Supplementary Seismic Evaluation

John Yehall Chin Elementary School
San Francisco Unified School District
350 Broadway Street
San Francisco, California

Prepared for:

San Francisco Unified School District
San Francisco, California

Prepared by:

Amec Foster Wheeler Environment & Infrastructure, Inc.
180 Grand Avenue, Suite 1100
Oakland, California 94612

April 2015

Project No. OD14170930

April 23, 2015

Project OD14170930

Mr. Sajeev Madhavan
Sr. Project Manager
San Francisco Unified School District – Prop A Bond Program
135 Van Ness Avenue, Suite 207A
San Francisco, CA 94102

Subject: **Supplementary Seismic Evaluation**
John Yehall Chin Elementary School
San Francisco Unified School District
350 Broadway Street
San Francisco, California 94114

Dear Mr. Madhavan:

Amec Foster Wheeler Environmental & Infrastructure, Inc. is pleased to submit this supplementary evaluation report to support the evaluation and design of improvements to the John Yehall Chin Elementary School. This report was developed in accordance with our Master Services Agreement with the San Francisco Unified School District, dated March 19, 2012 (Number 01473) revised on February 19, 2013 and Contract Modification No. (3), dated October 15, 2014.

Our supplementary seismic evaluation includes preparation of seismic parameters consistent with the requirements of American Society of Civil Engineers/Structural Engineers Institute (ASCE/SEI) Standards 41-06 and 41-13 (ASCE/SEI, 2007; 2013) and preparing this report.

If you have any questions about this report, please call any of the undersigned. It has been a pleasure working with you and we look forward to working with you on other future phases of the project.

Sincerely yours,
Amec Foster Wheeler Environment & Infrastructure, Inc.

Joseph C. de Larios, PE, GE
Associate Engineer

Donald L. Wells, CEG
Senior Associate Engineering Geologist

Christopher J. Coutu, PE, GE
Principal Engineer

JLC/DW/CJC/LDU
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Enclosure

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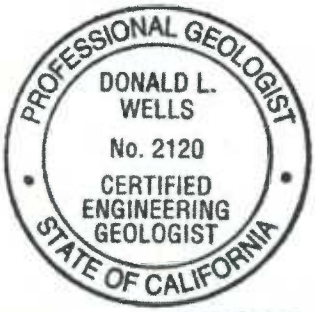
SUPPLEMENTARY SEISMIC EVALUATION
John Yehall Chin Elementary School
San Francisco Unified School District
350 Broadway Street
San Francisco, California

April 23, 2015
Project OD14170930

This report was prepared by the staff of Amec Foster Wheeler Environment & Infrastructure, Inc. under the supervision of the Engineer and/or Geologist whose seals and signatures appear hereon.

The findings, recommendations, specifications, or professional opinions are presented within the limits described by the client, in accordance with generally accepted professional engineering and geologic practice. No warranty is expressed or implied.



Donald L. Wells, CEG
Senior Associate Engineering Geologist

Joseph C. de Larios, PE, GE
Associate Engineer

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John Yehall Chin Elementary School
San Francisco Unified School District
San Francisco, California

1.0 INTRODUCTION AND PURPOSE

This report presents supplementary seismic parameters and information for the geotechnical investigation and geologic hazard evaluation that Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler) performed in support of design and construction of proposed improvements to the John Yehall Chin Elementary School (JYCES), in San Francisco, California. JYCES is in the San Francisco Unified School District (SFUSD), and is located at 350 Broadway St., near the base of Telegraph Hill (Figure 1). The site coordinates are 37º44'57.6"N, 122º25'58.5"W.

The primary objective of this supplementary evaluation is to provide seismic parameters consistent with American Society of Civil Engineers/Structural Engineers Institute (ASCE/SEI) Standards 41-06 and 41-13 (ASCE/SEI, 2007; 2013).

This report was prepared in general accordance with the applicable requirements of 2013 California Administrative Code (CAC) Title 24, Part 1, Chapter 4 (California Building Standards Commission [CBSC], 2013a), and 2013 California Building Code (CBC) Title 24, Part 2 (CBSC, 2013b), for construction or alterations to public school buildings. The report also was prepared to provide information specified on California Geological Survey Note 48, "Checklist for the Review of Engineering Geology and Seismology Reports for California Public Schools, Hospitals, and Essential Services Buildings." We understand the report will be submitted to the Division of the State Architect (DSA), and their reviewer, the California Geological Survey (CGS).

