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To: Ms. MILI LIM
Chief, Office of Design, Branch A
District 12

Date: September 30, 2012

File: 12-ORA-74, PM 2.93/5.06
12-0L720K
SR-74 Safety Project

Attention: Mr. Joseph Lee

From: DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design - South 1

Subject: Preliminary Geotechnical Evaluation and Recommendations for the PAED Phase of Proposed Widening of State Route 74 (SR-74) from Post Mile 2.93 to Post Mile 5.06

Introduction

This memorandum provides a brief description of the preliminary geotechnical investigation conducted by the Office of Geotechnical Design South 1 (OGDS1), Branch D in September 2012 for the proposed widening of SR-74. Based on discussions, OGDS1 and the Office of Design of District 12 (District) decided that a geotechnical evaluation based on the visual observations would be adequate for the PAED phase of the Project. Consequently, no subsurface exploration was conducted for the current geotechnical investigation. Therefore, the preliminary recommendations provided in this memorandum are solely based on visual observations of the subject site.

Proposed Project

The District plans indicate that the proposed project would consist of widening the roadway to provide standard 12-foot wide travel lanes and 4-foot wide shoulders. The proposed widening would require excavation into some of the ascending slopes and placement of additional fill on some of the embankment/fill segments of the roadway containing descending slopes. The widening of embankments/fill segments of the roadway would be achieved by either construction of retaining structures or building the existing descending slopes outwards. The project would also require mitigation of existing slope instabilities that could affect the improvements planned in the proposed project.

Previous Geotechnical Studies

OGDS1 submitted a memorandum containing geotechnical issues and constraints at the site, in May 2011, for the Project Study Report (PSR) phase of the project. This memorandum was titled "Preliminary Geotechnical Evaluation and Recommendations for Preparation of the Project Study Report for the Proposed Widening of State Route 74 (SR-74) from Post Mile 2.93 to 5.06" contained initial geotechnical observations of OGDS1. The geotechnical recommendations in the memorandum for the PSR were developed for providing 8-foot wide shoulders for the roadway.

The study was conducted to identify the geotechnical constraints to the proposed project in regard to the ascending and descending slopes on both sides of the roadway. The conclusions and recommendations for the PSR phase were based on limited visual observations of the site conditions within the proposed project limits and therefore are considered very preliminary.

Current Geotechnical Study

The current geotechnical study was performed to provide preliminary recommendations for widening the roadway to bring the lane widths to the current standards and provide 4-foot wide shoulders. Although, this study was also conducted with visual observations of the site conditions, an attempt was made to identify the geotechnical constraints and the needed mitigations in more detail than in the previous phase by using the exposed geologic conditions along SR-74. Therefore, the conclusions and recommendations provided in this memorandum should be considered more appropriate for this phase of work and should supersede the recommendations provided for the PSR phase. However, it should be noted that no subsurface explorations or surface mapping were conducted for this phase of the investigation too. Therefore, the conclusions and recommendations presented in this memorandum should be considered still preliminary and should be used primarily for the purpose of developing the project documents for this phase. A geotechnical investigation with subsurface exploration and laboratory testing is needed for developing conclusions and recommendations for design and construction of the structural and roadway items associated with the proposed widening.

The following information provided by the District was used to help make decisions on the geotechnical mitigations proposed in this memorandum.

1. Cross sections of the roadway segment within the project area, drafted on June 7, 2011. These cross sections depict the grade of the roadway and the adjacent slope areas at 50-foot intervals along the roadway. However, we believe that some cross sections do not extend far enough to depict the entire slope depths and heights.
2. A layout plan, dated October 3, 2011 of the project area.

OGDS1 conducted the geotechnical study in August 2012, observing the topographical and exposed geologic conditions. A brief description of the field observations and interpretations is given below.

- Visual observations of the descending slopes: The observations included the slope ratios, heights and visual identification of surficial soils on the exposed slopes and the surrounding areas. Based on the geologic units observed, attempts were made to interpret the possible subsurface structure at the slope areas. The interpreted subsurface structures were plotted on the roadway cross sections.

The surficial soils of most of the descending slopes are composed of man-made fills and slope wash. Fills and the slope wash are underlain by bedrock units and alluvium/terrace deposits. Based on the visual observation of the slopes and the adjacent areas, we estimate

that the thickness of fill could range from a sliver to the entire slope height. Silver fills and fills with variable depths occur at locations where the roadway contains cut-fill transitions. In areas, particularly where the roadway crosses the canyons, the slopes are underlain by relatively deep fills. Some of the slopes have performed reasonably well against deep seated failures without apparent distress. However, based on the observations in this study and the emergency repairs of past storm related damages, we are of the opinion that a number of slopes are only marginally stable against deep seated failures. Additionally, many of the slopes exhibit some degree of surficial distress. Surficial failures appear to have occurred due to the deterioration of surficial soils from the exposure to elements and animal burrowing. We observed that even at some locations where adequate space is available for the proposed widening, slope remedial work is needed to mitigate potential damages to roadway facilities resulting from future slope failures.

- Visual observation of the roadway structural pavement distress: In our previous visits and May, 2011 geotechnical study, we observed that at 2 locations, the roadway exhibited signs of distress that were indicative of potential slope failures extending into the travel lanes. At these locations, the roadway has experienced settlements over a roughly semi-circular area extending from the adjacent descending slopes. The cracks and the movements observed on the pavement were similar to those in the head scarp area of landslides. However, we could not observe these cracks as the roadway has been repaved recently. These areas should be investigated in the geotechnical exploration for the design phase to determine the potential for slope failure and any needed remedial work. OGDS1 will make an attempt to identify these areas during the geotechnical investigation of the design phase.
- Visual observations of the ascending slopes: The ascending slopes are located mainly on the south side of the roadway. Most of the ascending slopes are underlain by moderately weathered sandstone and silty sandstone. A few slope areas are underlain by either highly weathered claystone or terrace deposits.

