TRUEBECK CONSTRUCTION

Submittal #31 32 01-001.0

DSM Design Drawings

Project:	226013.300 - SMC-Pescadero Fire 340 Butano Cutoff Pescadero, California 94060 Phone: Fax:		
SPEC SECTION:	31 32 01 - Deep Soil Mixing Alternate Soil Stabilization	**SUBMITTAL MANAGER:**	Rafael Navarrete **(Truebeck Construction)**
ISSUE DATE:	07/02/2026	**REVISION:**	0
RESPONSIBLE CONTRACTOR:	Condon-Johnson & Assoc. Inc.	**FINAL DUE DATE:**	07/08/2026
APPROVERS:	Michael Bauer **(DCI Engineers)**, Leroy Chan **(ENGEO Inc. (Geotechnical Engineer))**, Matt Covall **(Perkins & Will, San Francisco)**, Aaron Gee **(DCI Engineers)**, Mee Lee **(Perkins & Will, San Francisco)**		

DISTRIBUTION:
Jared Franich **(Truebeck Construction)** , Kyle Angelini **(Truebeck Construction)** , Nicholas Meade **(Truebeck Construction)**

DESCRIPTION:
Please see the attached DSM design drawings for review and approval. We are requesting review by 7/8 so drawings can be submitted to CoSM.

ATTACHMENTS:
CJA - Pescadero Fire Station Design Submittal.pdf

SUBMITTAL WORKFLOW

#	NAME	SUBMITTER/ APPROVER	SENT DATE	DUE DATE	RETURNED DATE	RESPONSE	ATTACHMENTS	COMMENTS
1	Michael Bauer	Approver	7/2/2026	7/8/2026		Pending		
2	Leroy Chan	Approver	7/2/2026	7/8/2026		Pending		
3	Matt Covall	Approver	7/2/2026	7/8/2026		Pending		
4	Aaron Gee	Approver	7/2/2026	7/8/2026		Pending		
5	Mee Lee	Approver	7/2/2026	7/8/2026		Pending		

SUBMITTAL REVIEW

TRUEBECK CONSTRUCTION

Job No. 226013.300

Submittal No. 31 32 01-001.0

This review and notations part of this review does not in any way relieve the subcontractor or supplier of their responsibility for compliance with the contract documents. Deviations and/or variances, if allowed, must be clearly identified and requested to be considered. Also, the subcontractor or supplier is responsible for verification and accuracy of details, quantities, dimensions, coordination of their equipment, materials, and installation with all affected work and with related subcontractors and/or suppliers, particularly with specific emphasis on deviations and/ or variations.

Submitted By: Rafael Navarrete Date: 7/2/2026

DCI ENGINEERS

X No Exceptions Taken

____ Note Markings

____ Revise & Resubmit

By: mbauer Date: 07/09/2026

THIS REVIEW IS FOR GENERAL CONFORMANCE TO THE DESIGN CONCEPT AND CONTRACT DOCUMENTS AS TO THE STRUCTURAL ELEMENTS DESIGNED BY DCI ENGINEERS. REVIEW OF ANY NON-STRUCTURAL ELEMENTS DEPICTED IN THIS SUBMITTAL HAS BEEN SOLELY FOR THE PURPOSE OF EVALUATING THE IMPACT ON THE STRUCTURAL ELEMENTS DESIGNED BY DCI ENGINEERS. REVIEW OF THE SPECIALTY STRUCTURAL ENGINEERS (SSE) DESIGN IS FOR CONFORMANCE TO DESIGN CRITERIA AND COMPATIBILITY WITH THE DESIGN OF THE BUILDING AND DOES NOT RELIEVE THE SSE OF RESPONSIBILITY FOR THAT DESIGN. MARKINGS OR COMMENTS SHALL NOT BE CONSTRUED AS RELIEVING THE CONTRACTOR FROM COMPLIANCE WITH THE CONTRACT DOCUMENTS. THE CONTRACTOR REMAINS RESPONSIBLE FOR DETAILS AND ACCURACY; FOR CONFIRMING AND CORRELATING ALL QUANTITIES AND DIMENSIONS; FOR SELECTING FABRICATION PROCESSES; FOR TECHNIQUES OF ASSEMBLY; AND FOR PERFORMING WORK IN A SAFE MANNER.

Submittal Review

- A - No exceptions ☒
- B - Exceptions as noted ☐
- C - Revise and resubmit ☐
- D - Rejected ☐
- E - Not reviewed ☐

Submittals are reviewed for conformance with the design concept expressed in the Contract Documents. Review is not for the purpose of confirming or approving: (a) deviation from the Contract Documents, including but not limited to deviation with reference to material, quantity, location, quality, dimension, or orientation (except as expressly annotated in writing by the Architect herein), (b) means, methods, sequences, or techniques of construction (unless expressly called for in the Contract Documents and herein expressly highlighted for review and approval by the Architect), (c) safety of the contractor(s) work, work plan, procedures, workers or of the site, (d) any clarification of a patent or latent ambiguity or defect in the Contract Documents, or (e) the procurement or request for any labor, materials, or other expense of the contractor(s) which is in addition to that previously approved by the Owner. The Contractor shall be and shall remain responsible for: (a) compliance with the Contract Documents, (b) coordination of the Work (including amongst various trades), (c) performing the Work in a safe and satisfactory manner, (d) confirming and correlating quantity and dimensions, and (e) the construction schedule.

Project No. 492509.000
Reviewed by LeeMe
Date 7/9/2026

Perkins&Will

BY	DATE	COPIES TO

Project No.
11780.004.006

July 8, 2026

Mr. Edgar Lopez
County of San Mateo, Project Development Unit
555 County Center, 5th Floor
Redwood City, CA 94063

Subject: Fire Station No. 59
360 Butano Cutoff
Pescadero, California

GEOTECHNICAL REVIEW OF DEEP SOIL MIXING (DSM) GROUND IMPROVEMENT PLAN

References:

1. ENGEO. 2025. Supplemental Recommendations for Deep Soil Mixing Design, April 22, 2025. Project No. 11780.004.006.
2. Perkins & Will. 2026. Section 31 32 01 – Deep Soil Mixing (DSM) Alternate Soil Stabilization for Fire Station No. 59, Pescadero, California. June 26, 2026.
3. Condon – Johnson & Associates, Inc. 2026. Ground Improvement Design Submittal for Pescadero Fire Station No. 59, Pescadero, California. June 29, 2026.

Dear Mr. Lopez:

This letter presents the results of our geotechnical review of the ground improvement plan for Fire Station No. 59 project at 360 Butano Cutoff in Pescadero, California. The purpose of our review was to confirm that the ground improvement plan and supporting calculations were prepared in general conformance with our recommendations presented in Reference 1, as well as project specifications presented in Reference 2.

The ground improvement is proposed to provide mitigation for liquefaction and/or cyclic softening induced settlement during the design seismic event and static settlement to acceptable levels and to support the fire station, pump house, and water tank.

The ground improvement design was prepared by your specialty ground improvement contractor, Condon – Johnson & Associates, Inc. (CJA) in Reference 3, which included a plan set and supporting calculations. The plans show the ground improvement is to consist of an interconnected series of 3-foot-wide Deep Soil Mixing (DSM) shear panels. CJA's Design Submittal shows an area replacement ratio greater than 22 percent and that the DSM will extend to Elevation +15 feet (NAVD88).

Based on the design by CJA, once the DSM is constructed the static total settlement from building loads is estimated to be less than 1½ inches and less than ¾ inch over a horizontal distance of 30 feet; additional seismic total settlement is estimated to be less than 1½ inches. Similarly, seismic differential settlement is estimated to be less than ¾ inch over a horizontal distance of 30 feet. We understand that CJA confirmed with the project structural engineer, DCI Engineers, that these levels of settlement are acceptable and the structural mat is designed to span over the DSM layout proposed by CJA. CJA stated that their design will have no potential for damage, surface manifestation, or ejecta.

We understand that a Quality Control (QC) Program will be included as part of the overall Soil-Cement-Mixed (SCM) submittal that will be provided later.

Based on our review, it is our opinion that the geotechnical aspects of the ground improvement plan and supporting calculations are in general conformance with our recommendations as provided in References 1, as well as project specifications presented in Reference 2.

Any updated plans should be submitted to us for review prior to construction. We make no representations as to the accuracy of dimensions, measurements, calculations, or the design by others.

If you have any questions or comments regarding this letter, please contact us and we will be glad to discuss them with you.

Sincerely,

ENGEO Incorporated

Genesis Palacios, Ph.D. Leroy Chan, GE

gp/lc/tpb/ss

ATTENTION:

Truebeck Construction

2855 Campus Drive, Suite 100
San Mateo, CA 94403

Pescadero Fire Station No. 59

340 Butano Cutoff Pescadero, California

CONDON · JOHNSON & ASSOCIATES, INC.
CONTRACTORS AND ENGINEERS

GROUND IMPROVEMENT DESIGN SUBMITTAL

June 29, 2026

Supreethh Prasad, EIT

sprasad@condon-johnson.com

Soheil Kamalzare, PhD, PE

skamalzare@condon-johnson.com

MEMORANDUM

Condon-Johnson and Associates, Inc. (CJA) is pleased to present this submittal package for the ground improvement design of the Pescadero Fire Station No. 59 project. We prepared this submittal in accordance with our letter of intent, dated May 14, 2026.

Based on our review of the available information and detailed analyses, we propose the construction of Soil-Cement-Mixed (SCM) grids to support the new structures, mitigate liquefaction, and to reduce vertical deformation in both static and seismic conditions. SCM grids will have an area replacement ratio greater than 22% and extend to Elevation +15-ft. The SCM grids will have a minimum unconfined compressive strength of 150-psi after 28-days of curing.

Quality control and assurance will be performed by means of on-site data acquisition, soil-cement sampling, full-depth coring, and laboratory strength tests.

We appreciate the opportunity to work with you on this project. If you have any questions regarding this submittal, please contact us by phone: (425) 988-2150, or via email: skamalzare@condon-johnson.com.

