

DESIGN PERFORMANCE LEVELS

User notes:

About this chapter:

Chapter 3 is unique to this code. It is intended to provide a framework to establish minimum levels to which buildings or facilities should perform when subjected to events such as fires and natural hazards. The minimums established by this chapter are based on the types of risks associated with the use of the building or facility, the intended function of the building or facility and the importance of the building or facility to a community. This information is then compared with the type and sizes of events that may affect the building or facility. As noted in the Effective Use portion of this document, it is intended that this chapter provide a link between the policy makers and the designers. In many respects, this chapter is the performance code equivalent of the height and area requirements, occupancy classifications and related requirements.

SECTION 301—MINIMUM PERFORMANCE



[BG] 301.1 Purpose. This chapter provides the basis for developing the acceptable level of design based on building use, risk factors, magnitudes of event and acceptable level of damage. Magnitudes are defined in subsequent chapters of this code but interrelate with this chapter in the development of design methods for the mitigation of hazards.

[BG] 301.2 Objective. To establish performance groups for buildings and other structures and to establish minimum acceptable losses based on those performance groups.

[BG] 301.3 Functional statements.

[BG] 301.3.1 Performance level. The performance of a building or facility is based on the ability of the building or facility to tolerate specified magnitudes of event within tolerable limits of damage.

[BG] 301.3.2 Demonstration of performance. Performance is acceptable where the design performance levels are demonstrated to be met or exceeded, to the satisfaction of the code official, in accordance with the assigned or designated use groups, performance groups, magnitudes of event and maximum tolerable damage limits; and the objectives, functional statements and performance requirements of this code.

SECTION 302—USE AND OCCUPANCY CLASSIFICATION



[BG] 302.1 General. The objective of the assignment of use and occupancy classification is to identify the primary uses of buildings and other structures, and portions of buildings and other structures, and to identify risk factors associated with these uses, in order to facilitate design and construction in accordance with other provisions of this code.

[BG] 302.2 Determination of use. In determining the primary use of a building or other structure, or portion of a building or other structure, the following shall be considered:

1. **Principal purpose or function.** The principal purpose or function of the building or other structure.
2. **Hazards.** The hazard-related risk(s) to the users of the building or other structure.

[BG] 302.3 Guidance. The use and occupancy classifications found in the *International Building Code* shall be permitted to be used for guidance in determining the principal purposes or functions for buildings or other structures.

[BG] 302.4 Risk factors. In determining the hazard-related risk(s) to users of buildings and other structures, the following risk factors shall be considered:

[BG] 302.4.1 Nature of the hazard. The nature of the hazard, whether it is likely to originate internal or external to the building or facility, and how it may impact the occupants, the building or other structure, and the contents.

[BG] 302.4.2 Number of occupants. The number of persons normally occupying, visiting, employed in or otherwise using the building, other structure or portion of the building or other structure.

[BG] 302.4.3 Length of occupancy. The length of time the building or other structure is normally occupied by people.

[BG] 302.4.4 Sleeping characteristics. Whether people normally sleep in the building.

[BG] 302.4.5 Familiarity. Whether the building or other structure occupants and other users are expected to be familiar with the building or other structure layout and means of egress.

[BG] 302.4.6 Vulnerability. Whether a significant percentage of the building or other structure occupants are, or are expected to be, members of vulnerable population groups such as infants, young children, elderly persons, persons with physical disabilities, persons with mental disabilities, or persons with other conditions or impairments that could affect their ability to make decisions, egress without the physical assistance of others or tolerate adverse conditions.

[BG] 302.4.7 Relationships. Whether a significant percentage of building or other structure occupants and other users have family or dependent relationships.

SECTION 303—PERFORMANCE GROUPS

[BG] 303.1 Performance group allocation. Use groups and hazard-related occupancies have been allocated to performance groups using the risk factors identified in Section 302.4. Specific buildings and other structures have been allocated to performance groups using the risk factors identified in Section 302.4 combined with the relative importance of protecting the building or other structure to the community. The allocated performance group shall not be lower than the corresponding risk category determined in accordance with Table 303.1.



