A. Use of this Standard for Local or Directed Risk Mitigation Programs

A.1 General

This ASCE Standard for Seismic Rehabilitation of Buildings is written in mandatory language suitable for adoption and enforcement by code officials in local risk mitigation programs, by organizations or governmental agencies in directed mitigation programs covering many buildings, or for reference by building owners voluntarily undertaking rehabilitation of buildings. This appendix provides guidance on the use of this standard for local or directed risk mitigation programs.

Local or directed risk mitigation programs may target certain building types for rehabilitation or require complete rehabilitation coupled with other remodeling work. The incorporation of variable Rehabilitation Objectives and the use of Model Building Types in this standard allows creation of subsets of rehabilitation requirements to suit local conditions of seismicity, building inventory, social and economic considerations, and other factors. Provisions appropriate for local situations can be extracted, put into regulatory language, and adopted into appropriate codes, standards, or local ordinances.

A.2 Initial Considerations for Mitigation Programs

Local or directed programs can either target high-risk building types or set overall priorities. These decisions should be made with full consideration of physical, social, historic, and economic characteristics of the building inventory. Although financial incentives can induce voluntary risk mitigation, carefully planned mandatory or directed programs, developed in cooperation with those whose interests are affected, are generally more effective. Potential benefits of such programs include reduction of direct earthquake losses—casualties, costs to repair damage, and loss of use of buildings—as well as more rapid overall recovery. Rehabilitated buildings may also increase in value and be assigned lower insurance rates. Additional issues that should be considered for positive or negative effects include the interaction of rehabilitation with overall planning goals, historic preservation, and the local economy. These issues are discussed in *FEMA 275*.

A.2.1 Potential Costs of Local or Directed Programs

The primary costs of seismic rehabilitation—the construction work itself, including design, inspection, and administration—are normally paid by the owner. Additional costs that should be weighed when creating seismic risk reduction programs are those associated with developing and administering the program, such as the costs of identifying high-risk buildings, environmental or socioeconomic impact reports, training programs, plan checking and construction inspection.

The construction costs include not only the cost of the pure structural rehabilitation, but also the costs associated with new or replaced finishes that may be required. In some cases, seismic rehabilitation work will trigger other local jurisdictional requirements, such as hazardous material removal or partial or full compliance with the *Americans with Disabilities Act*. The costs of seismic or functional improvements to nonstructural systems should also be considered. There may also be costs to the owner associated with temporary disruption or loss of use of the building during construction. To offset these costs, there may be low interest earthquake rehabilitation loans available from state or local government, or building tax credits.

If seismic rehabilitation is the primary purpose of construction, the costs of various nonseismic work that may be required should be included as direct consequences. On the other hand, if the seismic work is an added feature of a major remodel, the nonseismic improvements probably would have been required anyway, and therefore should not be attributed to seismic rehabilitation.

A discussion of these issues, as well as guidance on the range of costs of seismic rehabilitation, is included in *FEMA 156* and *157*, and in *FEMA 276*. Since the data for these documents were developed prior to this standard, the information is not based on buildings rehabilitated specifically in accordance with the current document. However, performance levels defined in this standard are not intended to be significantly different than parallel levels used previously, and costs should still be reasonably representative.

A.2.2 Timetables and Effectiveness

Presuming that new buildings are being constructed with adequate seismic protection and that older buildings are occasionally demolished or replaced, the inventory of seismically hazardous buildings in any community will be gradually reduced. This attrition rate is normally small, since the structures of many buildings have useful lives of 100 years or more and very few buildings are actually demolished. If buildings or districts become historically significant, they may not be subject to attrition at all. In many cases, then, doing nothing (or waiting for an outside influence to force action) may present a large cumulative risk to the inventory.

It has often been pointed out that exposure time is a significant element of risk. The time aspect of risk reduction is so compelling that it often appears as part of book and workshop titles; for example, *Between Two Earthquakes: Cultural Property in Seismic Zones* (Feilden, 1987); *Competing Against Time* (California Governor's Board of Inquiry, 1990); and "*In Wait for the Next One*" (EERI, 1995). Therefore, an important consideration in the development of programs is the time allotted to reach a certain risk reduction goal. It is generally assumed that longer programs create less hardship than short ones by allowing more flexibility in planning for the cost and possible disruption of rehabilitation, as well as by allowing natural or accelerated attrition to reduce undesirable impacts. On the other hand, the net reduction of risk is smaller due to the increased exposure time of the seismically deficient building stock.

Given a high perceived danger and certain advantageous characteristics of ownership, size, and occupancy of the target buildings, mandatory programs have been completed in as little as five to ten years. More extensive programs—involving complex buildings such as hospitals, or with significant funding limitations—may have completion goals of 30 to 50 years. Deadlines for individual buildings are also often determined by the risk presented by building type, occupancy, location, soil type, funding availability, or other factors.