LICENSED PROFESSIONAL ENGINEER
SOHEIL KAMALZARE
C 89825
CIVIL
STATE OF CALIFORNIA

Expiration: 03/31/2027

Soheil Kamalzare, PhD, PE

06/29/2026

Supreeth Prasad, EIT

06/29/2026

Ibrahim Muhammad

06/29/2026

USE OF PROPOSALS AND DESIGNS

Any design or proposal prepared and furnished by Condon-Johnson and Associates, Inc. (CJA) including any Value-Engineering proposal or proposal for alternative designs, means and/or methods (collectively "Designs") have been prepared based upon and in anticipation of CJA performing the work called for in such Designs. As such, the Designs are specifically tailored for CJA's purposes and have been prepared for exclusive use by CJA. Owner and/or Contractor shall not use or control the Designs without the prior written consent of an authorized representative of CJA, and then only as absolutely necessary to perform such permitted use. The Designs are subject to protection under the Copyright Act of 1976 and Architectural Works Copyright Protection Act of 1990. Owner and/or Contractor shall not copy, reproduce, emulate or model the Designs or disclose, publish, or disseminate the Designs to any third parties without the prior written approval of an authorized representative of CJA. CJA is and shall continue to be the sole owner of the Designs.

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TABLE OF CONTENTS

1. PROJECT DESCRIPTION

The proposed project consists of constructing a new fire station, water tank and pump station to serve the City of Pescadero and the surrounding wildlands. The site is located east of Cloverdale Road, south-west of Pescadero High School and north of Butano Cutoff. The property is relatively flat, gently sloping westward. The existing grade is at approximately Elevation +55-ft with finished floor elevation (FFE) expected to be at Elevation +57-ft for the fire station and Elevation +55-ft for the water tank and pump station. The proposed structures are supported on mat foundations with thickness varying between 13 and 24-inches.

The sections of the site requiring ground improvement are generally underlain by Alluvial Fan Deposits. This material, approximately 115-ft thick, consists of soft to stiff lean clay (CL) with variable amount of sandy lean clay, fat clay (CH) and silt to silt with sand (ML). The lean clay is underlain by very dense silty sand (SM), as seen in the CPT explorations to the maximum depth of exploration. Groundwater was encountered in explorations between 5 and 13-ft below ground surface (bgs).

ENGEO Incorporated, the Geotechnical Engineer of Record (GEOR), stated the underlying fine-grained soil may experience consolidation-induced settlement. The GEOR also identified interbedded silt and sandy silt layers, generally below a depth of 30-feet that may experience liquefaction following a maximum considered earthquake (MCE). As a result, the GEOR recommended that soil-cement-mixed (SCM) grids should be installed, at minimum, to Elevation +15-ft.

DCI Engineers, the Structural Engineer of Record (SEOR), specified that the recommended SCM grids shall provide an allowable bearing pressure of 500-psf for the fire station, 350-psf for the pump station and 1500-psf for the water tank. These bearing pressure can be increased by 1/3 to account for seismic conditions.

In accordance with the recommendations of the GEOR and SEOR, CJA proposes the construction of SCM grids underneath the fire station, water tank and pump station mat foundations, as indicated in the project drawings. CJA's design focuses on: (1) evaluating the SCM grids for static and seismic geotechnical and structural capacity; (2) limiting static differential settlement to less than 0.75-inch over 30-ft; (3) mitigating seismic differential settlements to less than 0.75-inch over 30-ft; and (4) mitigate liquefaction to a factor of safety greater than 1.3.

CJA has relied on the GEOR's expertise regarding the site's local geology and soil characteristics. Specifically, the soil parameters and methodologies for calculating static settlement were provided by the GEOR and incorporated directly into this submission to estimate settlement. The design calculations are subject to review by the GEOR to ensure compliance with their recommendations.

Lastly, our design relies on the referenced documents listed in Section 2. Should any of the information in these documents change, CJA must be immediately informed to assess any potential design impacts.

2. REFERENCE DOCUMENTS

- SCM secant elastic modulus to unconfined compressive strength ratio parameter, provided by ENGEO Incorporated via email communication, dated June 18, 2026.
- Elastic modulus parameters, provided by ENGEO Incorporated via email communication, dated May 22, 2026.

- Static settlement and service load confirmation, provided by DCI Engineers via email communication, dated May 21, 2026.
- Boring elevation confirmation, provided by ENGO Incorporated via DSM Design RFI Log 4, dated May 18, 2026.
- Specification 31 32 01 – Deep Soil Mixing (DSM) Alternative Soil Stabilization, prepared by Parkins & Will, dated January 29, 2026.
- Pescadero Fire Station No. 59 Issue For Bid Drawings, prepared by Perkins & Will, dated January 23, 2026.
- Design-Level Geotechnical Exploration Report, prepared by ENGEO Incorporated, dated October 23, 2024 (Project No. 11780.003.006).

3. DESIGN CRITERIA

The SCM design is based on the following criteria.

Per the SEOR's requirements:

- SCM grid shall provide a uniform allowable static and seismic bearing pressure of 500-psf and 667-psf, respectively for the fire station.
- SCM grid shall provide a uniform allowable static and seismic bearing pressure of 350-psf and 467-psf, respectively for the pump station.
- SCM grid shall provide a uniform allowable static and seismic bearing pressure of 1500-psf and 2000-psf, respectively for the water tank.
- Service loads for settlement calculations shall be determined by subtracting the allowable static bearing pressure by 150-psf.
- Total static differential settlement shall be less than 0.75-inch over 30-ft.

Per the GEOR's recommendations:

- The design groundwater table shall be considered at 5-ft below ground surface (i.e. Ele. +50-ft).
- Design Earthquake Moment Magnitude, M = 7.5.
- Maximum Considered Earthquake Geometric Mean Peak Ground Acceleration, PGA_M = 0.77g.
- Liquefaction shall be mitigated to a factor of safety greater than 1.3 during the design earthquake.
- SCM secant elastic modulus to unconfined compressive strength ratio, E_{50}/UCS = 500.

Per the Specifications:

- Total seismic differential settlement shall be less than 0.75-inch over 30-ft.
- SCM grid shall have an area replacement ratio no less than 20%
- Ground improvement shall have a minimum depth below ground surface of 40-ft (i.e. to Ele. +15-ft).
- The average unconfined compressive strength (UCS) shall be greater than 150-psi.

- Ground improvement supporting the fire station shall have a center-to-center spacing less than 30-ft.
  - The mat foundation shall be able to span this distance.
- Ground improvement supporting the pump station and water tank shall have a center to center spacing less than 20-ft.
  - The mat foundation shall be able to span this distance.

4. DESIGN ASSUMPTIONS/CLARIFICATIONS

The SCM design is based on the following assumptions.

- Per the GEOR's recommendations, 2-ft of compacted fill shall be placed at the location of the proposed buildings. They also recommend "waiting a month prior to construction of the foundation system and, during that time, surveying the ground surface to evaluate when the settlement resulting from the fill load has completed". CJA has assumed:
  - The compacted fill unit weight will not exceed 120-pcf.
  - All settlement (immediate and long term) due to the compacted fill has occurred before the SCM grid installation. As a result, we have not considered additional settlement due to the compacted fill placement.
- According to the GEOR correspondence on May 18, 2026, the top of boring elevations reported in the geotechnical report should rely on the latest civil grading plans. As a result, the surface elevations reported in B-1 and B-2 shall be 55-ft and 54.4-ft instead of 51-ft and 51.4-ft.

5. DESIGN OF SCM GROUND IMPROVEMENT

We performed detailed analyses to identify the most effective SCM grid pattern for the project. The proposed SCM layout is provided in Appendix A. Our analysis confirms that the design criteria will be satisfied by supporting the building foundations on SCM grids. The SCM grids provide uniform bearing capacity beneath the foundation, transfers the load to deeper soil, and reduces static and seismic settlements. The SCM grids shall have a width of 37-inches and extend to Elevation +15-ft (approximately 40-ft bgs).

5.1. Soil Parameters and Profile

Soil data was collected from available borings and CPTs performed on site. We extracted soil design parameters from laboratory test results presented in the geotechnical report. Where laboratory tests were not available, CPT and SPT-based correlations were used to derive soil parameters. The GEOR also provided elastic modulus parameters as part of our settlement analysis. Figure 1 shows the design adopted soil profile.

5.2. Area Replacement Ratio

The area replacement ratio of the SCM grid was calculated as the ratio of the mixed area within the cell to the area of the cell. Figure 2 shows the largest SCM cell from the utilized pattern in Appendix A. The minimum area replacement ratio can be calculated as:

$$A_{r,\,grid} = \frac{\text{SCM Treated Area within the Cell}}{\text{Area of the Cell}} \times 100 \quad (1)$$

$$A_{r,\,grid} = \frac{151\ ft^2}{25\ \text{ft} \times 27\ \text{ft}} \times 100 = 22\%$$

5.3. Design Loading on the SCM

In our analysis, we conservatively assumed all design loads will be carried by the SCM grids. The loads on the grid were calculated based on the bearing pressures specified by the SEOR. The applied pressure on the grid can be calculated as follows:

$$q_{SCM} = \frac{q_{bldg}}{A_{r,\,grid}} \quad (2)$$

Where q_{bldg} is the allowable bearing pressure. Table 1 shows the calculated pressure on the SCM grid.

Table 1. Summary of Applied Pressure on SCM Grid

Building Type	Area Replacement Ratio (%)	Design Pressure Static (psf)	Design Pressure Seismic (psf)	Design Pressure on SCM Static (psf)	Design Pressure on SCM Seismic (psf)
Fire Station	22%	500	667	2243	2991
Pump Station	53%	350	467	663	884
Water Tank	33%	1500	2000	4546	6062

5.4. Geotechnical Capacity of SCM Grid

The bearing capacity of the SCM grid was estimated based on FHWA (2013) recommendations. We performed total stress analysis because the alluvial fan deposit at the toe of the grid is primarily lean clay. The ultimate bearing capacity was calculated using the following equation:

$$q_{ult.} = S_u N_c + q N_q \quad (3)$$

Where N_c, and N_q are bearing capacity factors; S_u is undrained shear strength; and q is the overburden at the toe of the grid. Figure 3 shows the design adopted undrained shear strength profile.

The following presents our ultimate bearing capacity calculations for the worst case scenario building (i.e. the water tank).