The geotechnical information and recommendations, and geological hazards evaluation, were submitted to SFUSD in a report dated November 3, 2014. This geotechnical report was reviewed by the DSA and CGS, and was approved on January 12, 2015, with a note that if seismic parameters following ASCE/SEI 41-06 were required by the structural engineers, these parameters should be submitted to DSA and CGS for review.

2.0 EXISTING CONDITIONS AND PROJECT DESCRIPTION

The Main School Building at JYCES is a three-story steel frame structure with brick masonry infill walls (Figure 3a). The building was constructed in about 1913, and has been renovated several times for various use functions. The building is supported on a shallow foundation system that includes shallow spread footings (under building columns), which are typically

connected to adjacent spread footings by retaining walls that also appear to function as continuous footings. The northern portion of the site appears to be cut in to the gently sloping terrain at the southeast base of Telegraph Hill. Some fill is present along the eastern portion of the site between the building and the east property line, where this area is elevated above Broadway Street. The site elevation ranges from approximately 63 feet (19 m) to 70 feet (21 m) above mean sea level (MSL), sloping down from north to south, and west to east.

3.0 SEISMIC PARAMETERS

The seismic design for this project will be in accordance with 2013 California Administrative Code (CAC) and the California Building Code (CBSC, 2013a, b), which incorporates by reference the seismic design procedures of ASCE/SEI 7 (ASCE, 2010) and ASCE/SEI 41-06 (ASCE/SEI, 2007). As described in the geotechnical report, seismic design parameters utilized by the CBC and ASCE/SEI 7 for new construction correspond to two levels of ground motion, the Maximum Considered Earthquake (MCE) and the Design Level. The intensity and characteristics of these ground motion levels are based on the location of the site relative to potential sources of earthquakes in the site region and on subsurface conditions at the site. Based on the expected ground motion intensity and site class designation, site coefficients are defined to account for site response effect in establishing the seismic design parameters appropriate for the site.

The site classification and seismic parameters presented in the November geotechnical report are included in Sections 3.1, 3.2, and 3.4 below. Additional seismic parameters for ground motion levels specified in ASCE 41-06 and 41-13 are presented in Section 3.3.

3.1 SITE CLASSIFICATION FOR SEISMIC DESIGN

Based on our review of local geologic information and logs of borings performed on the project site, and as described in the geotechnical report, we note that the subsurface conditions at the site consist of up to about 10 feet of clayey and sandy soils overlying weathered Franciscan Sandstone bedrock. In the absence of measured shear wave velocity data at the site to confirm the shear wave velocity of the bedrock, we recommend using a Site Class C (Very dense soil and soft rock) for characterizing potential earthquake ground shaking conditions and seismic design considerations.

3.2 MCE AND DESIGN LEVEL SEISMIC PARAMETERS FOR ASCE/SEI 7

The seismic parameters for ASCE/SEI 7 were provided in the November geotechnical report; these parameters presented below for reference in developing additional seismic parameters for ASCE/SEI 41.

In accordance with the 2013 CBC (1613A), the following seismic design parameters may be used for the project. The values of S_S, S_1, F_a, and F_v used in development of the site-adjusted Risk-Targeted Maximum Considered Earthquake (MCE_R) spectral parameters S_{MS} and S_{M1} are

listed below. The values of S_S and S_1 were obtained from the USGS online tool, U.S. Seismic Design Maps (http://earthquake.usgs.gov/hazards/designmaps/usdesign.php). The values of F_a and F_v are for Site Class C. The spectral acceleration parameters S_{DS} and S_{D1} are equal to two-thirds of S_{MS} and S_{M1}, respectively.

For use with the equivalent lateral force procedure, the mapped value of S_1 from ASCE 7-10 and the 2013 CBC is 0.600g, and the mapped long period transition period (T_L) is equal to 12 seconds.