[BS] TABLE 303.1—RISK CATEGORY OF BUILDINGS AND OTHER STRUCTURES	
RISK CATEGORY	NATURE OF OCCUPANCY
I	Buildings and other structures that represent a low hazard to human life in the event of failure, including but not limited to: Agricultural facilities. Certain temporary facilities. Minor storage facilities.
II	Buildings and other structures except those listed in Risk Categories I, III and IV.
III	Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to: Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300. Buildings and other structures containing one or more public assembly spaces, each having an occupant load greater than 300 and a cumulative occupant load of the public assembly spaces of greater than 2,500. Buildings and other structures containing Group E or Group I-4 occupancies or a combination thereof, with an occupant load greater than 250. Buildings and other structures containing educational occupancies for students above the 12th grade with an occupant load greater than 500. Group I-3 occupancies. Any other occupancy with an occupant load greater than 5,000. ^a Power-generating stations, water treatment facilities for potable water, wastewater treatment facilities and other public utility facilities not included in Risk Category IV. Buildings and other structures not included in Risk Category IV containing quantities of toxic or explosive materials that: <ul style="list-style-type: none"> • Exceed maximum allowable quantities per control area as given in Table 307.1(1) or 307.1(2) of the <i>International Building Code</i> or per outdoor control area in accordance with the <i>International Fire Code</i>. • Are sufficient to pose a threat to the public if released.^b
IV	Buildings and other structures designated as <i>essential facilities</i> , including but not limited to: Group I-2, Condition 2 occupancies. Ambulatory care facilities having emergency surgery or emergency treatment facilities. Fire, rescue, ambulance and police stations and emergency vehicle garages. Designated earthquake, hurricane or other emergency shelters. Designated emergency preparedness, communications and operations centers and other facilities required for emergency response. Power-generating stations and other public utility facilities required as emergency backup facilities for Risk Category IV structures. Buildings and other structures containing quantities of highly toxic materials that: <ul style="list-style-type: none"> • Exceed maximum allowable quantities per control area as given in Table 307.1(2) of the <i>International Building Code</i> or per outdoor control area in accordance with the <i>International Fire Code</i>. • Are sufficient to pose a threat to the public if released.^b Aviation control towers, air traffic control centers and emergency aircraft hangars. Buildings and other structures having critical national defense functions. Water storage facilities and pump structures required to maintain water pressure for fire suppression.
<p>a. For purposes of occupant load calculation, occupancies required by Table 1004.5 of the <i>International Building Code</i> to use gross floor area calculations shall be permitted to use net floor areas to determine the total occupant load. The floor area for vehicular drive aisles shall be permitted to be excluded in the determination of net floor area in parking garages.</p> <p>b. Where approved by the building official, the classification of buildings and other structures as Risk Category III or IV based on their quantities of toxic, highly toxic or explosive materials is permitted to be reduced to Risk Category II, provided that it can be demonstrated by a hazard assessment in accordance with Section 1.5.3 of ASCE 7 that a release of the toxic, highly toxic or explosive materials is not sufficient to pose a threat to the public.</p>	

[BG] 303.2 Unique performance group allocation. Where necessary or desired, allocation of specific buildings or other structures to performance groups differing from the corresponding risk category in Table 303.1 is permitted based on the needs specific to a community or owner or if there are unusual circumstances associated with the building or other structures.

[BG] 303.3 Magnitudes of event and level of damage. Performance groups identify the minimum required performance of buildings or other structures through a relationship of the magnitude of an event to the maximum level of impact or damage to be

[BG] 304.2.1.3 Occupant hazards. Injuries to building or other structure occupants from hazard-related applied loads are minimal in numbers and minor in nature. There is a very low likelihood of single or multiple life loss. The nature of the applied load, such as fire hazards, may result in higher levels of expected injuries and damage in localized areas, whereas the balance of the areas may sustain fewer injuries and less damage.

[BG] 304.2.1.4 Overall extent of damage. Damage to building or other structure contents from hazard-related applied loads is minimal in extent and minor in cost.

[BG] 304.2.1.5 Hazardous materials. There is no significant release of hazardous materials outside of the building or other structure. The risk to the community is minimal, and an emergency relocation or shelter in place order is not necessary.

[BG] 304.2.2 Moderate impact or damage. The tolerable impacts of the design loads are assumed as follows:

[BG] 304.2.2.1 Structural damage. There is moderate structural damage, which is repairable; some delay in reoccupancy can be expected.

[BG] 304.2.2.2 Nonstructural systems. Nonstructural systems needed for normal building or other structure use are fully operational, although some cleanup and repair may be needed. Emergency systems remain fully operational.

[BG] 304.2.2.3 Occupant hazards. Injuries to building or other structure occupants from hazard-related applied loads may be locally significant, but generally moderate in numbers and in nature. There is a low likelihood of single life loss with a very low likelihood of multiple life loss. The nature of the applied load, such as fire hazards, may result in higher levels of expected injuries and damage in localized areas, whereas the balance of the areas may sustain fewer injuries and less damage.

[BG] 304.2.2.4 Overall extent of damage. Damage to building or other structure contents from hazard-related applied loads may be locally significant, but is generally moderate in extent and cost. The nature of the applied load, such as fire hazards, may result in higher levels of expected injuries and damage in localized areas, whereas the balance of the areas may sustain fewer injuries and less damage.

[BG] 304.2.2.5 Hazardous materials. There is no significant release of hazardous materials outside of the building or other structure. The risk to the community is minimal and an emergency relocation or shelter in place order is not necessary.