Most of the ascending slopes have to be excavated to accommodate the proposed widening. Our observations indicated that in general, the existing slopes underlain by moderately weathered bedrock units have performed satisfactorily, with few minor shallow failures. We believe that those slopes could be excavated parallel to the existing slope ratios, provided that the existing slope ratios are no steeper than 1: $\frac{3}{4}$ (V:H) and the slopes do not contain adversely oriented joints and bedding. Our observations indicated that at few isolated locations slopes in moderately weathered materials contain overhangs. Such overhangs should be removed during the excavations for the proposed widening.

The slope segments containing highly weathered claystone or terrace materials have experienced distress mainly in the form of shallow failures. Such slopes may need to be laid back at slope ratios flatter than the existing or stabilized with other appropriate methods. However, the needed mitigation measures could only be determined by evaluating the stability of the slopes with the information obtained from a subsurface exploration.

Our observations indicated that at many of the locations the cause of slope distress has been the run-off from the area above the slope. The water flow has caused erosion and weathering leading to the eventual distress. At present, it appears that there are no drainage channels intercepting the run-off towards the slopes.

Conclusions and Recommendations

The proposed widening of the roadway would require placement of additional fill on many of the descending slopes and the excavation of the majority of ascending slopes. The placement of additional fill on descending slopes could be achieved by either constructing retaining walls on the slopes or extending the slope surface outwards. The feasibility of using a particular method or an option for a location depends on the slope ratio, slope height, the geology of the site and the availability of right of way. Based on our observations, we conclude that the construction of retaining walls would be more feasible at some locations while widening with additional fill on the slope would be more feasible at others. Due to the relative steepness of descending slopes and the right of way considerations, we recommend using geogrid-reinforced fills for the widening (without retaining structures). The locations of proposed retaining walls and slope constructions are presented in the attached Tables 1 and 2.

Our observations indicated that in some segments of the roadway, the hinge points of the descending slopes (top of the slopes) are located several feet away from the current edges of the travel lanes and the roadway embankment is wide enough to accommodate the proposed improvements. However, at several of those locations, we observed that the slopes have experienced failures and are in need of repair. These locations should be repaired as a part of this project in order to mitigate the damages to proposed improvements resulting from future slope distress. The slope segments needing remedial measures, as identified through visual observations, are presented in the attached Tables 1 and 2.

In general, the ascending slopes containing moderately weathered bedrock units with no adverse bedding/joints are anticipated to be grossly and surficially stable. Such slopes could be excavated parallel to the existing slope surfaces, provided that they are no steeper than 1:¾ (V:H). The overhangs observed at few isolated slope locations should be removed during the proposed grading. The slopes excavated at ratios steeper than 1:¾ (V:H) may require rock nets to mitigate the potential for rock falls on to the roadway. For the current phase, we recommend that the District assume that rock nets are needed at 50% of the slope segments steeper than 1:¾ (V:H). The slope segments containing highly weathered claystone or terrace materials have experienced distress mainly in the form of shallow failures. Slopes excavated at such locations may experience failure in the future unless laid back at slope ratios flatter than the existing and/or stabilized with other appropriate methods. However, the stability of the slopes and the needed mitigation measures could be determined only through a geotechnical investigation with geologic mapping, drilling, sampling and laboratory testing.

A major contributing factor to the distress of the existing slopes has been the run-off from the areas above the slope. Therefore, we recommend that properly sized V-ditches and downdrains be provided during the proposed project to intercept the run-off.

The recommendations for the ascending slope segments are presented in attached Tables 1 and 2.

It should be noted that the conclusions and recommendations presented in this memorandum are based on limited visual observations of site topography and exposed geologic conditions. The geotechnical issues associated with the proposed widening are largely governed by the subsurface conditions including groundwater conditions at the site, which were not evaluated in this phase. The actual subsurface conditions could be significantly different from those interpreted from the visual observations. Substantial variations of the subsurface conditions from those interpreted and the presence of any groundwater could have a significant impact on the recommendations and the project cost. A reasonable evaluation of the needed mitigation/remedial measures including the types and sizes of retaining structures can be made only through a geotechnical investigation and analyses. As such, the conclusions and recommendations provided in this memorandum should be considered preliminary. The mitigation measures and structure types/locations presented herein could be significantly different from those in the design phase of the project depending on the observed subsurface conditions and test data.

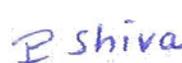
Please call Gamini Weeratunga at (949) 440-3427 or Shiva Karimi at (213) 620-2146, with any questions you may have on these memorandum.

Prepared by: Date: 9/30/12

Reviewed by: Date: 9/30/12




Gamini Weeratunga
Transportation Engineer
OGDS1, Branch D




Shiva Karimi, Ph.D., G.E.
Senior Transportation Engineer
OGDS1, Branch D

Attachment: Tables 1 and 2

cc:

District Project Manager	Bob Bazargan	Bob_Bazargan@dot.ca.gov
GS Corporate	Shira Rajendra	Shira_Rajendra@dot.ca.gov
District Construction R.E. Pending File	TBD	TBD
District Materials Engineer	Behdad Baseghi	Behdad_Baseghi@dot.ca.gov