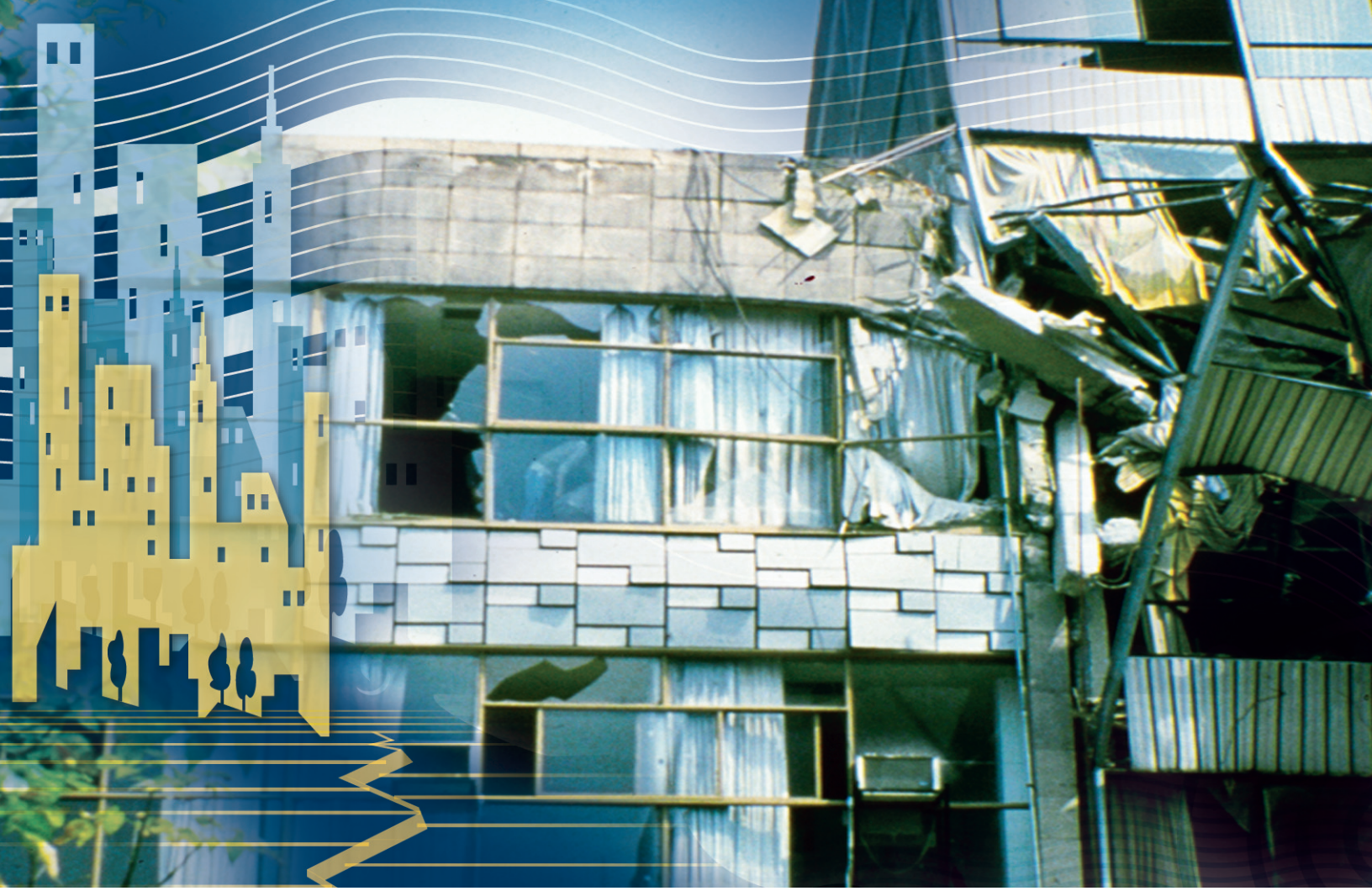


Risk Management Series

Incremental Seismic Rehabilitation of Hotel and Motel Buildings

FEMA 400 / April 2005

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RISK MANAGEMENT SERIES

Incremental Seismic Rehabilitation of Hotel and Motel Buildings

PROVIDING PROTECTION TO PEOPLE AND BUILDINGS



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Foreword and Scope

Earthquakes are a serious threat to safety in hotel and motel buildings and pose a significant potential liability to owners and operators. Hotel and motel buildings in 39 states are vulnerable to earthquake damage. Unsafe existing buildings expose hotel and motel building owners, operators, and guests to the following risks:

- *Death and injury to guests, visitors, and staff*
- *Damage to or collapse of buildings*
- *Damage to and loss of furnishings, equipment, and other building contents*
- *Disruption of hospitality functions and building operations*

The greatest earthquake risk is associated with existing hotel and motel buildings that were designed and constructed before the use of modern building codes. For many parts of the United States, this includes buildings built as recently as the early 1990s.

Although vulnerable hotel and motel buildings should be replaced with safe, new construction or rehabilitated to correct deficiencies, for many building owners, new construction is limited, at times severely, by budgetary constraints, and seismic rehabilitation is expensive and disruptive. However, **incremental seismic rehabilitation,** an innovative approach that phases in a series of discrete rehabilitation actions over a period of several years, is an effective, affordable, and non-disruptive strategy for responsible mitigation action that can be integrated efficiently into ongoing facility maintenance and capital improvement operations to minimize cost and disruption.

This manual and its companion documents are the products of a Federal Emergency Management Agency (FEMA) project to develop the concept of incremental seismic rehabilitation—that is, building modifications that reduce

seismic risk by improving seismic performance and that are implemented over an extended period, often in conjunction with other repair, maintenance, or capital improvement activities. It provides operators of hotels and motels and their owners, be they Real Estate Investment Trusts (REITs), pension funds, partnerships, individuals, or other forms of ownership, with the information necessary to assess the seismic vulnerability of their buildings and to implement a program of incremental seismic rehabilitation for those buildings.

The manual consists of three parts:

Part A, Critical Decisions for Earthquake Safety in Hotel and Motel Buildings, is for senior executives, board members, and policy makers of hotel and motel building owners and operators who will decide on allocating resources for earthquake mitigation.

Part B, Planning and Managing the Process for Earthquake Risk Reduction in Existing Hotel and Motel Buildings, is for facility managers, risk managers, and financial managers of hotel and motel building owners and operators, or those responsible for these areas of management, who will initiate and manage mitigation.

Part C, Tools for Implementing Incremental Seismic Rehabilitation in Existing Hotel and Motel Buildings, is for facility managers of hotel and motel building owners and operators, or those responsible for facility management, who will implement incremental seismic rehabilitation programs.

This manual is part of a set of manuals intended for building owners, managers, and their staff:

- *Incremental Seismic Rehabilitation of School Buildings (K-12),* FEMA 395
- *Incremental Seismic Rehabilitation of Hospital Buildings,* FEMA 396
- *Incremental Seismic Rehabilitation of Office Buildings,* FEMA 397

- *Incremental Seismic Rehabilitation of Multifamily Apartment Buildings,* FEMA 398
- *Incremental Seismic Rehabilitation of Retail Buildings,* FEMA 399
- *Incremental Seismic Rehabilitation of Hotel and Motel Buildings,* FEMA 400
- *Incremental Seismic Rehabilitation of Storage Buildings,* FEMA 401
- *Incremental Seismic Rehabilitation of Emergency Buildings,* FEMA 402

Each manual in this set addresses the specific needs and practices of a particular category of buildings and owners, and guides building owners and managers through a process that will reduce earthquake risk in their building inventory. The manuals answer the question, as specifically as possible: "What is the most affordable, least disruptive, and most effective way to reduce seismic risk in existing buildings?" By using the process outlined in these manuals, building owners and managers will become knowledgeable clients for implementing incremental seismic rehabilitation specifically geared to their building use category.

In addition to this set of manuals, there is a companion manual, *Engineering Guideline for Incremental Seismic Rehabilitation,* FEMA 420. It is intended to assist architects and engineers who provide services to building owners and operators. Architects and engineers using that manual will be effective consultants serving a knowledgeable owner and/or operator. Together they will be in a position to implement an effective incremental seismic rehabilitation program.

How to Use This Manual

Critical Decisions: Senior executives, board members, and similar policy makers of hotel and motel building owners and operators should read Part A. Section A.1 provides a general understanding of the earthquake hazard faced by a hotel and motel owner and operator. Section A.2 outlines how the seismic vulnerability of hotel and motel buildings and resultant losses can be estimated. Section A.3 summarizes the actions an owner or operator can take to reduce earthquake risk, including incremental seismic rehabilitation. Section A.4 details how to implement the concept of incremental seismic rehabilitation, including the additional benefits of integrating incremental seismic rehabilitation with other maintenance and capital improvement projects. **By understanding these four sections, hotel and motel owners' and operators' top management can establish a policy of seismic risk reduction and initiate a more specific, objective, and cost-effective program of incremental seismic rehabilitation by their technical staff.**

Program Development: Those responsible for the hotel and motel owner or operator facility, risk, and financial management should read Parts A and B, paying particular attention to Part B. Sections B.1 through B.3 provide detailed guidance on **how the initiation of a program of incremental seismic rehabilitation can fit into the ongoing facility management process** used by the owner or operator organizations and their hotel and motel buildings, and indicate specific activities that can be undertaken. Appendix I, Additional Information on Hotel and Motel Building Facility Management, is provided at the end of this manual for those seeking more information on facility management. It contains a discussion of specific phases of the facility management process and activities for hotel and motel owners and operators seeking further detail.

Project Implementation: Facility managers of hotel and motel building owners and operators should read Part C in addition to Parts A and B. Section C.1 provides guidance on using the consulting services of architects and engineers in implementing a program of incremental seismic rehabilitation. Section C.2 discusses specific opportunities for **combining increments of seismic rehabilitation with other maintenance and capital improvement projects.** Appendix II, Integration Opportunities for Incremental Seismic Rehabilitation for Small Organizations and Individual

Owners, is provided at the end of this manual for owners with limited professional facility management. It contains a simplified presentation of specific opportunities that can be identified on the basis of a quick evaluation by a design professional.

To get the most out of this manual:

- Communicate the importance of assessing your building inventory's risks and pass this manual on to staff members responsible for facility management, risk management, and financial planning. Specify that they develop an analysis of the current seismic risk of your buildings and a strategy for risk reduction.
- Promptly initiate a program of earthquake risk reduction in your buildings located in an earthquake-prone zone that were not designed and constructed to meet modern building codes.
- Consider incremental seismic rehabilitation as a cost-effective means to protect the buildings and, most importantly, the safety of guests, visitors, and staff, because it is a technically and financially manageable strategy that minimizes disruption of hotel and motel building operations.

