

**ARTICLE 11
EVALUATION OF CRITICAL NONSTRUCTURAL COMPONENTS
AND SYSTEMS**

11.0 INTRODUCTION

This article covers nonstructural components and systems critical to patient care.

11.01 NONSTRUCTURAL EVALUATION PROCEDURE

1. The nonstructural performance evaluation shall examine the respective critical nonstructural systems and elements for the planned NPC as specified in Table 11.1, "Nonstructural Performance Categories".

The nonstructural evaluation process shall include the following steps:

1. Site visit and data collection;
 2. Identification of building SPC;
 3. Identification of critical nonstructural systems for the planned NPC;
 4. Identification of critical care services housed in the building;
 5. Final evaluation for the critical nonstructural elements and systems for the planned NPC;
 6. Preparation of evaluation report, and
 7. Submittal of evaluation report to OSHPD.
2. A general acute care hospital facility may be exempted from a nonstructural evaluation upon submittal of a written statement by the hospital owner to OSHPD certifying the following conditions:
 1. The building is designated "NPC 1" in conformance with Table 11.1 "Nonstructural Performance Categories", or
 2. The building is designated "NPC 4" in conformance with Table 11.1 "Nonstructural Performance Categories" and provided:
 - a) The building was designed and constructed under a building permit issued by OSHPD;
 - b) All subsequent repairs, remodels, additions and alterations were performed under a permit issued by OSHPD, and
 - c) Fire sprinkler systems have been retrofitted in conformance with Table 11.1, "Nonstructural Performance Categories".
 3. If a hospital owner elects to obtain a higher NPC at a future date, additional nonstructural evaluations as specified in Section 11.01.1 will be required.

4. If a hospital owner sells or leases the hospital to another party, a complete nonstructural evaluation and list of all nonstructural deficiencies to achieve NPC 5 shall be submitted to the Office prior to the completion of the sale or lease.

11.1 NONSTRUCTURAL PERFORMANCE CATEGORIES

Each building shall be assigned a Nonstructural Performance Category (NPC), based upon the degree of anchorage and bracing of selected nonstructural elements and systems. This includes architectural, mechanical, electrical, and hospital equipment in addition to associated conduit, ductwork, piping, and machinery. NPCs are defined in Table 11.1.

11.1.1 Site Visit and Evaluation

The evaluator shall:

1. Visit the building to observe and record the type, nature, and physical condition of the nonstructural elements and systems for the planned NPC;
2. Note the SPC of the buildings based on procedures followed in Article 2;
3. Assemble building design data including:
 - a. Construction drawings, specifications and calculations, and
 - b. All drawings, specifications and calculations for remodeling work.
4. During the visit, the evaluator shall:
 - a. Verify existing data;
 - b. Develop other needed data (e.g., measure and sketch building if necessary);
 - c. Verify the critical nonstructural systems of the planned NPC;
 - d. Verify the critical care areas/services, and
 - e. Identify special conditions which may impact the nonstructural systems or endanger the function of the critical care areas/services.

If drawings are not available, the site visit and evaluation shall be performed as described in this section.

5. Review other data available such as assessments of building performance and function following past earthquakes;
6. Prepare a summary of data using an OSHPD approved format;
7. Perform the evaluation using the procedures in Section 11.2.
8. Prepare a report of the findings of the evaluation using an OSHPD approved format.

11.2 EVALUATION OF BUILDINGS

Conforming and nonconforming buildings shall be placed in an NPC based upon the degree of anchorage and bracing for those systems and equipment specified in Table

11.1. The scope of the nonstructural evaluation may be limited to the nonstructural systems and elements specified in Table 11.1 for the planned NPC. Buildings which do not meet the requirements for NPC 2 as defined in Table 11.1 shall be placed in NPC 1.

11.2.1. Evaluation Procedures for NPC 2

The following steps shall determine if the building meets the criteria for NPC 2:

- a) Identify the specific nonstructural components and equipment that are subject to the requirements of NPC 2 as specified in Table 11.1;
- b) Conduct an inventory of components and equipment noting whether the items are anchored or braced;
- c) Determine if the anchorage or bracing of the identified components and equipment complies with the following conditions:
 - 1. Installed under a permit issued by OSHPD. Drawings showing the installation and bearing an OSHPD approval stamp are required to show that the installation conforms to Part 2, Title 24; or,
 - 2. Reviewed and approved by the Department of General Services, Office of Architecture and Construction, Structural Safety Section. Drawings showing: a) the installation; b) bear an Office of Architecture and Construction, Structural Safety Section approval stamp; and c) a five digit project number on the approval that begins with the "H" prefix, are required to demonstrate that the installation conforms to Part 2, Title 24. It shall also be demonstrated by a written report submitted by the structural engineer, acceptable to the enforcement agency, that an investigation of the anchorage and bracing of components and equipment identified in Section 11.2.1(a) shows it to be constructed in reasonable conformity with these drawings.