The project is identified as Risk Category III (2013 CBC 1604A.5), and for the mapped S_1 value of 0.600g, the Seismic Design Category is D (2013 CBC 1613A.3.5).

Parameter	Value
Site Classification	C
Mapped MCE_R Spectral Acceleration for Short Periods, S_s	1.50g
Mapped MCE_R Spectral Acceleration for Period of 1.0 second, S_1	0.60g
Site Coefficient, F_a	1.0
Site Coefficient, F_v	1.3
Adjusted MCE Spectral Acceleration for Short Periods, S_{MS}	1.50g
Adjusted MCE Spectral Acceleration for Period of 1.0 Second, S_{M1}	0.78g
Design Spectral Acceleration for Short Periods, S_{DS}	1.00g
Design Spectral Acceleration for Period of 1.0 Second, S_{D1}	0.52g
Long-Period Transition, T_L (seconds)	12
Risk Category	III
Seismic Design Category	D

3.3 SEISMIC PARAMETERS FOR ASCE/SEI 41

In accordance with the 2013 CBC (Chapter 34) and ASCE/SEI 41, the following seismic design parameters may be used for the project. The values of S_S, S_1, F_a, and F_v used in development of the site-adjusted Basic Safety Earthquake (BSE) spectral parameters (described below) are obtained from the USGS online tool, U.S. Seismic Design Maps (http://earthquake.usgs.gov/hazards/designmaps/usdesign.php). The values of F_a and F_v are for Site Class C. For ASCE/SEI 41, the site-adjusted short and long period spectral parameters are referred to as S_{XS} and S_{X1}, respectively.

The spectra for ASCE/SEI 41-06 are:

- BSE-2 (equal to MCE_R of ASCE/SEI 7-10)
- BSE-1 (equal to ⅔ times MCE_R (Design level) of ASCE/SEI 7-10)

The spectra for ASCE/SEI 41-13 are:

- BSE-2N (equal to MCE_R of ASCE/SEI 7-10)
- BSE-1N (equal to ⅔ times MCE_R (Design level) of ASCE/SEI 7-10)
- BSE-2E (equal to 5% probability of exceedance in 50 years ground motion level)
- BSE-1E (equal to 20% probability of exceedance in 50 years ground motion level)

3.3.1 Seismic Parameters for ASCE/SEI 41-06 and CBC Chapter 34

Two ground motion levels are specified for evaluation and design of renovations/retrofits for existing buildings under ASCE 41-06, BSE-2 and BSE-1. The short period (S_{XS}) and long period (S_{X1}) BSE-2 parameters are equal to S_S* F_a and S_1*F_v, respectively. The 2013 CBC Section 3417.5 specifies that BSE-2 shall be the same as the MCE_R spectra in ASCE 7-10, thus S_{XS} and S_{X1} are equal to S_{MS} and S_{M1}, respectively. The BSE-1 spectral response parameters are taken as ⅔ of the BSE-2 parameters. The value of T_0 is equal to 0.2* $S_{X1}/S_{XS,}$ and T_S is equal to S_{X1}/S_{XS}.

The calculated values for S_{XS}, S_{X1}, and T_S for each ground motion level are listed below.

Parameter	BSE-2 (MCE_R)	BSE-1
S_{XS}	1.5 g	1.00 g
S_{X1}	0.78 g	0.52 g
T_0	0.104 second	0.104 second
T_S	0.52 second	0.52 second

3.3.2 Seismic Parameters for ASCE/SEI 41-13

Four levels of ground shaking are specified in ASCE/SEI 41-13 corresponding to specific performance objectives. Two ground motion levels, BSE-2N and BSE-1N, are the same as the ground motion levels specified in ASCE/SEI 7-10 for design of new buildings, MCE_R and Design (⅔*MCE_R). These ground motion levels are also equal to BSE-2 and BSE-1 of SSCE/SEI 41-06.