Overburden

The overburden was calculated by considering our design soil profile from Figure 1, as follows:

$$\sigma = \gamma \times h \quad (4)$$

Where γ is the soil unit weight and h is the thickness of each soil layer. Therefore, the total stress of the soil can be calculated as:

$$\sigma = 120\text{pcf} \times 2\text{ft} + 115\text{pcf} \times 21\text{ft} + 110\text{pcf} \times 12\text{ft} + 115\text{pcf} \times 5\text{ft} = 4550\text{ psf}$$

Bearing Capacity Factors

The bearing capacity factors can be calculated based on Hansen (1970) as follows:

$$N_q = 1$$

$$N_c = 5.14$$

Bearing Capacity of the SCM Grid

$$q_{ult.} = 1000\text{ psf} \times 5.14 + 4550\text{ psf} \times 1 = 9690\text{ psf}$$

Therefore, the SCM grid bearing capacity supports the maximum static (4546-psf) and seismic (6062-psf) pressures with a factor of safety of 2.1 and 1.6, respectively. Our target geotechnical factor of safety under static and seismic conditions are 2 and 1.5. Therefore, the SCM grid will adequately support the foundation loads. Table 2 summaries the bearing capacity factor of safety for each building.

Table 2. Summary of Bearing Capacity Factor of Safety

Building	Bearing Capacity Factor of Safety	
	Static	Seismic
Fire Station	4.42	3.32
Pump Station	14.62	10.96
Water Tank	2.13	1.60

5.5. Structural Capacity of SCM Grid

The SCM grids were designed with an Unconfined Compressive Strength (UCS) of 150-psi at 28 days. The SCM will not be completely loaded within a year from the date of installation. Furthermore, the risk of an MCE-level earthquake occurring within a year after construction is remote. Therefore, the UCS at 365-days was used in our analysis.

Based on the Deep Soil Mixing Manual from FHWA (2013), the time cured UCS is determined as follows:

$$UCS = f_r\ f_c\ f_v\ UCS_{28day} \tag{5}$$

Where f_r is the ratio of unconfined peak to confined large-strain strength (recommended 0.8); f_c is the curing factor and f_v is the strength variability factor (taken as 0.83). Table 3 shows the design strength of the SCM.

Table 3. Design Strength of SCM

Curing Time (days)	Curing Factor[(1)]	UCS (psi)	UCS (psf)
28	1.00	150	14342
365	1.48	147	21227

[(1)] Based on FHWA (2013) recommendations

The design UCS of the SCM grid can support the maximum static and seismic loads shown in Table 2, with minimum factors of safety of 4.7 and 3.5, respectively. Given that the targeted structural safety factors are 2.0 for static and 1.5 for seismic loads, the SCM mix design will provide adequate strength for the applied loads. Table 4 summaries the static and seismic structural capacities and associated factors of safety for each building.

Table 4. Summary of Structural Capacity Factor of Safety

Building	Structural Capacity Factor of Safety	
	Static	Seismic
Fire Station	9.47	7.10
Pump Station	32.02	24.02
Water Tank	4.67	3.50

5.6. Static Settlements

Static settlements consist of two parts: (1) elastic compression occurring within the improved zone; and (2) settlement beneath the improved zone. Settlement calculations are based on the maximum service static (dead plus live) loads listed in Table 5, applied to a SCM grid in a uniform manner.

Table 5. Maximum Service Static Load

Building	Service Load (psf)	Service Load on SCM Grid (psf)
Fire Station	350	1570
Pump Station	200	379
Water Tank	1350	4091

5.6.1. Static Settlement within the Improved Ground

Elastic Modulus of the SCM

According to Filz et al. (2015), the ratio of secant value of Young's modulus at 50% of the strength (E_{50}) to UCS varies from 600 to 900. Therefore,

$$\frac{E_{50}}{UCS_{365\ day}} = 500 \quad (6)$$

$$E_{50} = 500 \times 147\ \text{psi} \left(\frac{144\ \text{in}^2}{\text{ft}^2}\right) \times \left(\frac{1\ \text{tsf}}{2000\ \text{psf}}\right) \approx 5292\ \text{tsf}$$

Calculating Elastic Compression

The elastic compression within the SCM grid can be calculated using the following equation:

$$\Delta = \Delta_{static} = \frac{q_{service} h_{SCM}}{E_{50}} \quad (7)$$

Where $q_{service}$ is the service load on the SCM, h_{SCM} is the SCM grid height. Using the largest service load (i.e. from the water tank), the maximum compression within the SCM grid can be calculated as:

$$\Delta = \left(\frac{4091 \text{ psf} \times 40 \text{ ft}}{5292 \text{ tsf} \times 2000 \frac{\text{psf}}{\text{tsf}}} \right) \times \frac{12 \text{ in}}{1 \text{ ft}} = 0.19 \text{ in}$$

5.6.2. Static Settlement below the Improved Ground

The static settlement below the SCM grids were determined based on a design soil profile, developed in coordination with the GEOR, as shown in Figure 1.

As discussed in Section 5.4 and in accordance with FHWA (2013), the geotechnical capacity of the SCM grids were evaluated similar to strip footings (with a width equal to effective width of the panels), at the toe of the grid. To stay consistent with FHWA's recommendation, for settlement analysis, we assumed all loads will be transferred to the bottom of the SCM grid (i.e at Elevation +15-ft). The applied loads were subsequently distributed to the underlying soil following a conventional 2V:1H load distribution.

Per the GEOR, settlements below the SCM grid can be calculated using the Constrained Modulus Method. The GEOR provided elastic modulus parameters below the SCM grids, which were converted to constrained modulus using a poisson's ratio of 0.3. Both plots are displayed in Figure 4. Detailed analysis is provided in Appendix B. Table 6 summarizes the estimated settlement for each building.

Table 6. Summary of Settlement Results

Building	Elastic Compression (in)	Settlement Below DSM Grid (in)	Total Settlement (in)
Fire Station	0.1	< 0.05	< 1.5
Pump Station	< 0.05	< 0.05	< 1.5
Water Tank	0.20	0.10	< 1.5

In summary, the estimated static settlement for all buildings supported by ground improvement is less than 1.5-inches. Due to uniform support from the SCM grids, static differential settlement will not exceed 0.75-inches over a distance of 30-ft.

5.7. Seismic Settlements

CJA performed a CPT seismic analysis under a MCE event using all available CPTs and the geotechnical report referenced in Section 2.

Liquefaction-induced settlements were estimated based on Tokimatsu and Seed (1987), Zhang et al. (2002), Yoshimine et al. (2006) and Wu and Seed (2004). We incorporated Cetin et al. (2009) method to account for the depths of the liquefiable layers.

Liquefaction damage potential in terms of surface manifestation, ejecta and material loss was evaluated based on Iwasaki et al. (1978), Maurer et al. (2015) and Tonkin and Taylor (2013).

Seismic compression of dry (unsaturated) sands above water table were estimated using Pradel (1998), Yi (2010) and Volumetric Strain Material Model (VSMM) by Yee et al. (2014).

Appendix C shows the results of our seismic analysis with the lowest area replacement ratio (i.e. the fire station) during the MCE event. We used Nguyen et al. (2013) method of shear stress redistribution to avoid unconservative assumptions of shear strain compatibility. The shear modulus of the SCM was estimated based on experimental studies by Filz et al. (2015).

The results indicate that liquefaction is effectively mitigated to a factor of safety greater than 1.3 within the ground improvement extent. The estimated post-treatment seismic settlement is less than 1.5-inches. Due to uniform support from the SCM grids, seismic differential settlement will not exceed 0.75-inches over a distance of 30-ft. No potential for damage, surface manifestation or ejecta is anticipated. The SCM grids along with the top 25-ft of non-liquefiable lean clay will cap the deeper potentially liquefiable layers from affecting the planned structures.

6. CONCLUSIONS

Based on the design analyses performed herein, CJA has concluded that SCM grids can effectively meet the project requirements.

The SCM grids will achieve the allowable static and seismic bearing capacity requirements provided by the SEOR. Following guidance from the GEOR, the predicted static and seismic differential settlement is each less than 0.75-inch over 30-ft. The SCM grids also ensure that liquefaction is mitigated to a factor of safety greater than 1.3.

Finally, our design was developed in a manner consistent with the level of care and skill ordinarily exercised by members of the geotechnical engineering profession currently practicing under similar conditions and in the same locality. No warranty is made nor implied.

7. REFERENCES

Boulanger, R. W., and Idriss, I. M. (2014). “CPT and SPT based Liquefaction Triggering Procedures.” Center for Geotechnical Modeling, (14/01), 138.

Bruce, M. E. C., Berg, R. R., Collin, J. G., Filz, G. M., Terashi, M., and Yang, D. S. (2013), Deep Mixing for Embankment and Foundation Support. FHWA, Report No.: FHWA-HRT-13-046.

