1. INTRODUCTION

This chapter of the document describes the purposes of this e-document and describes the intended audience for the e-document.

1.1 Purpose

Nonstructural failures have accounted for the majority of earthquake damage in several recent U.S. earthquakes. Thus, it is critical to raise awareness of potential nonstructural risks, the costly consequences of nonstructural failures, and the opportunities that exist to limit future losses. Nonstructural components of a building include all of those components that are not part of the structural system; that is, all of the architectural, mechanical, electrical, and plumbing systems, as well as furniture, fixtures, equipment, and contents. Windows, partitions, granite veneer, piping, ceilings, air conditioning ducts and equipment, elevators, computer and hospital equipment, file cabinets, and retail merchandise are all examples of nonstructural components that are vulnerable to earthquake damage. The primary purpose of this guide is to explain the sources of nonstructural earthquake damage and to describe methods for reducing the potential risks in simple terms.

1.2 Intended Audience

This guide is intended for use by a non-engineer audience located within the United States; this audience includes building owners, facility managers, maintenance personnel, store or office managers, corporate or agency department heads, business proprietors, risk managers, and safety personnel. The guide is also designed to be useful for design professionals, especially those who are not experienced with seismic protection of nonstructural components. It addresses nonstructural issues typically found in schools, office buildings, retail stores, hotels, data centers, hospitals, museums, and light manufacturing facilities. It is not intended as a guide for homeowners. How to make homes safer from earthquakes is covered in FEMA 232 *Homebuilders' Guide to Earthquake-Resistant Design and Construction* (2006). This document is also not intended to address nonstructural issues relevant to heavy manufacturing, specialized industrial manufacturing, or power generation facilities.

The guide is aimed at a wide audience with varying needs. Some readers may be small business owners with a limited number of potential problems, which could be addressed in a few days by hiring someone to install some of the non-engineered or prescriptive details that are presented in Chapter 6 of this guide. Other readers may be responsible for hundreds of facilities and may

need a survey methodology like the one described in Chapter 3, to help them understand the magnitude of their potential risk. For those who need to implement nonstructural details, the specification and responsibility matrices in Appendices A and B can be used to clarify the scope of work and assign parties responsible for implementation. The prospective audience can be subdivided into the following four general categories:

- General Interest—the non-engineer reader who wants an illustrated overview of the subject of nonstructural earthquake damage.
- Small Business Owner—the reader who wants a general overview of the subject, along with help in identifying potential risks and specific guidance on suggested protective measures that the reader can implement on his or her own. This may be all that is required for a small business or simple facility, if the items can be addressed using the non-engineered or prescriptive details shown in Chapter 6.
- Facilities and Planning Personnel—the reader who needs an overview of the subject, as well as a survey methodology that is applicable to an organizational setting. This guide contains forms and checklists that can be used to survey a facility, in order to identify potential risks and to estimate seismic vulnerability and potential earthquake losses. The guide includes suggestions for both existing and new construction and differentiates between methods that can be readily implemented by a handy worker following the non-engineered and prescriptive details in Chapter 6 and methods that require professional design assistance and additional engineered details.
- Architect or Engineer—the architect or engineer who has limited knowledge of nonstructural earthquake damage and who needs an introduction to the subject, along with a list of resources that will provide more detailed technical information. For this audience, the examples provided in Chapter 6 may serve as a starting point or conceptual design for common conditions; calculations may be required to size members and connection hardware for each particular situation. Each example contains brief summaries of the nonstructural bracing requirements in the codes that govern the design of new buildings and the

General Interest Sidebar

This style of sidebar is used in this guide to provide additional clarification or examples for the general interest reader.

Technical Sidebar

This style of sidebar is used in this guide to provide additional technical details for architects and engineers.

seismic strengthening of existing buildings. The specification and responsibility matrices in Appendices A and B are also targeted for this audience; these are tools intended to help clarify the scope of work and assign responsibility for the various tasks involved.

Table 1.2-1 below is intended to help readers identify those portions of the guide that may apply to their particular situation and interests. The chapters and their respective audiences are intended to be helpful, not restrictive. Readers are encouraged to use this guide and to adapt the forms and checklists herein in any way that is helpful to their particular circumstances. The flowchart on the following page provides some additional guidance on how to use this document. While earlier editions of FEMA 74 were aimed at a more general audience, the 4th edition has been greatly expanded to assist owners, facility managers, and design professionals implement nonstructural mitigation programs. A flowchart is also provided in Figure 1.2-1 to help readers identify portions of the guide that may apply to their situation.

