



Planning & Development Department
Building and Safety Division



City of Berkeley Framework Guidelines for Nonstructural Component Seismic Retrofit Design

This document presents Guidelines for voluntary seismic retrofits performed as part of the Retrofit Grants Program. For wood-framed buildings that receive grants to retrofit structural vulnerabilities, these Guidelines address nonstructural components that are permitted, but not required, to be included in the retrofit scope. To be eligible for funding for nonstructural components under the Retrofit Grants Program using these Guidelines, buildings shall be in accordance with the following:

Eligibility Criteria: One or more of the listed vulnerabilities are permitted to be included in the retrofit scope, provided the applicable eligibility criteria are met.

For all Nonstructural Components:

- Building or portion of building is wood-framed, and
- Building has received a Retrofit Program Grant to retrofit a structural vulnerability, and

Masonry Chimneys:

- Chimneys are brick or stone masonry, and were constructed prior to 2000, and
- Chimneys have not had a seismic retrofit.

Egress Stairs and Decks:

Egress stair or deck does not have positive tension anchorage (steel straps, tie-down brackets, etc.) from the stair or deck to the framing inside of the supporting wood-framed building.

Clay Roof Tiles:

Clay roof tiles are not fastened in accordance with 2019 California Building Code (CBC) Section 1507.3.7 or approved equivalent.

Storefront Glass:

- Storefront glass is adjacent to a publicly accessible area (such as a sidewalk), and
- Storefront glass is not in accordance with California Building Code (CBC) Section 2404 or approved equivalent.

Other Falling Hazards:

- Heavy nonstructural components or building appendages on the building exterior that are more than six feet above adjacent grade, and
- Heavy nonstructural components or building appendages are adjacent to an egress path or an occupiable area or publicly accessible area, such as a sidewalk, and present a possible falling hazard as a result of earthquake shaking.

Water Heaters:

- Gas water heaters do not have seismic bracing, and/or
- Gas water heaters do not have flexible water and gas connections.

Commentary: Heavy nonstructural components or building appendages can include a wide variety of items that occur at the building exterior. Nonstructural components can include items such as mechanical, electrical, or similar equipment or architectural components such as cladding, signage or marquees. Appendages can include towers or similar elements.

Refer to the Retrofit Grants Program Rules for additional eligibility requirements, grant application procedures, and program details. Please visit the Retrofit Grants Program webpage at: <https://www.cityofberkeley.info/retrofitgrants/>

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Part A. Requirements for All Nonstructural Component Retrofit Projects

A.1 Intent, Scope, and Criteria

A.1.1 Retrofit Intent

These Guidelines describe requirements for voluntary seismic retrofits to reduce earthquake risks by limiting structural damage in vulnerable wood-frame buildings and their nonstructural components. The engineering criteria addressed in these Guidelines were selected to support this overall intent. Compliance with these Guidelines is not intended to achieve the seismic performance expected of a new building. Instead, the provisions aim to reduce risk by addressing common seismic weaknesses of wood-frame buildings with significantly less design effort, construction cost, and tenant disruption than would be needed to achieve new building equivalence. Risk reduction does not take a comprehensive approach to life safety, does not aim to protect property or function, and is not necessarily equivalent to new construction under the current building code.

A.1.2 Retrofit Scope

Retrofit Scope: *Retrofit scope is permitted to address one or more of the listed nonstructural component vulnerabilities. Once selected for retrofit, the vulnerability is required to be addressed in all locations that meet the eligibility criteria, except as otherwise permitted by the Building Official.*

A.1.3 Engineering and Prescriptive Criteria

Each building subject to these Guidelines shall be evaluated for eligibility (when required by eligibility criteria) and shall be retrofitted in conformance with one of the following engineering criteria or, to the extent applicable, prescriptive criteria. Retrofit in conformance with more stringent engineering criteria is acceptable subject to the approval of Retrofit Grants Program staff and the Building Official.

Engineering criteria are:

1. 2019 (or current edition) California Building Code (CBC) (see Guidelines Part B); or
2. ASCE 41-17, Seismic Evaluation and Retrofit of Existing Buildings, Chapter 13, using a nonstructural performance objective of Hazards Reduced for the BSE-2E earthquake (see Guidelines Part C); or
3. Other criteria as approved by the Building Official.