Anchorage and bracing of elements that comply with either of these conditions are considered to meet the requirements of NPC 2;

Installation is defined as that which shows the size and type of material for all components of the system, including the anchor or fastener manufacturer (if proprietary), type, total number and embedment if connected to structural concrete, masonry or wood.

- d) If the components and equipment inventoried in 11.2.1(b) is anchored or braced, but do not meet the requirements of Section 11.2.1(c), determine if the bracing and anchorage is sufficient to meet the code requirements specified in Table 11.1. The bracing capacity shall be determined by calculations based upon information shown in the construction documents. If these documents are incomplete or unavailable, the evaluation shall be based on the as-built conditions, with the capacity of fasteners to masonry, concrete, or wood determined by approved tests, and

- e) If any of the items inventoried in 11.2.1(b) are unanchored or inadequately braced as determined by Section 11.2.1(d), the building shall be placed in NPC 1.

11.2.2 Evaluation Procedures for NPC 3 and NPC-3R

The following steps shall determine if the building meets the criteria for NPC 3 or NPC 3R:

- a) Identify the specific nonstructural components and equipment that are subject to the requirements of NPC 2 and NPC 3 or NPC 3R;
- b) Conduct an inventory of components and equipment specified in Table 11.1, NPC 3 and NPC 3R, noting whether the components and equipment are anchored or braced;

Exception: Any general acute care hospital facility located in both a “rural area” as defined in Section 70059.1, Division 5, Title 22 and Seismic Zone 3 per 1995 California Building Code (CBC) or later version of the CBC shall comply with the fire sprinkler system anchorage and bracing requirements of NFPA 13, 1994 edition or subsequent standard by January 1, 2013.

- c) Determine the level of NPC-3 conformance desired.
 - 1. Buildings classified as SPC 1 or SPC 2 are permitted to meet the NPC 3 performance level, or the NPC-3R performance level. See also Section 11.2.3(c).
 - 2. Buildings classified as SPC 3 or higher must meet the NPC 3 performance level.
- d) Determine if the anchorage or bracing of the identified components and equipment complies with the following conditions:
 - 1. Installed under a permit issued by OSHPD. Drawings showing the installation and bearing an OSHPD approval stamp are required to show that the installation conforms to Part 2, Title 24; or,
 - 2. Reviewed and approved by the Department of General Services, Office of Architecture and Construction, Structural Safety Section. Drawings showing: a) the installation; b) bear an Office of Architecture and Construction, Structural Safety Section approval stamp; and c) a five-digit project number on the approval stamp that begins with an “H” prefix, are required to demonstrate that the installation conforms to Part 2, Title 24. It shall also be demonstrated by a written report submitted by the structural engineer, acceptable to the enforcement agency, that an investigation of the anchorage and bracing of components and equipment identified in Section 11.2.2(a) shows it to be constructed in reasonable conformity with these drawings.

Anchorage and bracing of elements that comply with either of these conditions are considered to meet the requirements of NPC 2 and NPC 3 or NPC 3R.

Installation is defined as that which shows the size and type of material for all components of the system including the anchor or fastener manufacturer (if proprietary), type, total number and embedment if connected to structural concrete, masonry or wood.

- e) If the components and equipment inventoried in 11.2.2(b) are anchored or braced, but do not meet the requirements of Section 11.2.2(d), determine if the bracing and anchorage is sufficient to meet the code requirements specified in Table 11.1 for NPC 3 or NPC 3R. The bracing capacity shall be determined by calculations based upon information shown in the construction documents. If these documents are incomplete or unavailable, the evaluation shall be based on the as-built conditions, with the capacity of fasteners to masonry, concrete, or wood determined by approved tests. For NPC 3R, the investigation of the adequacy of anchorage and bracing may be limited to the connection of the component or equipment to the support when the total reaction at the point of support (including the application of F_p) is less than:
1. 250 pounds for components or equipment attached to light frame walls. For the purposes of this requirement, the sum of the absolute value of all reactions due to component loads on a single stud shall not exceed 250 pounds.
 2. 1,000 pounds for components or equipment attached to roofs, or walls of reinforced concrete or masonry construction.
 3. 2,000 pounds for components or equipment attached to floors or slabs-on-grade.