For Senior Executives, Board Members, and Similar Policy Makers

Part A Critical Decisions for Earthquake Safety in Hotel and Motel Buildings

Introduction

This manual is designed to give decision makers the framework and information for making informed decisions about investing in earthquake risk management measures. It is structured to follow the decision-making process of existing planning and management practices and will help you evaluate financial, safety, and strategic planning priorities.

Owners of hotel and motel buildings may vary greatly in size, wealth, and technical capability. Some have comprehensive long-term facility management, maintenance, and development plans. Some have none. Operators of hotels and motels vary in the scope of standards they apply to the facilities they operate, as well as in their long-term facility management, maintenance, and development plans. The successful implementation of improved earthquake safety should be part of a comprehensive and coordinated approach by both owners and operators to building safety and multi-hazard mitigation.

Failure to address earthquake risk leaves the hotel and motel owner and operator exposed to potential losses, disruption, and liability for deaths and injuries. While purchasing insurance may protect owners or operators from financial losses and liability, it still leaves them susceptible to disruption as well as deaths and injuries. Only building rehabilitation can reduce losses, deaths, and injuries, as well as control liability and disruption. However, single-stage seismic rehabilitation can be expensive and disruptive. Incremental seismic rehabilitation can reduce that cost and disruption.

Hotel and Motel Buildings, Risk, and Liability

Earthquakes are low-probability, high-consequence events. Though they may occur only once in the life of a building, they can have devastating, irreversible consequences.

Moderate earthquakes occur more frequently than major earthquakes. Nonetheless, moderate earthquakes can cause serious damage to building contents and nonstructural building systems, serious injury to guests, visitors, and staff, and disruption of building operations. Major earthquakes can cause catastrophic damage including structural collapse and massive loss of life. Those responsible for hotel and motel building safety must understand and manage these risks, particularly risks that threaten the lives of guests, visitors, and staff.

Earthquake risk is the product of hazard exposure and building vulnerability, as shown in the following equation:

RISK = HAZARD x VULNERABILITY

To manage earthquake risk in existing hotels and motels, one must understand the earthquake hazard and reduce building vulnerability.

Considering Incremental Seismic Rehabilitation

The incremental rehabilitation approach to seismic risk mitigation focuses on improvements that will decrease the vulnerability of hotel and motel buildings to earthquakes at the most appropriate and convenient times in the life cycle of those buildings. The approach clarifies, as specifically as possible, what is the most affordable, least disruptive, and most effective way to reduce seismic risk in your buildings.

Prior to initiating a program of incremental seismic rehabilitation, an owner and operator must first address the following three questions:

- Are your hotels and motels located in a seismic zone?
- Are these buildings vulnerable to earthquakes?
- What can you do to reduce earthquake risk in existing vulnerable buildings?

This manual will help you find the right answers.

A.1 Is There an Earthquake Hazard for Your Hotel and Motel Buildings?

In Brief

- **The primary parameters of seismic hazard are the likelihood of occurrence and severity of an earthquake.**
- **Geographic location is the most significant factor of seismic hazard.**
- **Soil conditions at a particular site also influence the seismic hazard.**

Earthquakes are one of the most serious natural hazards to which hotel and motel building owners and operators may be exposed. Although owners and operators face a variety of risks to their investments, guest and visitor safety, and facility operations that may appear more immediate, the consequences of earthquakes can be catastrophic. Therefore, despite the rare occurrence of earthquakes, earthquake safety should be given full consideration in design and investment for risk management and safety.

The first step in understanding earthquake risk:

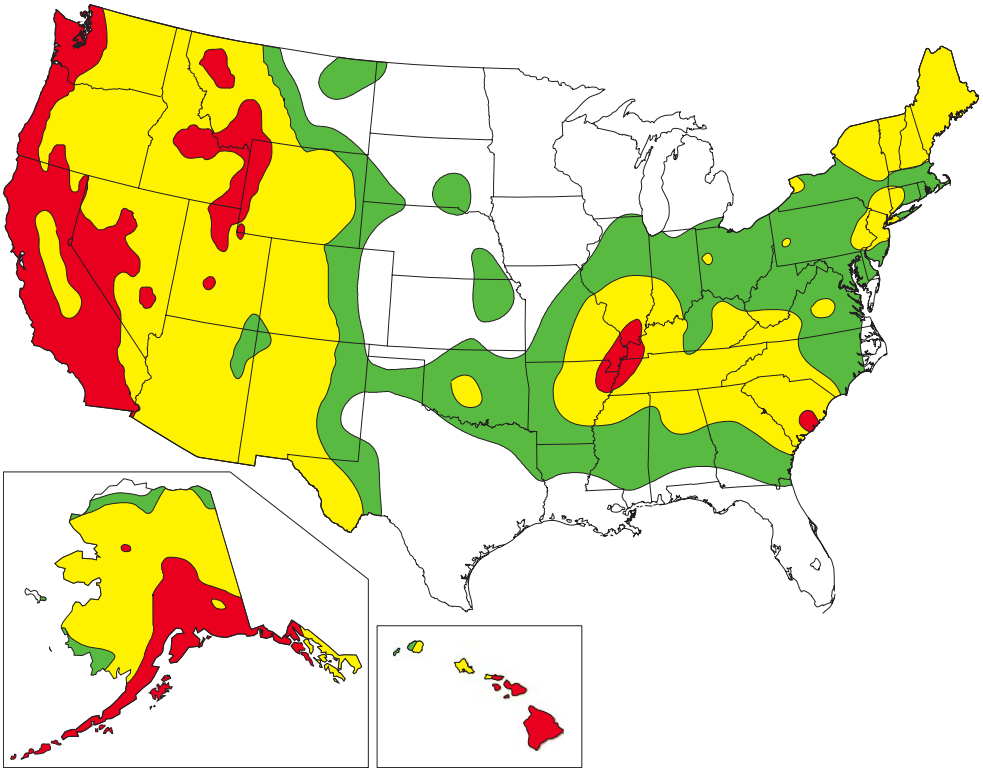
*RISK = **HAZARD** x VULNERABILITY*

*is to learn the **likelihood and severity** of an earthquake affecting your buildings.*

The Earthquake Hazard: Where, When, and How Big

The surface of the earth consists of solid masses, called tectonic plates, that float on a liquid core. The areas where separate plates meet each other are called faults. Most earthquakes result from the movement of tectonic plates, and seismic hazard is strongly correlated to known faults. A map of zones of seismic hazard for the United States, based on maps provided by the U.S. Geological Survey (USGS), shows three zones from the lowest, green, to the highest, red. The white areas have negligible seismic hazard.

The USGS earthquake hazard map is based on a complex assessment of expected seismic activity associated with recognized faults. The scientific understanding of earthquakes continues to improve and has resulted in estimates of increased seismic hazard in various parts of the country over the last decade.



Seismic Hazard Map

Hotel and motel owners and operators responsible for the safety of guests, visitors, and staff need to know whether to be concerned about earthquakes. Some guidelines for determining earthquake risk in your location are:

If your hotel or motel building is located in a red zone on the map

Earthquakes are one of the most significant risks facing your facilities.

- Take immediate action to undertake comprehensive vulnerability assessment. Professional structural engineers should perform this assessment.
- Identify and either replace or rehabilitate vulnerable existing buildings as soon as possible.

If your hotel or motel building is located in a yellow zone

The probability of severe earthquake occurrence is sufficiently high to demand systematic investigation of your buildings.

- Assign responsibility for investigation to the risk managers and facility managers within the organization. If they are not available, seek professional engineering assistance from outside.
- Identify vulnerable buildings and schedule them for replacement, rehabilitation, or change of use.
- Also consider mitigation of nonstructural hazards, such as securing equipment and suspended lighting that could injure building occupants in an earthquake.

If your hotel or motel building is located in a green zone

- Consider low-cost mitigation strategies that protect building occupants and the owner's investment in facilities and systems, even though the probability of an earthquake is low.

Beyond this broad seismic zone designation, expected earthquake ground motion at a particular location is further influenced by local geology and soil conditions. Geotechnical engineering studies should be done to fully understand the earthquake hazard at a particular site in red and yellow zones.

A.2 Are Your Hotel and Motel Buildings Safe?

The second step in understanding earthquake risk:

*RISK = HAZARD x **VULNERABILITY***

*is to learn the **expected damage and losses** that could result from an earthquake.*

What Happens to Hotel and Motel Buildings in Earthquakes

Earthquake fault rupture causes ground motion over a wide area. This ground motion acts as a powerful force on buildings. Buildings are principally designed to resist the force of gravity, but resistance to earthquake forces requires specialized earthquake engineering. Horizontal earthquake forces cause rapid movement of the foundation and displacement of upper levels of the structure. When inadequately designed to resist or accommodate these earthquake forces, structures fail, leading to serious structural damage and, in the worst case, total building collapse.

In addition to ground motion, buildings may suffer earthquake damage from the following effects:



Fault rupture under or near the building, often occurring in buildings located close to faults.



Earthquake-induced landslides near the building.



Reduction of the soil bearing capacity under or near the building.



Earthquake-induced waves in bodies of water near the building (tsunami on the ocean and seismic seiche[1] on lakes).

In Brief

- **Seismic vulnerability consists of expected damages and losses.**
- **Seismic vulnerability depends on structural type, age, condition, contents, and use of hotel and motel buildings.**
- **Hazard exposure and building vulnerability may result in substantial death, injury, building and content damage, and serious disruption of building use.**

[1] A wave on the surface of a lake or landlocked bay caused by atmospheric or seismic disturbances.

Building Age and Earthquake Vulnerability

The first earthquake design legislation was enacted in 1933 for schools in California (the Field Act). Since that time, awareness of earthquake risk has expanded across the country, and building codes have been improved because of research and experience. Since the early 1990s, most new hotel and motel buildings in the United States have been constructed in accordance with modern codes and meet societal standards for safety. However, older buildings should be reexamined in light of current knowledge. Some seismically active parts of the country (the Midwest) have only recently adopted appropriate seismic design standards, and in other parts of the country (the Northwest), estimates of seismic risk have been revised upward. The serious problem resides in existing vulnerable hotel and motel buildings constructed without seismic requirements or designed to obsolete standards. The building code is not retroactive; there is no automatic requirement to bring existing buildings up to current standards. Safety in existing buildings is the responsibility of the owner/operator.

Estimating Building Vulnerability

Engineers have defined levels of damage that can be expected in particular types of buildings due to varying intensities of earthquake motions. These levels of damage range from minor damage, such as cracks in walls, to total building collapse. In addition to building type, expected damage is also a function of building age and the state of maintenance. Hotel and motel buildings suffering from deferred maintenance will experience greater damage than well-maintained buildings will. For example, failure to maintain masonry parapets significantly increases the possibility of life threatening failure in even a moderate earthquake.