Alternative prescriptive criteria by component type are:

4. For masonry chimneys, FEMA P-1100, Chapter 7 prescriptive or engineered criteria; or
5. For egress stairs or decks, 2019 California Residential Code (CRC) Section R507.9.2; or
6. For clay roof tiles 2019 California Building Code (CBC) Section 1507.3.7; or
7. Other prescriptive criteria as approved by the Building Official.

A.2 Permit Submittal Requirements

The permit application shall include as part of the “Brief Description of Work” field, the following statement in addition to similar statements addressing other retrofit scope: “This project is

intended to comply with the Retrofit Grants Guidelines for Voluntary Retrofits of Nonstructural Components,” and specify what component(s) are to be retrofit. Please visit the City of Berkeley’s Permit Service Center website for current submittal information at https://www.cityofberkeley.info/Planning_and_Development/Permit_Service_Center/Permit_Submittal_Information.aspx

A.2.1 Construction Drawings

When using engineering retrofit criteria, construction drawings shall be prepared by a registered design professional and shall be stamped and signed prior to permit issuance. When using prescriptive design criteria, construction drawings shall be prepared by a licensed contractor or by the owner. Drawings shall include, as a minimum:

1. The registered design professional’s seal and signature on each drawing sheet, or where prepared by a contractor or owner, the contractor or owner’s signature on each drawing sheet.
2. All information necessary for plan review and for construction. Drawings shall accurately reflect the results of the engineering investigation and structural calculations.
3. The first sheet shall include a statement that the work was designed in compliance with the Retrofit Grants Guidelines for voluntary retrofit of Nonstructural Components (list component type(s) included in the retrofit) (see Guidelines Section A.6).
4. Retrofit projects seeking federal funding under the Retrofit Grants Program require an additional environmental and historic preservation (EHP) review as part of a retrofit grant approval process. If the seismic retrofit work results in exterior alterations to the existing building, please include exterior elevation drawings clearly showing any exterior changes when submitting a building permit application, in addition to the structural drawings.
5. The work proposed under the seismic retrofit permit may trigger additional requirements. Please see Building and Safety Division website <https://www.cityofberkeley.info/Triggers/> for a list of requirements triggered by building permit submittal based on the type and valuation of work.
6. Any deferred submittals or revisions to approved plans that affect the building’s exterior or significantly change the proposed scope of work may impact grant eligibility under the Retrofit Grants Program. Please alert Retrofit Grants Program staff of any deferred submittals or revisions to approved plans, as these may require additional review and approval by Federal Emergency Management Agency (FEMA) staff.

A.2.2 Structural Calculations and Supporting Documents

Structural calculations, where required by the selected retrofit criterion, shall be prepared by a registered design professional. Calculations and supporting documents shall demonstrate compliance with the selected engineering criteria. Calculations and supporting documents shall be specific to the engineering criteria used and shall include, at minimum:

1. The registered design professional’s seal and signature on the cover page of structural calculations and reports.
2. A statement that the calculations were prepared to demonstrate compliance with the Retrofit Grants Guidelines for voluntary retrofit of Nonstructural Components (list component types) (see Guidelines Section A.6).

3. Identification of the engineering criteria used for the retrofit design (see Guidelines Section A.1.3).
4. Building investigation and other reports referenced by the calculations, with a report summary indicating how the findings or conclusions are reflected in the calculations (see Guidelines Section A.3.1).
5. Identification of structural properties and capacities assumed for all existing materials and elements, including any capacity reductions for damage, deterioration, or defect.
6. Identification of structural properties and capacities assumed for all new materials and elements, including product literature for proprietary devices.
7. If requested by the Building Official, verification calculations for engineering software.
8. Other information required by the Building Official.

A.3 Assessment of Existing Building Conditions

A.3.1 Building Investigation

In support of a retrofit design, the registered design professional shall conduct an investigation of the existing building. The registered design professional shall document procedures, findings, and conclusions of the investigation and incorporate them into the permit submittal documents. The documentation may reference previous engineering evaluation reports or other materials submitted to support findings and conclusions. Where prescriptive design is used, the contractor or owner shall provide and document required investigations.

A.3.1.1 Scope of investigation. At minimum, the investigation shall comply with any investigation and assessment provisions in the specific engineering criteria selected from these Guidelines, as modified by subsequent Parts of these Guidelines. Otherwise, the investigation scope and methods may generally be set at the discretion of the registered design professional. Findings relevant to the evaluation shall be included in the permit submittal documents. The Building Official is authorized to require additional investigation as needed to fulfill the intent of the Guidelines. With the approval of the Building Official, field verification of assumed conditions may be performed during the construction phase.