Exception: If the anchorage or bracing is configured in a manner that results in significant torsion on a supporting structural element, the effects of the nonstructural reaction force on the structural element shall be considered in the anchorage design.

- f) If any of the items inventoried in 11.2.2(b) are inadequately anchored or braced, as determined by Section 11.2.2(d), the building shall be placed in NPC 2.

11.2.3 Evaluation Procedures for NPC 4

The following steps shall be followed to determine if the building meets the criteria for NPC 4:

- a) Identify the specific nonstructural components and equipment that are subject to the requirements of NPC 2 through NPC 4;
- b) Conduct an inventory of components and equipment specified in Table 11.1, NPC 2 through NPC 4, noting whether the components and equipment are anchored or braced;

- c) Determine if the anchorage or bracing of the identified components and equipment complies with the following conditions:
 - 1. Installed under a permit issued by OSHPD. Drawings showing the installation and bearing an OSHPD approval stamp are required to show that the installation conforms to Part 2, Title 24. Installation or retrofit of components that were designed to meet NPC-3R requirements must be shown to meet the anchorage and bracing requirements of the California Building Code for new construction. Components designed to meet NPC 3R requirements that do not meet the anchorage and bracing requirements for new construction shall be retrofitted to meet those requirements; or
 - 2. Reviewed and approved by the Department of General Services, Office of Architecture and Construction, Structural Safety Section. Drawings showing: a) the installation; b) bear an Office of Architecture and Construction, Structural Safety Section approval stamp; and c) a five digit project number on the approval stamp that begins with an "H" prefix, are required to demonstrate that the installation conforms to Part 2, Title 24. It shall also be demonstrated by a written report submitted by the structural engineer, acceptable to the enforcement agency, that an investigation of the anchorage and bracing of components and equipment identified in Section 11.2.3(a) shows it to be constructed in reasonable conformity with these drawings.

Anchorage and bracing of elements that comply with either of these conditions are considered to meet the requirements of NPC 4;

Installation is defined as that which shows the size and type of material for all components of the system including the anchor or fastener manufacturer (if proprietary), type, total number and embedment if connected to structural concrete, masonry or wood.

- d) If the components and equipment inventoried in 11.2.3(b) are anchored or braced, but do not meet the requirements of Section 11.2.3(c), determine if the bracing and anchorage is sufficient to meet the code requirements specified in Table 11.1. The bracing capacity shall be determined by calculations based upon information shown in the construction documents. If these documents are incomplete or unavailable, the evaluation shall be based on the as-built conditions, with the capacity of fasteners to masonry, concrete, or wood determined by approved tests, and
- e) If any of the items inventoried in 11.2.3(b) is unanchored or inadequately braced as determined by Section 11.2.3(d), the building shall be placed in NPC 3.

11.2.4 Evaluation Procedures for NPC 5

The following steps shall determine if the building meets the criteria for NPC 5:

- a) Identify the specific nonstructural components and equipment that are subject to the requirements of NPC 2 through NPC 5;

- b) Conduct an inventory of components and equipment specified in Table 11.1, NPC 2 through NPC 5, noting whether the components and equipment are anchored or braced;
- c) Determine if the anchorage or bracing of the identified components and equipment complies with the following conditions:
 - 1. Installed under a permit issued by OSHPD. Drawings showing the installation and bearing an OSHPD approval stamp are required to show that the installation conforms to Part 2, Title 24; or,
 - 2. Reviewed and approved by the Department of General Services, Office of Architecture and Construction, Structural Safety Section. Drawings showing: a) the installation; b) bear an Office of Architecture and Construction, Structural Safety Section approval stamp; and c) a five digit project number on the approval stamp that begins with an "H" prefix, are required to demonstrate that the installation conforms to Part 2, Title 24. It shall also be demonstrated by a written report submitted by the structural engineer, acceptable to the enforcement agency, that an investigation of the anchorage and bracing of components and equipment identified in Section 11.2.4(a) shows it to be constructed in reasonable conformity with these drawings.