It is possible to estimate roughly the vulnerability of an owner or operator's portfolio of buildings and to identify problem buildings with a technique called "rapid visual screening."[2] Hotel and motel building owners and operators can produce generalized estimates of expected damage in the initial seismic risk assessment of their buildings.

After initial rapid screening, specific seismic risk assessment for individual hotel and motel buildings requires detailed engineering analysis.

Other Earthquake Losses

While a serious concern in its own right, building failure is the direct cause of even more important earthquake losses:

- Death and injury of guests, visitors, and staff
- Destruction of contents (equipment, furniture, and property of guests)
- Disruption of occupancy and use

The expected extent of these losses can also be estimated based on hazard and vulnerability assessments. See Section B.2.2, Elements of an Incremental Seismic Rehabilitation Program, for applicable references.

[2] FEMA 154, *Rapid Visual Screening of Buildings for Potential Seismic Hazards: A Handbook, Second Edition.*

In Brief

- Seismic rehabilitation of existing vulnerable hotel and motel buildings can reduce future earthquake damage.
- Incremental seismic rehabilitation is a strategy to reduce the cost of rehabilitation and related disruption of occupancy and use.

A.3 What Can Be Done to Reduce Earthquake Risk in Existing Vulnerable Hotel and Motel Buildings?

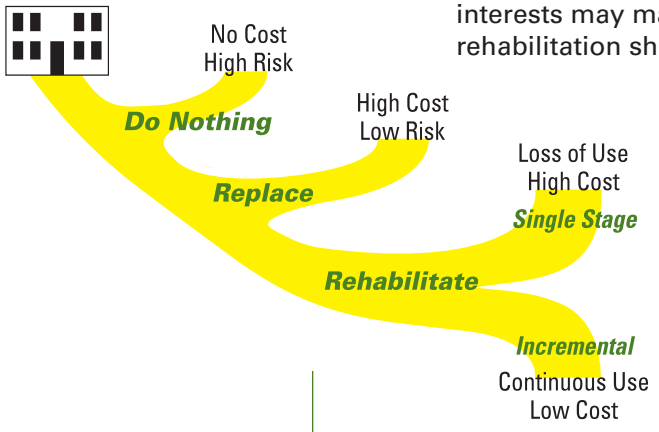
Failure to address earthquake risk leaves the hotel and motel building owner and operator exposed to potential losses, disruption, and liability for deaths and injuries.While purchasing insurance may protect owners and operators from financial losses and liability, it still leaves them exposed to disruption as well as deaths and injuries. Only building rehabilitation can reduce losses, deaths, and injuries and control liability and disruption.

The implementation of seismic risk reduction through building rehabilitation will primarily involve the facility manager. However, to be effective it will require coordination among the facility managers, risk managers, and financial managers of both owners and operators. This is further discussed in Part B (for Facility Managers, Risk Managers, and Financial Managers). In addition, it is the responsibility of hotel and motel owners' and operators' top administrators to make sure that hazards are assessed and risk reduction measures implemented.

Options for Seismic Risk Reduction

The most important consideration for earthquake safety in hotels and motels is to reduce the risk of catastrophic structural collapse. Most likely in existing vulnerable buildings, structural collapse poses the greatest threat to life in a major earthquake. Choosing the method of protection from structural collapse in a deficient building requires two critical decisions:

Replace or Rehabilitate: If you decide to replace a building, new construction is carried out according to modern codes and can be assumed to meet current safety standards. However, financial constraints, historic preservation concerns, and other community interests may make the replacement option infeasible. In that case, rehabilitation should be considered.



Single-Stage Rehabilitation[3] or Incremental Rehabilitation: If the rehabilitation option is chosen, there are still issues of cost and disruption associated with the rehabilitation work. The cost of single-stage seismic rehabilitation has proved to be a serious impediment to its implementation by many hotel and motel building owners. Incremental seismic rehabilitation is specifically designed to address and reduce the problems of cost and disruption.

Estimating the Costs and Benefits of Seismic Rehabilitation of Existing Hotel and Motel Buildings

The direct and indirect costs of seismic rehabilitation of a building are:

- Engineering and design services
- Construction
- Disruption of building occupancy and use during construction

[3] Single-stage rehabilitation refers to completing the rehabilitation in a single continuous project.

The benefits of seismic rehabilitation of a building are:

- Reduced risk of death and injury of guests, visitors, and staff
- Reduced building damage
- Reduced damage to contents and equipment
- Reduced disruption of the delivery of hospitality and related services

Engineers have developed estimates of the reduction of earthquake damage that can be achieved with seismic rehabilitation following the Federal Emergency Management Agency's (FEMA's) current rehabilitation standards. This type of estimate, however, may significantly undervalue the benefit of seismic rehabilitation. In considering the return on seismic rehabilitation investments, it is appropriate to consider the value of damages avoided as well as the difficult-to-quantify values of deaths, injuries, and disruption of occupancy and use functions avoided.

The primary obstacles to single-stage rehabilitation of vulnerable existing hotel and motel buildings are the cost of rehabilitation construction work and related disruption of hospitality and related services. Incremental seismic rehabilitation offers opportunities to better manage rehabilitation costs and reduce its disruption. The following section explains incremental seismic rehabilitation in more detail.

A.4 Incremental Seismic Rehabilitation of Existing Hotel and Motel Buildings

Incremental rehabilitation phases seismic rehabilitation into an ordered series of discrete actions implemented over a period of several years, and whenever feasible, these actions are timed to coincide with regularly scheduled repairs, maintenance, or capital improvements. Such an approach, if carefully planned, engineered, and implemented, will ultimately achieve the full damage reduction benefits of a more costly and disruptive single-stage rehabilitation. In fact, for hotel and motel buildings, a key distinction between the incremental and single-stage rehabilitation approaches is that the incremental approach can effectively eliminate or drastically reduce disruption cost if the incremental approach can be organized so that most rehabilitation increments occur during the period of seasonal low occupancy. Incremental seismic rehabilitation can be initiated in the near-term as a component of planned maintenance and capital improvement with only marginal added cost. Getting started as soon as possible on a program of earthquake safety demonstrates recognition of responsibility for hotel and motel building safety and can provide protection from liability.

In Brief

- **Whereas single-stage seismic rehabilitation of an existing hotel or motel building represents a significant cost, rehabilitation actions can be divided into increments and integrated into normal maintenance and capital improvement projects.**
- **The implementation of incremental seismic rehabilitation requires assessing the buildings, establishing rehabilitation priorities, and planning integration with other projects.**

Assessment of Deficiencies

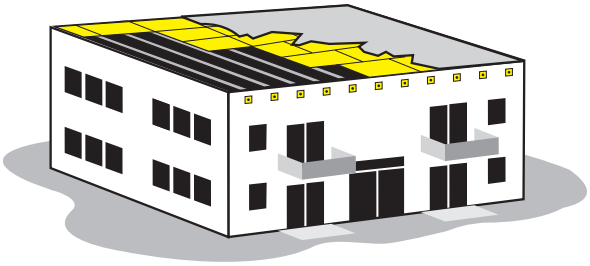
A necessary activity that must precede a seismic rehabilitation program, be it single-stage or incremental, is an assessment of the seismic vulnerability of the owner's or operator's building inventory. Facility managers can implement such an assessment using owner or operator staff or outside engineering consultants as appropriate. The assessment should rank the owner's or operator's respective building inventories in terms of seismic vulnerability and identify specific deficiencies. FEMA publishes a number of documents that can guide you through the assessment process. Portions of the assessment activities can be integrated with other ongoing facility management activities such as periodic building inspections. Facility

assessments and the FEMA publications available to help you conduct them are discussed in more detail in Part B.[4]

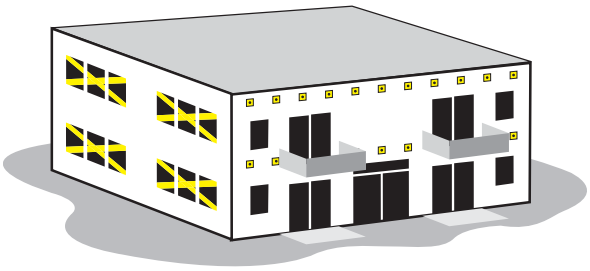
Rehabilitation Strategy

The incremental seismic rehabilitation program will correct the deficiencies identified by the assessment. The order in which seismic rehabilitation increments are undertaken can be important to their ultimate effectiveness. There are three aspects to prioritizing seismic rehabilitation increments:

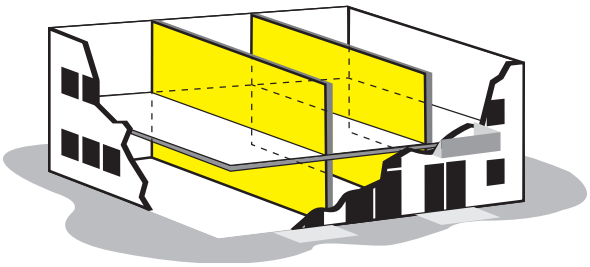
SCHEMATIC INTEGRATION OPPORTUNITIES



Roof Work



Exterior Wall Work



Interior Work

- **Structural Priority:** An initial prioritization of seismic rehabilitation increments should be established primarily in terms of their respective impact on the overall earthquake resistance of the structure. Facility managers will begin with these priorities when determining the order of seismic rehabilitation increments to be undertaken. However, the final order of increments may deviate from this priority order depending on other planning parameters. Additional engineering analysis may be required for certain building types when deviating from the structural priority order. This subject is discussed in more detail in Part B, Section B.2, and Part C.
- **Use Priority:** Hotel and motel building owners should consider planning alternative future uses of their existing buildings. Some vulnerable buildings may be scheduled for demolition or converted to other uses (for example, storage). Others may be scheduled for expansion and intensification of use. These considerations, among others, will influence the prioritization of seismic rehabilitation increments.
- **Integration:** A major advantage of the incremental seismic rehabilitation approach is that specific work items can be integrated with other building maintenance or capital improvement projects undertaken routinely. Such integration will reduce the cost of the seismic rehabilitation action by sharing engineering costs, design costs, and some aspects of construction costs. Integration opportunities are a key consideration in adapting the sequence of actions suggested by the foregoing discussions of rehabilitation priorities. Integration opportunities are discussed in more detail in Part C, Section C.2.

Incremental Seismic Rehabilitation Plan

An essential feature of implementing incremental seismic rehabilitation in specific hotel and motel buildings is the development and documentation of a seismic rehabilitation plan. The seismic rehabilitation plan will include

[4] To order FEMA publications you may write to FEMA, PO Box 2012, Jessup, MD 20794-2012; or you may call 1-800-480-2520, Monday–Friday, 8:00 a.m.–5:00 p.m., eastern time; or you may Fax your request to 301-362-5335.

all the anticipated rehabilitation increments and their prioritization as previously discussed. The documentation will guide the implementation of the incremental seismic rehabilitation program and should ensure that the hotel and motel building owner and operator do not lose sight of overall rehabilitation goals during implementation of individual increments.

