

CHAPTER 1

GENERAL

1-1. Purpose and Scope.

This document is intended to provide qualified designers with the necessary criteria and guidance for the performance-based seismic analysis and design of new military buildings, and the nonstructural systems and components in the buildings.

1-2. Applicability.

a. General. The criteria in this document are applicable to all elements responsible for the design of military construction in the United States and its territories and possessions. The procedures in this document may be used to verify the performance objectives of any new construction.

b. Nonapplicability. Non-building structures and hazardous critical facilities (e.g., nuclear power plants, piers, wharves, dams, and liquefied gas facilities) are not within the scope of this document.

c. Design Team. When use of this document is required, the selected design team will include an engineer knowledgeable in seismic design. That engineer will be included in the facility planning process from the beginning to provide guidance in the selection of the appropriate seismic resisting system. Early input and a special peer review team are required when seismic isolation or energy dissipation devices are a potential alternative.

1-3. Basis for Design.

The primary basis for this document is the 1997 edition of the *NEHRP Provisions for Seismic Regulations for New Buildings and Other Structures* (FEMA 302), and the terminology and general design procedures are incorporated by reference in this document. This document provides guidance in the interpretation and implementation of the FEMA 302 provisions for the Life Safety performance objective for all buildings, and it provides criteria for the design and analysis of buildings with enhanced performance objectives.

a. Introduction to Seismic Design. Chapter 2 provides an introduction to principles of performance-based seismic design as prescribed in this document.

b. Classification of Buildings. All buildings are classified regarding use and/or function into one of four Seismic Use Groups indicated in Table 4-1. Based on these seismic use groups and the applicable design ground motion, the buildings are further assigned a Seismic Design Category, as shown in Tables 4-2a and 4-2b. The Seismic Use Group classification dictates the seismic performance objective for the building, while the Seismic Design Category influences the permissible structural system, allowable height, and other design parameters.

c. Ground Motion. Two levels of ground motion are prescribed in this document. Both levels are defined in terms of spectral ordinates with reference to the Maximum Considered Earthquake (MCE). Contours of spectral ordinates at periods of 0.2 second and 1.0 second are delineated on the

MCE maps that accompany FEMA 302. Ground Motion A, which is the reference ground motion in FEMA 302, is defined as two-thirds of the site-adjusted MCE spectral ordinates, and Ground Motion B is three-quarters of the same MCE ordinates. The derivation of the MCE ground motion and the representations of the design ground motions in seismic analysis of buildings are described in Chapter 3.

d. Performance Objectives. Three acceptable performance levels are established: 1) Life Safety, 2) Safe Egress, and 3) Immediate Occupancy, as described in Table 4-3. The three performance levels are combined with the two design ground motions to define a performance objective for each of the four seismic use groups, as indicated in Table 4-4. Performance Objective 1A (Life Safety) is the basic objective for Seismic Use Group I (Standard Occupancy) buildings in FEMA 302, and is the required minimum performance for all buildings governed by this document. The remaining three objectives define enhanced performance required for special occupancy, and hazardous or essential facilities. The expected seismic response of these performance objectives is indicated graphically in Figure 1-1 for ductile structures, and Figure 1-2 for non-ductile structures.

e. Seismic Design and Analysis Procedures.

(1) Seismic design and detail requirements. All structures are required to comply with the applicable requirements of the *NEHRP Recommended Provisions for Seismic Regulations for New Buildings and Other Structures* (FEMA 302) as modified by this document. Additionally, structures requiring enhanced performance

objectives shall comply with the applicable provisions of this document. For Seismic Use Group IIIE buildings that must be available for post-earthquake recovery and/or other mission-essential functions immediately following an earthquake, it is important to have structural engineering input early in the functional development and building layout phase of the project. When these buildings are assigned to Seismic Design Category D, E, or F, base isolation or energy dissipation, in accordance with Chapter 8, should be considered to reduce the ground shaking effects on the building and its contents.

(2) Additions will be designed as new buildings and will be kept structurally independent of the existing building, if at all possible. When an addition is *not* structurally independent, the addition will be designed as a new building and the combined building structure, new and old, will be evaluated using the provisions of this document. If found deficient, the existing structure will be upgraded to comply with the appropriate performance objective corresponding to the seismic use group assigned to the building.

