope along their length up to 2H:1V (horizontal:vertical), provided the wall base is stepped.
2. Wall face batter should be no steeper than 1H:48V.
3. The base width of the wall should be greater than or equal to 70 percent.
4. The top reinforcing layer should be placed no lower than 2 feet below the top of the wall.
5. Wall embedment should be at least 2 feet or 10 percent of the wall height, whichever is greater.
6. Provisions for permanent control of subsurface water behind the wall should consist of a slotted drain pipe embedded in Gravel Backfill for Drains (Section 9-03.12(4)).
7. Drainage structures should be located outside the reinforced zone where possible. If drainage structures are planned within the reinforced zone, they must be shown on the plans and profile sheets provided to the wall

proprietor so they can account for the structures in their design. If drainage structures are located behind the face of a MSE wall, the outfall pipe should run perpendicular to the wall face.

Prior to contract advertisement, the Project office should contact each of the wall proprietors listed in the General Special Provisions to confirm that they want to be included in the contract.

Recommended Additional Services

Because the future performance and integrity of the geotechnical elements of this project will depend largely on proper PS&E preparation and diligent construction procedures, we recommend that the Geotechnical Division (GD) in conjunction with the Regional Materials Engineer (RME) provide the following post-report services:

The GD should prepare the Summary of Geotechnical Conditions to be included in the PS&E as an appendix. The summary should be prepared as part of the PS&E review process.

The GD/RME should review all construction plans and specifications to verify that the design criteria presented in this report have been interpreted correctly and properly integrated into the design.

The GD/RME should attend pre-construction conferences with the Construction Project Engineer and Contractor to discuss important geotechnical related construction issues.

The GD/RME should review Contractor submittals for all shoring walls and other geotechnical elements of this project.

The RME should observe all exposed subgrades after completion of stripping and excavation to contract elevations. The RME should confirm that suitable soil conditions have been reached and determine appropriate subgrade compaction methods.

In addition to the aforementioned services, the Geotechnical Division can provide inspector training for construction personnel, assist in change of condition claims, and review cost reduction incentive proposals (CRIPs).

Intended Report Use and Limitations

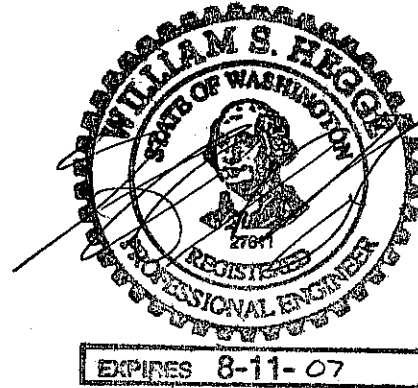
This report has been prepared to assist the Washington State Department of Transportation in the engineering design and construction of the subject project. It should not be used, in part or in whole for other purposes without contacting the EEP Geotechnical Division for a review of the applicability of such reuse. This report should be made available to prospective contractors for their information or factual data only and not as a warranty of ground conditions.

The conclusions and recommendations contained in this report are based on the Geotechnical Division's understanding of the project at the time that the report was written and on site conditions that existed at the time of the field exploration. If significant changes to the nature, configuration, or scope of the project occur during the design process, the Geotechnical Division should be consulted to determine the impact of such changes on the recommendations and conclusions presented in this report.

Site exploration and testing describes subsurface conditions only at the sites of subsurface exploration and at the intervals where samples are collected. These data are interpreted by members of the Geotechnical Division who then render an opinion regarding the general subsurface conditions. The distribution, continuity, thickness, and characteristics of identified (and unidentified) subsurface materials may vary considerably from that indicated by the subsurface data. While nothing can be done to prevent such variability, the Geotechnical Division is prepared to work with the Design Team to reduce the impacts of variability on project design, construction, and performance. Periodic geotechnical observation during construction may be beneficial in this respect. This ongoing involvement of the Geotechnical Division throughout the design and project development process will also help to avoid costly mistakes associated with misinterpretation of the contents of this report and resulting shortcomings of project design or contract documents.

The conclusions and recommendations presented in this report assume that surface and subsurface conditions, as observed during field exploration activities are representative of the site conditions throughout the project area. Because of this assumption, these recommendations should be considered subject to change depending on the actual subsurface conditions encountered. Actual subsurface conditions can be discovered only during earthwork and construction operations. Accordingly, the Geotechnical Division should be involved in the construction of the project in order to make appropriate observations and recommendations for alteration in design, as appropriate.

If you have questions or require further information, please contact Tony Allen at (360) 709-5450 or Mark Frye at (360) 709-5469.



Prepared By:
Mark A. Frye
Geotechnical Designer

Reviewed By:
William S. Hegge
Senior Foundation Engineer

Agency Approval Authority:
Tony M. Allen
State Geotechnical Engineer

TMA/maf

- cc: Chris Johnson, Northwest Region Materials Engineer, MS NB 82-29
Phil Nash, Bridge and Structures Office, MS 47340
Mark Anderson, Bridge and Structures Office, MS 47340
Munindra Talukdar, Bridge and Structures Office, MS 47340