Two additional ground motion levels, BSE-2E and BSE-1E, are specified in ASCE/SEI 41-13 for use in seismic evaluation and design of seismic retrofits for existing buildings; the BSE-2E and BSE-1E ground motions are defined such that these motions will be less than or equal to the motions developed for BSE-2N and BSE-1N, respectively. The BSE-2E parameters are taken as the 5% probability of exceedance (PE) in 50 years ground motion level, and the BSE-

1E parameters are taken as the 20% PE in 50 years ground motion level. The values of S_S and S_1 for BSE-2E and BSE-1E probability levels also were obtained from the USGS online tool, U.S. Seismic Design Maps (http://earthquake.usgs.gov/hazards/designmaps/usdesign.php).

Parameter	BSE-2E (5%PE in 50 years)	BSE-1E (20% PE in 50 years)
S_S	1.468 g	0.854 g
S_1	0.592 g	0.320 g
T_0	0.105 second	0.105 second
T_S	0.52 second	0.52 second

For BSE-2N and BSE-2E, the values of F_a and F_v are the same as for ASCE 7-10, 1.0 and 1.3, respectively. For BSE-1E, the values for F_a and F_v are obtained by interpolation for the BSE-2E and BSE-1E spectral acceleration levels (S_S and S_1), and are calculated as equal to 1.058 and 1.480, respectively. The calculated values for S_{XS}, S_{X1}, T_0, and T_S for each ground motion level are listed below.

Parameter	BSE-2N (MCE_R)	BSE-1N	BSE-2E	BSE-1E
S_{XS}	1.5 g	1.00 g	1.468 g	0.904 g
S_{X1}	0.78 g	0.52 g	0.769 g	0.474 g
T_0	0.104 second	0.104 second	0.105 second	0.105 second
T_S	0.52 second	0.52 second	0.524 second	0.524 second

The general horizontal response spectrum is calculated for each ground motion level following the procedures shown in Figure 11.4-1 of ASCE 7-10 and Figure 2-1 of ASCE 41-13; these spectrums are presented in Table S-1 and on Figure S-1. If a vertical spectrum is required for any analysis, it may be taken as equal to ⅔ of the appropriate horizontal spectrum.

3.4 SEISMIC PARAMETERS FOR LIQUEFACTION, SETTLEMENT, AND SEISMIC EARTH PRESSURES

The seismic parameters for liquefaction, settlement and seismic earth pressures were presented in the November geotechnical report, and are repeated below. The ground motion required by the 2013 CBC for assessment of liquefaction and seismically-induced settlement is the geomean MCE peak ground acceleration (PGA_M). The PGA_M from the 2013 CBC and ASCE 7-10 is 0.508g.

For other calculations such as seismic earth pressures, the design level PGA may be taken as 0.458g, which is equal to S_{DS}*(0.4+0.6*T/T_0), where T =0.01 s and T_0 is equal to 0.2*(S_{D1}/S_{DS}), and S_{DS} and S_{D1} are taken as noted in the table in Section 3.2 above. Note that the PGA value of 0.458g is updated from the result presented in the November report.

4.0 BASIS OF RECOMMENDATIONS

The evaluations made in this report are based on the assumption that soil conditions at the site do not deviate appreciably from those described herein, and are disclosed in the exploratory borings. In the performance of our professional services, Amec Foster Wheeler, its employees, and its agents comply with the standards of care and skill ordinarily exercised by members of our profession practicing in the same or similar localities. No warranty, either express or implied, is made or intended in connection with the work performed by us, or by the proposal for consulting or other services or by the furnishing of oral or written reports or findings. We are responsible for the evaluations contained in this report, which are based on data related only to the specific project and location discussed herein. In the event conclusions based on these data are made by others, such conclusions are not our responsibility unless we have been given an opportunity to review and concur in writing with such conclusions.

5.0 REFERENCES

AMEC Environment and Infrastructure, Inc., 2014, Geotechnical Investigation and Geologic Hazard Evaluation: John Yehall Chin Elementary School, San Francisco Unified School District, San Francisco, California, November.

American Society of Civil Engineers/Structural Engineers Institute (ASCE/SEI), 2007, ASCE/SEI 41-06, Seismic Rehabilitation of Existing Buildings: ASCE, Reston, Virginia, 411 p.

ASCE/SEI, 2010, ASCE/SEI 7-10, Minimum Design Loads for Buildings and Other Structures: ASCE, Reston, Virginia.