Summary of Part A

- The primary parameters of seismic hazard are the likelihood of occurrence and severity of an earthquake.
- Geographic location is the most significant factor of seismic hazard.
- Soil conditions at a particular site also influence the seismic hazard.
- Seismic vulnerability consists of expected damages and losses.
- Seismic vulnerability depends on structural type, age, condition, contents, and use of hotel and motel buildings.
- Hazard exposure and building vulnerability may result in substantial death, injury, building and content damage, and serious disruption of building use.
- Seismic rehabilitation of existing vulnerable hotel and motel buildings can reduce future earthquake damage.
- Incremental seismic rehabilitation is a strategy to reduce the cost of rehabilitation and related disruption of occupancy and use.
- Whereas single-stage seismic rehabilitation of an existing hotel or motel building represents a significant cost, rehabilitation actions can be divided into increments and integrated into normal maintenance and capital improvement projects.
- The implementation of incremental seismic rehabilitation requires assessing the buildings, establishing rehabilitation priorities, and planning integration with other projects.

Recommended Actions

1. Communicate the importance of assessing your respective building inventories' risks and pass this manual on to the staff members responsible for facility management, risk management, and financial planning. Specify that they develop an analysis of the current seismic risk of your buildings and a strategy for risk reduction.
2. Promptly initiate a program of earthquake risk reduction in your buildings located in an earthquake-prone zone that were not designed and constructed to meet modern building codes.
3. Consider incremental seismic rehabilitation as a cost-effective means to protect the buildings and, most importantly, the safety of guests, visitors, and staff, because it is a technically and financially manageable strategy that minimizes disruption of hotel and motel building operations.

For Facility Managers, Risk Managers, and Financial Managers

Part B Planning and Managing the Process for Earthquake Risk Reduction in Existing Hotel and Motel Buildings

Introduction

Part B of this manual is written specifically for hotel and motel building facility managers, risk managers, and financial managers concerned with the seismic safety of their buildings. These managers may be on the owner's staff, operator's staff, or both. The organization's senior management may have requested you, the manager, to make a recommendation to address seismic safety in hotel and motel buildings or may have made the decision to address it, or there may already be a seismic safety program in place. Part B describes when and how specific activities that will accomplish the goal of seismic risk reduction can be introduced into an ongoing hotel and motel facility management process, regardless of how simple or sophisticated that process is. Part B also provides the framework and outline that can be used by the facility managers, risk managers, and financial managers in developing and communicating their recommendations to senior management.

An incremental seismic rehabilitation program is one of several seismic risk reduction strategies that can be implemented in hotel and motel buildings. It can be implemented separately or in combination with other seismic risk reduction actions. If you determine that such a program is appropriate for your organization, the planning and implementation of incremental seismic rehabilitation should be integrated into the facility management processes and integrated with other seismic risk reduction actions that will complement it or support it.

Part B of this manual is applicable to organizations that own hotels and motels and/or that operate them. Where differences apply to these different types of organizations, it is noted in the text.

In Brief

Planning for earthquake risk reduction in hotel and motel buildings requires a coordinated and integrated effort by facility managers, risk managers, and financial managers of both the owner and operator organizations.

B.1 Integrating the Efforts of Facility Management, Risk Management, and Financial Management of Owners and Operators

Preparing an analysis of a hotel and motel building owner's and/or operator's earthquake risk reduction needs, and planning and managing such a process, benefits from an integrated effort by the organizations' respective facility managers, risk managers, and financial managers, or by the administrators charged with those respective responsibilities. Such an integrated effort may be a departure from current practices, but collaboration is the key to improving safety cost-effectively and with a minimum of disruption.

Facility Managers

Facility managers currently carry out their planning activities by considering the parameters of market conditions, area demographics, and the physical condition and projected useful life of existing hotel and motel buildings. Often they consider pressing social issues such as physical security and accessibility. Some of these issues become federal or local government mandates, such as asbestos and lead abatement, energy conservation, or accessibility compliance. Sometimes facility managers consider the risks to hotel and motel buildings from natural disasters such as earthquakes or windstorms. In general, the owner's facility managers are concerned about the overall condition of the assets (such as structural condition and indoor air quality) while the operator's facility managers are concerned about interior design and the functioning of the asset as a hospitality facility. Both parties have a stake in earthquake risk reduction, and their roles and participation will overlap.

Risk Managers

Risk managers, relatively recent additions to many hotel and motel owners' organizations, have long held key positions on hotel operators' organizations. They carry out planning activities by considering three aspects: risk identification, risk reduction, and risk transfer. The latter generally involves the purchase of insurance. Currently, hotel and motel operator risks are classified into four broad areas: liability risk, larceny risk, employee risk, and facility and environmental risk. Hotel and motel owners generally share facility and environmental risk with the operators. Hotel *operators'* risk managers may consider the risks to hotel and motel buildings and their occupants from natural disasters: however, rarely do *owners'* risk managers consider these risks. Rather, they tend to assume that they are addressed by building codes and similar regulations.

Financial Managers

Financial managers currently deal with facilities by controlling and managing maintenance budgets, capital improvement budgets, and insurance budgets. These budgets are usually subject to the agreement between the hotel owner and operator. The respective facility managers and risk managers

present the demands on these budgets to the financial managers, but rarely are the potential tradeoffs among these budgets considered. The costs and benefits of various options of facility risk management are rarely explicitly addressed.

Addressing the problem of earthquake risk reduction requires establishing active communication among the three management functions within both owner and operator organizations, and coordinating activities into an integrated planning and management effort. The sharing of facility risks between owners and operators will have to be understood and clearly defined. Facility and risk managers will have to consider facility risk, and financial managers will have to consider the costs and benefits of various options for managing facility risk. Specific recommendations on implementing such an effort are provided in the following sections.

B.2 Integrating Incremental Seismic Rehabilitation into the Facility Management Process

B.2.1 A Model of the Facility Management Process for Existing Hotel and Motel Buildings

In Brief

Eleven specific activities can be added to the current facility management process to implement an incremental seismic rehabilitation program.

The typical facility management process for existing hotel and motel buildings consists of eight phases of activities: Acquisition, Change of Management, Redevelopment, Current Building Use, Planning, Maintenance & Rehabilitation Budgeting, Maintenance & Rehabilitation Funding, and Maintenance & Rehabilitation Implementation. Each phase consists of a distinct set of activities as follows:

Acquisition: due diligence (by owner)

Change of Management: due diligence and redevelopment standards (by operator)

Redevelopment: capital improvement (by operator)

Current Use: facility occupancy, facility operation, facility maintenance, and facility assessment (by operator and owner)

Planning: strategic planning and facility planning (by operator and owner)

Budgeting: capital budgeting, maintenance budgeting, and insurance budgeting (by operator and owner)

Funding: financing of capital, maintenance, and insurance budgets (by operator and owner)

Implementation: capital improvement and maintenance (by operator and owner)

This process is sequential, except that the first two—acquisition and change of management—can occur in either order, or simultaneously. Furthermore, change of management can occur any time in the process during the current building use phase. The process progresses from acquisition or change of management through implementation of rehabilitation in any given building. An owner or operator of a large inventory of buildings is likely to have ongoing activities in all of these phases in different buildings. The process is illustrated in the following diagram. Appendix I to this manual, Additional Information on Hotel and Motel Building Facility Management, contains a discussion of the specific phases and the activities therein for owners and

operators seeking further detail on the facility management process. This is a generalized model subject to local variation.



B.2.2 Elements of an Incremental Seismic Rehabilitation Program

The following 11 activities are considered essential elements of an incremental seismic rehabilitation program for hotel and motel buildings, and can be added to the facility management process by facility, risk, and financial managers who implement such a program:

Incremental Seismic Rehabilitation Element 1 ***Due Diligence Analysis***

B.2.2.1 Due Diligence Analysis

Due diligence analysis is carried out by the hotel and motel building owner before acquisition of an existing property and by the hotel and motel operator when management of the property changes. In regions of higher and moderate seismicity, due diligence should include a probabilistic analysis of potential earthquake risks. Such an analysis considers damage from earthquakes of all levels of intensity, and will provide information on seismic vulnerabilities in the building. The owner and operator will likely have different perceptions of the relative importance of different seismic vulnerabilities. The owner is likely to focus on reducing earthquake damage to buildings, while the operator is likely to focus on liability for earthquake deaths and injuries to guests and staff. If the building is acquired or the management changes, the due diligence analysis will provide information for the initiation of a full seismic assessment. Probabilistic analysis, because of its detail and scope, will be more expensive than more simplistic Probable Maximum Loss (PML) analysis.

Incremental Seismic Rehabilitation Element 2 ***Operator Risk Reduction Standards***

B.2.2.2 Operator Risk Reduction Standards

Hotel and motel operators are likely to have well-defined risk reduction standards derived from their perceived liabilities related to potential hazards. In regions of higher and moderate seismicity, these standards may address seismic risk reduction. If hotel management changes, the new operator will include implementation of its risk reduction standards in its agreement with the owner. These standards may lead to the initiation of a full seismic assessment.

Incremental Seismic Rehabilitation Element 3 ***Initial Integration Opportunities***

B.2.2.3 Initial Integration Opportunities

Even if seismic rehabilitation is not among the capital improvements being undertaken in the redevelopment phase following a hotel acquisition or a change in hotel management, and even though seismic screening and evaluation may not have taken place prior to the determination of redevelopment phase capital improvements, there may be some seismic rehabilitation increments that can be identified with minimal evaluation and analysis (for example, parapet and gable bracing or anchoring of mechanical equipment). Depending on the nature of these increments, it may be possible to integrate them with specific capital improvements being undertaken in this phase. Part C, Section C.2 should be used to identify such integration Opportunities.

B.2.2.4 Seismic Screening

Following building acquisition and initial redevelopment, seismic screening of the owner's or operator's hotel and motel building inventory is the first step of the incremental seismic rehabilitation process. Seismic screening procedures can be incorporated into other facility assessment activities. Begin with a determination of the status of the archival records. If building plans are available, a document review for the determination of building structure types is the first step in seismic screening. The following chart can be used to obtain an overall view of seismic concerns based on the seismic hazard map in Part A.

Initial Hotel and Motel Facility Manager/ Risk Manager Screening of Seismic Concerns

Level of Seismic Concern by Typical Building Type	Level of Seismic Concern by Building Location*		
	Green	Yellow	Red
Wood Frame		Low	High
Steel Frame		Low	High
Concrete Frame	Very Low	Medium	Very High
Unreinforced Masonry	Low	High	Very High

Patterned after recommendations developed by Dr. Charles Scawthorn for the California Seismic Safety Commission's *Earthquake Risk Management: A Toolkit for Decision Makers.*

* Locations refer to the seismic hazard map in Part A, Section A.1.

