

Engineering Design Review Team
(301 Mission Street Tower Permit)

August 27, 2019

Tom C. Hui, S.E., C.B.O.
Director and Chief Building Official
City and County of San Francisco
Department of Building Inspection
1660 Mission Street
San Francisco, CA 94103-2414

RE: Engineering Design Review
Voluntary Seismic Upgrade and Foundation Stabilization
301 Mission Street Tower
San Francisco, CA
**BUILDING PERMIT APPLICATION NOS. 2018.12.04.7402, 2018.12.07.7819,
AND 2018.12.07.7828**

Dear Tom,

This letter provides a summary of the independent Engineering Design Review of the voluntary seismic upgrade and foundation stabilization for the 301 Mission Street Tower (Permit No. 2018.12.04.7402), and the associated shoring and excavation design (Permit No. 2018.12.07.7819) and indicator pile program (2018.12.07.7828). The Engineer of Record (EOR) for the project is Ronald Hamburger, S.E., of Simpson, Gumpertz & Heger, Inc. (SGH), who has been assisted with supporting geotechnical engineering by John A. Egan, GE and Slate Geotechnical Consultants (Slate). The Engineering Design Review Team (EDRT) consists of Dr. Shahriar Vahdani, Mr. Craig Shields, Dr. Marko Schotanus, and Dr. Gregory Deierlein (chair).

The main features of the structural upgrade are the addition of new piles, extending down to rock on the north and west sides of the building, which will be attached to the building through an extension to the existing mat foundation. Note that the foundation upgrade will require construction beyond the current property line on the north (Mission Street) and west (Fremont Street) sides of the building. Associated with the foundation retrofit is installation and testing of an indicator pile and installation of temporary shoring to retain the sides of the excavation required to construct the foundation upgrade. As stated in the EOR's basis of design, the structural upgrade is designed to meet the requirements of Section 403.9, Voluntary seismic improvements, of the San Francisco Existing Building Code (SFEBC), with the intent to reduce future building settlement and improve the seismic performance of the foundation.

The number and size of piles added is limited mostly by constraints of the site and the capability of the existing construction to transfer loads to the new piles, rather than driven by a targeted improvement in performance. As a result, and consistent with Section 403.9, the focus of the review by the EDRT is an assurance (1) that the altered structure is no less conforming to the

provisions of the San Francisco Building Code with respect to earthquake design than it was prior to the alteration, and (2) that the alterations do not create structural irregularities.

SCOPE OF REVIEW

The EDRT's independent review for the project was performed in accordance with the requirements of AB-082 (Nov. 21, 2018). Specifically, the review addressed the following topics:

- Project design criteria, including performance objectives, site-specific spectra for the Maximum Considered Earthquake (MCE_R) hazard, and MCE_R ground motion histories;
- Review of the geotechnical data and models to estimate resistance of the foundation elements to MCE_R ground motions and settlement under gravity loads;
- Review of structural models and criteria to assess the safety of the superstructure and foundations under MCE_R ground motions and gravity loads;
- Design of new piles and mat extension to meet the San Francisco Building Code requirements for new buildings under MCE_R ground motions and gravity loads;
- Assessment of the existing piles, foundation mat, and superstructure to meeting the requirements of Section 403.9 of the California Existing Building Code.

The EDRT has reviewed material presented to us by SGH, John A. Egan, and Slate during the design process. The following key documents, which reflect the state of the design as of August 23, 2019, include SGH's and Slate's satisfactory responses to EDRT comments.

- Drawings: 301 Mission Street, Perimeter Pile Upgrade. Sheets S001 through S503 (23 sheets total, SGH, dated 8/23/2019).
- Drawings: Perimeter Pile Upgrade – Indicator Pile Program, Sheets T000 through T002 (3 sheets total, SGH, dated 8/23/2019).
- Drawings: Perimeter Pile Upgrade – Temporary Excavation Shoring, Sheets H000 through S527 (12 sheets total, SGH, dated 8/23/2019).
- Project Manual Millennium Tower Perimeter Pile Upgrade (443 pgs., dated 8/23/2019).
- Structural Design Calculations Volumes #1 (R6, 8/21/2019), #2 (R5, 6/7/2019), #3 (R5, 6/7/2019), and #4 (R4, 5/20/2019)
- Final Geotechnical Report_Revision 1 (48 pages plus Appendices A-E, Egan/Slate, dated 8/13/2019).
- Written supplements and reports to EDRT comment log questions (through 8/26/2019).