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FIGURES

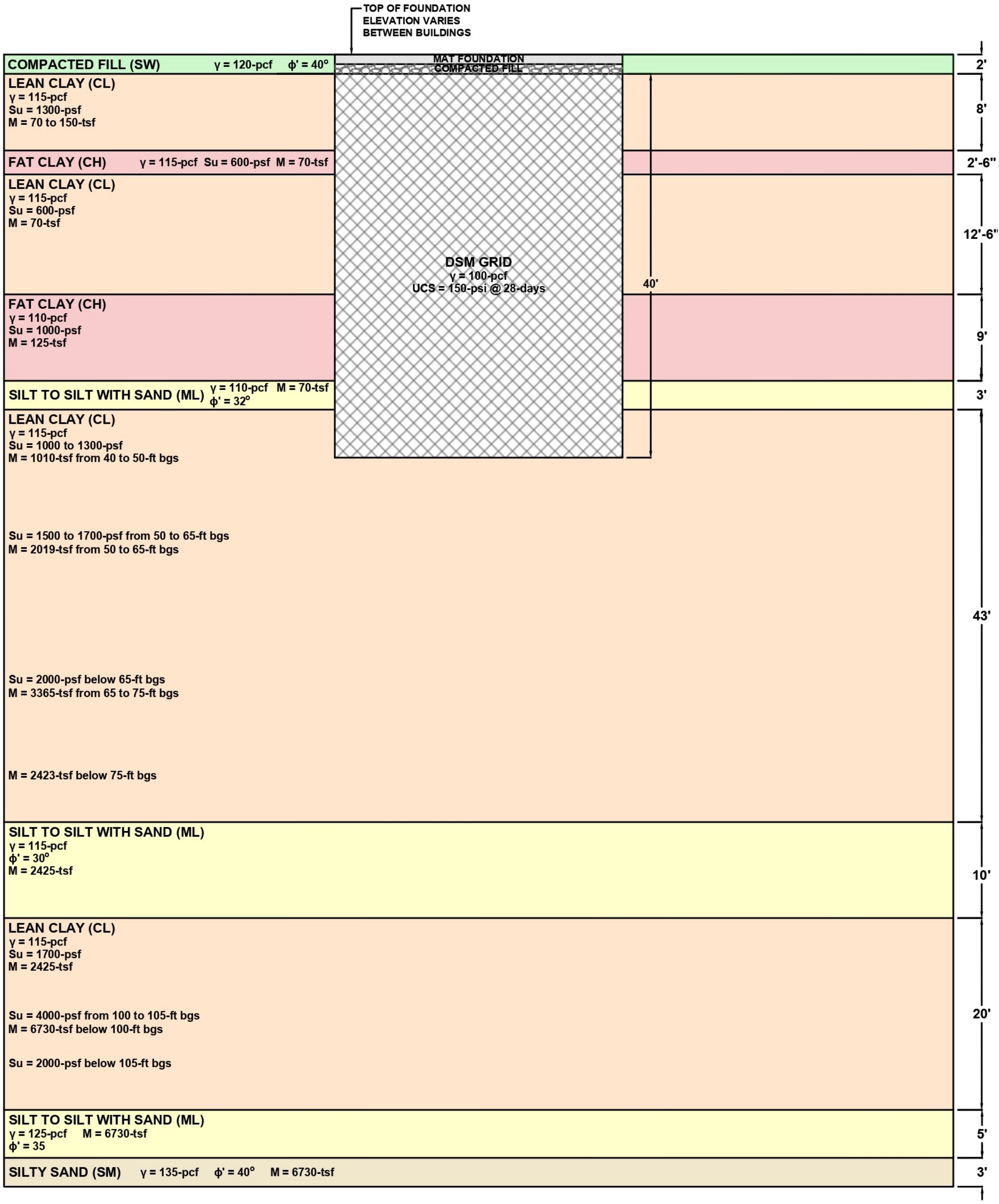


Figure 1. SCM Panel Schematic with Design Soil Profile

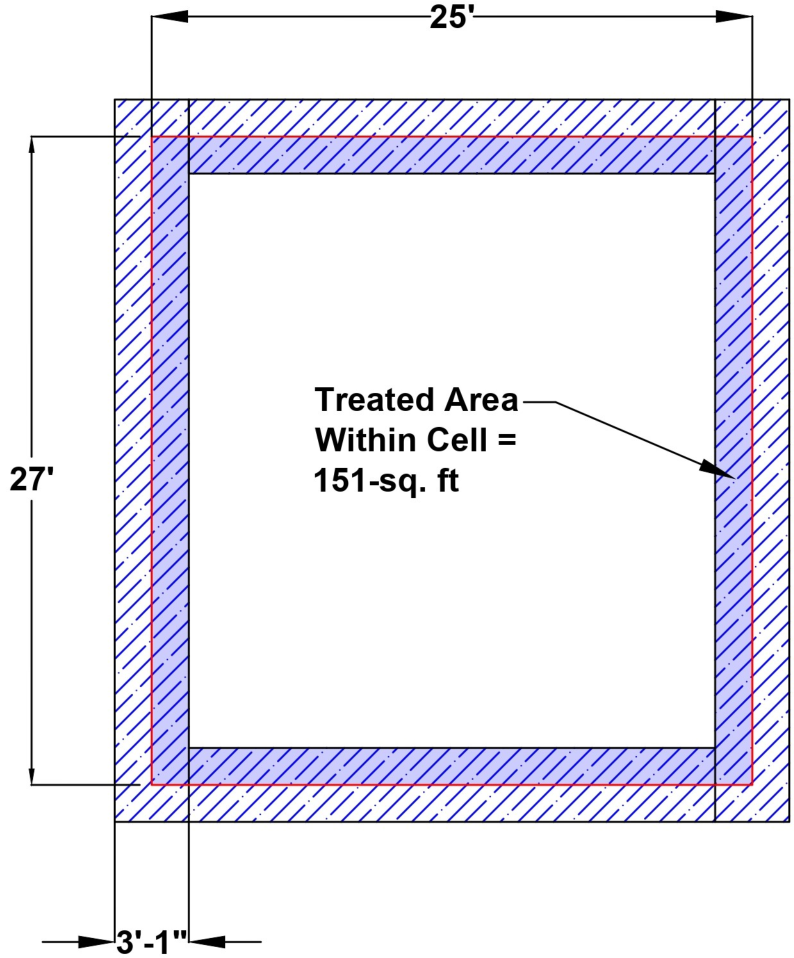


Figure 2. SCM Spacing Schematic

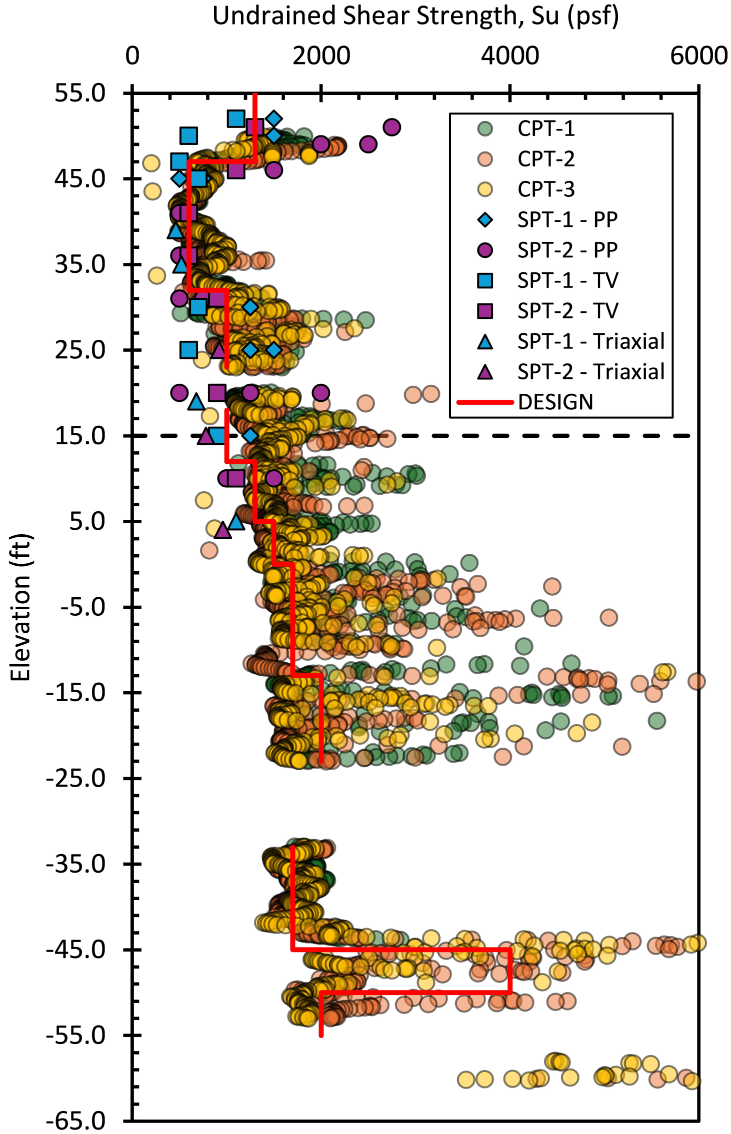


Figure 3. Undrained Shear Strength Design Profile

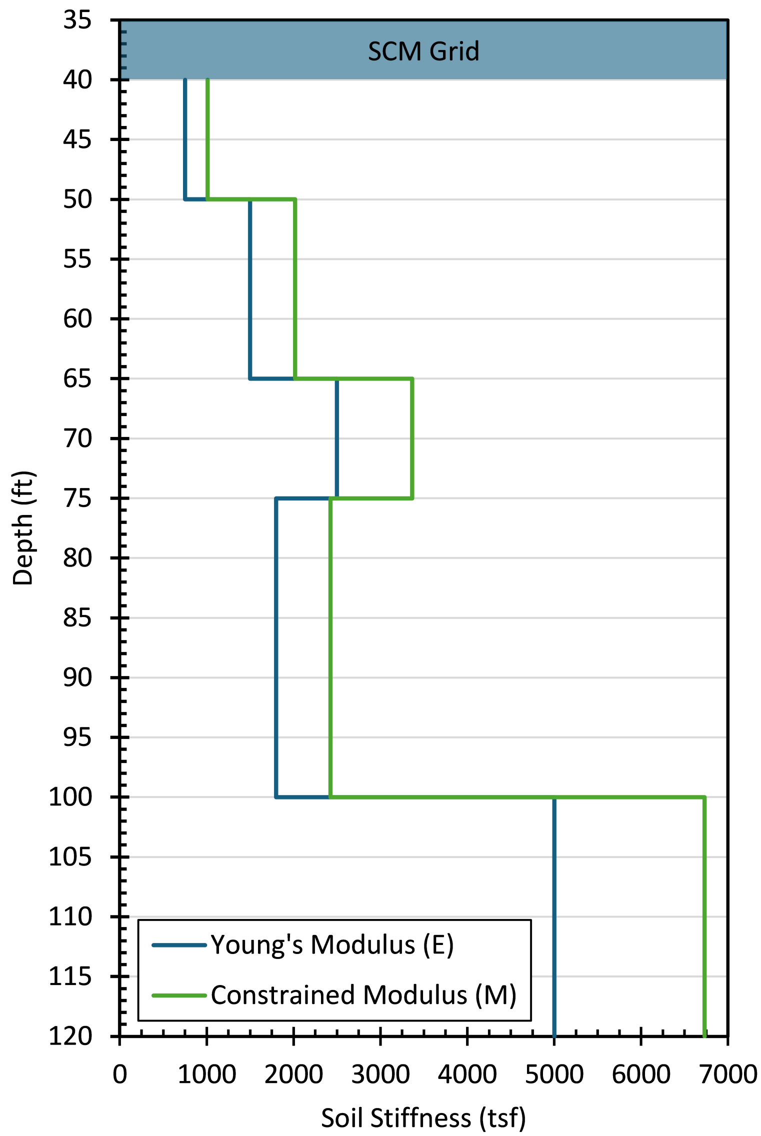
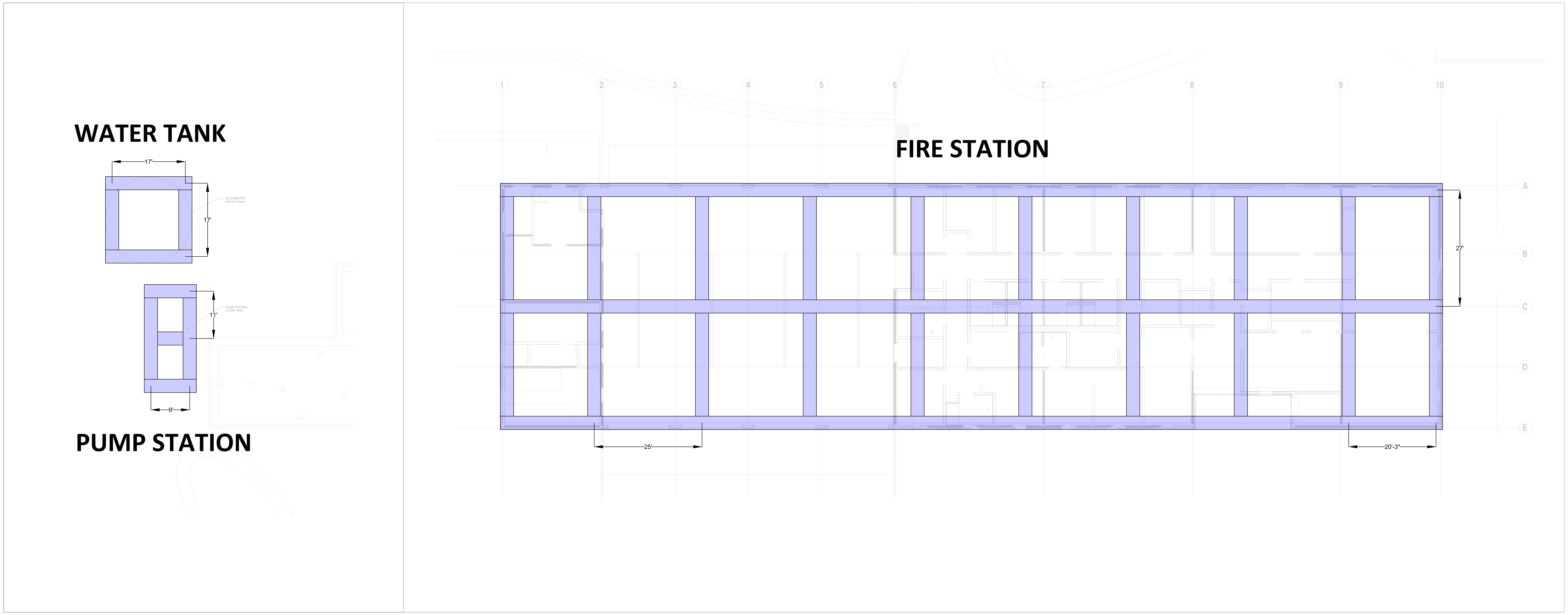


Figure 4. Young Modulus by GEOR, Constrained Modulus by CJA

APPENDIX A

Ground Improvement Layout



SOIL-CEMENT MIX (SCM) NOTES:

1. WORKING GRADE FOR THE FIRE STATION SHALL BE AT ELEVATION +56-FT.
2. WORKING GRADE FOR THE WATER TANK AND PUMP STATION SHALL BE AT ELEVATION +55-FT.
3. SCM SHALL BE 37-INCH WIDE AND EXTEND TO ELE. +15-FT AS SHOWN IN THE DRAWING.
4. SCM GRIDS SHALL HAVE A MINIMUM AREA REPLACEMENT RATIO OF 20%.
5. SCM GRIDS SHALL HAVE A MINIMUM 28-DAY UNCONFINED COMPRESSIVE STRENGTH OF 150-PSI.
6. 2-FT OF COMPACTED FILL SHALL BE PLACED AT THE LOCATION OF THE PROPOSED BUILDING AREAS PRIOR TO SCM GRID INSTALLATION.
7. THE COMPACTED FILL SHALL HAVE A UNIT WEIGHT NOT TO EXCEED 120-PCF.
8. FILL PLACEMENT SHALL BE PREPARED IN ACCORDANCE WITH THE GEOTECHNICAL REPORT, UNLESS NOTED OTHERWISE. GEOTECHNICAL ENGINEER SHALL APPROVE FILL CONDITIONS AND SURVEY FILL-INDUCED SETTLEMENTS PRIOR TO SCM INSTALLATION.
9. DURING SCM PLACEMENT, THE SOIL CEMENT SPOILS (REFLOW) WILL FLOW INTO 3-FT WIDE BY 4-FT DEEP SPOILS TRENCHES FOR CONTINUOUS MANAGEMENT. SPOIL HANDLING IS LIMITED TO MAINTAINING ACCESS FOR CJA'S WORK. HANDLING, REMOVAL AND DISPOSAL OF SPOILS SHALL BE BY OTHERS.
10. MAT FOUNDATION SHALL BE DESIGNED TO SPAN BETWEEN SCM PANELS
11. PERFORM QA/QC PROGRAM AS DESCRIBED IN CJA'S WORK PLAN, DATED 06/29/2026.
12. IT IS THE GENERAL CONTRACTOR'S RESPONSIBILITY NOT TO DAMAGE CJA'S GROUND IMPROVEMENT SYSTEM DURING THE INSTALLATION OF THE FOUNDATION OR ANY SUBSEQUENT WORK.

LEGEND (NTS):

37" WIDE SCM GRIDS

0' 10' 20' 30' 40'

SCALE: 1" = 10'

CONDON · JOHNSON & ASSOCIATES, INC. CONTRACTORS AND ENGINEERS

GROUND IMPROVEMENTS, DEEP FOUNDATIONS, DRILLED SHAFTS, MICRO PILES AND SHORING
Oakland | Seattle | Los Angles | San Diego | Portland
Address: 9012 South 208th Street, Kent, WA, 98031
Tel: (425) 988-2150 Fax: (425) 988-2151

Project: Pescadero Fire Station

Location: 340 Butano Cutoff, Pescadero, California

Owner: County of San Mateo

General Contractor: Truebeck Construction

GROUND IMPROVEMENT LAYOUT

LICENSED PROFESSIONAL ENGINEER SOHEIL KAMALZARE C 89825 CIVIL STATE OF CALIFORNIA

Expiration: 03/31/2027