The Federal Emergency Management Agency (FEMA) has developed FEMA 154, *Rapid Visual Screening of Buildings for Potential Seismic Hazards: A Handbook, Second Edition,*[1] as guidance for seismic screening of an inventory of buildings. It describes a technique for identifying the relatively more vulnerable buildings in a large inventory so that they can be addressed in more detail.

The FEMA 154 publication is nationally applicable and addresses all building types. In some cases, the screening will suggest specific seismic rehabilitation opportunities that do not require additional engineering and risk analyses.

The incorporation of seismic screening into ongoing facility assessment activities requires assigning the screening to the appropriate inspectors. If inspections are periodically carried out by the owner or operator in the hotel and motel buildings for other purposes, such as life safety, insurance, occupational health and safety, or hazardous materials identification, it may be possible to assign the seismic screening to the same inspectors with some additional training. Alternatively, the seismic screening can be assigned to a consulting architect or engineer.

B.2.2.5 Seismic Evaluation

Seismic evaluation is an engineering analysis of individual hotel or motel buildings. It usually follows the seismic screening, when the buildings identified as relatively more vulnerable are subjected to a more detailed

[1] To order this and other FEMA publications, you may write to FEMA, PO Box 2012, Jessup, MD 20794-2012; or you may call 800-480-2520, Monday – Friday, 8:00 a.m. – 5:00 p.m., eastern time; or you may fax your request to 301-362-5335.

analysis. However, in some cases, such as when the owner's or operator's building inventory is small, seismic evaluation of individual buildings may be the first step of the incremental seismic rehabilitation process.

Guidance for seismic evaluation of buildings is contained in standard ASCE 31,[2] *Seismic Evaluation of Existing Buildings,* which is based on FEMA 310, *Handbook for the Seismic Evaluation of Existing Buildings—A Prestandard.* The standard provides engineering guidance on how to evaluate categories of buildings in order to identify deficiencies and determine effective rehabilitation measures.

Seismic evaluation can be done by the owner's or operator's professional staff or by a consulting engineer.

Incremental Seismic Rehabilitation

Element 6
Developing a Risk Reduction Policy

B.2.2.6 Developing a Risk Reduction Policy

Convince the board of directors to adopt a clear policy statement supporting seismic risk reduction. Such a policy should, at a minimum, establish seismic performance objectives for the owner's and/or operator's hotel and motel buildings. Seismic performance objectives define the target performance of a building following an earthquake of a specified intensity. The policy and objectives should be developed and documented as part of the seismic rehabilitation planning process.

Owner and operator risk reduction policies are likely to differ. Owner seismic risk reduction is more likely to focus on reducing earthquake damage to the hotel building, while operator risk reduction is more likely to focus on liability for earthquake deaths and injuries to guests and staff. Both are likely to be concerned about business interruption, though their focuses may differ as a function of their management agreement. With such potential divergence of interest, it is important that owners and operators not only develop a risk reduction policy, but also that they communicate with each other and coordinate their policies.

This coordination is multi-faceted, because owners are likely to have agreements with different operators for different hotel buildings, and operators are likely to deal with multiple owners.

Incremental Seismic Rehabilitation

Element 7
Seismic Rehabilitation Planning for Specific Buildings

B.2.2.7 Seismic Rehabilitation Planning for Specific Buildings

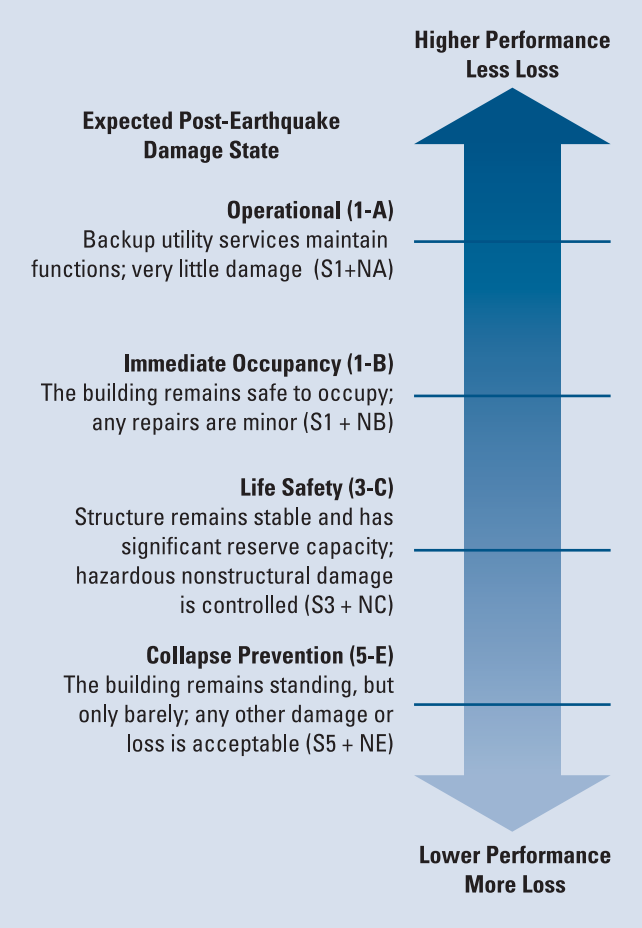
FEMA has developed engineering guidance to plan seismic rehabilitation for specific buildings, including FEMA 356, *Prestandard and Commentary for the Seismic Rehabilitation of Buildings,* which includes specific techniques for analyzing and designing effective seismic rehabilitation. The planning task entails four specific facility planning **subtasks:**

1. **Establish seismic target performance levels:** With cooperation between central management and local facility management, as well as between the owner and operator, establish the performance level desired in each of the owner's or operator's hotel and motel buildings following an earthquake. Performance levels used in FEMA 356 are, in declining level of protection:
    - Operational
    - Immediate Occupancy
    - Life Safety
    - Collapse Prevention

[2] ASCE 31 can be obtained from the American Society of Civil Engineers at 1-800-548-2723.

This is an expansion of the two performance levels—immediate occupancy and life safety—included in ASCE 31, *Seismic Evaluation of Existing Buildings.* The figures adapted from FEMA 356 on this and the following page demonstrate the use of these performance levels. Reasonable objectives and expectations should be considered for moderate, severe, and rare great earthquakes.

Target Building Performance Levels and Ranges



Adapted from FEMA 356, Figure C1-2

2. **Prioritize rehabilitation opportunities:** Carry out additional engineering and risk analysis in order to prioritize the seismic rehabilitation opportunities identified in the seismic evaluation in terms of risk reduction. ASCE 31 and FEMA 356 include lists of seismic rehabilitation measures as a function of common building types. Priorities for these measures are established in terms of respective contribution to the overall earthquake resistance of the structure.

   Apply a "worst first" approach. Attend to heavily used sections of the most vulnerable buildings housing the greatest number of occupants, as well as to areas housing critical functions and equipment. For example, higher priorities may be given to rehabilitation of areas of higher human occupancy, such as banquet rooms and restaurants; to areas that facilitate the evacuation of the building in an earthquake, such as lobbies, corridors, stairs, and exits; and to areas where important information and equipment are housed.

3. **Define increments:** Break down the specific seismic rehabilitation opportunities into discrete incremental rehabilitation measures that make sense in engineering and construction terms. When establishing increments, consider scheduling to minimize disruption to normal hospitality operations.

4. **Integrate with other rehabilitation work:** Link each incremental rehabilitation measure with other related facility maintenance or capital improvement work. The related work classifications may differ from one building owner or operator to another, and some may be the owner's responsibility while other may be the operator's, but they will fall into the following generic categories:

   - Building envelope improvements
   - Interior space reconfiguration
   - Life safety and accessibility improvements
   - Refinishing and hazardous materials removal
   - Building systems additions, replacements, and repairs
   - Additions to existing buildings

Damage Control and Building Performance Levels

	Target Building Performance Levels Lower Performance More Loss → Higher Performance Less Loss			
	Collapse Prevention Level (5-E)	**Life Safety Level (3-C)**	**Immediate Occupancy Level (1-B)**	**Operational Level (1-A)**
Overall Damage	**Severe**	**Moderate**	**Light**	**Very Light**
General	Little residual stiffness and strength, but load-bearing columns and walls function. Large permanent drifts. Some exits blocked. Infills and unbraced parapets failed or at incipient failure. Building is near collapse.	Some residual strength and stiffness left in all stories. Gravity-load-bearing elements function. No out-of-plane failure of walls or tipping of parapets. Some permanent drift. Damage to partitions. Building may be beyond economical repair.	No permanent drift. Structure substantially retains original strength and stiffness. Minor cracking of facades, partitions, and ceilings as well as structural elements. Elevators can be restarted. Fire protection operable.	No permanent drift. Structure substantially retains original strength and stiffness. Minor cracking of facades, partitions, and ceilings as well as structural elements. All systems important to normal operations are functional.
Nonstructural Components	Extensive damage.	Falling hazards mitigated but many architectural, mechanical, and electrical systems are damaged.	Equipment and contents are generally secure, but may not be operable due to mechanical failure or lack of utilities.	Negligible damage occurs. Power and other utilities are available, possibly from standby sources.
Comparison with performance intended for buildings designed under the *NEHRP Provisions* for the Design Earthquake	Significantly more damage and greater risk.	Somewhat more damage and slightly higher risk.	Less damage and lower risk.	Much less damage and lower risk.

Adapted from FEMA 356, Table C1-2

Opportunities for project integration are listed in Part C, Section C.2 of this manual. Some examples of the opportunities you can use to link projects are: when accessing concealed areas, when removing finishes and exposing structural elements, when performing work in a common location, when sharing scaffolding and construction equipment, and when sharing contractors and work force.

The four subtasks described above form an iterative process. The definition and related cost estimation of increments, as well as the integration with other maintenance and capital improvement projects (subtasks 3 and 4), may lead to a revision of target performance levels (subtask 1) or to specific analysis carried out as part of subtask 2.