ASCE/SEI, 2014, ASCE/SEI 41-13, Seismic Evaluation and Retrofit of Existing Buildings: ASCE, Reston, Virginia, 518 p.

California Building Standards Commission (CBSC), 2013a, 2013 California Administrative Code, California Code of Regulations Title 24, Part 1, July; published by the International Code Council, Washington, D.C.

CBSC, 2013b, 2013 California Building Code, California Code of Regulations Title 24, Part 2, Volume 2 of 2, July; published by the International Code Council, Washington, D.C.

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TABLE

TABLE S-1

GENERAL PROCEDURE RESPONSE SPECTRA FOR GROUND SHAKING LEVELS OF ASCE/SEI 7-10, 41-06, AND 41-13

Supplementary Seismic Evaluation
John Yehall Chin Elementary School
San Francisco Unified School District
San Francisco, California

Period (seconds)	Spectral Acceleration (g)			
	MCE_R (ASCE 7-10) BSE-2 (ASCE 41-06) BSE-2N (ASCE 41-13)	Design (ASCE 7-10) BSE-1 (ASCE41-06) BSE-1N (ASCE 41-13)	BSE-2E (ASCE 41-13)	BSE-1E (ASCE 41-13)
0.01	0.687	0.458	0.671	0.413
0.02	0.773	0.515	0.755	0.465
0.03	0.860	0.573	0.839	0.517
0.05	1.033	0.688	1.007	0.620
0.075	1.249	0.833	1.217	0.750
0.1	1.465	0.977	1.427	0.879
0.15	1.500	1.000	1.468	0.904
0.2	1.500	1.000	1.468	0.904
0.25	1.500	1.000	1.468	0.904
0.3	1.500	1.000	1.468	0.904
0.4	1.500	1.000	1.468	0.904
0.5	1.500	1.000	1.468	0.904
0.75	1.040	0.693	1.026	0.631
1	0.780	0.520	0.770	0.474
1.5	0.520	0.347	0.513	0.316
2	0.390	0.260	0.385	0.237
3	0.260	0.173	0.257	0.158
4	0.195	0.130	0.192	0.118
5	0.156	0.104	0.154	0.095
7.5	0.104	0.069	0.103	0.063
10	0.078	0.052	0.077	0.047