No.	Date	By	Revisions

Scale: 1" = 10'

Date: June 29, 2026

Designed By: Soheil Kamalzare, PhD, PE

Reviewed By: Dominic Parmantier, PE

Drawn By: Supreeth Prasad, EIT

Job Number: CJA - 26XXX

Sheet: GI - 1.0

APPENDIX B

Settlement Analysis below SCM Grid

Table 7. Settlement Analysis Below SCM Grid – Fire Station

Soil Type	Top of Layer (ft)	Bottom of Layer (ft)	Thickness (ft)	Depth to Middle of (ft)	Net Foundation Load, (psf)	Constrained Modulus, M (tsf)	Settlement, δ (inch)
CL	40	45	5	2.5	331	1010	0.010
CL	45	50	5	7.5	299	1010	0.009
CL	50	55	5	12.5	271	2019	0.004
CL	55	60	5	17.5	248	2019	0.004
CL	60	65	5	22.5	227	2019	0.003
CL	65	70	5	27.5	210	3365	0.002
CL	70	75	5	32.5	194	3365	0.002
CL	75	78	3	36.5	183	2423	0.001
ML	78	83	5	40.5	172	2423	0.002
ML	83	88	5	45.5	161	2423	0.002
CL	88	93	5	50.5	151	2423	0.002
CL	93	98	5	55.5	141	2423	0.002
CL	98	100	2	59	135	2424	0.001
CL	100	105	5	62.5	130	6731	0.001
CL	105	110	5	67.5	122	6731	0.001
ML	110	115	5	72.5	116	6731	0.001
SM	115	118	3	76.5	111	6731	0.000
							0.05

Table 8. Settlement Analysis Below SCM Grid – Pump Station

Soil Type	Top of Layer (ft)	Bottom of Layer (ft)	Thickness (ft)	Depth to Middle of (ft)	Net Foundation Load, (psf)	Constrained Modulus, M (tsf)	Settlement, δ (inch)
CL	40	45	5	2.5	150	1010	0.004
CL	45	50	5	7.5	95	1010	0.003
CL	50	55	5	12.5	65	2019	0.001
CL	55	60	5	17.5	48	2019	0.001
CL	60	65	5	22.5	37	2019	0.001
CL	65	70	5	27.5	29	3365	0.000
CL	70	75	5	32.5	23	3365	0.000
CL	75	78	3	36.5	20	2423	0.000
ML	78	83	5	40.5	17	2423	0.000
ML	83	88	5	45.5	15	2423	0.000
CL	88	93	5	50.5	13	2423	0.000
CL	93	98	5	55.5	11	2423	0.000
CL	98	100	2	59	10	2424	0.000
CL	100	105	5	62.5	9	6731	0.000
CL	105	110	5	67.5	8	6731	0.000
ML	110	115	5	72.5	7	6731	0.000
SM	115	118	3	76.5	7	6731	0.000
							0.01

Table 9. Settlement Analysis Below SCM Grid – Water Tank

Soil Type	Top of Layer (ft)	Bottom of Layer (ft)	Thickness (ft)	Depth to Middle of (ft)	Net Foundation Load, (psf)	Constrained Modulus, M (tsf)	Settlement, δ (inch)
CL	40	45	5	2.5	1067	1010	0.032
CL	45	50	5	7.5	714	1010	0.021
CL	50	55	5	12.5	511	2019	0.008
CL	55	60	5	17.5	384	2019	0.006
CL	60	65	5	22.5	299	2019	0.004
CL	65	70	5	27.5	239	3365	0.002
CL	70	75	5	32.5	196	3365	0.002
CL	75	78	3	36.5	169	2423	0.001
ML	78	83	5	40.5	148	2423	0.002
ML	83	88	5	45.5	126	2423	0.002
CL	88	93	5	50.5	109	2423	0.001
CL	93	98	5	55.5	95	2423	0.001
CL	98	100	2	59	87	2424	0.000
CL	100	105	5	62.5	79	6731	0.000
CL	105	110	5	67.5	71	6731	0.000
ML	110	115	5	72.5	63	6731	0.000
SM	115	118	3	76.5	58	6731	0.000
							0.08