Incremental Seismic Rehabilitation

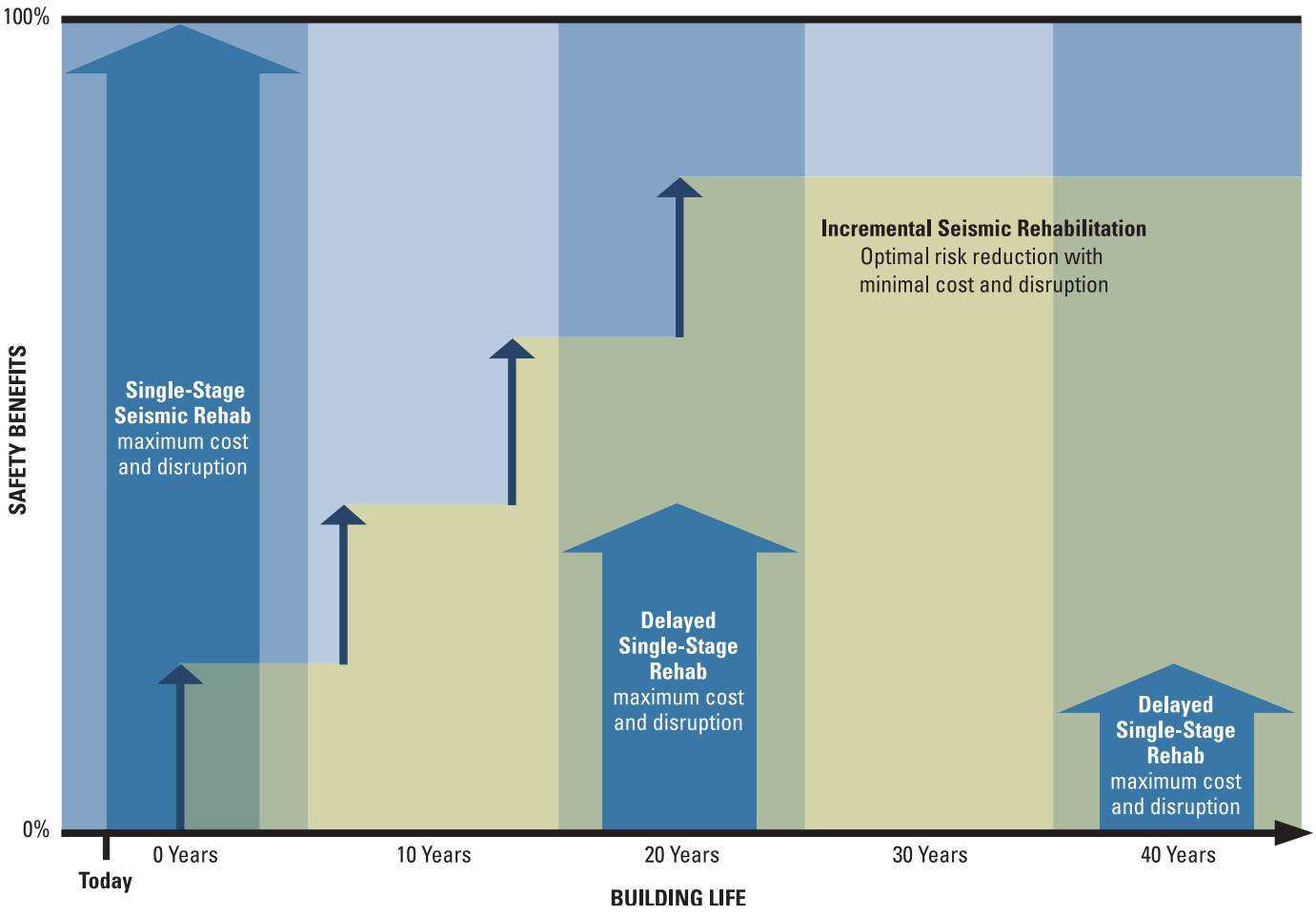
Element 8
Staging Seismic Rehabilitation Increments

B.2.2.8 Staging Seismic Rehabilitation Increments

Determine the number and scope of incremental stages that will be undertaken and the length of time over which the entire rehabilitation strategy will be implemented.

Estimates of seismic damage can be quantified in terms of percentage of building value damaged. Annual seismic damage is calculated as the probable damage that can result in any year from all possible earthquakes. The benefits of seismic rehabilitation are quantified as the reduction in annual seismic damage resulting from specific rehabilitation actions (also quantified in terms of percentage of building value). A generalized life-cycle benefit analysis shows that incremental approaches can return a substantial portion of the expected benefits of single-stage seismic rehabilitation carried out now.

The schematic diagram below illustrates such a life-cycle benefit analysis. The three wide arrows represent the benefits of single-stage rehabilitation occurring at three points in time: now, in 20 years, and in 40 years. Clearly, the largest benefit derives from a single-stage rehabilitation done now, and it is designated as 100%. The benefits of single-stage rehabilitation done in the future must be discounted and expressed as some percentage lower than 100%, as represented by the decreased arrows. The stepped portion of the diagram represents incremental rehabilitation starting soon and completed in four increments over 20 years. The benefits of the future increments must also be discounted, and the benefit of the completed incremental rehabilitation is therefore expressed as a percentage lower than 100%, but higher than the single-stage rehabilitation in year 20. Reducing the overall duration of the incremental rehabilitation will increase its benefit, and extending the duration will decrease it.



Incremental seismic rehabilitation affords great flexibility in the sequence and timing of actions when the following precautions are kept in mind:

- It is important to get started as soon as possible. Any early reduction of risk will provide benefit over the remaining life of the building. Delaying action extends risk exposure. The incremental approach can be more effective than a delayed, single-stage rehabilitation, as long as one gets started soon.
- Even if the completion of the incremental program takes 10 or 20 years, most of the risk reduction benefit is realized.
- There is a wide margin of error. For example, you may unintentionally increase the probability of damage in the first few years due to an initial rehabilitation increment that inadvertently makes the building more vulnerable to damage, and still realize the benefit of risk reduction if you complete the incremental rehabilitation over a reasonable period.

Incremental Seismic Rehabilitation

Element 9
Budget Packaging

B.2.2.9 Budget Packaging

The facility, risk, and financial managers should carefully plan how to present the incremental seismic rehabilitation budgets to maximize the probability of their being approved, given the financial realities of owner and operator organizations. Hotel and motel capital improvement budgets are generally categorized into escrow and outside escrow accounts. Escrow accounts, usually consisting of 3.5–5.0% of revenues, are set aside for specific types of improvements that are under the control of the operator. Outside escrow accounts cover other improvements that are usually under the authority of the owner; in some cases they may be required by the operator or subject to the owner-operator agreement. Most incremental seismic rehabilitation improvements will be in the outside escrow category, while some, such as attachment and anchoring of light fixtures or mechanical equipment, may fall in the escrow category. The facility maintenance and capital improvement work with which the seismic rehabilitation increments are to be integrated may also be outside escrow or escrow improvements. Thus, integrated incremental seismic rehabilitation may present an opportunity for the creative packaging of escrow and outside escrow accounts into integrated budget packages.

The facility capital improvements and maintenance budget proposals, generated both locally at the building and centrally at owner or operator headquarters, are results of the facility planning process. The budget, however, is also a vehicle for establishing funding priorities through a board decision, a special agreement between the owner and operator, or other process. It is unlikely for most hotel and motel building owners and operators in the United States to be able to raise funds for a comprehensive seismic rehabilitation program of all their buildings. While the incremental rehabilitation approach appears to be a viable alternative, in some organizations it may be necessary to "package" incremental seismic rehabilitation with other work in order to get it funded.

In regions of moderate seismicity and low seismic awareness (parts of New York and New England, for example), it may be useful to concentrate on rehabilitation measures that also reduce the risk of loss due to other natural or man-made forces, such as high winds or terrorist attack. Such a multi-hazard approach will help justify mitigation investments.

For those parts of the country where the understanding of earthquake risk is limited, it may be necessary and appropriate to combine seismic rehabilitation costs with normal maintenance budgets.

B.2.2.10 Financial Packaging

Incremental Seismic Rehabilitation

Element 10
Financial Packaging

Aside from escrow improvements that are funded directly from revenues, hotel and motel owners can fund outside escrow improvement from three sources: equity, commercial credit, and operator credit. The mode of financing should be decided prior to initiation of the seismic rehabilitation.

B.2.2.11 Seismic Rehabilitation Project Management

Incremental Seismic Rehabilitation

Element 11
Seismic Rehabilitation Project Management

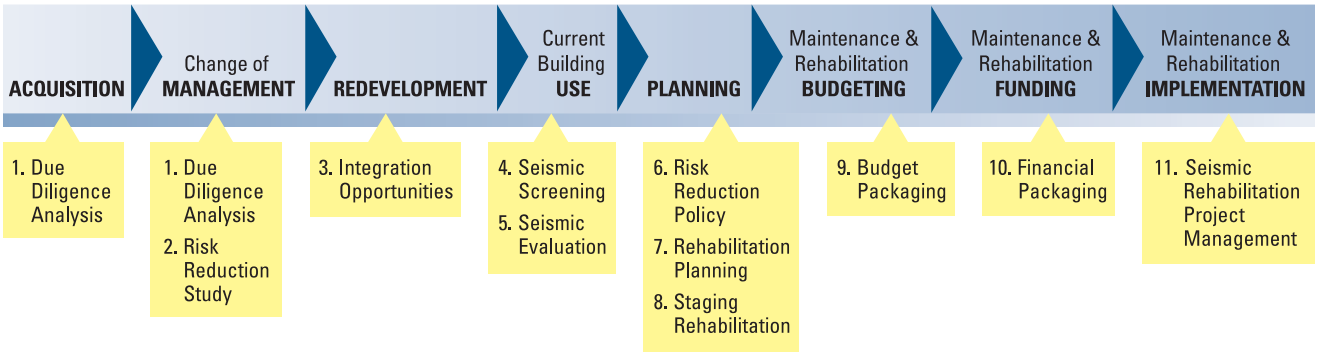
In addition to management coordination between the operator and owner, the implementation of the selected incremental seismic rehabilitation measures in combination with other building work may require detailed project design and bid packaging.

- Fully brief or train in-house architects/engineers or outside consultants preparing the bid documents on the rationale behind the rehabilitation measures in order to assure that the risk reduction objectives are achieved.
- Ensure the continuity of building documentation from the analysis and design through construction and as-built drawings.
- Conduct a pre-bid conference to explain to all prospective bidders the seismic risk reduction objectives and the rationale for their selection.

Federal and state mandates and programs represent opportunities for seismic rehabilitation. Federal and state programs may establish requirements affecting the implementation phase that have implications for hotels and motels (e.g., Americans with Disabilities Act [ADA] and Occupational Safety and Health Administration [OSHA] requirements).

B.2.3 Integration into the Hotel and Motel Facility Management Process

The following diagram illustrates the integration of the 11 elements discussed in the preceding sections (B.2.2.1 through B.2.2.11) into the hotel and motel facility management process. The elements are shown in the phase of the management process in which they are most likely to be implemented.



In Brief

Ten additional activities can be added to the facility management process to further reduce seismic risk.