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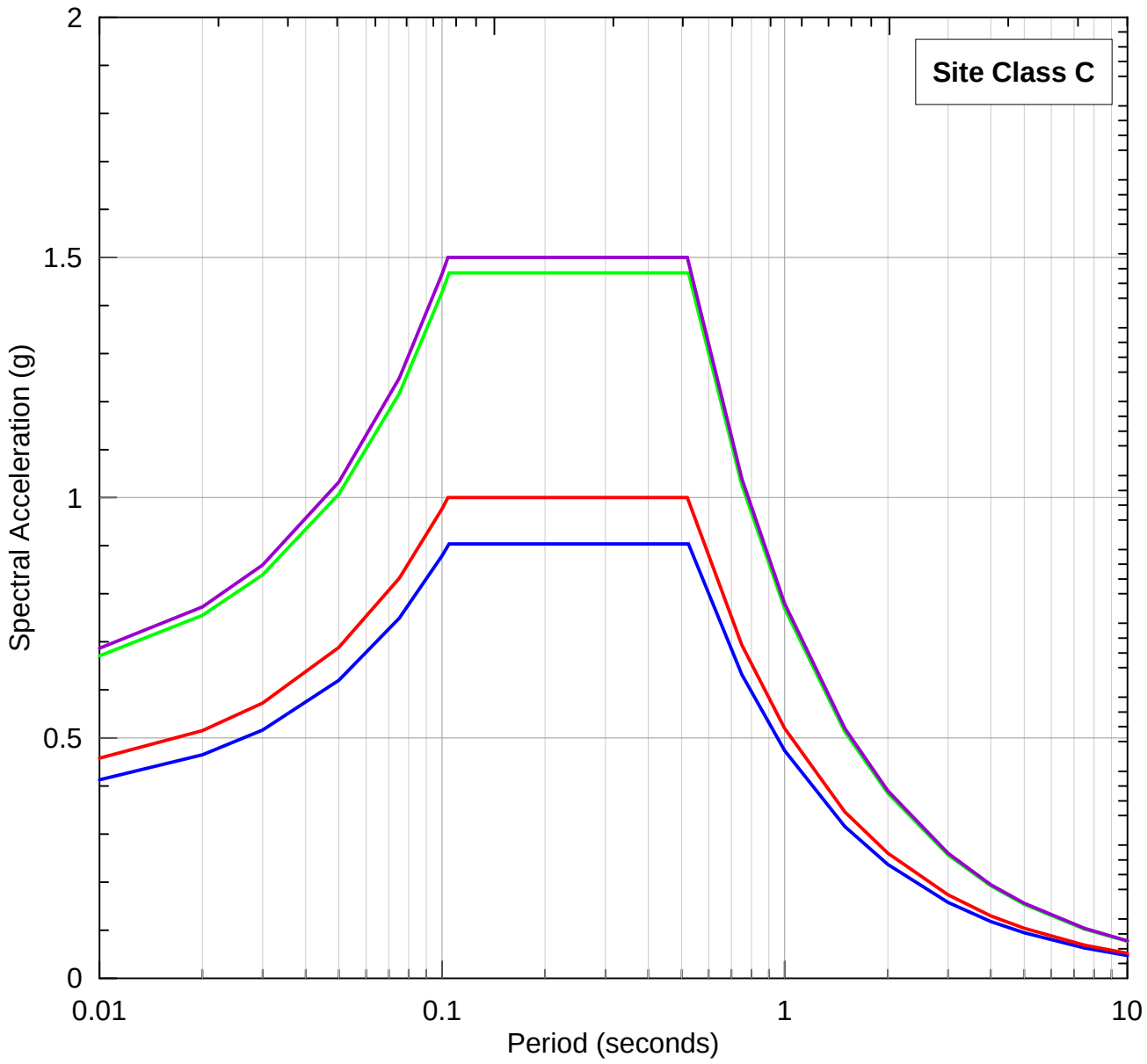
FIGURE



Explanation

- MCER, BSE-2, BSE-2N
- Design, BSE-1, BSE-1N
- BSE-2E
- BSE-1E

Notes:
1. Spectra are five-percent damped.

GENERAL PROCEDURE RESPONSE SPECTRUMS FOR ASCE/SEI 7-10, 41-06, AND 41-13
Supplementary Seismic Evaluation
John Yehall Chin Elementary School
San Francisco, CA

Date: April 2015 | Project No. OD14170930

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Figure
S-1

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APPENDIX A

California Geological Survey Review Letter

DEPARTMENT OF CONSERVATION

CALIFORNIA GEOLOGICAL SURVEY

SCHOOL REVIEW UNIT • 801 K STREET, MS 12-32 • SACRAMENTO, CALIFORNIA 95814

PHONE 916 / 324-7324 • FAX 916 / 322-4765 • TDD 916 / 324-2555 • WEB SITE conservation.ca.gov/cgs

Mr. Sajeev Madhavan
Senior Project Manager
San Francisco Unified School District
135 Van Ness Avenue, 2nd Floor
San Francisco, CA 94102

January 12, 2015

Subject: **Engineering Geology and Seismology Review for**
John Yehall Chin Elementary School
Modernization and Voluntary Seismic Upgrades of 3-Story Building
350 Broadway Street, San Francisco, San Francisco County, California
CGS Application No. 01-CGS1829

Dear Mr. Madhaven:

In accordance with your request and our receipt of documents on December 1, 2014, the California Geological Survey has reviewed the engineering geology and seismology aspects of the consulting report prepared for the proposed modernization and voluntary seismic upgrades of a three-story building at John Yehall Chin Elementary School in San Francisco, California. Specific improvements are not yet identified; however, the consultants indicate subsurface information and bearing capacities are needed to evaluate existing foundations and recommendations for modifications to foundations. This review was performed in accordance with Title 24, California Code of Regulations, 2013 California Building Code (CBC) and followed CGS Note 48 guidelines. We reviewed the following reports:

> **Geotechnical Investigation and Geologic Hazard Evaluation, John Yehall Chin Elementary School, 350 Broadway Street, San Francisco, California:** AMEC Environment & Infrastructure, 180 Grand Avenue, Suite 1100, Oakland, California 94612; report dated November 3, 2014; Project No. OD14170930; 20 pages; 6 Figures; Appendices A – C.