APPENDIX C

Liquefaction Analysis with Ground Improvement during MCE Event

CONDON · JOHNSON
& ASSOCIATES, INC.
CONTRACTORS AND ENGINEERS

Project Title:	Pescadero Fire Station
Location:	Pescadero, CA
Engineer:	Supreeth Prasad
Date:	6/29/2026

CPT-1 (SCM)

Input Parameters and Analysis Data

Analysis Method:	Boulanger and Idriss (2014)
Grain Characterization:	Robertson (2016)
Soil Unit Weight:	Robertson (2010)
Fine Contents:	Boulanger and Idriss (2014)
Soil Relative Density:	Idriss and Boulanger (2008)
Soil Shear Wave Velocity:	Robertson (2009)
Transition Zones:	Active - Ic = 1.8-3, m = 0.5
Depth Factor:	Cetin et al. (2009): BoF to 59-ft

Elevations		
Top of CPT:	55.00	(ft)
Finshed Floor:	57.00	(ft)
Bottom of Foundation:	56.00	(ft)
Ground Water Table:	50.00	(ft)
Earthquake Magnitude, M_w:	7.50	
Earthquake PGA:	0.77	(g)
Liquefaction Cut-Off I_c:	2.60	
Surface Capping Layer:	Depth to FS<1	
Added Fill:	2-ft - 120-pcf	

Ground Improvement Properties

Improvement Type:	Grid
Densification Method:	no densification
Stress Redist. Method:	Nguyen et al. (2013) (no shear strain compatibility)

Area Replacement Ratio:	22.00	(%)
Toe Elevation:	15.00	(ft)
Shear Modulus:	3330	(tsf)
Minimum Stiffness Ratio:	25	

Summary of Results

Liquefaction Damage Potential

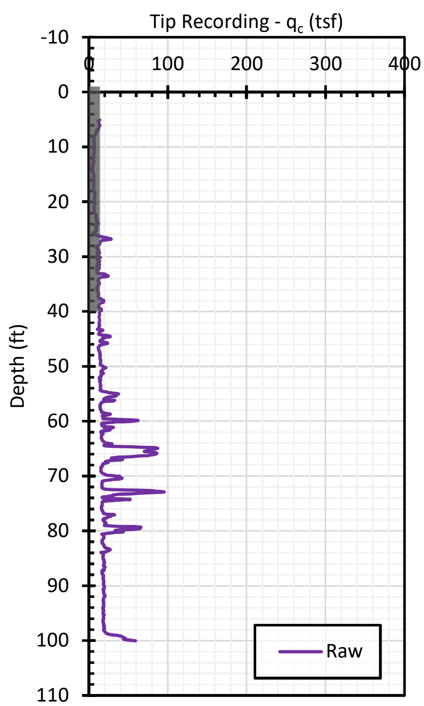
Iwasaki et al. (1978):	0.35	< 5 low potential
Maurer et al. (2015):	0.23	< 5 no manifestation expected
Tonkin and Taylor (2013):	0.37	< 10 little to no potential

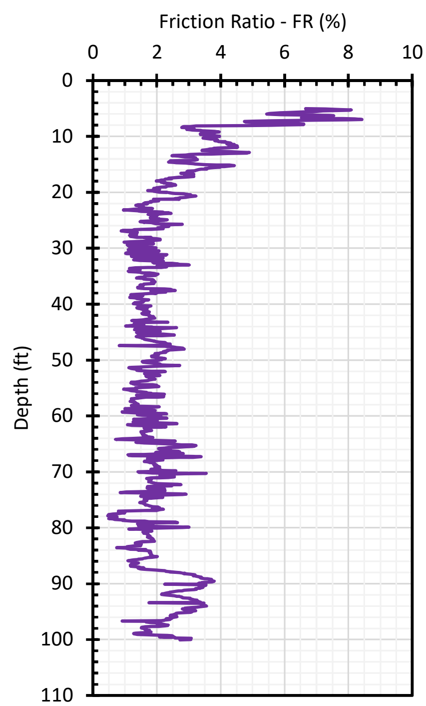
Liquefaction Induced Settlements

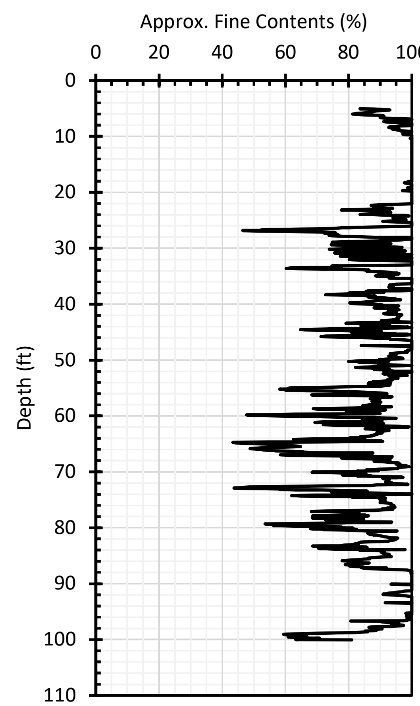
Tokimatsu and Seed (1987):	0.03	(in)
Zhang et al. (2002):	0.03	(in)
Yoshimine et al. (2006):	0.04	(in)
Wu and Seed (2003):	0.03	(in)

Seismic Compression

Pradel (1998):	0.00	(in)
Yi (2010):	0.00	(in)
VSMM (2014):	0.00	(in)



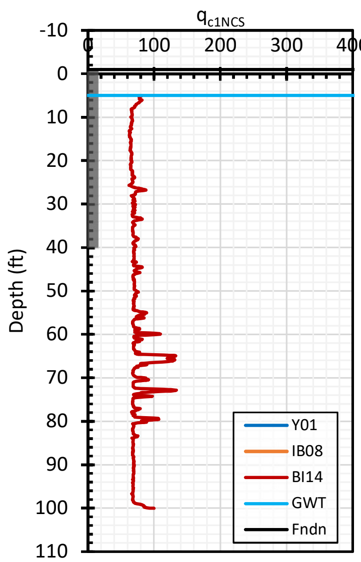


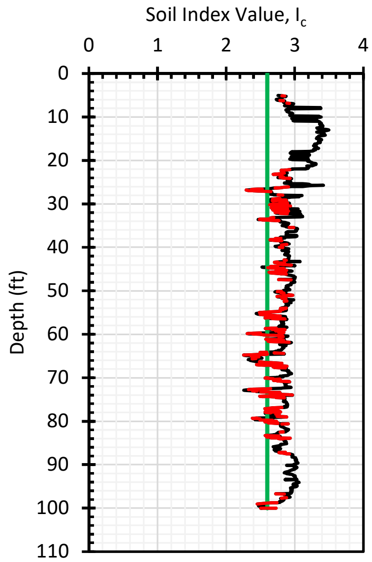


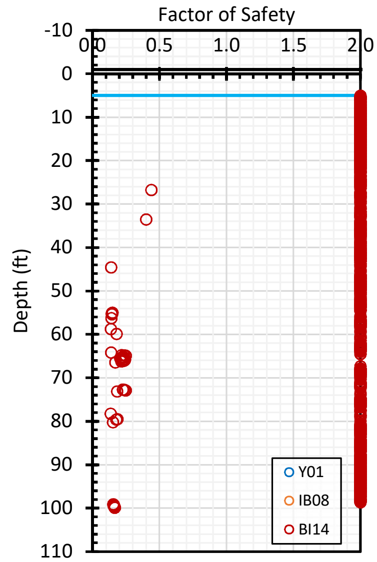
Project Title:	Pescadero Fire Station
Location:	Pescadero, CA
Engineer:	Supreeth Prasad
Date:	6/29/2026

CPT-1 (SCM)

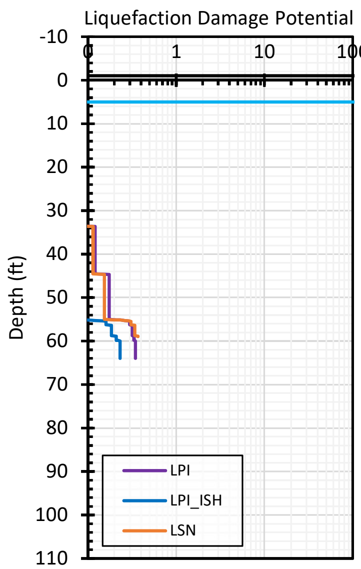
Liquefaction Analysis

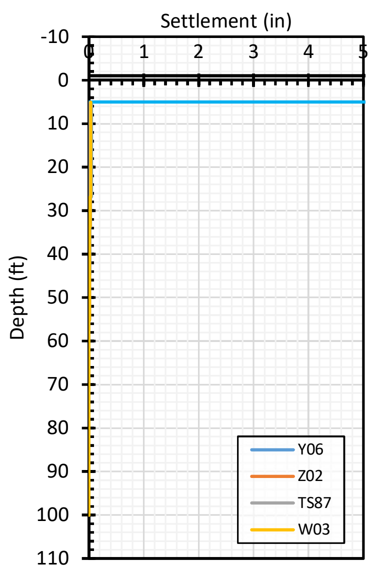


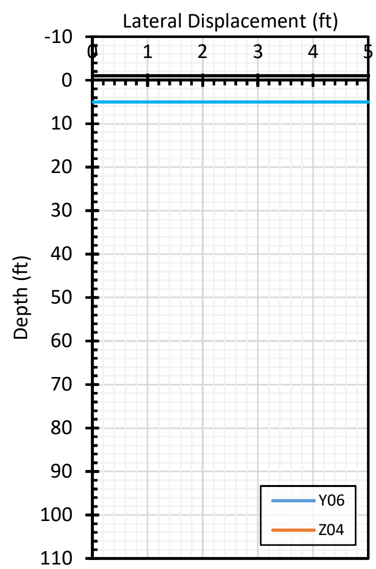




Predicted Seismic Performance







Legend:		W03	Wu et al. (2003)
GWT	Ground Water Table	Y06	Yoshimine et al. (2006)
Fndn	Foundation Level	Z02	Zhang et al. (2002)
Y01	NCEER - Youd et al. (2001)	Z04	Zhang et al. (2004)
IB08	Idriss and Boulanger (2008)	LPI	Liquefaction Potential Index by Iwasaki et al. (1978)
BI14	Boulanger and Idriss (2014)	LPI-ISH	Ishihara Inspired Liquefaction Potential Index by Maurer et al. (2015)
TS87	Tokimatsu and Seed (1987)	LSN	Liquefaction Severity Number by Tonkin and Taylor (2013)

