

INTERNATIONAL BUILDING CODE 2003

STORY DRIFT

REQUIREMENTS

I. CONTRACTORS RESPONSIBILITY

Establishes the contractor is responsible for story-drift compliance for the structure and components

1705.3 Contractor responsibility.

Each contractor responsible for the construction of a seismic-force-resisting system, designated seismic system, or **component** listed in the quality assurance plan shall submit a written contractor's statement of responsibility to the building official and to the owner prior to the commencement of work on the system or component.

The contractor's statement of responsibility shall contain the following:

1. Acknowledgment of awareness of the special requirements contained in the quality assurance plan.
2. Acknowledgment of awareness of the special requirements contained in the quality assurance plan.. **Acknowledgment that control will be exercised to obtain conformance with the construction documents approved by the building official.**
3. Procedures for exercising control within the contractor's organization, the method and frequency of reporting and the distribution of the reports.
4. Identification and qualifications of the person(s) exercising such control and their position(s) in the organization.

II. STAIRS, A COMPONENT OF THE STRUCTURAL SYSTEM

Defines COMPONENT

COMPONENT. A part or element of an architectural, electrical, mechanical or structural system.

Component, equipment. A mechanical or electrical component or element that is part of a mechanical and/or electrical system within or without a building system.

Component, flexible. Component, including its attachments, having a fundamental period greater than 0.06 second.

Component, rigid. Component, including its attachments, having a fundamental period less than or equal to 0.06 second.

SEISMIC-FORCE-RESISTING SYSTEM. The part of the structural system that has been considered in the design to provide the required resistance to the seismic forces prescribed herein.

SEISMIC FORCES. The assumed forces prescribed herein, related to the response of the structure to earthquake motions, to be used in the design of the structure and its **components.**

SEISMIC USE GROUP. A classification assigned to a building based on its use as defined in Section 1616.2.

Stairs are a component.

1621.1 Component design.

Architectural, mechanical, electrical and nonstructural systems, components and elements permanently attached to structures, including supporting structures and attachments (hereinafter referred to as “components”), and nonbuilding structures that are supported by other structures, shall meet the requirements of **Section 9.6 of ASCE 7** except as modified in **Sections 1621.1.1, 1621.1.2 and 1621.1.3, excluding Section 9.6.3.11.2, of ASCE 7, as amended in this section.**

9.6 Architectural, mechanical, and electrical components and systems.

Requires components to have same Seismic Design Category as that of the structure.

9.6.1 General

Section 9.6 establishes minimum design criteria for architectural, mechanical, electrical, and nonstructural systems, components, and elements permanently attached to structures including supporting structures and attachments (hereinafter referred to as “components”). The design criteria establish minimum equivalent static force levels and relative displacement demands for the design of components and their attachments to the structure, recognizing ground motion and structural amplification, component toughness and weight, and performance expectations. Seismic Design Categories for structures are defined in Section 9.4.2. For the purposes of this Section, components shall be considered to have the same Seismic Design Category as that of the structure that they occupy or to which they are attached unless otherwise noted.

This Section also establishes minimum seismic design force requirements for nonbuilding structures that are supported by other structures where the weight of the nonbuilding structure is less than 25% of the combined weight of the nonbuilding structure and the supporting structure. Seismic design requirements for nonbuilding structures that are supported by other structures where the weight of the nonbuilding structure is 25% or more of the combined weight of the nonbuilding structure and supporting structure are prescribed in Section 9.14. Seismic design requirements for nonbuilding structures that are supported at grade are prescribed in Section 9.14; however, the minimum seismic design forces for nonbuilding structures that are supported by another structure shall be determined in accordance with the requirements of Section 9.6.1.3 with R equal to the value of R specified in Section 9.14 and $a = 2.5$ for nonbuilding structures with flexible dynamic characteristics and $a = 1.0$ for nonbuilding structures with rigid dynamic characteristics. The distribution of lateral forces for the supported nonbuilding structure and all nonforce requirements specified in Section 9.14 shall apply to supported nonbuilding structures.

In addition, all components are assigned a component importance factor (I) in this chapter. The default value for I is 1.00 for typical components in normal service. Higher values for I are assigned for components, which contain hazardous substances, must have a higher level of assurance of function, or otherwise require additional attention because of their life safety characteristics. Component importance factors are prescribed in Section 9.6.1.5.

All architectural, mechanical, electrical, and other nonstructural components in structures shall be designed and constructed to resist the equivalent static forces and displacements determined in accordance with this Section. The design and evaluation of support structures and architectural components and equipment shall consider their flexibility as well as their strength.

Exception: The following components are exempt from the requirements of this Section:

1. All components in Seismic Design Category A.
2. Architectural components in Seismic Design Category B other than parapets supported by bearing walls of shear walls provided that the importance factor (I) is equal to 1.0.
3. Mechanical and electrical components in Seismic Design Category B.
4. Mechanical and electrical components in structures assigned to Seismic Design Category C provided that the importance factor (I) is equal to 1.0.
5. Mechanical and electrical components in Seismic Design Categories D, E, and F where $I = 1.0$ and flexible connections between the components and associated ductwork, piping, and conduit are provided and that are mounted at 4 ft (1.22m) or less above a floor level and weigh 400 lb (1780 N) or less.
6. Mechanical and electrical components in Seismic Design Categories D, E, and F weighing 20 lb (95 N) or less where $I = 1.0$ and flexible connections between the components and associated ductwork, piping, and conduit are provided, or for distribution systems, weighing 5 lb/ft (7 N/m) or less.

The functional and physical interrelationship of components and their effect on each other shall be designed so that the failure of an essential or nonessential

architectural, mechanical, or electrical component shall not cause the failure of a nearby essential architectural, mechanical, or electrical component.

