

ADMINISTRATIVE BULLETIN

NO. AB-082 :

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SUBJECT : Permit Processing and Issuance

TITLE : **Guidelines and Procedures for Structural, Geotechnical, and Seismic Hazard Engineering Design Review**

PURPOSE : The purpose of this Administrative Bulletin is to present guidelines and procedures for Structural, Geotechnical, and Seismic Hazard Engineering Design Review of buildings and other structures. Such Review may be required by the San Francisco Building Code, by another Administrative Bulletin, or at the request of the Director of the Department of Building Inspection (SFDBI).

REFERENCES :

- 2016 San Francisco Building Code (SFBC)
 - Section 101A.2, Purpose
 - Section 104A.2, Powers and Duties of Building Official
 - Section 104A.2.8, Alternate for materials, design, tests and methods of construction
 - Section 105A.6, Structural Advisory Committee
 - Chapter 16, Structural Design

ASCE 7-10 Minimum Design Loads for Buildings and Other Structures:

- Section 16.2.5 Design Review, Seismic Response History Procedures
- Section 17.7 Design Review, Seismically Isolated Structures
- Section 18.8 Design Review, Structures with Damping Systems

SEAOC, 1999, "Project Design Peer Review" (Chapter 4, October 1995)
Recommended Guidelines for the practice of Structural Engineering in California, Structural Engineers Association of California, Sacramento, California

DISCUSSION : See Commentary sections throughout this document.

1. SCOPE OF THIS BULLETIN

This bulletin addresses Structural, Geotechnical, and Seismic Hazard Engineering Design Review of buildings and other structures (referred to herein as "Review"). Review may apply to design of new structures, or addition, alteration, or retrofit of existing structures. It may apply to projects designed to the prescriptive provisions of the SFBC or to projects incorporating exceptions to the prescriptive provisions of the SFBC, at the discretion of the Director of the Department of Building Inspection (SFDBI). Review may include one or more of the following disciplines:

1. Structural Engineering
2. Geotechnical Engineering
3. Site-Specific Seismic Hazard Assessment
4. Earthquake Ground Motion Selection and Scaling

Commentary: The term “Structural, Geotechnical, and Seismic Hazard Engineering Design Review” (or “Review”) used herein is often referred to as “Peer Review.” It encompasses “Design Review” as required by ASCE 7-10 Section 16.2.5 (Seismic Response History Procedures), 17.7 (Seismically Isolated Structures), and 18.8 (Structures with Damping Systems). The Director requires Review when implicated by these Building Code sections, and may require Review in other instances as deemed necessary by the Director.

Reviewers and Review teams are distinct from a Structural Advisory Committee, which is a public body that the Director may convene in accordance with SFBC Section 105A.6 “to advise the Building Official on matters pertaining to the design and construction of buildings with special features or special design procedures.”

2. PURPOSE OF REVIEW

If the Director determines that Review is required, the Director shall request one or more Structural, Geotechnical, or Seismic Hazard Reviewers having specialized knowledge and experience to provide their professional opinion on identified aspects of a project. The purpose of the Review is to provide an independent, objective, technical review of those aspects of the project design that are identified in the scope of the Review. For projects that are intended to be fully compliant with the prescriptive provisions of the SFBC, the purpose of the Review also includes advising the Director whether the design aspects in the scope of the Review satisfy the prescriptive requirements of the SFBC. For projects incorporating exceptions to the prescriptive provisions of the SFBC, the purpose of the Review also includes advising the Director whether the design aspects in the scope of the Review satisfy the requirements of SFBC 2016 Section 104.11 (“Alternative materials, design and methods”) or other requirements or criteria identified in the scope of the review.

The Review shall not be construed to replace quality assurance measures ordinarily exercised by the Structural or Geotechnical Engineer of Record in the design of a structure or development of geotechnical design recommendations. Responsibility for the design, and the responsibility to demonstrate conformance of the design to the SFBC, resides solely with the Engineer of Record. The responsibility for conducting plan check resides with the Director and any plan check consultants. The responsibility for acceptance of a design and any decisions on the issuance of permits resides solely with the Director.

3. ADMINISTRATION OF REVIEW

Reviewers contract with SFDBI and are responsible to the Director. SFDBI is responsible for the payment of fees and other expenses for the professional services of the Reviewer(s). Reviewers shall provide their professional opinion to the Director and shall sign all written communication to the Director.

