CHAPTER 3

DESIGN PERFORMANCE LEVELS

SECTION 301
MINIMUM PERFORMANCE

301.1 Purpose. This chapter provides the basis for developing the acceptable level of design based upon building use, risk factors and magnitudes of event. 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.

301.2 Objective. To establish performance groups for buildings and facilities and to establish minimum acceptable losses based upon those performance groups.

301.3 Functional statements.

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.

301.3.2 Demonstration of performance. Performance is acceptable when 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

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

302.2 Determination of use. In determining the primary use of a building or facility, or portion of a building or facility, the following shall be considered:

302.2.1 Principal purpose or function. The principal purpose or function of the building or facility; and

302.2.2 Hazards. The hazard-related risk(s) to the users of the building or facility.

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 facilities.

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

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 facility, and the contents.

302.4.2 Number of occupants. The number of persons normally occupying, visiting, employed in, or otherwise using the building, facility, or portion of the building or facility.

302.4.3 Length of occupancy. The length of time the building or facility is normally occupied by people.

302.4.4 Sleeping characteristics. Whether people normally sleep in the building.

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

302.4.6 Vulnerability. Whether a significant percentage of the building or facility 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.

302.4.7 Relationships. Whether a significant percentage of building or facility occupants and other users have family or dependent relationships.

SECTION 303
PERFORMANCE GROUPS

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 facilities 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 facility to the community. These performance group allocations are shown in Table 303.1.

303.2 Unique performance group allocation. Where necessary or desired, allocation of specific buildings or facilities to performance groups differing from 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 facility. See also Model Adopting Ordinance, Section 2.

TABLE 303.1
PERFORMANCE GROUP CLASSIFICATIONS FOR BUILDINGS AND FACILITIES

PERFORMANCE GROUP	USE AND OCCUPANCY CLASSIFICATIONS FOR SPECIFIC BUILDINGS OR FACILITIES
I	Buildings and facilities that represent a low hazard to human life in the event of failure, including, but not limited to: 1. Agricultural facilities. 2. Certain temporary facilities. 3. Minor storage facilities.
II	All buildings and facilities except those listed in Performance Groups I, III and IV.
III	Buildings and facilities that represent a substantial hazard to human life in the event of failure, including, but not limited to: 1. Buildings and facilities where more than 300 people congregate in one area. 2. Buildings and facilities with elementary school, secondary school or day-care facilities with a capacity greater than 250. 3. Buildings and facilities with a capacity greater than 500 for colleges or adult education facilities. 4. Health-care facilities with a capacity of 50 or more residents but not having surgery or emergency treatment facilities. 5. Jails and detention facilities. 6. Any other occupancy with an occupant load greater than 5,000. 7. Power-generating facilities, water treatment for potable water, wastewater treatment facilities and other public utilities facilities not included in Performance Group IV. 8. Buildings and facilities not included in Performance Group IV containing sufficient quantities of highly toxic gas or explosive materials capable of causing acutely hazardous conditions that do not extend beyond property boundaries.
IV	Buildings and facilities designated as essential facilities, including, but not limited to: 1. Hospitals and other health care facilities having surgery or emergency treatment facilities. 2. Fire, rescue, and police stations and emergency vehicle garages. 3. Designated earthquake, hurricane or other emergency shelters. 4. Designated emergency preparedness, communication, and operation centers and other facilities required for emergency response. 5. Power-generating stations and other utilities required as emergency backup facilities for Performance Group IV buildings or facilities. 6. Buildings and facilities containing highly toxic gas or explosive materials capable of causing acutely hazardous conditions beyond the property boundaries. 7. Aviation control towers, air traffic control centers and emergency aircraft hangars. 8. Buildings and facilities having critical national defense functions. 9. Water treatment facilities required to maintain water pressure for fire suppression. 10. Ancillary structures (including, but not limited to, communication towers, fuel storage tanks or other structures housing or supporting water or other fire suppression material or equipment) required for operation of Performance Group IV structures during an emergency.

303.3 Magnitudes of event and level of damage. Performance groups identify the minimum required performance of buildings or facilities through a relationship of the magnitude of an event to the maximum level of damage to be tolerated shown in Table 303.3. The use of Table 303.3 shall be an iterative process. It shall be used to determine the acceptable impact of certain events based upon their magnitude, and then used itera-tively to evaluate various designed mitigation features. Assignment of performance groups is accomplished through consideration of building or facility uses, building or facility risk factors, and the importance of a building or facility to a community.

TABLE 303.3
MAXIMUM LEVEL OF DAMAGE TO BE TOLERATED BASED ON PERFORMANCE GROUPS AND DESIGN EVENT MAGNITUDES

		INCREASING LEVEL OF PERFORMANCE →→→ PERFORMANCE GROUPS			
		Performance Group I	Performance Group II	Performance Group III	Performance Group IV
MAGNITUDE OF DESIGN EVENT (INCREASING MAGNITUDE OF EVENT ↑↑↑)	VERY LARGE (Very Rare)	SEVERE	SEVERE	HIGH	MODERATE
	LARGE (Rare)	SEVERE	HIGH	MODERATE	MILD
	MEDIUM (Less Frequent)	HIGH	MODERATE	MILD	MILD
	SMALL (Frequent)	MODERATE	MILD	MILD	MILD

303.4 Performance groups. There are four performance groups (PG), identified as I, II, III and IV.

303.4.1 Performance Group I. The minimum design performance level with which all buildings or facilities posing a low risk to human life, should the buildings or facilities fail, shall comply.