(3) Compliance with agency manuals. Criteria and design standards in the agency manuals for ordinary or nonseismic design are applicable to seismic design except where criteria in this document are more stringent. Details of construction shown in this document represent those acceptable for conforming systems. Site adaptation of standard drawings will include design revisions for the seismic

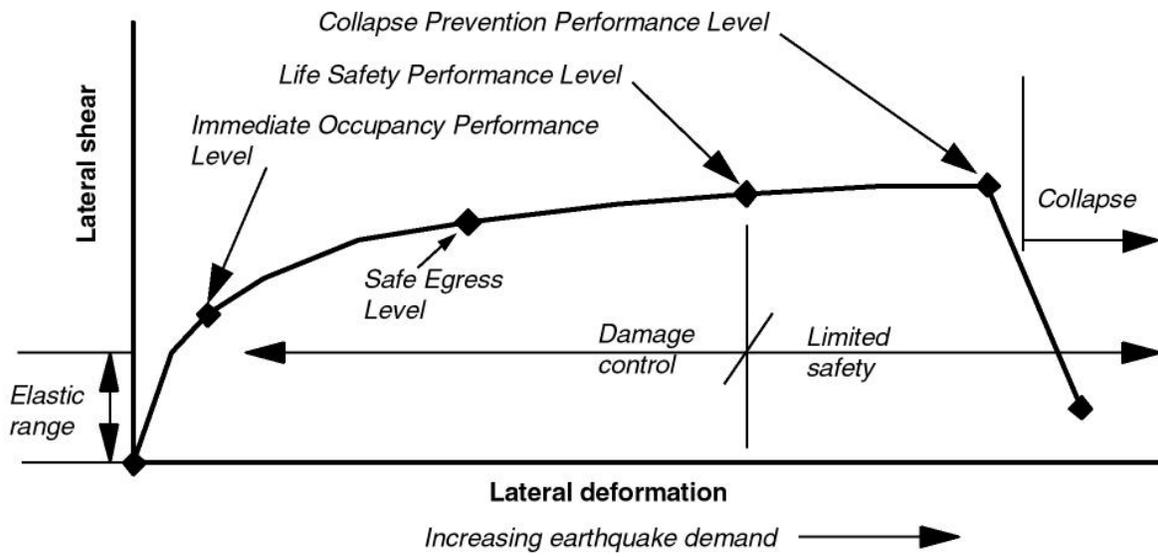


Figure 1-1 Performance and structural deformation demand for ductile structures.