B.3 Opportunities for Seismic Risk Reduction in Support of Integrating Incremental Seismic Rehabilitation into the Facility Management Process

The following ten opportunities for seismic risk reduction support the integration of an incremental seismic rehabilitation program:

1. Responding to Occupant Concerns
2. Emergency Management/Response Planning (establishing liaison)
3. Emergency Management/Mitigation Planning (establishing liaison)
4. Developing a Risk Reduction Policy
5. Incorporating Federal and State Mandates and Programs
6. Coordinating with Risk and Insurance Managers
7. Coordinating with Lenders
8. Becoming Familiar with Applicable Codes
9. Establishing and Maintaining a Roster of Design Professionals
10. Negotiating Code Enforcement

These opportunities are created by internal and external factors that typically influence the hotel and motel facility management process. Internal factors are generated within the owner's or operator's organization. External factors are imposed on organizations by outside pressures, such as the government, insurance regulations and practices, or the financial climate. The following factors may influence each respective phase:

Acquisition: external market conditions, lenders and insurers, and internal risk management

Change of Management: external market conditions and insurers, and internal risk management

Redevelopment: external market conditions, lenders and insurers, and internal marketing, architectural, and risk reduction policies

Current Use: external federal and state programs, and internal occupant concerns

Planning: external insurance carriers and brokers and government mandates, and internal board policies

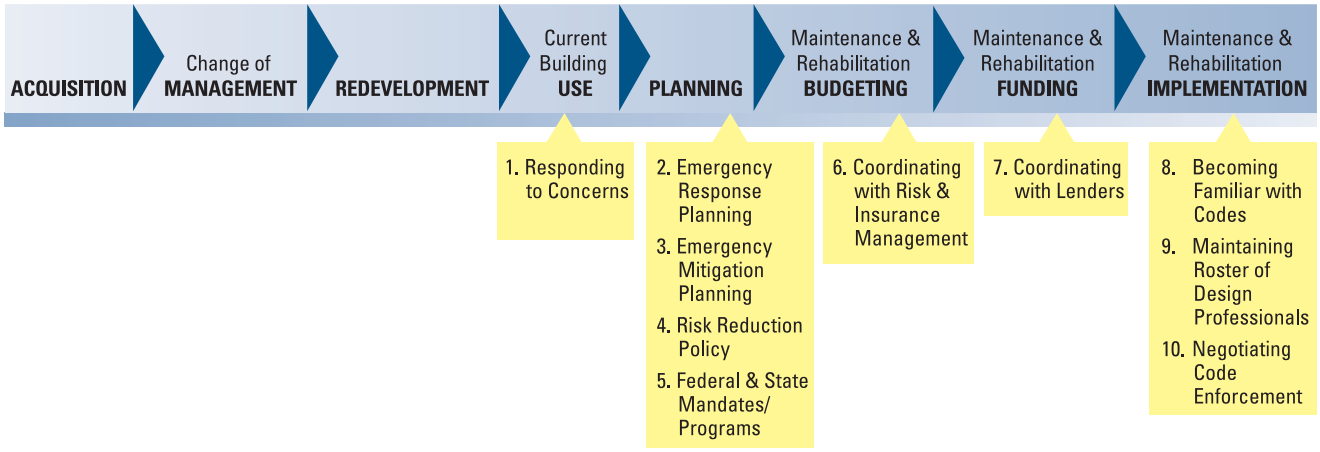
Budgeting: external government fiscal regulations and lender requirements, and internal budgetary constraints and risk management

Funding: external economic conditions

Implementation: external federal and state mandates and programs, codes and code enforcement

Appendix I to this manual, Additional Information on Hotel and Motel Building Facility Management, contains a discussion of the specific phases and the related internal and external influences for those seeking more information on the facility management process.

The following diagram illustrates the integration of these opportunities into the hotel and motel facility management process. The opportunities are shown in the phase of the management process in which they are most likely



to be implemented. Each opportunity is discussed in detail in the following sections (B.3.1 through B.3.10).

B.3.1 Responding to Occupant Concerns

Hotel and motel operators should track all guest and staff concerns that relate to earthquake vulnerability, and make sure they are understood and considered by both owners and operators in the **planning** phase.

Be alert to guest concerns, especially as they affect occupancy. They can be a source of considerable influence on risk managers as well as a potentially significant pressure on the facility management process. Occupant concerns may become the vehicle for channeling owner and operator internal pressures of all kinds, including policies adopted by the board, into capital improvements and maintenance actions.

B.3.2 Emergency Management/Response Planning

Hotel and motel operators should establish a liaison with emergency management agencies and volunteer agencies such as the Red Cross.

Become familiar with the role of hotels and motels in the local emergency response plans. If it is a significant role, become active in the emergency planning process. Define the role in specific detail, assigning specific functions to specific facilities. The role of specific hotel and motel buildings in the local emergency response plans (such as shelter and housing for disaster victims) should affect seismic performance objectives and the priority of specific seismic rehabilitation measures. Therefore, there should be full coordination between an operator's emergency planning and facility planning functions.

B.3.3 Emergency Management/Mitigation Planning

Hotel and motel owners and operators should establish a liaison with emergency management mitigation planners at the state and local levels.

Endeavor to incorporate the hotel and motel building earthquake mitigation into the state's mitigation plan, and to recognize the owner's and operator's incremental seismic rehabilitation measures as elements of the mitigation plan.

Federal resources and funds are available to small business owners following a presidentially declared disaster for the support of disaster recovery and mitigation planning activities in the form of Small Business Administration

(SBA) loans. Hotel and motel owners who qualify should make every effort to obtain these resources.

B.3.4 Developing a Risk Reduction Policy

Convince the board of directors to adopt a clear policy statement supporting seismic risk reduction. Such a policy should, at a minimum, establish seismic performance objectives for the owner's and operator's hotel and motel buildings. Seismic performance objectives define the target performance of a building following an earthquake of a specified intensity. The policy and objectives should be developed and documented as part of the seismic rehabilitation planning process.

Currently there are no seismic rehabilitation mandates or implications in any federal or state programs related to existing commercial buildings with the exception of California.

B.3.5 Incorporating Federal and State Mandates and Programs

Hotel and motel owners and operators should become familiar with the seismic rehabilitation requirements imposed on hotel and motel buildings by federal and state programs, currently or under discussion for the future, and take them into account in planning activities.

B.3.6 Coordinating with Risk and Insurance Managers

Establish coordination between the facility management and risk management functions within the respective hotel and motel building owner's and operator's organizations, as well as between these organizations.

The owner's or operator's risk and insurance managers may have a direct or indirect role in the planning and budgeting phases of the facility management process with regard to decisions related to insurance as well as other budget categories.

In regions of seismic risk, the risk of building loss or damage, the risk of occupant death or injury, and the risk of the owner's and operator's liability must all be assessed. The risk managers should be fully informed on the individual building or project approaches to seismic risk reduction and should participate in the planning process. Insurance carriers are more than willing, when asked, to provide building owners and operators with Loss Control and Prevention Reports that include recommendations for loss prevention. If seismic risk is covered by the owner's or operator's insurance carrier, it may be possible to negotiate a rate reduction, deductible reduction, or increased maximum benefit. On the other hand, the insurer may require some seismic rehabilitation as a condition of coverage.

Hotel and motel facility operators have practiced formal risk management for a long time, but it usually focuses on issues of loss reduction from injury, theft, and other crimes. Facility losses are of relatively recent concern to many hotel and motel building owners and operators. For large owners or operators with nationwide portfolios, risk management is usually placed at central headquarters. Facility management is a local function that takes place at a particular building, or regionally, for a group of buildings. In this case, there is a need to establish effective communication lines between central organization staff and local facility managers. Risk managers may develop checklists, questionnaires, or other planning tools to be used by facility managers in planning for seismic risk reduction.

B.3.7 Coordinating with Lenders

Hotel and motel owners should become familiar with the requirements likely to be imposed by lenders on their capital improvement program. Some lenders may waive or reduce their requirement for seismic insurance if certain seismic improvements are included in the program.

B.3.8 Becoming Familiar with Applicable Codes

Both owners and operators should become familiar with the seismic rehabilitation requirements imposed in their building inventory's jurisdictions by building codes or other codes and ordinances, currently or under discussion for the future such as rehabilitation codes, and take them into account in planning activities.

B.3.9 Establishing and Maintaining a Roster of Design Professionals

Both owners and operators should develop and maintain a roster of architects, engineers, and other consultants with expertise in the fields of seismic assessment of buildings, seismic design, and risk analysis to quickly make use of their specialized expertise when needed. Such qualified professionals can be identified with the assistance of professional societies, such as the American Society of Civil Engineers, the American Institute of Architects, or the Earthquake Engineering Research Institute.

B.3.10 Negotiating Code Enforcement

Discuss the owner's or operator's planned incremental seismic rehabilitation actions with the applicable code enforcement authorities.

Building codes impose requirements on the implementation phase in cases of repair, alteration, or addition to existing buildings. These requirements may be enforced by a state or local agency. Such requirements can add costs to a project and jeopardize feasibility if not taken into account.

Although additions must comply with building code seismic requirements, few codes mandate seismic rehabilitation in repair and alteration projects. Incremental seismic rehabilitation is consistent with most building code requirements applicable to existing buildings.

If applicable, negotiate with code enforcement authorities an optimization of life safety and risk reduction when undertaking seismic rehabilitation. Some code enforcement agencies negotiate required life safety and other improvements with owners of existing buildings who undertake voluntary building rehabilitation. Such negotiations attempt to strike a compromise between safety, feasibility, and affordability.

B.4 Additional Components of a Comprehensive Earthquake Safety Program

In Brief

Two additional components of an earthquake safety program can be initiated.

In addition to integrating an incremental seismic rehabilitation program into the hotel and motel facility management process and integrating opportunities to support and implement such a program, there are additional activities that can become part of a comprehensive earthquake safety program for hotel and motel buildings. These activities can be implemented by the operator at any time.

B.4.1 Building Contents Mitigation

Communicate with maintenance staff to initiate housekeeping or maintenance measures to reduce or eliminate risks from earthquake damage to equipment, furnishings, and unsecured objects in buildings. Work may include such tasks as:

- Fastening desktop equipment

- Anchoring display cases, bookcases, file cabinets, storage shelves, and other large furnishings
- Restraining objects on shelves
- Securing the storage of hazardous materials such as chemicals

FEMA has developed materials that contain information on contents mitigation. These include FEMA 74, *Reducing the Risk of Nonstructural Earthquake Damage: A Practical Guide,* and FEMA 241, *Identification and Reduction of Nonstructural Earthquake Hazards in Schools.* (While the latter primarily addresses schools, it is equally applicable to other facility types.)

B.4.2 Earthquake Drills

Introduce earthquake drills and appropriate earthquake preparedness materials into the regular hotel and motel building emergency preparedness program. Knowing what to do and where to go in an emergency can be critical to life safety in earthquakes.

B.5 Preparing a Plan for the CEO and the Board

In Brief

There are three options to propose a seismic safety program.

This section provides guidance to hotel and motel facility managers, risk managers, and financial managers when preparing a proposal for a seismic safety program in response to top management's request.