303.4.2 Performance Group II. The minimum design performance level with which all buildings or facilities subject to this code, except those classified as PG I, PG III or PG IV, shall comply.

303.4.3 Performance Group III. The minimum design performance level with which buildings or facilities of an increased level of societal benefit or importance shall comply.

303.4.4 Performance Group IV. The minimum design performance level with which buildings or facilities that present an unusually high risk or that are deemed essential facilities shall comply.

303.5 Alternative performance group designations. The performance group for specific buildings or facilities or classes of buildings or facilities are permitted to be re-designated with the approval of the code official. If a higher design performance level is desired, the design team, with the approval of the code official, may choose a higher performance group. For existing buildings or facilities, the code official is authorized to adjust tolerable limits of impact to a building or facility and its contents.

SECTION 304
MAXIMUM LEVEL OF DAMAGE TO BE TOLERATED

304.1 General. Design performance levels establish how a building or facility is expected to perform, in terms of tolerable limits, under varying load conditions. For each magnitude of event (small to very large), considered as a design load, based on realistic event scenarios, the design shall provide high confidence that the corresponding maximum level of damage to be tolerated for the appropriate performance group will be met. This relationship is illustrated in Table 303.3.

304.2 Level of impact. There are four design performance levels defined in terms of tolerable limits of impact to the building or facility, its contents, and its occupants: mild, moderate, high and severe.

304.2.1 Mild impact. The tolerable impacts of the design loads are assumed as follows:

304.2.1.1 Structural damage. There is no structural damage and the building or facility is safe to occupy.

304.2.1.2 Nonstructural systems. Nonstructural systems needed for normal building or facility use and emergency operations are fully operational.

304.2.1.3 Occupant hazards. Injuries to building or facility 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 (i.e., fire hazard) 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.

304.2.1.4 Overall extent of damage. Damage to building or facility contents from hazard-related applied loads is minimal in extent and minor in cost.

304.2.1.5 Hazardous materials. Minimal hazardous materials are released to the environment.

304.2.2 Moderate impact. The tolerable impacts of the design loads are assumed as follows:

304.2.2.1 Structural damage. There is moderate structural damage, which is repairable; some delay in re-occupancy can be expected.

304.2.2.2 Nonstructural systems. Nonstructural systems needed for normal building or facility use are fully operational, although some cleanup and repair may be needed. Emergency systems remain fully operational.

304.2.2.3 Occupant hazards. Injuries to building or facility 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 (i.e., fire hazard) 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.

304.2.2.4 Overall extent of damage. Damage to building or facility contents from hazard-related applied loads may be locally significant, but is generally moderate in extent and cost. The nature of the applied load (i.e., fire hazard) 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.

304.2.2.5 Hazardous materials. Some hazardous materials are released to the environment, but the risk to the community is minimal. No emergency relocation is necessary.

304.2.3 High impact. The tolerable impacts of the design loads are assumed as follows:

304.2.3.1 Structural damage. There is significant damage to structural elements but no large falling debris; repair is possible. Significant delays in re-occupancy can be expected.

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

304.2.3.3 Occupant hazards. Injuries to building or facility 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 (i.e., fire hazard) 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.

304.2.3.4 Overall extent of damage. Damage to building or facility contents from hazard-related applied loads may be locally total and generally significant. The nature of the applied load (i.e., fire hazard) 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.

304.2.3.5 Hazardous materials. Hazardous materials are released to the environment with localized relocation needed for buildings and facilities in the immediate vicinity.

304.2.4 Severe impact. The tolerable impacts of the design loads are assumed as follows:

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 facility is not safe for re-occupancy, as re-occupancy could cause collapse.

304.2.4.2 Nonstructural systems. Nonstructural systems for normal building or facility use may be completely nonfunctional. Egress routes may be impaired; emergency systems may be substantially damaged and nonfunctional.

304.2.4.3 Occupant hazards. Injuries to building or facility 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 (i.e., fire hazard) 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.

304.2.4.4 Overall extent of damage. Damage to building or facility contents from hazard-related applied loads may be total. The nature of the applied load (i.e., fire hazard) 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.

304.2.4.5 Hazardous materials. Significant hazardous materials are released to the environment, with relocation needed beyond the immediate vicinity.

SECTION 305
MAGNITUDES OF EVENT

305.1 General. Magnitude of event encompasses all loads that can be reasonably expected to impact on a building or facility, 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.

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 facility, its users, and its contents during its intended life are provided in Chapter 5 of this code.

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

305.1.2.1 Fires (Chapters 6, 16 and 17).

305.1.2.2 Explosions (Chapters 5, 22, and Section 801).

305.1.2.3 Toxic materials (Chapter 22 and Section 801).

305.1.2.4 Corrosive materials (Chapter 22 and Section 801).

305.1.2.5 Infectious materials or agents (Chapter 22 and Section 801).

305.2 Definition of magnitude of event. Magnitude of event may be defined, quantified and expressed deterministically or probabilistically according to 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 (e.g., nominal live and dead loads are defined only for Performance Group II). In other cases, magnitude of event may be provided for all performance levels (e.g., 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.

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.