The principal geologic/seismic hazard identified by the consultants is the potential for damaging strong earthquake ground motion. The consultants' evaluation indicates liquefaction and slope instability are not design concerns for this project.

To address ground motion, the consultants provide general procedure seismic design parameters in accordance with the 2013 CBC and ASCE Standard 7-10 for new construction. The consultants recommended design spectral acceleration parameters S_{DS} = **1.000g** and S_{D1} = **0.520g** are considered reasonable.

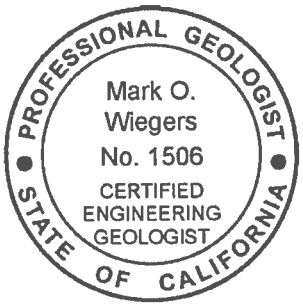
CGS notes the consultants do not provide seismic design values addressed in Chapter 34 of the 2013 CBC and ASCE Standard 41, which may be required for seismic upgrades of existing buildings. These values should be provided if required by the structural engineer.

The consultants do not identify any other significant geologic and/or seismic hazards affecting the site and provide adequate data to support their conclusions.

In conclusion, the structural engineer should determine if seismic design values for rehabilitation of existing buildings in accordance with Chapter 34/ASCE 41 are required for this project. If these values are needed, they should be provided for our review. If not, then ***no additional information is requested of the consultants for this project.*** If you have any further questions about this review letter, please telephone the California Geological Survey at (707) 576-2205.

Respectfully submitted,

Mark O. Wiegers
Engineering Geologist
PG 4157 CEG 1506



Concur:

Jennifer Thornburg
Senior Engineering Geologist
PG 5476, CEG 2240

Enclosures:

Note 48 Checklist Review Comments
Keyed to: *Note 48 - Checklist for the Review of Engineering Geology and Seismology Reports for California Public Schools, Hospitals, and Essential Services Buildings*

Copies to:

Joseph C. de Larios, *Registered Geotechnical Engineer;* Donald L. Wells, *Certified Engineering Geologist*
180 Grand Avenue, Suite 1100, Oakland, California 94612

Dara Youngdale, *Architect*
HKIT Architects, 538 Ninth Street, Suite 240, Oakland, CA 94607

Karen Van Dorn, *Senior Architect*
Division of State Architect, 1515 Clay Street, Suite 1201, Oakland, CA 94612

Note 48 Checklist Review Comments

In the numbered paragraphs below, this review is keyed to the paragraph numbers of California Geological Survey Note 48 (October, 2013 edition), *Checklist for the Review of Engineering Geology and Seismology Reports for California Public Schools, Hospitals, and Essential Services Buildings.*

Project Location

1. Site Location Map, Street Address, County Name: Adequately addressed.
2. Plot Plan with Exploration Data with Building Footprint: Adequately addressed.
3. Site Coordinates: Adequately addressed. Latitude and Longitude provided in report: 37.7986°N, 122.4031°W

Engineering Geology/Site Characterization

4. Regional Geology and Regional Fault Maps: Adequately addressed.
5. Geologic Map of Site: Adequately addressed. The map shows the site is underlain by slope debris deposits on the south side of Telegraph Hill. The slope above the site is underlain by massive sandstone of the Franciscan Fromation.
6. Subsurface Geology: Adequately addressed. The consultants drilled 2 test borings to depths of 9.5 and 17.5 feet. The borings encountered 9 to 10.5 feet of colluvial soils consisting of very stiff to hard sandy clay with some gravel. Weathered sandstone bedrock was encountered in both borings below the colluvial deposits. Groundwater was not encountered in either boring.
7. Geologic Cross Sections: Not provided but not critical for this project.
8. Active Faulting & Coseismic Deformation Across Site: Adequately addressed. The site is not in Alquist-Priolo Earthquake Fault Zone (APEFZ). The consultants conclude the potential for fault rupture at the site is very low.
9. Geologic Hazard Zones (Liquefaction & Landslides): Adequately addressed. According to the Seismic Hazard Map of the City and County of San Francisco, the site is not located in a Zone of Required Investigation for liquefaction and seismically-induced landsliding (CGS, 2000).
10. Geotechnical Testing of Representative Samples: Adequately addressed.
11. Geological Consideration of Grading Plans and Foundation Plans: Adequately addressed.