Project Title:	Pescadero Fire Station
Location:	Pescadero, CA
Engineer:	Supreeth Prasad
Date:	6/29/2026

CPT-2 (SCM)

Input Parameters and Analysis Data

Analysis Method:	Boulanger and Idriss (2014)
Grain Characterization:	Robertson (2016)
Soil Unit Weight:	Robertson (2010)
Fine Contents:	Boulanger and Idriss (2014)
Soil Relative Density:	Idriss and Boulanger (2008)
Soil Shear Wave Velocity:	Robertson (2009)
Transition Zones:	Active - Ic = 1.8-3, m = 0.5
Depth Factor:	Cetin et al. (2009): BoF to 58-ft

Elevations		
Top of CPT:	54.00	(ft)
Finshed Floor:	57.00	(ft)
Bottom of Foundation:	56.00	(ft)
Ground Water Table:	49.00	(ft)
Earthquake Magnitude, M_w:	7.50	
Earthquake PGA:	0.77	(g)
Liquefaction Cut-Off I_c:	2.60	
Surface Capping Layer:	Depth to FS<1	
Added Fill:	3-ft - 120-pcf	

Ground Improvement Properties

Improvement Type:	Grid
Densification Method:	no densification
Stress Redist. Method:	Nguyen et al. (2013) (no shear strain compatibility)

Area Replacement Ratio:	22.00	(%)
Toe Elevation:	15.00	(ft)
Shear Modulus:	3330	(tsf)
Minimum Stiffness Ratio:	25	

Summary of Results

Liquefaction Damage Potential

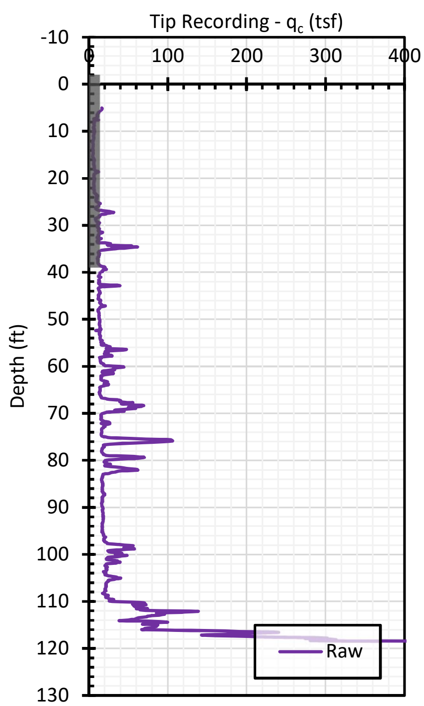
Iwasaki et al. (1978):	0.83	< 5 low potential
Maurer et al. (2015):	0.11	< 5 no manifestation expected
Tonkin and Taylor (2013):	0.80	< 10 little to no potential

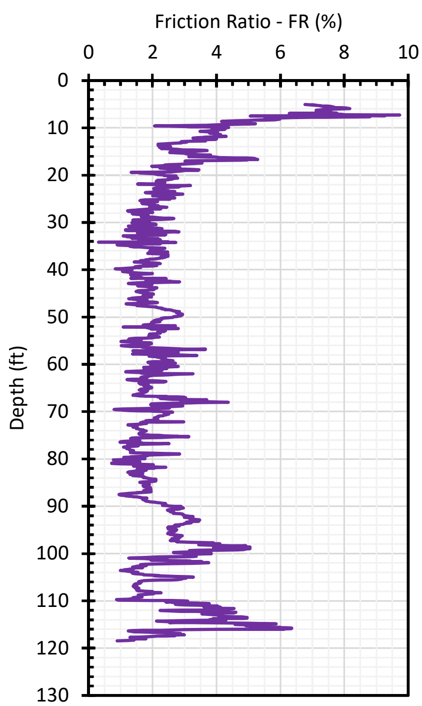
Liquefaction Induced Settlements

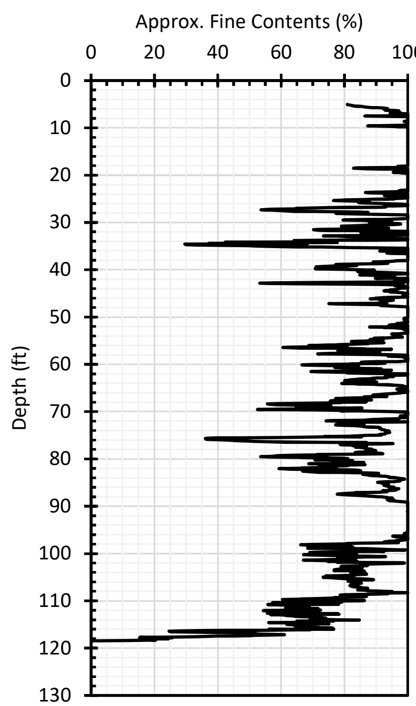
Tokimatsu and Seed (1987):	0.10	(in)
Zhang et al. (2002):	0.13	(in)
Yoshimine et al. (2006):	0.18	(in)
Wu and Seed (2003):	0.13	(in)

Seismic Compression

Pradel (1998):	0.00	(in)
Yi (2010):	0.00	(in)
VSMM (2014):	0.00	(in)



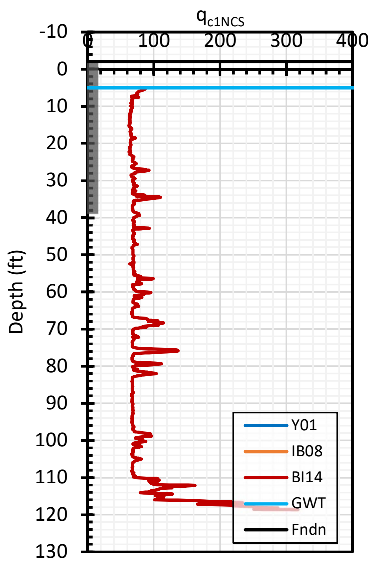


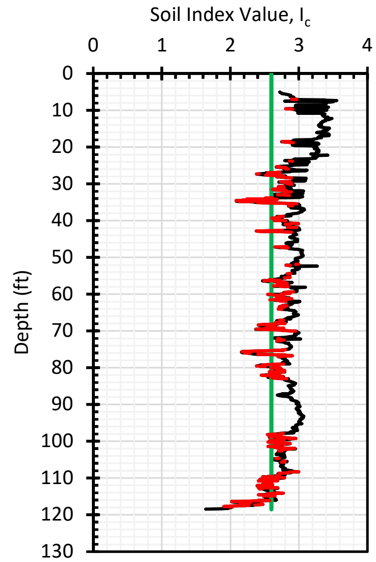


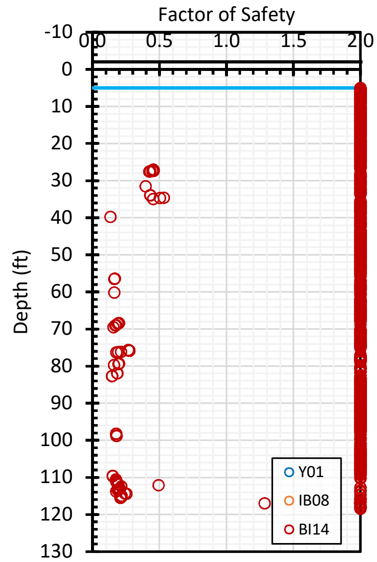
Project Title:	Pescadero Fire Station
Location:	Pescadero, CA
Engineer:	Supreeth Prasad
Date:	6/29/2026

CPT-2 (SCM)

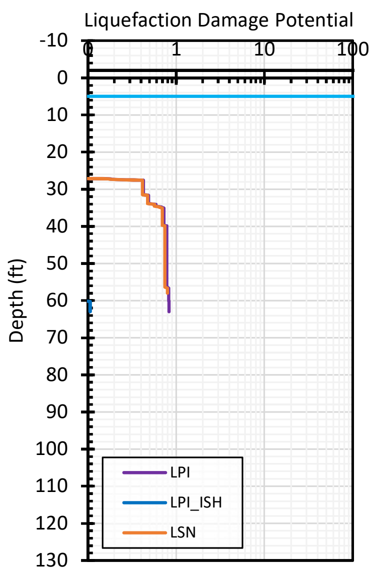
Liquefaction Analysis

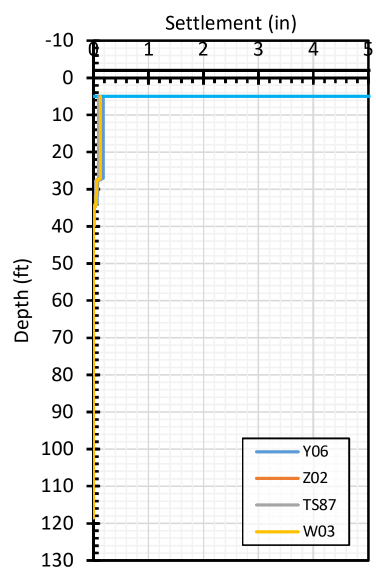


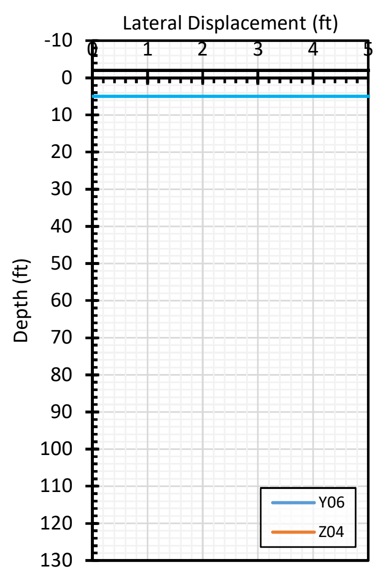




Predicted Seismic Performance







Legend:		W03	Wu et al. (2003)
GWT	Ground Water Table	Y06	Yoshimine et al. (2006)
Fndn	Foundation Level	Z02	Zhang et al. (2002)
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9012 South 208th Street; Kent, WA 98031
P: (425) 988-2150 F: (425) 988-2151

