



## 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 2021 International Building Code (IBC) and 2022 California Building Code (CBC), Section 104.2.6 of the 2023 Los Angeles Building Code (LABC), and Section 12.6 of ASCE 7-16, 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 the design of tall buildings and buildings with complex structural systems, 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, which leads to a better understanding of the structural systems and a more accurate application of design and analysis. At the same time, it releases the design from non-applicable prescriptive 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," 2023 edition ([www.latallbuildings.org](http://www.latallbuildings.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 on a Modification of Building Ordinance form. ([www.ladbs.org](http://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))

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## **SUMMARY OF PROCEDURE**

The following is a brief summary of the 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 7-16, Section 16.5, 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 and a practicing Structural Engineer with expertise in the structural system, performance-based design and nonlinear response history procedures. 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. 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.

## **PEER REVIEW PANEL**

Refer to Information Bulletin, P/BC 2023-147 for Structural Peer Review (SPR) protocol.