Commentary: SFDBI’s new process retains the Reviewer’s responsibility to the Director and aligns with a number of jurisdictions that contract directly with Reviewers and pass the cost through to the Project Sponsor. Previously, the City of San Francisco procedures for procurement of professional services have not been suited to directly contracting with consulting engineers, and Reviewers instead contracted with the Project Sponsor. The Reviewers nevertheless are responsible to and act under the instructions of the Director.

The Structural Engineers Association *Recommended Guidelines for the Practice of Structural Engineering in California*, 5th Edition (1999) recommends that appropriate language regarding design responsibility be included in the Reviewer’s contract:

“Responsibility for the structural design remains with the [Engineer of Record] because the [Reviewer] has no contractual ability to change or prepare contract documents. For this reason, an appropriate indemnification clause should be included in the [Reviewer’s] agreement with the client.”

Responsibilities of the Chair of a Review Team

On a project for which there is more than one Reviewer, the Director shall designate one of the Reviewers to serve as Chair of the Review Team. The Chair is responsible for leading the Review in his or her own discipline and for coordinating the Review. The Chair does not take responsibility for the professional opinions of Reviewers of other disciplines. Either the Reviewers jointly write a letter or

letters expressing the opinions of the Review Team, or the Reviewers in each discipline write separate letters to the Director addressing the findings and review scope for their discipline. Reviewers provide their professional opinion only in their area of expertise.

Distinction between Review reports and Construction Documents

None of the reports or documents from the Reviewer(s) are Construction Documents. Under no circumstances should letters or other documents from the Reviewer(s) be put into the Engineer of Record's project drawings or reproduced in any other way that makes Reviewer documents appear to be part of the Construction Contract Documents. The Engineer of Record is solely responsible for the Construction Contract Documents. Documents from the Reviewer(s) will be retained as part of SFDBI's project files.

4. QUALIFICATIONS AND SELECTION OF REVIEWERS

Each Reviewer shall be selected by the Director based on the Reviewer's qualifications applicable to the project and considering availability relative to the project schedule. The Director may, at his or her discretion, consult with the Project Sponsor, the Engineer of Record, or others before selecting the Reviewer(s), with the final selection of the Reviewer(s) being the sole responsibility of the Director. Reviewers shall disclose to the Director, in writing, any potential conflict of interest related to the project, the desired scope of Review, or the ability of the Reviewer to be independent and objective in the Review.

Each Reviewer providing professional engineering services shall be a Registered Design Professional holding a Professional Engineer (P.E.) license, in accordance with California law. Qualified engineering staff and reviewers not registered as a P.E., including reviewers from academia, can contribute to the review under the responsible charge of a registered P.E.

Additional registration requirements for each Review discipline are specified below. Where suitably qualified, it is acceptable for one Reviewer to fulfill more than one of these roles.

Structural Engineering Design Reviewers

Structural Engineering Design Reviewers shall have experience in structural engineering pertinent to the review scope and type of structure. If applicable to the review scope, they shall have experience in:

- Prescriptive requirements and, where applicable, the "alternative materials, design and methods" provisions of the SFBC
- Performance-based engineering
- Structural design and detailing for seismic performance
- Seismic evaluation and retrofit of existing structures
- Design of structures incorporating the materials, systems, and technologies to be incorporated in the project
- Nonlinear response-history analysis
- Applicable structural engineering research

In addition to having the experience described above, the lead Structural Engineering Design Reviewer shall be registered as a Structural Engineer (S.E.) in California. Additional Structural Engineering Design Reviewers who work as part of the Review team are not required to be registered Structural Engineers.

Geotechnical Engineering Reviewers

Geotechnical Engineering Reviewers shall have experience in geotechnical engineering pertinent to the review scope and type of site and foundation. If applicable to the review scope, they shall have experience in:

- Design of shallow and/or deep foundation systems of the type proposed for the project

- Interpretation of geotechnical and geological investigations
- Soil-foundation-structure interaction under static (gravity) and seismic loading conditions
- Liquefaction, landslides, and other geological site hazards
- Ground improvement
- Static and dynamic earth pressures
- Effects of dewatering on the project site and its vicinity
- Effects of construction-related activities on foundation performance of neighboring structures
- Numerical modeling of geotechnical and seismic hazards, and associated soil- structure interaction issues

In addition to having the experience described above, the lead Geotechnical Engineering Reviewer shall be registered as a Geotechnical Engineer (G.E.) or a Civil Engineer (C.E.) in California. Additional Geotechnical Engineering Reviewers who work as part of the Review team are not required to be registered Geotechnical or Civil Engineers.