The investigation shall include identification, verification, and assessment of existing conditions relevant to the engineering assumptions applied in the retrofit design. The investigation shall be based on a combination of non-destructive testing or inspection, destructive testing or inspection, and reference to record documents. Where record documents are used to reduce the scope of testing or other on-site work, appropriate field verification is required.

The investigation shall as a minimum include:

As required to determine eligibility and typical retrofit details.

- General configuration and condition of visible structural elements supporting the nonstructural components and their connections.*
- Where damage or defects are identified during the investigation, those conditions should be further investigated. The scope of the additional investigation will vary based on conditions observed.*

A.3.1.2 Timing of investigation. Unless otherwise required by the specific engineering criteria selected from these Guidelines, as modified by subsequent Parts of these Guidelines, and with the approval of the Building Official, portions of the investigation may be deferred to the construction phase. In such cases, the deferred investigation shall be specified as a deferred submittal item in accordance with CBC Section 107.3.4.1. Alert Retrofit Grants Program staff of any deferred submittals or revisions to approved plans, as these may require additional review and approval by Federal Emergency Management Agency (FEMA) staff.

A.3.2 Engineering Evaluation

Where required to determine eligibility for retrofit, an engineering evaluation of the existing condition shall be provided in accordance with the criteria of Sections A.1.3 and A.3.

A.3.3 Existing Materials and Components

Where the applicable engineering criteria specify material or structural properties of existing elements, those criteria shall be used. Otherwise, the general rules of this section apply.

A.3.3.1 Damage and defects. The capacity of any element damaged by deterioration, wear, or other causes or altered so as to differ from its intended condition shall be reduced based on the judgment of the registered design professional, subject to review of condition assessment findings and the approval of the Building Official. This provision shall apply where the applicable engineering criteria do not make an explicit provision for capacity reduction.

A.3.3.2 Concrete footings and stem walls. Evaluation of existing concrete footings shall be permitted to assume a default concrete strength of 2,500 psi for buildings constructed in 1950 or later, 2,000 psi for buildings constructed prior to 1950, or a larger value, if determined in accordance with ASCE 41-17.

A.4 New Materials and Components

All new materials and components incorporated into the retrofit shall conform to the requirements of the 2019 California Building Code.

A.5 Site Seismicity, Soil, and Geotechnical Considerations

A.5.1 Seismic Ground Motion Values

Where seismic ground motion values are calculated per ASCE 7-16 Section 11.4 or by similar provisions, and the site class is not known, Site Class D can be assumed. This requirement applies to any code-based procedure for calculating seismicity parameters, such as that used by ASCE 7-16 or ASCE 41-17.

A.5.2 Geologic Site Hazards

For purposes of complying with these Guidelines, geologic site hazards, including potential liquefaction, landslide, and fault rupture, need not be analyzed or mitigated.

A.6 Testing and Inspection

All work shall comply with inspection and testing requirements of CBC Chapters 1 and 17. Additional field verification, testing, and inspection may be required in accordance with the selected engineering criteria or as directed by the Building Official. Where required by the 2019 CBC, structural observation by the registered design professional responsible for the retrofit design is required for seismic retrofit projects performed in accordance with these Guidelines.

A.7 Requirements for Project Completion

To be eligible for Construction Grant reimbursement, the owner shall do all of the following:

1. Complete the seismic retrofit work along with the required city inspections.
2. Provide the City of Berkeley building inspector with completed special inspection reports, structural observation reports, and any other documents required.
3. Obtain an approved final inspection.
4. Where structural observation is required by the 2019 CBC, provide a final letter of structural observation wet-signed from the responsible registered design professional indicating that structural observation has been performed and the work has been completed in conformance with approved plans. This letter should be addressed to the Building and Safety Division, 1947 Center Street, Berkeley, CA 94704 or to the area inspector.
5. Provide the final affidavit from the special inspection agency for projects requiring special inspections.

A.8 Resources

The following resources provide general guidance for approaches to retrofitting:

1. FEMA 547
2. FEMA E-74
3. FEMA P-1100 (chimneys)
4. FEMA P-530 (water heaters)
5. "Guidelines for Earthquake Bracing of Residential Water Heaters," California Department of General Services, Division of the State Architect, March 2014.