Table 1.2-1 How to use this guide

Chapter Title	General Interest	Small Business Owner	Facilities and Planning Personnel	Architect or Engineer
Chapter 1. Introduction	X	X	X	X
Chapter 2. Behavior of Nonstructural Components	X	X	X	X
Chapter 3. Survey and Assessment Procedures for Existing Buildings		X	X	X
Chapter 4. Nonstructural Risk Reduction for Existing Buildings			X	X
Chapter 5. Nonstructural Risk Reduction for New Buildings			X	X
Chapter 6. Seismic Protection of Nonstructural Components	X	X	X	X
Chapter 7. Post-Earthquake Data Collection	X		X	X
Appendix A. Specification				X
Appendix B. Responsibility Matrices				X
Appendix C. Survey Form		X	X	X
Appendix D. Checklist		X	X	X
Appendix E. Risk Ratings		X	X	X
Appendix F. Post-Earthquake Data Collection Forms	X		X	X
Appendix G. Resources				
Appendix H. Glossary				

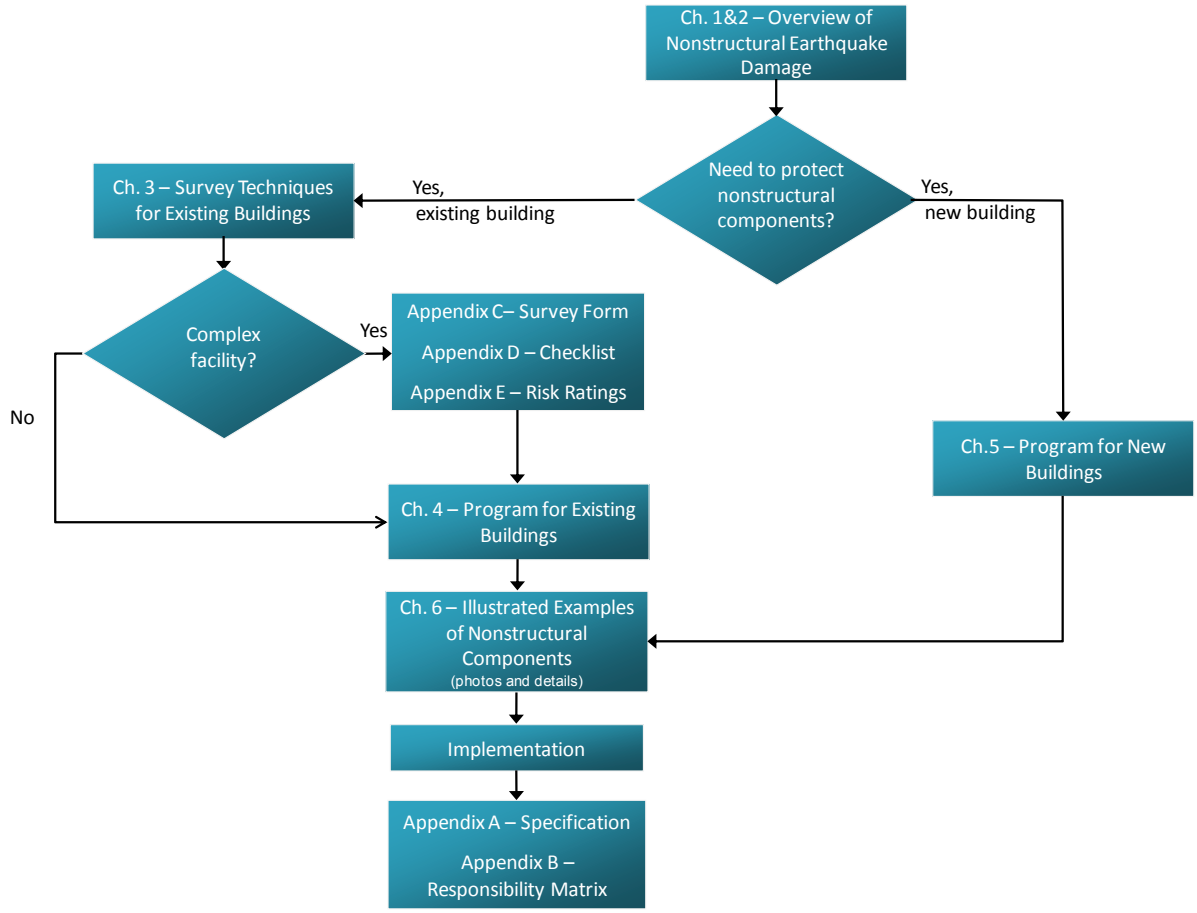

Figure 1.2-1 Flowchart describing the relationship of document chapters and appendices. The forms discussed in Chapter 7 and provided in Appendix F can be used