Seismology & Calculation of Earthquake Ground Motion

12. Evaluation of Historic Seismicity: Adequately addressed. The consultants provide a summary of historical seismicity in the region.
13. Classify the Geologic Subgrade (Site Class): Adequately addressed. The consultants classify the site soil profile as Site Class C based on geologic evaluation of subsurface conditions.

14. General Procedure Seismic Parameters. **Additional information may be needed.** The consultant provides the following general procedure seismic design parameters in accordance with Chapter 16A of the 2013 CBC and ASCE Standard 7-10 for new construction:
    $S_S = 1.500$ and $S_1 = 0.600$
    $S_{DS} = 1.000$ and $S_{D1} = 0.520$.

    CGS notes the consultant does not provide seismic design values derived from Chapter 34 of the 2013 CBC and ASCE Standard 41 which may be required for rehabilitation of existing buildings. These values should be provided if required by the structural engineer.

15. Seismic Design Category: Adequately addressed. The site is classified Seismic Design Category D ($S_1 < 0.75$).
16. Site-Specific Ground Motion Analysis: Not addressed, therefore not reviewed. Under the 2013 CBC a site-specific ground motion analysis is not required for this project.
17. Deaggregated Seismic Source Parameters: Not addressed, therefore not reviewed.
18. Time-Histories of Earthquake Ground Motion: Not applicable.

Liquefaction/Seismic Settlement Analysis

19. Geologic Setting for Occurrence of Seismically Induced Liquefaction: Adequately addressed. The consultants' subsurface data shows the site is underlain by 9 to 10 feet of very stiff to hard clay which is in turn underlain by bedrock. Based on these conditions the consultants conclude the potential for liquefaction and liquefaction-induced settlement is very low and not a significant hazard.
20. Seismic Settlement Calculations: Adequately addressed. Based on subsurface data, the consultants conclude the potential for significant seismic settlement is low and any future seismic settlement is not expected to be large enough to impact the design or performance of proposed improvements.
21. Other Liquefaction Effects: Adequately addressed. There are no other potential liquefaction effects identified.
22. Mitigation Options for Liquefaction: Not applicable.

Slope Stability Analysis

23. Geologic Setting for Occurrence of Landslides: Adequately addressed. The consultant reports the slope directly above of the site is covered with buildings and retaining walls with no apparent instability. While some of the very steep slopes on Telegraph Hill are in Zones of Required Investigation for seismically-induced landslides (CGS, 2000), the slope directly above the school is not.
24. Determination of Static and Dynamic Strength Parameters: Not applicable.
25. Determination of Pseudo-Static Coefficient: Not applicable.
26. Identify Critical Slip Surfaces for Static and Dynamic Analyses: Not applicable.

27. Dynamic Site Conditions: Not applicable.
28. Mitigation Options/Other Slope Failure: Not applicable.

Other Geologic Hazards or Adverse Site Conditions

29. Expansive Soils: Adequately addressed. The consultants performed an Atterberg Limits test indicating the clayey soils have a plasticity index on the border between low and moderate expansion potential. They conclude the potential hazard of expansive soils to retrofit elements is low, but add if elements sensitive to soil expansion are planned, mitigation may be warranted.
30. Corrosive/Reactive Geochemistry of the Geologic Sub grade: Adequately addressed. The consultants performed a corrosion test that indicates the site soils have a low potential to corrosion of foundation elements.
31. Conditional Geologic Assessment: Selected geologic hazards addressed by the consultant: No other geologic hazards are identified by the consultant.

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32. Geology, Seismology, and Geotechnical References: Adequately addressed.
33. Certified Engineering Geologist: Adequately addressed.
    Donald L. Wells, Certified Engineering Geologist #2120
34. Registered Geotechnical Engineer: Adequately addressed.
    John C. de Larios, Registered Geotechnical Engineer #2349