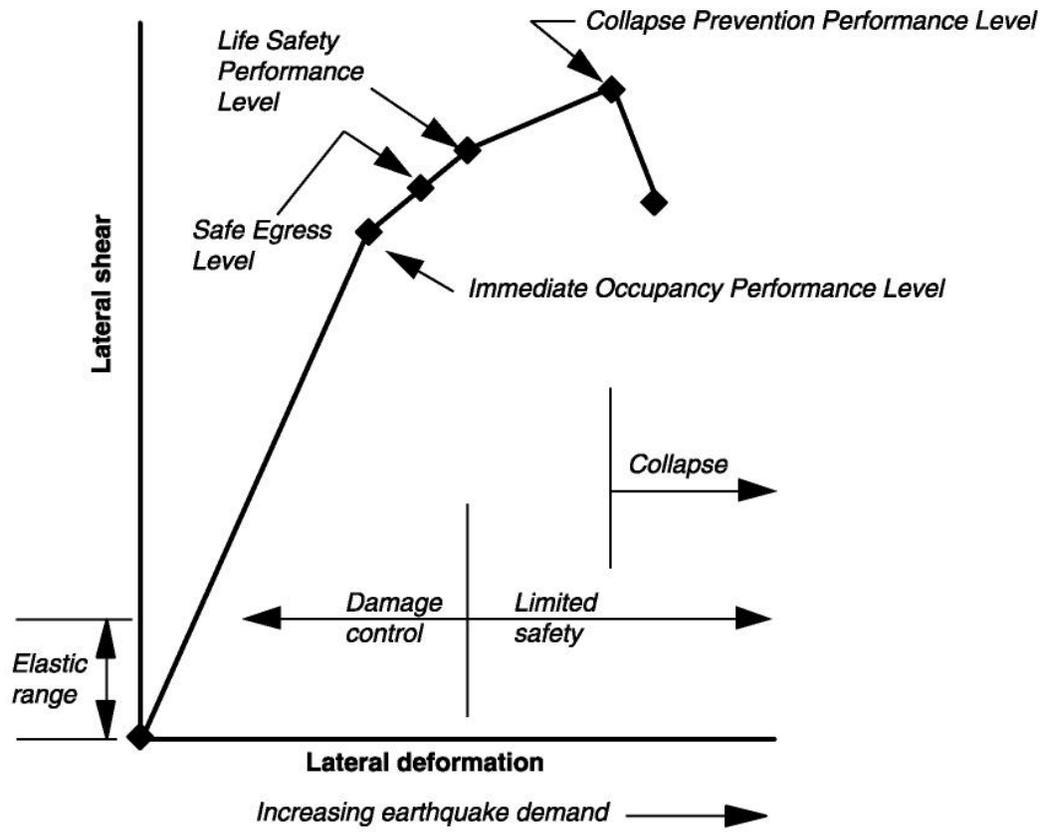


Figure 1-2 Performance and structural deformation demand for nonductile structures.

area as required. In overseas construction where local materials of grades other than those stated herein are used, the nominal capacities, grades, and other requirements of this document will be modified as acceptable.

(4) Minimum analytical procedures. The three basic analytical procedures prescribed by this document are described in Chapter 5, and the minimum analytical procedure permitted for each performance objective is indicated in Table 4-4. Chapter 5 also provides guidance as to the limitations of the minimum procedures and the need for more rigorous analyses.

(5) Acceptance criteria. The acceptance criteria for the various performance objectives are prescribed for each of the three analytical procedures in Chapter 6, and numerical values of the acceptance criteria for various structural and nonstructural systems are provided in Chapters 7 through 10.

(6) Seismic isolation and energy dissipation. Chapter 8 provides guidance for the design of seismic isolation and energy dissipation systems.

(7) Nonstructural systems and components. The seismic analysis and design of nonstructural systems and components for various performance objectives is prescribed in Chapter 10.

1-4. References.

Appendix A contains a list of references pertaining to this document.

1-5. Symbols and Notations.

Symbols and notations pertaining to the text are defined where they occur. Other symbols and notations pertaining to ground motion and design examples are defined in Appendix B.

1-6. Glossary.

Technical terms pertaining to seismic and geological hazards are defined in the Glossary in Appendix C.

1-7. Ground Motion Data.

Ground motion background data are provided in Appendix D; site-specific probabilistic seismic hazard analyses are described in Appendix E; geologic hazard evaluations are provided in Appendix F; and geologic screening examples are provided in Appendix G.

1-8. Design Examples.

Examples of structural design for buildings are provided in Appendix H; design for architectural components are provided in Appendix I; and design for mechanical and electrical components are provided in Appendix J.

1-9. Bibliography.

A bibliography of publications that may furnish additional information or background data is provided in Appendix K.

1-10. Quality Assurance.

a. Design Quality Assurance. In addition to the normal internal design and review procedures required of all design projects, peer review as discussed below will be required for the seismic design of buildings in Seismic Use Group III, Seismic Design Category D, E, or F; all buildings being designed with seismic isolation or energy dissipation; and other buildings that may be designated by the cognizant design authority.

(1) Peer review is the technical review of an engineering project by peers of the project design team in order to provide an increased level of confidence regarding the desired performance and safety of the project as envisioned by the design.

(2) The scope of the peer review should be defined in writing by the cognizant design authority, and in general should include review of the following:

(a) Compatibility of the design criteria with the following objectives:

1. Quality of the design and the design approach.
2. Quality of the documentation.
3. Constructibility.
4. Anticipated structural performance.

(3) After completing the review, the peer review team, consisting of one or more design professionals, shall discuss the results of the review with the project design team prior to submitting a report summarizing the scope and limitations of the review, conclusions, and recommendations.

b. Construction Quality Assurance. A quality assurance plan conforming to the requirements of Chapter 3 of FEMA 302 shall be developed and implemented for all projects governed by this document.