CONDON · JOHNSON & ASSOCIATES, INC.
CONTRACTORS AND ENGINEERS

Project Title:	Pescadero Fire Station	**CPT-3 (SCM)**
Location:	Pescadero, CA	
Engineer:	Supreeth Prasad	
Date:	6/29/2026	

Input Parameters and Analysis Data

Analysis Method:	Boulanger and Idriss (2014)
Grain Characterization:	Robertson (2016)
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Finshed Floor:	57.00	(ft)
Bottom of Foundation:	56.00	(ft)
Ground Water Table:	50.00	(ft)
Earthquake Magnitude, M_w:	7.50	
Earthquake PGA:	0.77	(g)
Liquefaction Cut-Off I_c:	2.60	
Surface Capping Layer:	Depth to FS<1	
Added Fill:	2-ft - 120-pcf	

Ground Improvement Properties

Improvement Type:	Grid
Densification Method:	no densification
Stress Redist. Method:	Nguyen et al. (2013)
	(no shear strain compatibility)

Area Replacement Ratio:	22.00	(%)
Toe Elevation:	15.00	(ft)
Shear Modulus:	3330	(tsf)
Minimum Stiffness Ratio:	25	

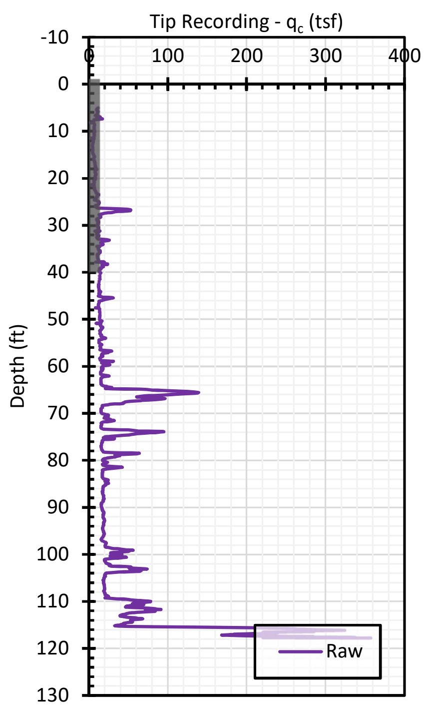
Summary of Results

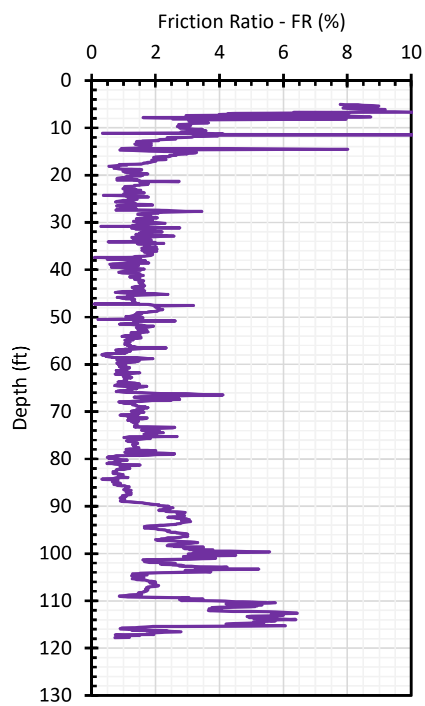
Liquefaction Damage Potential

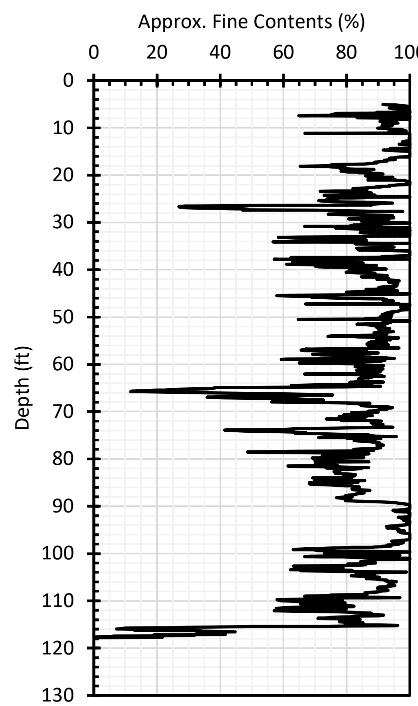
Iwasaki et al. (1978):	0.94	< 5 low potential
Maurer et al. (2015):	0.24	< 5 no manifestation expected
Tonkin and Taylor (2013):	0.90	< 10 little to no potential

Liquefaction Induced Settlements

Tokimatsu and Seed (1987):	0.11	(in)
Zhang et al. (2002):	0.13	(in)
Yoshimine et al. (2006):	0.18	(in)
Wu and Seed (2003):	0.15	(in)
Seismic Compression		
Pradel (1998):	0.00	(in)
Yi (2010):	0.00	(in)
VSMM (2014):	0.00	(in)





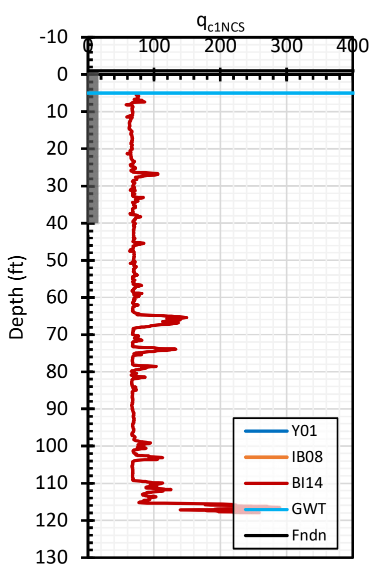


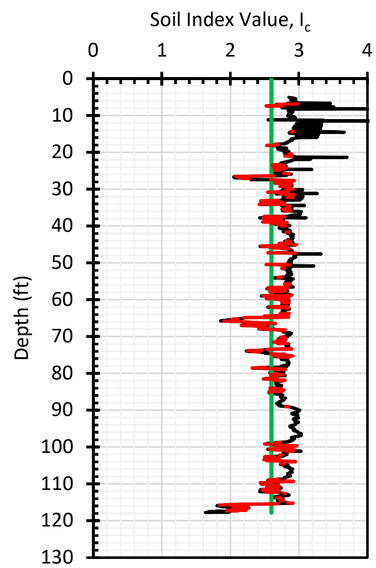
CONDON · JOHNSON
& ASSOCIATES, INC.
CONTRACTORS AND ENGINEERS

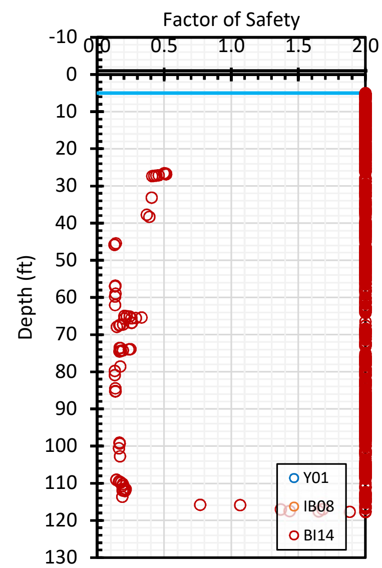
Project Title:	Pescadero Fire Station
Location:	Pescadero, CA
Engineer:	Supreeth Prasad
Date:	6/29/2026

CPT-3
(SCM)

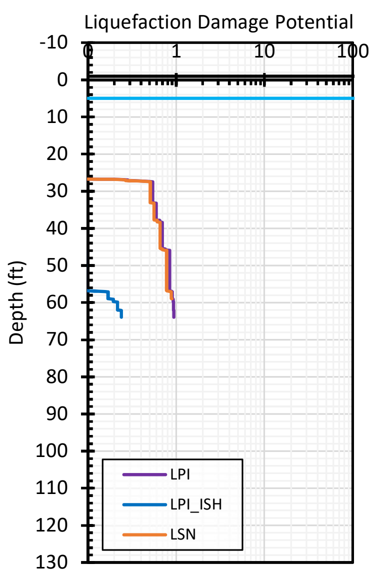
Liquefaction Analysis

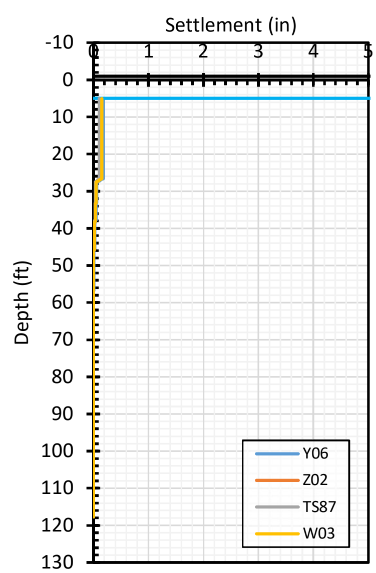


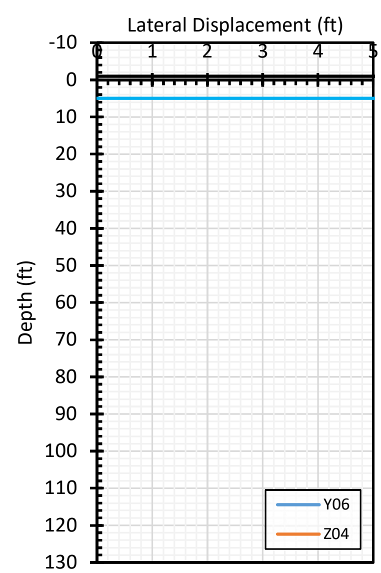




Predicted Seismic Performance







Legend:			
		W03	Wu et al. (2003)
GWT	Ground Water Table	Y06	Yoshimine et al. (2006)
Fndn	Foundation Level	Z02	Zhang et al. (2002)
Y01	NCEER - Youd et al. (2001)	Z04	Zhang et al. (2004)
IB08	Idriss and Boulanger (2008)	LPI	Liquefaction Potential Index by Iwasaki et al. (1978)
BI14	Boulanger and Idriss (2014)	LPI-ISH	Ishihara Inspired Liquefaction Potential Index by Maurer et al. (2015)
TS87	Tokimatsu and Seed (1987)	LSN	Liquefaction Severity Number by Tonkin and Taylor (2013)