June 14, 2019
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Mr. Ron Johnson
Contra Costa Community College District
2600 Mission Bell Drive
San Pablo, CA 94806
Email: ronj@cslpm.com

SUBJECT: Response to DSA Review Comments Regarding
Geotechnical Engineering Addendum Letter Nos. 1 and 4
Foundation Uplift Anchors
C-4016 New Allied Science Building
Contra Costa College
2600 Mission Bell Drive
San Pablo, California

Dear Mr. Johnson:

Kleinfelder has provided this letter summarizing our responses to review comments provided by the Division of the State Architect (DSA). Background information as well as our comment responses are provided below.

BACKGROUND

Kleinfelder prepared a geotechnical report for the project in October 2017. As the design progressed, uplift anchors were determined to be necessary to resist uplift forces caused by a seismic event. Kleinfelder prepared this letter based on the results of that investigation and our previous supplemental reports, which include the following:

- "Geotechnical Engineering Investigation Report," dated October 17, 2017
- "Geologic and Seismic Hazards Assessment Report," dated October 20, 2017
- "Response to Comments and Addendum Letter No. 1, Foundation Uplift Anchors," dated March 2, 2018.
- "Response to Comments and Addendum Letter No. 2, Temporary Shoring and use of Native Soil as Backfill," dated June 14, 2018
- "Addendum #3 – Geotechnical Recommendations, Bearing Capacity Factor of Safety," dated August 16, 2018
- "Response to DSA Geotechnical Comments on Increment 1 Submittal," dated October 12, 2018
- "On-Site Soil Analytical Testing," dated December 4, 2018

- "Geotechnical Engineering Addendum Letter No. 4, Additional Geotechnical Investigation and Recommendations for Foundation Uplift Anchors," dated December 5, 2018.

This letter provides responses to DSA review comments that were provided to us by Rutherford & Chekene on June 7, 2019 as well as updated uplift anchor testing recommendations.

Review Comments

In preparing our responses, we have discussed the project with Rutherford & Chekene, the anchor designer. The following comments from DSA were addressed to the geotechnical engineer based on the requirements of Section 1811A of the California Building code:

1. Define maximum unbonded length
2. State maximum recommended anchor tension
3. Provide allowable bond stress at the grout to ground interface and applicable factors of safety
4. For anchor axial tension stiffness evaluation, provide discussion of amount of slip of anchor bond zone under design load
5. Define minimum grout pressure for installation and post-grout pressure
6. Discuss acceptable drilling methods

In addition to the above comment responses, we have provided additional clarification and/or recommendations regarding the rock anchors as appropriate. The testing recommendations provided in this letter supersede those provided in the referenced Addendum 4 letter.

Responses to Review Comments

1. The unbonded length shall be the length of tendon or bar that is required to extend from the anchor bearing plate to top of the grouted bond zone in the bedrock unit. The maximum unbonded lengths should be selected by the designer and be shown on the plans.
2. The maximum recommended anchor tension specified by the designer is 245 kips ultimate. The design load is 94 kips.
3. As stated in the referenced Addendum 4 letter, " Based on our explorations and laboratory testing, as well as the presumptive bond stress values provided in Table C6.2 in the Post-Tensioning Institute (PTI) "Recommendations for Prestressed Rock and Soil Anchors," (Publication No. PTI DC35.1-14, dated 2014), a preliminary, ultimate bond stress value of 20 to 25 psi is recommended for the claystone and other bedrock units beneath the site provided the anchors are post-grouted following initial installation and grouting. To achieve these preliminary design bond stress values, multiple stages of post-grouting may be required. We recommend no more than 3 stages of post grouting be performed. Post-grout injection ports should be spaced no further than 5 feet apart along the grout tubes." Since these anchors are for seismic uplift restraint only, the allowable anchor bond stress should be calculated using a factor of safety of at least 2.5 applied to the ultimate bond stress.
4. The anchors should be designed such that the bond zones do not slip or creep under design loads. The final design should be based on the results of verification tests conducted on sacrificial test anchors so that creep is avoided.

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5. Initial grouting of the anchors can be performed by gravity grouting. Post-grouting should be done under pressure. Grouting pressures may range from about 50 to 400 psi but it is not uncommon to see pressures as high as about 600 psi during post grouting. The post-grout pressure must be sufficient to open the grout ports along the secondary grout tubes and allow the initial bond zone to fracture and be completely refilled with grout under pressure.
6. Acceptable drilling methods include rotary auger drills and air percussion drills capable of drilling the required hole diameters.

UPDATED FOUNDATION UPLIFT ANCHOR TESTING RECOMMENDATIONS

Verification Load Testing

Sacrificial load tests (often termed pre-production load tests or verification tests) should be performed to verify the design and installation procedure for the uplift anchors prior to final design and construction of production anchors, per 2016 CBC Section 1811A.3.8. These load tests are also needed to evaluate the anchor grout to ground bond stress for final design. The tests should be performed at three (3) locations to be determined by the designer and Geotechnical engineer.

Each anchor should be load tested in tension to the ultimate load of 245 kips, in accordance with the ASTM D 3689 test method. Creep should be evaluated during testing. The central reinforcing bar should be designed such that the maximum tensile stress does not exceed 80 percent of the yield strength of the steel. The jack should be positioned at the beginning of the test such that unloading and repositioning of the jack during the test will not be required. Upon completion of the load testing, the geotechnical and structural engineers should evaluate the data obtained and provide final recommendations for the production anchors.

Performance Testing

Per Section 1811A of the CBC, performance test the first 2 production anchors and at least 2 percent of the remaining anchors at locations selected by the designer and Geotechnical Engineer. Each anchor should be load tested in tension to at least 1.6 times the design load, in accordance with the ASTM D 3689 test method. The central reinforcing bar should be designed such that the maximum tensile stress does not exceed 80 percent of the yield strength of the steel. Creep testing should be performed.

Proof-Load Testing

During production anchor construction, proof-load testing should be performed on all production anchors that were not performance tested. Apply axial test load up to 1.33 times the design load, per PTI, 2014.

LIMITATIONS

This letter is subject to the recommendations and provisions and requirements outlined in the limitations section of the referenced 2017 geotechnical investigation report. No warranty, express or implied, is made.

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CLOSURE

Unless specifically superseded in this addendum, the recommendations presented in the above-referenced geotechnical reports remain applicable. This document is intended to provide specific recommendations for design and construction of uplift anchors for the subject project based on DSA review comments. Accordingly, it cannot be considered an independent document, as it does not contain adequate background information. This document is directed only to the personnel with detailed knowledge of the subject project. The conclusions and recommendations presented in this addendum were prepared under the conditions and limitations presented in our above-referenced October 2017 geotechnical investigation report.

We trust this information meets your current needs. We appreciate the opportunity to be of professional service to you on this project. If you have any questions, please do not hesitate to contact us at (916) 366-1701.

Respectfully submitted,

KLEINFELDER, INC.

Rebecca L. Money, PE, GE
Senior Geotechnical Engineer

Kenneth G. Sorensen, PE, GE
Principal Geotechnical Engineer

Don Adams, PE
Project Manager

cc: Jeff Smith, Rutherford & Chekene

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