



INFORMATION BULLETIN / PUBLIC - BUILDING CODE

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ALTERNATIVE DESIGN PROCEDURE (PERFORMANCE-BASED DESIGN) FOR SEISMIC ANALYSIS AND DESIGN OF TALL BUILDINGS AND BUILDINGS UTILIZING COMPLEX STRUCTURAL SYSTEMS

SCOPE

This Information Bulletin describes the acceptable alternate, performance-based approach for seismic design and analysis of tall buildings. The procedure is also applicable to all structural systems and highly recommended for buildings utilizing complex structural systems. Justifications for the use of alternative design procedures, which have traditionally been in the building codes, are found in the current codes: Section 104.11 of the 2015 International Building Code (IBC) and 2016 California Building Code (CBC), Section 104.2.6 of the 2017 Los Angeles Building Code (LABC), and Section 12.6 of ASCE 7-10, adopted by reference in the CBC and the LABC.

OVERVIEW

The building code provides a minimum level of safety through a series of prescriptive provisions. The prescriptive provisions are broadly applied to all types of buildings; from single story buildings to tall buildings. These building code provisions result in the application of requirements that are not specifically applicable to design of tall buildings and buildings with complex structural systems, and which may result in designs that are less optimal and less safe. Advances in performance-based design methodologies and capacity design principles allow for a more direct, non-prescriptive, and rational approach to analysis and design. The use of performance-based seismic design requires a detailed assessment of how a building will most likely perform during an earthquake event. This detailed assessment in the performance-based design process also provides a clear understanding of structural systems and detailed design and analysis while, at the same time, freeing the design from arbitrary restrictions.

APPROVED PROCEDURE

The Los Angeles Tall Buildings Structural Design Council (LATBSDC) document, "An Alternative Procedure for Seismic Analysis and Design of Tall Buildings Located in the Los Angeles Region," 2017 edition (www.tallbuildings.org) is the approved alternative procedure for the seismic design of buildings. Use of this performance-based approach is subject to prior approval by LADBS for the subject building, documented in the Modification of Building Ordinance form (www.ladbs.org, click on

[http://www.ladbs.org/docs/default-source/forms/plan-check-2014/request-for-modification-of-building-ordinances-\(blank\)-pc-all-mod00.pdf](http://www.ladbs.org/docs/default-source/forms/plan-check-2014/request-for-modification-of-building-ordinances-(blank)-pc-all-mod00.pdf)

SUMMARY OF PROCEDURE

The following is a brief summary of LADBS requirements and the requirements outlined in the above referenced LATBSDC document. Refer to the LATBSDC document for detailed procedures and guidance.

1. During the preliminary design, a discussion with LADBS management regarding the use of the alternate design procedure concept is necessary for approval and development of steps to follow through for timely completion of permitting and construction.
2. Early in the conceptual phase, submittal of the proposed design criteria and analysis by the Structural Engineer of Record and the design team with expertise in sophisticated structural and earthquake engineering is required. The team shall have expertise in the application of performance-based design and nonlinear history analysis including the project's Geotechnical/Geoseismic Engineer.
3. In accordance with ASCE 7-10, Section 16.2.5, a Seismic Peer Review Panel will be established by LADBS composed of at least two individuals, including a geotechnical engineer or engineering geologist with expertise in the development of ground motions and geotechnical/geoseismic engineering; a practicing structural engineer with expertise in the structural system, performance-based design and nonlinear response history. In addition, an academic of structural engineering with research expertise in the proposed structural system is required for buildings with more than 40 stories, buildings with unusual structural systems, or buildings with unconventional or atypical materials as determined by LADBS.
4. The performance-based design procedure will include the following three step seismic analysis and design procedure with the intent of providing the following characteristics:
 - a. Well-defined inelastic behavior where nonlinear actions and members are clearly defined and all other members are designed to be stronger than the elements designed to experience nonlinear behavior (Capacity Design Approach).
 - b. 43-Year Return Period – The building's structural and nonstructural systems and components remain serviceable when subjected to frequent earthquakes (50% in 30 years).
 - c. 2500-Year Return Period – The building has a very low probability of collapse during an extremely rare event (2% in 50 years with deterministic cap).

Proper application of this procedure and the subsequent analysis should result in a safer and more economical design along with a higher degree of confidence in building performance than the prescriptive requirements of the code.

SEISMIC PEER REVIEW PANEL

The Seismic Peer Review Panel provides an independent objective, technical review of those aspects of the structural design of the building that relates to seismic performance according to the requirements and guidelines described in this Bulletin, and advises LADBS whether the design generally conforms to the intent of this Bulletin and other requirements set forth by LADBS.

The Seismic Peer Review Panel will use the following guidelines to provide the necessary advice to LADBS:

1. The composition of the Seismic Peer Review Panel shall be subject to approval by LADBS. The cost of the Seismic Peer Review Panel shall be borne by the owner/applicant and be independent of the plan review and permitting fees required by LADBS.
2. The scope of review should include the following:
 - a. Earthquake hazard determination,
 - b. Ground motion characterizations,
 - c. Seismic design methodology,
 - d. Seismic design performance goals,
 - e. Acceptance criteria,
 - f. Mathematical modeling and simulation,
 - g. Seismic design and results,
 - h. Drawings and specifications, and
 - i. Location of seismographs and building structural monitoring systems.
3. A comment log shall be maintained with the Seismic Peer Review Panel's comments and Engineer of Record's written responses.
4. At the conclusion of the review, a written report shall be provided to LADBS indicating the professional opinions of the Seismic Peer Review Panel regarding the design's general conformance to the requirements of this Bulletin. This report shall also be incorporated in the final set of building plans.

Refer to Information Bulletin, P/BC 2017-147 for Structural Peer Review (SPR) protocol.