Anchorage and bracing of elements that comply with either of these conditions are considered to meet the requirements of NPC 5;

Installation is defined as that which shows the size and type of material for all components of the system including the anchor or fastener manufacturer (if proprietary), type, total number and embedment if connected to structural concrete, masonry or wood.

- d) If the components and equipment inventoried in 11.2.4(b) are anchored or braced, but do not meet the requirements of Section 11.2.4(c), determine if the bracing and anchorage is sufficient to meet the code requirements specified in Table 11.1. The bracing capacity shall be determined by calculations based upon information shown in the construction documents. If these documents are incomplete or unavailable, the evaluation shall be based on the as-built conditions, with the capacity of fasteners to masonry, concrete, or wood determined by approved tests, and
- e) If any of the items inventoried in 11.2.4(b) is inadequately anchored or braced as determined by 11.2.4 (d), the building shall be placed in NPC 4.

11.3 TESTING REQUIREMENTS FOR EVALUATING THE PERFORMANCE OF EXISTING MECHANICAL FASTENERS

A testing program shall be instituted to determine the capacity of mechanical fasteners used to anchor non-structural components including the bracing of pipes, ducts, and conduit, and the attachment of equipment and other components listed in the 1995 CBC, Part 2, Title 24, Table 16A-O. Anchors shall be categorized as either seismic bracing of

pipes ducts or conduit or equipment and other component anchors.

11.3.1 Anchors Used in the Seismic Bracing of Pipes, Ducts, or Conduit

For anchors used in the seismic bracing of pipes, ducts, or conduit, the following shall apply:

1. 20% of the anchors (20 minimum) of a given size and type (wedge, shell and sleeve for expansion bolts), at each level of the structure shall be tension tested to 3 times the maximum calculated design load specified in Section 1630B of 1998 California Building Code (CBC) or equivalent provision in later version of the CBC but not less than 500 pounds. A minimum of one anchor in any 4-bolt group shall be tested assuming an equal distribution of the calculated force to the bolt group. One-quarter (1/4) inch diameter anchors need not be tested. Where none of the anchors in the group have calculated tension, testing shall consist of torque testing.

Exception: Internally threaded anchors, such as shell type anchors, shall be tested to 4 times the maximum calculated design loads. Attachment hardware shall be shimmed or removed prior to testing so that it does not prevent the possible withdrawal of the anchor.

2. If an anchor fails the tension test, 20 anchors, installed by the same trade, in the immediate vicinity of the failed anchor shall be tested prior to resuming to a 20% sampling rate for testing.

11.3.2 Anchors used in the attachment of equipment and other components

For anchors used in the attachment of equipment and other components listed in the 1995 CBC, Part 2, Title 24, Table 16A-O, The following shall apply:

1. A minimum of one anchor of a given size shall be tension tested for each piece of equipment or other component under consideration. Where the number of anchors for the piece of equipment or component exceeds four, a minimum of 20% of the anchors shall be tension tested. Where none of the anchors in the group have calculated tension, testing shall consist of torque testing.
2. The tension test load shall be 3 times the maximum tension force calculated for an anchor in the attachment group using the design loads specified in Section 1630B of 1998 California Building Code (CBC) or equivalent provision in later version of the CBC or 500 pounds minimum. One-quarter (1/4) inch diameter anchors need not be tested.

Exception: Internally threaded anchors, such as shell type anchors, shall be tested to 4 times the maximum calculated design loads. Attachment hardware shall be shimmed or removed prior to testing so that it does not prevent the possible withdrawal of the anchor.

3. If a single anchor fails, all anchors in the attachment group shall be tested. If two (2) or more anchors fail, the component shall be retrofitted for the forces as for new construction.

11.3.3 Tension Testing Procedure

1. Testing of anchors shall be accomplished by the application of externally applied direct tension force to the anchor. The testing apparatus shall not restrict the probable shear cone failure surface of the concrete or masonry.
2. Torque testing is not permitted in lieu of tension testing unless specifically allowed in these provisions.
3. A failure is defined when the tension load on the anchor produces a slip of 1/8 inch, a shear cone failure in the concrete or masonry, concrete splitting, or fracture of the steel anchor itself prior to attaining the test load value.

Exception: For internally threaded anchors the allowable slip shall not exceed 1/16 inch.

