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February 1, 2012

El Dorado County Department of Transportation
2850 Fairlane Court
Placerville, CA 95667

Attention: Mr. Matt Smeltzer

Subject: Bridge Foundation Report – Addendum 1
Gerle Creek Bridge
Forest Road 14N34 at Gerle Creek
El Dorado County, California

2009-0152
39120-A4:015N:021W

The following addendum provides alternative foundation recommendations to our December 21, 2009 foundation report. El Dorado County has asked for recommendations for a spread footing supported abutment as an alternative to the initially recommended driven pile foundation. It is our understanding that the County is aware of the possible settlement issues presented by this type of foundation at the subject site.

Supporting the proposed bridge on spread footing at the subject site will likely result in substantial settlement of the abutments. To reduce this settlement and reduce the amount of differential settlement to an acceptable level we recommend the use of geosynthetic reinforced soil (GRS) techniques. This has been discussed with the County prior to being directed to develop these recommendations. It should be understood that substantial settlement is possible, especially after earthquake shaking, and these recommendations are given with the understanding that these settlements are tolerable for this project. With the recommended GRS foundation improvements discussed below it should be expected that static settlement on the order of 1.5-inches can be expected and that after earthquake shaking 2-inches or more settlement may occur.

It is recommended to construct a GRS mat below the proposed spread footing at both proposed abutments. This mat should be constructed to be a minimum of 15 feet wide (i.e. 7.5 ft to either side of footing centerline) and 31 feet long with the spread footing centered on this mat. The recommended reinforcement is a biaxial geogrid meeting or exceeding the specifications of Tensar BX1200 style geogrid. The following table provides the recommended reinforcement elevations for support of the proposed spread footing. All elevations are based on the elevations shown on the provided plans titled "Wentworth Springs Road at Gerle Creek Bridge Replacement Project," dated December 02, 2011.

Table 1 - Geogrid Placement

Elevations	Abutment 1	Abutment 2
Bottom of Footing	5833.38	5835.02
Geogrid Layer 1	5832.38	5834.02
Geogrid Layer 2	5831.38	5833.02
Geogrid Layer 3	5830.38	5832.02
Geogrid Layer 4 – Bottom of GRS Mat	5829.38	5831.02

The bottom of the excavation can be anticipated to be wet and will likely require the use of a working base to allow for compaction. If, as anticipated, the excavation is wet at the planned bottom of the GRS mat then the excavation should be over-excavated 12-inches. A 12-inch thick layer of clean crushed rock meeting the alternative fill gradation given below should be placed to create a "working" base. In the case that the excavation at the planned bottom of GRS mat is found to be dry the bottom of the excavation should be scarified to 6-inch depth and recompact to a minimum 95% compaction prior to placement of the geogrid.



The bottom most layer (Geogrid Layer 4) should be placed on the prepared working base or excavation bottom. Geogrid should be laid flat with adjacent pieces of geogrid overlapped a minimum of 2 ft when more than one piece of geogrid is required.

Fill should be placed and compacted in thin lifts (6-inch thickness maximum) to 95% compaction per Cal 216. The granular fill should be placed onto the geogrid and spread in the direction the geogrid was unrolled. Equipment should not bear directly on the geogrid and a minimum of 4 inches of fill should be placed before equipment bears on the geogrid reinforced soil.

Soils meeting the following minimum gradation (Table 2) are recommended for use as engineered fill and should be approved by this office. In areas of high groundwater the alternate gradation should be used to allow for compaction; this material should be composed of crushed rock with minimal fines meeting the alternative gradation in Table 2.

Table 2 – Fill Requirements
Minimum Fill Gradation

Sieve Size	Percentage Passing	California Test
2"	100	202
#4	50-80	202
#40	0-30	202
#200	0-15	202

Alternative Fill Gradation for Wet Conditions

Sieve Size	Percentage Passing	California Test
2"	100	202
1/2"	50	202
#40	0-10	202



To reduce possible differential settlement of the approach fills planned for behind each proposed abutment, it is recommended to place geogrid layers at 2 ft intervals from the top of the proposed GRS mat to the top of the planned fills. The installation and fill requirements are the same as for the GRS mat. The top layer of geogrid should have a minimum of 1 ft of granular fill above it. Where large crushed rock road base will be placed the geogrid should have a minimum cover of 6-inches of granular fill meeting gradations in Table 2 prior to placement of road base.

Design of the abutment should use soil pressures provided in the referenced report. For design purposes, allowable bearing pressures of 3 tons per square foot for footing bearing on GRS can be used. For resistance to lateral loads, concrete footings may be assigned an ultimate base friction coefficient of 0.40 for footings poured neat against the GRS. If the upper 6-inches of the GRS is constructed with clean crushed rock (minimum of $\frac{3}{4}$ inch diameter and approved by this office) then an ultimate base friction coefficient of 0.50 may be used.

The proposed abutment and GRS mat will require protection from scour. It is understood that the recommended base of planned footing is below the calculated scour depth. It is further understood that the plans call for $\frac{1}{4}$ ton rock slope protection (RSP) to be placed above the planned footing to below the calculated scour depth. If this RSP is large enough to provide protection from anticipated flows then no further scour protection is recommended.

Excavations for the planned GRS mat and approach embankments are anticipated to be possible at 2H:1V (Horizontal : Vertical) for short-term open excavations, but the contractor should be aware of possible sloughing and caving potential of the loose sand soils found during our investigation. Excavation design and safety is the sole responsibility of the contractor.



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Reviewed by: Ronald E. Loutzenhiser
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GENERAL CONDITIONS

The conclusions and recommendations of this study are professional opinion based upon the indicated project criteria and the limited data described herein. It is recognized there is potential for sufficient variation in subsurface conditions that modification of conclusions and recommendations might emerge from further, more detailed study.

This report is intended only for the purpose, site location and project description indicated and assumes design and construction in accordance with Caltrans practice.

As changes in appropriate standards, site conditions and technical knowledge cannot be adequately predicted, review of recommendations by this office for use after a period of two years is a condition of this report.

A review by this office of any foundation and/or grading plans and specifications or other work product insofar as they rely upon or implement the content of this report, together with the opportunity to make supplemental recommendations as indicated therefrom is considered an integral part of this study and a condition of recommendations.

Subsequently defined construction observation procedures and/or agencies are an element of work that may affect supplementary recommendations.

Should there be significant change in the project, or should earth materials or conditions different from those described in this report be encountered during construction, this office should be notified for evaluation and supplemental recommendations as necessary or appropriate.

Opinions and recommendations apply to current site conditions and those reasonably foreseeable for the described development--which includes appropriate operation and maintenance thereof. They cannot apply to site changes occurring, made, or induced, of which this office is not aware and has not had opportunity to evaluate.

The scope of this study specifically excluded sampling and/or testing for, or evaluation of the occurrence and distribution of, hazardous substances. No opinion is intended regarding the presence or distribution of any hazardous substances at this or nearby sites.