In addition to providing written comments to the Design Team, which we tracked in a comment log (attached to this letter), we met face-to-face with members of the Design Team eleven times since September 2018. On each occasion we received updates on the design and discussed our most significant comments and the Design Team's responses to those comments. Where appropriate, the Design Team developed supplemental material relating to specific comments for our further review.

FINDINGS

To date, all our comments on the geotechnical and structural design have been adequately addressed by the Design Team, and there are no outstanding or unresolved issues. In our

professional opinion, once the foundation retrofit is constructed, the building is expected to have performance consistent with the stated design objectives and section 403.9 of the SFEBBC. Therefore, on the basis of our review we see no reason to withhold approval of the building permit for the structural upgrade of the foundation and the associated permits for shoring and excavation and the indicator pile program.

Given the inherent uncertainties in the foundation settlement and response, we recommend that the building performance be monitored during and upon completion of the proposed construction. Due to the characteristics of the Old Bay clay, which underlies the building foundation, the maximum stress developed within the existing mat and its extension due to uplift forces imposed by the new piles could occur over months, if not years, after jacking of the new piles has been completed. As specified in the design drawings, the EOR (SGH) has proposed a system of monitoring the mat settlement, pile forces, and building movement during jacking of the new piles and continuing for 10 years after completion of construction. The proposed construction has been designed to maintain necessary access to perform the monitoring and inspection of the new piles. The monitoring is to be performed by the Geotechnical Engineer and reported to the EOR and the San Francisco Department of Building Inspection. The EDRT considers the 10-year monitoring program, as specified in the foundation retrofit design drawings, to be appropriate and consistent with San Francisco's building code requirements.

The proposed foundation improvements are not currently considered a required repair according to the provisions of the San Francisco Existing Building Code and are therefore classified as a voluntary seismic retrofit. If the proposed retrofit is not implemented, further building tilt due to continued settlement may increase forces and deformations on the foundation, which in the future, could trigger mandatory repair provisions of the San Francisco Existing Building Code.

Finally, to the extent that successful execution of the proposed design is contingent on field conditions that are consistent with assumptions made in the design and will be validated by (1) testing during the indicator pile program, (2) installation and jacking of the new piles within tolerances, (3) surveys and inspection of structural attachments to the existing mat foundation, and (4) monitoring of building performance after implementation of the proposed foundation upgrade, we recommend that the EDRT remain engaged to advise the City of San Francisco through completion of construction and the 10-year monitoring program.

LIMITATIONS OF SCOPE

The EDRT's scope is limited to Engineering Design Peer Review, where our findings are based on the review of material submitted to us as indicated in our scope of work and the comment log. The responsibility for the design remains fully with the Structural Engineer of Record and Geotechnical Engineer of Record, consistent with AB-082 and Section 6.1.1 of the SEAOC recommendations for Project Design Peer Review [SEAOC, 1999, Recommended Guidelines for the Practice of Structural Engineering in California, Chapter 4, Project Design Peer Review, Professional Practice Committee, Structural Engineers of California, Sacramento California, Fifth Edition, September 1999.]. As outlined in our scope of work, our review has not addressed permitting issues associated with construction that extends outside of the 301 Mission Street building's property line. Moreover, the City of San Francisco is responsible for plan review of the design, including

coordination of the construction work with utilities, transportation, and other infrastructure and activities that are impacted by the construction work.

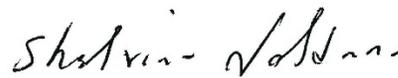
The EDRT is pleased to continue to assist SFDBI on this important project. Please contact us if you have any questions or need any further discussion in this regard.

Sincerely,

301 Mission Street Foundation Retrofit Engineering Design Review Team



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Craig Shields, P.E., G.E.
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cc: Naomi Kelly (City Administrator), Richard Tam (DBI), Ronald Hamburger (EOR)

Enclosure: 301 Mission Street - EDRT Comment Log - Final, August 27, 2019.