11.3.4 Alternate test criteria. In lieu of testing in accordance with Sections 11.3.1 or 11.3.2, a test load may be established by the evaluating engineer. The allowable load that the anchor can resist shall be determined by dividing the test load by the appropriate factors noted in Sections 11.3.1 or 11.3.2. No one-third increase is permitted for seismic or wind loads.

11.3.5 Allowable shear loads. Allowable shear loads on anchors shall be determined by either of the following:

1. Shear values listed in Table 19B-E of 1998 California Building Code (CBC) or equivalent provision in later version of the CBC, or;
2. Shear values shall be obtained by analysis using **Strength Design of Anchorage to Concrete**, Section A.6 published by the Portland Cement Association, 1999, with the specified reduction coefficient(s) to convert the "strength" values to allowable stress design values of 1.7.

**Table 11.1
Nonstructural Performance Categories**

Time frames	Nonstructural Performance Category ¹	Description
	NPC 1	Buildings with equipment and systems not meeting the bracing and anchorage requirements of any other NPC.
January 1, 2002	NPC 2	<p>The following are braced or anchored in accordance with Part 2, Title 24¹:</p> <ul style="list-style-type: none"> • communications systems, • emergency power supply, • bulk medical gas systems, • fire alarm systems; and • emergency lighting equipment and signs in the

		means of egress.
January 1, 2008	NPC 3 / NPC-3R	<p>The building meets the criteria for NPC “2” and in critical care areas, clinical laboratory service spaces, pharmaceutical service spaces, radiological service spaces, and central and sterile supply areas, the following components meet the bracing and anchorage requirements of Part 2, Title 24² :</p> <ul style="list-style-type: none"> • Nonstructural components, listed in the 1995 CBC, Part 2, Title 24, Table 16A-O, Part 2 . Exception: For NPC-3R, lateral bracing of suspended ceiling systems may be omitted in rooms with a floor area less than 300 square feet, provided the room is not an intensive care or coronary care unit patient room, angiography laboratory, cardiac catheterization laboratory, delivery room, operating room, or post-operative recovery room. • Equipment, as listed in the 1995 CBC, Part 2, Title 24, Table 16A-O, “equipment” including equipment in the physical plant that service these areas. Exceptions: <ol style="list-style-type: none"> 1. Seismic restraints need not be provided for cable trays, conduit and HVAC ducting. Seismic restraints may be omitted from piping systems, provided that an approved method of preventing release of the contents of the piping system in the event of a break is provided. 2. Only elevator(s) selected to provide service to patient, surgical, obstetrical, and ground floors during interruption of normal power need meet the structural requirements of Part 2, Title 24. • Fire sprinkler systems comply with the bracing and anchorage requirements of NFPA 13, 1994 edition or subsequent applicable standards. Exception: Acute care hospital facilities in both a rural area as defined by Section 70059.1, Division 5 of Title 22 and Seismic Zone 3 shall comply with the bracing and anchorage requirements of NFPA 13, 1994 edition or subsequent applicable standards by January 1, 2013.
	NPC 4	<p>The building meets the criteria for NPC “3” and all architectural, mechanical, electrical systems, components and equipment, and hospital equipment meet the bracing and anchorage requirements of Part 2, Title 24². This category is for classification purposes of the Office of Emergency Services.</p>
January 1, 2030	NPC 5	<p>The building meets the criteria for NPC “4” and on-site supplies of water and holding tanks for wastewater, sufficient for 72 hours emergency operations, are integrated into the building plumbing systems. As an alternative, hook-ups</p>

		to allow for the use of transportable sources of water and sanitary waste water disposal have been provided. An on-site emergency system as defined within Part 3, Title 24 is incorporated into the building electrical system for critical care areas. Additionally, the system shall provide for radiological service and an onsite fuel supply for 72 hours of acute care operation.
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¹ For the purposes of NPC 2 and NPC 5, all enumerated items within Table 11.1 shall meet the requirements of Section 1632A of 2001 California Building Code (CBC) or equivalent provision in later version of the CBC by the specified timeframe as indicated by their respective NPC.

² For the purposes of NPC 3 and NPC 4, all enumerated items within Table 11.1 shall meet the requirements of the 1998 CBC, Section 1630B, by the specified timeframe. For the purposes of NPC 3R, all enumerated items within Table 11.1 shall meet the requirements of the 1995 CBC, Section 1630A, using $I_p=1.0$, by the specified timeframe.