Seismic Hazard and Ground Motion Reviewers

Reviewers of seismic hazard and ground motions shall have experience in these fields pertinent to the review scope and the hazard and ground motion approaches being used. If applicable to the review scope, they shall have experience in:

- SFBC requirements related to hazard and ground motions
- Fault sources and characteristics in the San Francisco Bay Area
- Probabilistic and deterministic seismic hazard assessment
- Site effects and site response analysis
- Ground motion prediction equations
- Selection and scaling of motions, and application of motions to a structure
- Applicable research on seismic hazard and ground motion selection and scaling

In addition to having the experience described above, the Reviewer of seismic hazard and ground motions shall be registered as a Professional Engineer in California or shall provide his or her services under the responsible charge of a registered Professional Engineer on the Review team.

5. PROJECTS REQUIRING REVIEW

The Director shall require Review for projects where Review is required by the SFBC. The Director may require Review for other projects at the Director's discretion. Table 1 lists project characteristics commonly considered by the Director in determining whether Review is required. Along with the characteristics in Table 1, the Director's determination of whether a project requires Review, and what Review disciplines are required, may depend on factors such as:

- Size, importance, occupant load, post-earthquake functionality requirements, or risk category of the structure
- Characteristics of the site, foundation system, and adjacent structures
- Irregular or unusual structural configurations
- Pertinent qualifications within SFDBI to conduct an in-house review

Commentary: Project Sponsors are strongly encouraged to contact SFDBI early in the project design process and to request a pre-application meeting with SFDBI and the Engineer of Record to determine Review requirements. The SFDBI AB-028 "Pre-application and Pre-addendum Plan Review Procedures" specifies procedures for requesting and carrying out such a meeting.

Table 1: Project Characteristics considered by the Director in determining whether Review is required

	Review discipline		
	Structural	Geotechnical	Site-specific Hazard ^e
Projects that require Review			
Projects where Review is required by the SFBC ^{a, b, c}	√	√	√
Projects that typically require Review			
Projects incorporating exception(s) to prescriptive requirements of the SFBC ^c	√	√	√
Projects incorporating materials, systems, or technologies that are not directly addressed by the SFBC ^c	√	√	√
Buildings with structural height (h_n as defined in ASCE 7) 240 feet or taller, including projects designed to the prescriptive provisions of the SFBC ^d	√	√	√
Projects that may require Review, depending on size, occupant load, importance, and similar considerations^h			
Addition or alteration of existing structures, where seismic retrofit is required by the SFBC ^f	√	√	
Projects on Site Class F sites requiring site responses analysis		√	√
Projects on sites with mapped or potential geologic or seismic ground deformation hazards		√	√
Projects on sites with compressible soils below the foundation, having potential for long-term consolidation settlement under gravity loads ^g		√	
Projects using ground improvement or special foundation systems		√	√
Projects with dewatering that lowers groundwater by more than 10 feet, located adjacent to major structures or utilities		√	
Projects with below-grade excavation deeper than 15 feet, located adjacent to major structures or utilities		√	

- ^a Ground Motion Review is required whenever response-history analysis is used.
- ^b Where Review is required by the SFBC, such review process shall also conform to the specific requirements of the SFBC. The 2016 SFBC references ASCE 7-10, which requires design review in Sections 16.2.5 (Seismic Response History Procedures), 17.7 (Seismically Isolated Structures), and 18.8 (Structures with Damping Systems)
- ^c The Director shall determine which Review disciplines are required based on which disciplines relate to the code requirements, code exceptions, or technologies proposed for the project.
- ^d All projects of new buildings 240 feet or taller located in the City's softest soils and/or liquefaction zones, as defined by the California Seismic Hazard Zone Map, released by the California Department of Conservation, Division of Mines and Geology, dated November 17, 2000, shall include two Geotechnical Reviewers on the Engineering Design Review Team unless the project will include piles/drilled piers anchored to bedrock. Only one Geotechnical Reviewer is required for a project that will anchor piles/piers to bedrock.
- ^e Review of site-specific hazard is not required if the general (rather than site-specific) earthquake response spectrum is used.
- ^f See commentary regarding Review of existing structures.
- ^g Soils with potential for long-term consolidation settlement typically include normally to lightly overconsolidated clayey soils, such as Bay Mud and Old Bay Clay, though other soils may also exhibit such behavior.
- ^h It is intended that most projects in this category would not require Review, except for major structures based on the list of considerations above this table.