A.2.3 Historic Preservation

Seismic rehabilitation of buildings can affect historic preservation in two ways. First, the introduction of new elements that will be associated with the rehabilitation may in some way impact the historic fabric of the building. Second, the seismic rehabilitation work can serve to better protect the building from possibly unrepairable future earthquake damage. The effects of any seismic risk reduction program on historic buildings or preservation districts should be carefully considered during program development, and subsequent work should be carefully monitored to assure compliance with national preservation guidelines discussed in Section A.6.

A.3 Use in Passive Programs

Programs that only require seismic rehabilitation in association with other activity on the building are often classified as "passive." "Active" programs, on the other hand, are those that mandate seismic rehabilitation for targeted buildings in a certain time frame, regardless of other activity associated with the building (see Section 1.6.3). Activities in a building that may passively generate a requirement to seismically rehabilitate—such as an increase in occupancy, structural modification, or a major remodeling that would significantly extend the life of the building—are called "triggers." The concept of certain activities triggering compliance with current standards is well established in building codes. However, the details of the requirements have varied widely. These issues have been documented with respect to seismic rehabilitation in California (Hoover, 1992). Passive programs reduce risk more slowly than active programs.

A.3.1 Selection of Seismic Rehabilitation Triggers

This standard does not cover triggers for seismic rehabilitation. The extent and detail of seismic triggers will greatly affect the speed, effectiveness, and impacts of seismic risk reduction, and the selection of triggers is a policy decision expected to be done locally by the person, agency, or jurisdiction responsible for the inventory. Triggers that have been used or considered in the past include revision of specified proportions of the structure, remodeling of specified percentages of the building area, work on the building that costs over a specified percentage of the building value, change in use that increases the occupancy or importance of the building, and changes of ownership.

A.3.2 Selection of Passive Seismic Rehabilitation Standards

This standard purposely affords a wide variety of options that can be adopted for seismic rehabilitation to facilitate risk reduction. Standards can be selected with varying degrees of risk reduction and varying costs by designating different Rehabilitation Objectives. As described previously, a Rehabilitation Objective is created by specifying a desired target Building Performance Level for specified earthquake ground motion criteria. A jurisdiction can thus specify appropriate standards by extracting applicable requirements and incorporating them into its own code or standard, or by reference.

A single Rehabilitation Objective could be selected under all triggering situations (the BSO, for example), or more stringent objectives can be used for important changes to the building, less stringent objectives for minor changes. For example, it is sometimes necessary for design professionals, owners, and building officials to negotiate the extent of seismic improvements done in association with building alterations. Complete rehabilitation is often required by local regulation for complete remodels or major structural alterations. It is the intent of the standard to provide a common framework for all of these various uses.

A.4 Use in Active or Mandated Programs

Active programs are most often targeted at high-risk building types or occupancies. Active seismic risk reduction programs are those that require owners to rehabilitate their buildings to specified Rehabilitation Objectives in a certain time frame or, in the case of government agencies or other owners of large inventories, to set self-imposed deadlines for completion.

A.4.1 Selection of Buildings to be Included

Programs would logically target only the highest-risk buildings or at least create priorities based on risk. Risk can be based on the likelihood of building failure, the occupancy or importance of buildings, soil types, or other factors. This standard is primarily written to be used in the process of rehabilitation and does not directly address the comparative risk level of various building types or other risk factors. Certain building types, such as unreinforced masonry bearing wall buildings and older improperly detailed reinforced concrete frame buildings, have historically presented a high risk, depending on local seismicity and building practice. Therefore, these building types have sometimes been targeted in active programs.

A more pragmatic consideration is the ease of locating targeted buildings. If certain building types cannot be easily identified, either by the local jurisdiction or by the owners and their engineers, enforcement could become difficult and costly. In the extreme, every building designed prior to a given acceptable code cycle would require a seismic evaluation to determine whether targeted characteristics or other risk factors are present, the cost of which may be significant. An alternate procedure might be to select easily identifiable building characteristics to set timelines, even if more accurate building-by-building priorities are somewhat compromised.

A.4.2 Selection of Active Seismic Rehabilitation Standards

As discussed for passive programs in Section A.3.2, the standard is written to facilitate a wide variation in risk reduction. Factors used to determine an appropriate Rehabilitation Objective include local seismicity, the costs of rehabilitation, and local socioeconomic conditions.

It may be desirable to use Simplified Rehabilitation Methods for active or mandated programs. Only Limited Performance Objectives are included in this standard for this method. However, if a program has identified a local building type with few variations in material and configuration, a study of a sample of typical buildings using Systematic Methods may establish that compliance with the requirements of Simplified Rehabilitation meets the BSO, or better, for this building type in this location. Such risk and performance decisions can only be made at the local level.