[BG] 304.2.3 High impact or damage. The tolerable impacts of the design loads are assumed as follows:

[BG] 304.2.3.1 Structural damage. There is significant damage to structural elements but there is not large falling debris; repair is possible. Significant delays in reoccupancy can be expected.

[BG] 304.2.3.2 Nonstructural systems. Nonstructural systems needed for normal building or other structure use are significantly damaged and inoperable; egress routes may be impaired by light debris; emergency systems may be significantly damaged, but remain operational.

[BG] 304.2.3.3 Occupant hazards. Injuries to building or other structure occupants from hazard-related applied loads may be locally significant with a high risk to life, but are generally moderate in numbers and in nature. There is a moderate likelihood of single life loss, with a low probability of multiple life loss. The nature of the applied load, such as fire hazards, may result in higher levels of expected injuries and damage in localized areas, whereas the balance of the areas may sustain fewer injuries and less damage.

[BG] 304.2.3.4 Overall extent of damage. Damage to building or other structure contents from hazard-related applied loads may be locally total and generally significant. The nature of the applied load, such as fire hazards, may result in higher levels of expected injuries and damage in localized areas, whereas the balance of the areas may sustain fewer injuries and less damage.

[BG] 304.2.3.5 Hazardous materials. There is no major release of hazardous materials outside of the facility. The risk to the community is minimal, and an emergency relocation or shelter in place order is not necessary.

[BG] 304.2.4 Severe impact or damage. The tolerable impacts of the design loads are assumed as follows:

[BG] 304.2.4.1 Structural damage. There is substantial structural damage, but all significant components continue to carry gravity load demands. Repair may not be technically possible. The building or other structure is not safe for application of loads, as reoccupancy could cause collapse.

[BG] 304.2.4.2 Nonstructural systems. Nonstructural systems for normal building or other structure use may be completely nonfunctional. Egress routes may be impaired; emergency systems may be substantially damaged and nonfunctional.

[BG] 304.2.4.3 Occupant hazards. Injuries to building or other structure occupants from hazard-related applied loads may be high in numbers and significant in nature. Significant risk to life may exist. There is a high likelihood of single life loss and a moderate likelihood of multiple life loss. The nature of the applied load, such as fire hazards, may result in higher levels of expected injuries and damage in localized areas, whereas the balance of the areas may sustain fewer injuries and less damage.

[BG] 304.2.4.4 Overall extent of damage. Damage to building or other structure contents from hazard-related applied loads may be total. The nature of the applied load, such as fire hazards, may result in higher levels of expected injuries and damage in localized areas, whereas the balance of the areas may sustain fewer injuries and less damage.

[BG] 304.2.4.5 Hazardous materials. Hazardous materials are released outside of the building or facility and an emergency relocation or shelter in place order may be needed.

SECTION 305—MAGNITUDES OF EVENT



[BG] 305.1 General. Magnitude of event encompasses all loads that can be reasonably expected to impact on a building or other structure, its users and its contents, during construction and throughout its intended life. This includes building and facility-related and occupancy-related loads, as well as loads resulting from natural and technological hazards.

Determination of magnitude of event shall take into account the design performance levels established by this code, the risk factors identified in Section 302.4 and specific performance criteria established by relevant authoritative documents.

[BG] 305.1.1 Natural hazards. The types of loads affecting main-force-resisting systems, components and contents that may be reasonably expected to impact on the building or other structure, its users and its contents during its intended life are provided in Chapter 5.

[BG] 305.1.2 Technological hazards. The types of loads due to technological hazards that may be reasonably expected to impact on the building or other structure, its users and its contents during construction and throughout its intended life include, but are not limited to:

[BG] 305.1.2.1 Fires (Chapter 15).

[BG] 305.1.2.2 Explosions (Chapters 5 and 19).

[BG] 305.1.2.3 Toxic materials (Chapter 19).

[BG] 305.1.2.4 Corrosive materials (Chapter 19).

[BG] 305.1.2.5 Infectious materials or agents (Chapter 19).

[BG] 305.2 Definition of magnitude of event. Magnitude of event can be defined, quantified and expressed either deterministically or probabilistically in accordance with the best current practice of the relevant profession as published in recognized authoritative documents. In some authoritative documents, magnitude of event may be expressed only for a single performance group. In other cases, magnitude of event may be provided for all performance levels such as seismic provisions. In all cases, it is the responsibility of the design engineer to demonstrate that the design performance levels are met for the loads anticipated.

[BG] 305.2.1 Classification of event magnitude. For the purpose of this code, the magnitude of event shall be classified as: small, medium, large and very large. Where authoritative documents do not present magnitude of event in this format, it will be the responsibility of the designer to relate the loads to this format and to demonstrate that the minimum design performance levels will be met by the proposed design.