Commentary: Review may be appropriate for the seismic evaluation or retrofit design of existing structures when such an evaluation is carried out according to either (a) SFEBC Sections 301.1.4.2.3/301.1.4.1.2, which reference the ASCE 41 standard, or (b) SFEBC Sections 301.1.4.2.1/301.1.4.1.1, which require a lateral strength of 75%/100% of that required for new buildings, sometimes assumed to be taken only in elements with structural detailing conforming to current code requirements. Review issues applicable to existing structures can include:

- Establishing appropriate material properties.
- Properly accounting for strength degradation, including acceptability limits for degrading components.
- Use of materials not covered in building codes, such as fiber-reinforced polymer (FRP).
- For evaluations per SFEBC Sections 301.1.4.2.1/301.1.4.1.1, evaluating the behavior and compatibility of existing elements, including gravity framing.

6. SCOPE OF REVIEW SERVICES

The scope of services for each Reviewer shall be approved by the Director. Each Reviewer shall provide to the Director a written copy of the proposed scope of services for the Reviewer's contract with SFDBI. The proposed scope of services in the contract and any changes proposed to be made thereto shall be approved by the Director. The following describes possible review services for the disciplines addressed in this bulletin.

Services common to all Review disciplines

The scope of services for Review disciplines addressed herein shall include the following:

- Define the scope of the Review.
- Participate in meetings with the Engineer of Record, other Reviewers, and representatives of the Director, either in person or remotely, to discuss and resolve technical issues.
- Review design criteria, methods, and assumptions, and compatibility of the criteria with the project objectives.
- Review, typically by spot-check, analysis results, calculations, and structural drawings. As appropriate, conduct limited independent analyses or calculations as a check of the design.
- Maintain a project Review comment log addressing the material reviewed, including Reviewer comments, the Engineer of Record's responses, and resolution of comments.
- Prepare a letter report that summarizes the findings of the Review and provides the Reviewer's professional opinion whether the aspects of the project in the Reviewer's purview are in conformance with criteria identified in the scope of the Review. Prepare interim letters if required for partial permitting.

At the discretion of the Director, the Review may be restricted to a single aspect, such as seismic design of the structural system, or it may include other aspects of design, such as design for wind resistance, design of special foundation or earth retaining systems, or the structural bracing of important non-structural elements.

The Review may cover design-build or contractor-designed items that affect structural and geotechnical performance relevant to the intended scope of the Review.

Structural Engineering Design Review services

If a Review of Structural Engineering Design is undertaken, the scope of services shall indicate the aspects of design or structural elements (e.g. seismic design, dampers, etc.) that are included in the Review. The scope of services may include review of the following:

- Structural performance goals

- Structural basis of design and overall concept
- Design methodology and acceptance criteria
- Mathematical modeling and simulation, including input assumptions
- Structural calculations
- Interpretation of analysis results
- Design and detailing of members and systems
- Structural Construction Documents, including drawings, specifications, and quality control and inspection provisions

Geotechnical Engineering Review services

If a Review of Geotechnical Engineering is undertaken, the scope of services shall include review of geotechnical engineering methods and assumptions and the geotechnical aspects of foundation design, as well as evaluation of the recommendations regarding geotechnical aspects of construction, which may include load testing and construction monitoring. This may include review of the following:

- Project geotechnical report, including draft versions as appropriate, and the final report
- Geotechnical basis of design
- Plans and drawings for the selected foundation system, including below-grade walls
- Pertinent calculations performed in support of geotechnical or foundation recommendations
- The proposed foundation system and its appropriateness for the structure and ground conditions encountered at the site
- Allowable foundation bearing pressures for gravity, seismic, and other relevant loading conditions
- Predicted foundation settlement, including expected and potential variation, under anticipated gravity and seismic loading conditions
- Design earth pressure, including static and seismic, for below-grade walls
- If used in the design evaluations, load-deflection characteristics of the soil-foundation system
- The assessment of risk for liquefaction, landslide, or other site geologic hazards
- Ground improvement recommendations, including static and seismic performance criteria
- The potential effects of construction activities
- Long-term interaction with foundations of existing adjacent and nearby structures
- The proposed foundation load testing program and load test program results
- The proposed quality control and quality assurance program for ground improvement
- The proposed monitoring program for evaluating performance of shoring, dewatering, adjacent buildings, and nearby improvements

Commentary: Often, design of ground improvement systems (e.g. deep soil mixing) is performed by a design-build contractor. In that case, the design team should provide to the Reviewers design-build contractor's calculations demonstrating that the ground improvement will perform as intended during the design ground motions. The contractor's ground improvement plan – including test section, quality control and quality assurance procedures, and post-improvement verification field measurements – should be reviewed by the Geotechnical Engineering Reviewer.

If design of deep foundations is performed by a specialty deep foundation contractor (e.g. torqued-in pipe piles), foundation performance criteria should be established by the design team, and verification load test results should be reviewed by the Geotechnical Engineering Reviewer.