1.3 Regional Applicability

Different geographic areas of the U.S. are likely to experience different levels of seismic shaking in future earthquakes. In conjunction with the Probable Shaking Intensity Map shown in Figure 3.2.1-1, the following considerations will help to determine if these guidelines are applicable to your facility:

- If the Shaking Intensity Map indicates that the building site is located in an area with minimal level of shaking, then the seismic hazard risk is extremely low and thus seismic anchorage and bracing of nonstructural components is not considered necessary.
- If the Shaking Intensity Map indicates that the building site

Essential Facilities

Hospitals, fire, rescue, and police stations, emergency vehicle garages, and designated emergency shelters are examples of essential facilities that require special design considerations.

is located in an area with low level of shaking and if the facility is not an essential type facility, then only parapets and exterior unreinforced masonry walls should be considered for seismic retrofit.

- If the Shaking Intensity Map indicates that the building site is located in an area denoted with moderate level of shaking, and if the facility is not an essential type facility, then only architectural components should be considered for seismic retrofit; anchorage and bracing for other nonstructural components may not be necessary.
- If the Shaking Intensity Map indicates that the building site is located in an area denoted with high level of shaking, then adequate retrofitting of all nonstructural component items should be considered.

If in doubt about the applicability of these guidelines to a particular case, then it may be useful to check the requirements in ASCE/SEI 7-10 *Minimum Design Loads for Buildings and Other Structures* (ASCE, 2009) for new construction. If the nonstructural component does not require bracing for new construction at the site, then it may not be necessary to brace this component in existing construction, pending consideration of the specific risks posed by potential damage.

1.4 Limitations

This guide advises users on how to identify nonstructural hazards and how to implement earthquake protection measures. Earthquake engineering expertise is often desirable when identifying and reducing earthquake risks, and in some situations, it is required. This guide attempts to provide advice regarding earthquake protection measures and presumes that the advice will be applied wisely, and that expert assistance will be obtained whenever necessary.

When in doubt about the seismic vulnerability of a facility, one should consult a civil or structural engineer or an

Limitations of the Non-engineered Approach

If this guide explained how a person could administer his or her own health exam, diagnose any health problems, and prescribe and administer appropriate treatment, then an obvious question would arise: How far can an untrained person proceed before requiring the services of a physician? While doctors commonly recommend many self-help measures, such as taking one's own temperature and treating minor colds with home remedies, it is important to recognize when one has exceeded the limits of commonsense measures and needs to seek the advice of a medical professional.

When in doubt about a health problem, consult a medical professional.

When in doubt about the "seismic health" of a facility, consult a civil or structural engineer or architect.

architect with specific training and expertise related to the evaluation and mitigation of nonstructural earthquake hazards.

1.5 Acknowledgements

This document was originally completed in 2011 under the ATC-69-1 project. ATC gratefully acknowledges the ATC-69-1 Project Management Committee, including Maryann Phipps, Cynthia Perry, Robert Bachman, James Carlson, Eduardo Fierro, and Richard Kirchner for their efforts in researching and developing the material contained in this report. The Project Review Panel, consisting of Tim Brown, Mary Comerio, David Conover, Doug Fitts, Michael Griffin, John Henry, Robert Reitherman, and Jeffrey Soulages, provided technical review, advice and consultation at key stages of the work. In addition, Dawn Anderson, Jon Gregg, and Eric Peabody provided review comments for Appendices A and B.

While the ATC-69-1 Project aimed to include as many photographs of damage to nonstructural components during earthquakes that occurred in 2010 (Chile, New Zealand) and 2011 (New Zealand and Japan), the development timeframe did not allow for a thorough study of all lessons learned and data collected from these earthquakes to be incorporated in the FEMA E-74 document. Thus, the ATC-69-2 project developed an update to FEMA E-74 in 2012. ATC gratefully acknowledges the ATC-69-2 Project Management Committee, including Maryann Phipps, Robert Bachman, John Gillengerten, William Holmes, and Eduardo Miranda. In addition, Philip Caldwell provided technical review comments. Ayse Hortacsu and Thomas McLane served as ATC project managers for this work. The affiliations of these individuals are provided in the list of project participants.

ATC also gratefully acknowledges Mike Mahoney and Cathleen Carlisle (FEMA Project Monitors) and Barry Welliver (Subject Matter Expert) for their input and guidance in the preparation of this report, Peter N. Mork for ATC report production services, Scott Hiner for the expert graphics, and Steven Kuan as ATC Board Contact on this project.