Requires components to function after an earthquake

9.6.1.5 Component Importance Factor. The component importance factor (I) shall be selected as follows:

$I = 1.5$ life safety component required to function after an earthquake (e.g., fire Protection sprinkler system)

$I = 1.5$ component that contains hazardous content

$I = 1.5$ storage racks in structures open to the public (e.g., warehouse retail Stores)

$I = 1.0$ all other components

In addition, for structures in Seismic Use Group III:

$I = 1.5$ all components needed for continued operation of the facility or whose failure could impair the continued operation of the facility

Requires Manufacture to test the component and the mounting or anchoring system, and submit a certificate of compliance.

1707.7.2 Component and attachment testing.

The component manufacturer shall test or analyze the component and the component mounting system or anchorage for the design forces in Chapter 16 for those components having a Component Importance Factor of 1.0 or 1.5 in accordance with Chapter 16. The manufacturer shall submit a certificate of compliance for review and acceptance by the registered design professional responsible for the design, and for approval by the building official. The basis of certification shall be by test on a shaking table, by three-dimensional shock tests, by an analytical method using dynamic characteristics and forces from Chapter 16 or by more rigorous analysis. The special inspector shall inspect the component and verify that the label, anchorage or mounting conforms to the certificate of compliance.

The manufacturers certificate of compliance will be submitted to the authority having jurisdiction.

9.6.3.6 Component Certification.

Architectural, mechanical, and electrical components shall comply with the force requirements of Section 9.6. Components designated with an I greater than 1.0 in Seismic Design Category C, D, E, and F shall meet additional requirements of Section A.9.3.4.5 and in particular, mechanical and electrical equipment which must remain operable following the design earthquake shall demonstrate operability by shake table testing of experience data.

The manufacturer's certificate of compliance indicating compliance with this Section shall be submitted to the authority having jurisdiction when required by the contract documents or when required by the regulatory agency.

III. EARTHQUAKE LOADS—MINIMUM DESIGN LATERAL FORCE AND RELATED EFFECTS

SECTION 1617

Calculations for seismic load effects come from ASCE

1617.1 Seismic load effect E and E_m .

The seismic load effect, E , for use in the basic load combinations of Sections 1605.2 and 1605.3 shall be determined from Section 9.5.2.7 of ASCE 7. The maximum seismic load effect, E_m , for use in the special seismic load combination of Section 1605.4 shall be the special seismic load determined from Section 9.5.2.7.1 of ASCE 7.

Components to be designed to be adequate for vertical load-carrying capacity

1617.6.2.4.3 Deformational compatibility.

Every structural component not included in the seismic force-resisting system in the direction under consideration shall be designed to be adequate for vertical load-carrying capacity and the induced moments and shears resulting from the design story drift, Δ , as determined in accordance with Section 1617.5.4. Where allowable stress design is used, Δ shall be computed without dividing the earthquake force by 1.4. The moments and shears induced in components that are not included in the seismic-force-resisting system in the direction under consideration shall be calculated including the stiffening effects of adjoining rigid structural and nonstructural elements.

Exception: Reinforced concrete frame members not designed as part of the seismic-force-resisting system and slabs shall comply with Section **21.11 of ACI 318**.

Shall have adequate stiffness to limit deflections and lateral drift.

1604.3 Serviceability.

Structural systems and members thereof shall be designed to have adequate stiffness to limit deflections and lateral drift. See Section **1617.3** for drift limits applicable to earthquake loading.

Design story-drift not to exceed the allowable story-drift

1617.3.1 Deflection and drift limits (for use in the simplified analysis procedure of Section 1617.5).

The design story drift, as determined in Section **1617.5.4**, shall not exceed the allowable story drift, a , as obtained from Table **1617.3.1** for any story. All portions of the building shall be designed to act as an integral unit in resisting seismic forces unless separated structurally by a distance sufficient to avoid damaging contact under total deflection as determined in Section **1617.5.4**. Buildings shall not exceed the limitations of Section **1616.6.1**.

TABLE 1617.3.1
ALLOWABLE STORY DRIFT, Δa (inches)^a

BUILDING	SEISMIC USE GROUP		
	I	II	III
Buildings, other than masonry shear wall or masonry wall frame buildings, four stories or less in height with interior walls, partitions, ceilings and exterior wall systems that have been designed to accommodate the story drifts	$0.025hsxb$	$0.020hsx$	$0.015hsx$
Masonry cantilever shear wall buildings <i>c</i>	$0.010hsx$	$0.010hsx$	$0.010hsx$
Other masonry shear wall buildings	$0.007hsx$	$0.007hsx$	$0.007hsx$
Masonry wall frame buildings	$0.013hsx$	$0.013hsx$	$0.010hsx$
All other buildings	$0.020hsx$	$0.015hsx$	$0.010hsx$

For SI: 1 inch = 25.4 mm.

- a. There shall be no drift limit for single-story buildings with interior walls, partitions, ceilings and exterior wall systems that have been designed to accommodate the story drifts.
- b. hsx is the story height below Level x .

c. Buildings in which the basic structural system consists of masonry shear walls designed as vertical elements cantilevered from their base or foundation support which are so constructed that moment transfer between shear walls (coupling) is negligible.

1% of story height

1617.5.4 Design drift.

For the purposes of Sections **167.3.1** and **1620.4.6**, the design story drift, shall be taken as 1 percent of the story height unless a more exact analysis is provided.

1617.4 Equivalent lateral force procedure for seismic design of buildings.

The provisions given in Section **9.5.5 of ASCE 7** shall be used.