A.5 Social, Economic, and Political Considerations

The scope of this standard is limited to the engineering basis for seismically rehabilitating a building, but the user should also be aware of significant nonengineering issues and social and economic impacts presented in this section. These problems and opportunities, which vary with each situation, are discussed in *FEMA 275*.

A.5.1 Construction Cost

If seismic rehabilitation were always inexpensive, the social and political costs and controversies would largely disappear. Unfortunately, seismic rehabilitation often requires removal of architectural materials to access the vulnerable portions of the structure. Nonseismic upgrading (e.g., electrical, handicapped access, historic restoration) is frequently "triggered" by a building code's remodeling permit requirements and is desirable to undertake at the same time.

A.5.2 Housing

While seismic rehabilitation ultimately improves the housing stock, units can be temporarily lost during the construction phase, which may be very lengthy, and can require relocation of tenants.

A.5.3 Impacts on Lower-Income Groups

Lower-income residents and commercial tenants can be displaced by seismic rehabilitation and nonseismic upgrading, which can raise rents and real estate prices because of the need to recover the costs of the work. Possible hardships on these groups need to be given heavy consideration because they may affect the very societal fabric of a community.

A.5.4 Regulations

As with efforts to impose safety regulations in other fields, mandating seismic rehabilitation is often controversial. This standard is written as mandatory code provisions for possible application and adaptation for that use. In such cases political controversy should be expected, and nonengineering issues of all kinds should be carefully considered.

A.5.5 Architecture

Even if a building is not historic, there are often significant architectural impacts. The exterior and interior appearance may change, and the division of spaces and arrangement of circulation routes may be altered.

A.5.6 Community Revitalization

Seismic rehabilitation not only poses issues and implies costs, it also confers benefits. In addition to enhanced public safety and economic protection from earthquake loss, seismic rehabilitation can play a leading role in the revitalization of older commercial and industrial areas as well as residential neighborhoods. Potential synergies between these two programs in a community should be carefully explored by local planners, officials, and design professionals.

A.6 Considerations for Historic Buildings

It must be determined early in the process whether a building is "historic." A building is historic if it is at least 50 years old, and is listed in or potentially eligible for the National Register of Historic Places and/or a state or local register as an individual structure, or as a contributing structure in a district. Structures less than 50 years old may also be historic if they possess exceptional significance. For historic buildings, users should develop and evaluate alternative solutions with regard to their effect on the loss of historic character and fabric. This section provides guidance for developing such alternative solutions.

A.6.1 Secretary of Interior's Standards

For historic buildings, users should develop alternative solutions using the *Standards for Rehabilitation* (Secretary of the Interior, 1990).

In addition to rehabilitation, the Secretary of the Interior also has standards for preservation, restoration, and reconstruction (Secretary of the Interior, 1992). A seismic rehabilitation project may include work that falls under the Rehabilitation Standards, the Treatment Standards, or both.

For historic buildings as well as for other structures of architectural interest, it is important to note that the Secretary of the Interior's *Standards* define rehabilitation as "the process of returning a property to a state of utility, through repair or alteration, which makes possible an efficient contemporary use while preserving those portions and features of the property which are significant to its historic, architectural and cultural values." Further guidance on the treatment of historic properties is contained in publications listed in the *Catalog of Historic Preservation Publications* (NPS, 1995).

A.6.2 Application of Building Codes and Standards

It should be noted that many codes covering historic buildings allow some amount of flexibility in required

performance, depending on the effect of rehabilitation on important historic features.

If a building contains items of unusual architectural interest, consideration should be given to the value of these items. It may be desirable to rehabilitate the building to the Damage Control Structural Performance Range as specified in this standard to ensure that the architectural fabric survives certain earthquakes.

A.6.3 Rehabilitation Strategies

In development of initial risk mitigation strategies, consideration must be given to the architectural and historic value of the building and its fabric. Development of a Historic Structure Report identifying the primary historic fabric may be essential in the preliminary planning stages for certain buildings. Some structurally adequate solutions may nevertheless be unacceptable because they involve destruction of historic fabric or character. Alternate rehabilitation methods that lessen the impact on the historic fabric should be developed for consideration. Partial demolition may be inappropriate for historic structures. Elements that create irregularities may be essential to the historic character of the structure. The advice of historic preservation experts may be necessary early on in the rehabilitation process.

Structural rehabilitation of historic buildings may be accomplished by hiding the new structural members or by exposing them as admittedly new elements in the building's history. Often, the exposure of new structural members is preferred because alterations of this kind are "reversible"; that is, they could conceivably be undone at a future time with no loss of historic fabric to the building. The decision to hide or expose structural members is a complex one and is best made by a preservation professional.

A.6.4 Rehabilitation Objectives

If seismic rehabilitation is required by the governing building jurisdiction, the minimum seismic requirements should be matched with a Rehabilitation Objective defined in this standard.