Resources listed are intended to provide general retrofit approaches and detailing recommendations. Where the stated purpose, scope, reference codes or other requirements of the resources provided conflict with those of these Guidelines, the provisions of these Guidelines shall apply, subject to the discretion of the Building Official.

Part B. 2019 (or Current Edition) CBC

B.1 General Clarifications

Where the stated purpose, scope, reference codes or other requirements of 2019 CBC conflict with those of these Guidelines, the provisions of these Guidelines shall apply, subject to the discretion of the Building Official.

B.2 Specific Clarifications

B.2.1 Scope of Analysis

The seismic evaluation and retrofit design are to be in accordance with the 2019 CBC.

B.2.2 Default Strength Values for Existing Materials and Components

Default values for seismic evaluation and retrofit design involving existing components in sound condition may be taken from ASCE 41-17, SDPWS (AF&PA, 2015), or Guidelines Table B.2.2, with adjustments for nominal vs. expected strength, ASD, or LRFD as appropriate for code-based design using the IEBC.

Table B.2.2 Default Nominal Strength Values for Existing Materials and Components

Existing Material or Component	Default Nominal Strength Value ¹
Roof diaphragms with straight sheathing and roofing applied directly to the sheathing, in shear	300 plf ²
Roof diaphragms with diagonal sheathing and roofing applied directly to the sheathing, in shear	750 plf ²
Floor diaphragms with straight tongue-and-groove sheathing, in shear	300 plf ²
Floor diaphragms with straight sheathing and finished wood flooring with board edges offset or perpendicular, in shear	750 plf ²
Floor diaphragms with diagonal sheathing and finished wood flooring, in shear	750 plf ²
Plain concrete footings	
Buildings Constructed 1950 and later	$f'c=2,500 \text{ psi}$
Other buildings	$f'c=2,000 \text{ psi}$
Douglas Fir wood	Same as DF No.1
Reinforcing steel	$f_y = 40,000 \text{ psi}$
Structural steel	$F_y = 33,000 \text{ psi}$

¹ Where element capacities are based on allowable stresses from codes and standards, nominal strengths shall be taken no greater than the allowable stresses multiplied by the following factors: 1.7 for steel; 2.5 for masonry; 2.0 for wood.

² For LRFD, the capacity reduction factor or resistance factor may be taken as 1.0.

Part C. ASCE 41-17

C.1 General Clarifications

Where the stated purpose, scope, reference codes or other requirements of ASCE 41-17 conflict with those of these Guidelines, the provisions of these Guidelines shall apply, subject to the discretion of the Building Official.

C.2 Specific Clarifications

C.2.1 Retrofit Procedures (ASCE 41-17 Section 2.3.2)

For purposes of compliance with these Guidelines, retrofit shall be in accordance with Chapter 13, Architectural, Mechanical, and Electrical Components, using a Hazards Reduced nonstructural performance level.

C.2.2 Seismic Hazard Parameters (ASCE 41-17 Section 2.4.1)

Seismic hazard parameters for the BSE-2E hazard may be obtained using the web tool available at <https://seismicmaps.org/>.

C.2.3 Site Classes (ASCE 41-17 Section 2.4.1.6)

Where the Site Class is known from available documents, the known Site Class should be used. Where the Site Class is not known, Site Class D may be assumed.

References

- AF&PA, 2009. *ASD/LRFD Wind & Seismic: Special Design Provisions for Wind and Seismic, 2008 Edition* [ANSI/AF&PA SDPWS-2008]. American Forest & Paper Association, Inc.
- ASCE, 2016. *Minimum Design Loads and Associated Criteria for Buildings and Other Structures* (ASCE/SEI 7-16). American Society of Civil Engineers.
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- Berkeley, 2020. *Berkeley Municipal Code* (BMC). Available at: <http://codepublishing.com/ca/berkeley/>
- DSA, 2014. "Guidelines for Earthquake Bracing of Residential Water Heaters," California Department of General Services, Division of the State Architect.
- CBC, 2019. *2019 California Building Code*. California Building Standards Commission. Available at: <https://www.dgs.ca.gov/BSC/Codes>.
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- FEMA, 2019. Vulnerability-Based Seismic Assessment and Retrofit of One- and Two-Family Dwellings (FEMA P-1100), Federal Emergency Management Agency.
- FEMA, 2006. Techniques for the Seismic Rehabilitation of Existing Buildings (FEMA 547), Federal Emergency Management Agency.

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