Site-Specific Seismic Hazard Review services

If a Review of site-specific seismic hazard is undertaken, the scope of services shall include the review of site-specific earthquake spectra, the methods and assumptions used in development of the spectra, and SFBC requirements. This may include the review of:

- Fault sources, and associated magnitude ranges
- Site information and assumed shear wave velocity and other properties
- Application of ground motion prediction equations
- Adjustment for rupture directivity, orientation with respect to the fault, basin effects, maximum direction effects, or other effects
- Site response analysis, including effect of the presence of deep foundations and/or ground improvement on site response.
- Comparison of spectra to code-minimum requirements
- Soil-foundation-structure interaction effects, where included in the seismic hazard analysis

Earthquake Ground Motion Review services

The scope of services shall include the review of the motions to be used in the design, their selection, scaling to response spectra, their duration, and SFBC requirements. This may include review of:

- Fault sources and characteristics
- The method used for scaling or matching and the period range for scaling
- Suitability related to record characteristics such as magnitude, distance, mechanism, V_s 30 or other site parameters, scale factor, and the presence and period of pulses
- Orbit plots of the horizontal components of the records
- The location and orientation of how the records are applied to the structure

7. REVIEW PROCESS**Schedule**

Reviewers should be engaged as early in the design process as practical. This affords Reviewers and the design team an opportunity to evaluate fundamental design decisions, which could disrupt design development if addressed later in the design phase. Early in the design process, the Engineer(s) of Record, a representative of the Director, and the Reviewer(s) should convene a meeting to establish the scope of the Review, the methods and lines of communication, the timing of Review milestones, and the degree to which the Engineer(s) of Record anticipates the design will be developed for each milestone.

Submittals by the Engineer(s) of Record to the Reviewer(s)

The Engineer(s) of Record shall provide design submittals to the Reviewer(s). Submittals shall be organized and documented in a manner that facilitates review by the Reviewer(s).

Where engineering software is used to perform structural or geotechnical analysis, the Engineer of Record shall identify the version of software used and shall indicate key assumptions and how the analysis is applied to the project. The Engineer of Record shall, as requested, provide copies of data input and output for the Reviewer(s) and shall indicate those aspects of the output that govern the design. Where the software used is not commercially available or commonly used in the industry for the purpose undertaken, the Engineer of Record shall provide verification records indicating that the software is capable of proper solution of analysis of the type performed on the project. If the software is not available to the Reviewer(s) for the evaluation of the input and interpretation of results, the Engineer of Record shall provide such data as the Reviewer(s) deem necessary to perform verification that the work is properly executed.

Comment log

Reviewers shall provide written comments in a timely fashion to the Engineer(s) of Record and to the Director, with requests for response as necessary. The Engineer(s) of Record are responsible for responding to all comments. The Reviewer(s) shall maintain a log that summarizes Reviewer comments, Engineer of Record responses to comments, and resolution of comments. The Reviewer(s) shall make the log available to the Engineer(s) of Record, the Director, and the Project Sponsor as requested.

For projects designed to the prescriptive provisions of the SFBC, the comment log may identify aspects of the project for which performance might be improved by introducing design enhancements exceeding the minimum requirements of the SFBC. It is not required for the design to be modified to comply with these enhancements unless so directed by the Director.

Review findings reports

At the conclusion of the Review, and at other times requested by the Director, the Reviewer(s) shall submit to the Director a written report documenting the scope of the Review, the comment log, and the professional opinions of the Reviewer(s) regarding the design's conformance with the criteria identified in the scope of the Review.

8. DISPUTE RESOLUTION

The Engineer of Record and the Reviewer(s) shall interact in a professional manner. Reviewers shall prepare comments in a respectful manner, shall prepare in writing all requests for response, and shall make reasonable requests of the Engineer of Record for additional evaluations or backup information. The Engineer of Record shall respond clearly and completely to Reviewer comments.

The Engineer of Record and the Reviewer(s) shall attempt to develop a resolution on each issue raised. If the Engineer of Record and the Reviewer(s) are unable to resolve particular comments, the Reviewer(s) shall report the impasse to the Director, and the Director shall give the Engineer of Record and the Reviewer(s) the opportunity to explain their arguments.

The Director, as Building Official, makes all decisions concerning acceptance of a design and issuance of permits. The responsibility of the Reviewer is limited to providing his or her professional opinion to the Director. The Director, should the need arise, may address differences of opinion between the Engineer of Record and the Reviewer(s) in a method the Director deems appropriate. The Director also may engage additional outside consultants to assist in issue resolution.


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