The owner's or operator's facility, risk, and financial managers should prepare a proposal for a seismic risk reduction program. This proposal should be based on an analysis of each of the elements of an incremental seismic rehabilitation program (B.2.2), opportunities for seismic risk reduction (B.3), and additional components (B.4) as discussed above. The proposal should include the following elements:

- A discussion of each recommendation in Part B from the perspective of the owner's or operator's current facility management, risk management, and financial management practices. This may take the form of a comprehensive rewriting of Part B.
- A specific plan and recommendation for initiating the first two steps following building acquisition, change of management, and redevelopment, **Seismic Screening** and **Seismic Evaluation**. The plan should include a budget and schedule of activities.
- A request for the budget for these first steps.

If the necessary resources are available to the facility manager, perform a rapid visual screening, as outlined in B.2.2.4, prior to preparing the program proposal. Then, expand the proposal based on the known inventory of potentially vulnerable buildings as determined in the screening process.

If the owner or operator has a current 5-year capital improvement plan or its equivalent, add the following details to the proposal discussed above:

- Identify existing buildings currently included for rehabilitation in the current 5-year plan.
- Perform a preliminary review of their seismic vulnerabilities, as outlined in B.2.2.4.
- Using Part C of this manual, identify potential seismic rehabilitation increments that could be integrated with the rehabilitation program.

- Add a FEMA 356, *Prestandard and Commentary for the Seismic Rehabilitation of Buildings,* seismic rehabilitation design task to the rehabilitation projects.

Summary of Part B

- Planning for earthquake risk reduction in hotel and motel buildings requires a coordinated and integrated effort by facility managers, risk managers, and financial managers of both the owner and operator organizations.
- Eleven specific activities can be added to the current facility management process to implement an incremental seismic rehabilitation program.
    1. Due Diligence Analysis
    2. Operator Risk Reduction Standards
    3. Initial Integration Opportunities
    4. Seismic Screening
    5. Seismic Evaluation
    6. Developing a Risk Reduction Policy
    7. Seismic Rehabilitation Planning for Specific Buildings
    8. Staging Seismic Rehabilitation Increments
    9. Budget Packaging
    10. Financial Packaging
    11. Seismic Rehabilitation Project Management
- Ten additional activities can be added to the facility management process to further reduce seismic risk.
- Two additional components of an earthquake safety program can be initiated.
- There are three options to propose a seismic safety program.

Recommended Actions

1. Prepare an analysis of your buildings using Part B of this manual as a guide.
2. Based on this analysis, prepare a seismic risk reduction plan for top management that includes the costs and benefits of such a plan.
3. Adopt a comprehensive earthquake safety program and begin to implement incremental seismic rehabilitation in your buildings.

For Facility Managers

Part C

Tools for Implementing Incremental Seismic Rehabilitation in Existing Hotel and Motel Buildings

Introduction

An owner or operator of hotel and motel buildings or a hotel and motel facility manager charged with the responsibility of implementing a program of incremental seismic rehabilitation may be entering unfamiliar territory. Part C of this manual is intended to provide the owner, operator, and facility manager with information and tools regarding building systems, maintenance, repair, and rehabilitation that should be of assistance in implementing such a program.

A program of incremental seismic rehabilitation is likely to be more affordable and less disruptive if specific increments of seismic rehabilitation are integrated with other maintenance and capital improvement projects that would be undertaken regardless of whether or not seismic issues were being addressed.

Guide to Sections C.1 and C.2

Section C.1, How to Use Engineering Services, provides the facility manager with practical information on the special services offered by seismic rehabilitation professionals. Several essential activities must be carried out by the facility manager in order to successfully implement a program of incremental seismic rehabilitation. (These activities are identified and

discussed in Part B of this manual.) Some of these activities may require professional architectural and engineering services that differ from or exceed the traditional services usually retained by hotel and motel building owners.

Section C.2, Discovering Integration Opportunities for Incremental Seismic Rehabilitation, provides the facility manager with a set of tools to link specific increments of seismic rehabilitation with specific maintenance and capital improvement projects. These tools will assist the facility manager in defining appropriate scopes of work for projects that will include incremental seismic rehabilitation actions.

Appendix II to this manual, Integration Opportunities for Incremental Seismic Rehabilitation for Small Organizations and Individual Owners, presents integration opportunities for owners with limited professional facility management support, who are also likely to be their own operators.

A companion document, *Engineering Guideline for Incremental Seismic Rehabilitation,* FEMA 420, provides design professionals with additional technical guidance for the detailed design of specific rehabilitation projects.

In Brief

- **Engineering services should be retained for three specific phases: seismic screening and evaluation, incremental seismic rehabilitation planning and design, and construction period support.**
- **Continuity of building documentation is of special importance.**

C.1 How to Use Engineering Services

To successfully implement integrated incremental seismic rehabilitation, a hotel owner or operator should retain engineering services for three specific phases:

- Seismic screening and evaluation
- Incremental seismic rehabilitation planning and design
- Construction period support

In the case of managed—as opposed to franchised—hotels and motels, the operator may recommend that the owner retain these engineering services, or the owner may retain the services of the operator's architect/engineer.

Seismic Screening and Evaluation

Seismic screening and evaluation of the owner's hotel and motel building inventory begins with a review of archival drawings and specifications, if available, to determine the types of construction used. This determination is essential for all subsequent phases. If drawings and specifications are not available, this determination must be made on the basis of visual inspection. In the case of potentially vulnerable buildings, the operator may initiate such a review.

Following this review, building inventories at one location or region should be screened in a process based on FEMA 154, *Rapid Visual Screening of Buildings for Potential Seismic Hazards: A Handbook, Second Edition.* The goal of the screening is to identify vulnerabilities in the inventory. Buildings that have little or no vulnerability are removed from further scrutiny.

For the buildings identified as vulnerable, the next category of service is a detailed seismic evaluation using ASCE 31, *Seismic Evaluation of Existing Buildings,* which is based on FEMA 310, *Handbook for the Seismic Evaluation of Existing Buildings: A Prestandard.* Hotel and motel building owners with few buildings, or operators concerned about potential vulnerability of a particular building, may begin with this evaluation, which addresses individual buildings and identifies both structural and nonstructural deficiencies that require rehabilitation. The output of each building evaluation is a list, possibly prioritized, of needed specific rehabilitation actions.

An owner or operator may retain the services of a single engineering firm to perform both the screening and evaluation, or it can retain a firm for screening and one or more firms for building evaluation.

Incremental Seismic Rehabilitation Planning and Design

A complete seismic rehabilitation plan covering all the deficiencies identified in the evaluation should be prepared for each building that has been evaluated. This can be done using ASCE 31 and FEMA 356, *Seismic Rehabilitation of Buildings.* However, in incremental seismic rehabilitation the correction of all the deficiencies is not implemented at once, but rather in discrete increments over a period of time. In order to accomplish this, it is necessary to carry out four specific steps:

- Establish target seismic performance levels
- Prioritize seismic rehabilitation opportunities
- Define increments
- Integrate seismic rehabilitation into maintenance and capital improvement programs

Each of these steps, and how it relates to owner and operator responsibilities, is amplified in the discussion of the hotel and motel building planning phase in Section B.2.

The potential for unintentional weakening of the building as the result of a particular increment should be carefully analyzed and must be avoided. This subject is discussed in more detail in the companion document, *Engineering Guideline for Incremental Seismic Rehabilitation,* FEMA 420.

Seismic rehabilitation planning and design may be carried out by the same engineering firm that performed the evaluation, or by a separate firm. Close coordination with the owner's and operator's risk management functions is a prerequisite for the successful implementation of performance objectives and prioritization steps. The definition of increments and integration of activities will also require close coordination with financial managers so as to be consistent with budgeting and funding processes, as discussed in Part B. The contractual agreement covering this work should reflect the fact that some of the work is implemented immediately and some of the work is left to the future.

Construction Period Support

Construction period support for incremental seismic rehabilitation is much the same as for any other construction project. The plans and specifications should be implemented correctly, and all specified quality control measures should be followed. All substitutions or changes should be carefully analyzed by the design professionals in terms of their seismic implications. Particular attention should be paid to the proper bracing and anchorage of nonstructural elements undergoing rehabilitation.

Continuity of Building Documentation

Assuring the continuity of building documentation is of particular importance for incremental seismic rehabilitation. The rehabilitation of each individual building may be staged over a period of several years or decades as discussed in Section B.2. The screening, evaluation, planning, and design may be split among several engineering firms. Institutional memory may disappear as owner or operator personnel, and even building ownership and/or operation, changes. It is therefore essential that the hotel and motel facility

manager document all aspects and requirements of seismic rehabilitation from the earliest building screening through evaluation, seismic rehabilitation planning, and completion of each increment of seismic rehabilitation, paying special attention to the scheduling of follow-up requirements and actions over time.

Fees for Professional Services

The professional services required to implement incremental seismic rehabilitation, as discussed above, clearly exceed the scope of traditional architectural/engineering design services. An appropriate fee structure for these new services will need to be developed and integrated into the budgeting process.

C.2 Discovering Integration Opportunities for Incremental Seismic Rehabilitation

In Brief

- **Opportunities to add seismic rehabilitation increments exist within most major maintenance and capital improvement activities.**
- **Incremental seismic rehabilitation opportunities are suggested for nine specific maintenance and capital improvement categories.**

In order to benefit from opportunities to integrate incremental seismic rehabilitation with other maintenance and capital improvement activities, it is useful to discuss these activities as they are typically undertaken in hotel and motel buildings. Most hotel and motel building owners and operators are familiar with their respective building inventories and the related patterns of maintenance and capital improvement. A significant parameter of patterns of maintenance and capital improvement may be the operator's or franchiser's hotel brand standards. Aggregate national data is of no particular relevance to a given owner or operator, but may be of general interest and is summarized in the sidebar on the opposite page.

Categories of Maintenance and Capital Improvement Projects

Hotel and motel owners and operators often categorize maintenance and capital improvement projects in two groups: escrow improvements (usually under the authority of the operator) and outside escrow improvements (usually under the authority of the owner, but sometimes required by the operator). Within these groups are the following nine categories of projects:

Outside escrow

1. Roofing maintenance and repair/re-roofing
2. Exterior wall and window maintenance/façade modernization
3. Fire and life safety improvements
4. Public and service area modernization (usually at acquisition or change of operator)
5. Underfloor and basement maintenance and repair
6. Heating, ventilating, and air conditioning (HVAC) upgrade and energy conservation/indoor air quality improvement
7. Hazardous materials abatement (usually at acquisition or change of operator)

Escrow

8. Guestroom finishing, furniture, and equipment (FF&E)
9. Public area FF&E

These categories reflect groupings of building elements, administrative and funding categories, categories of spaces, or other parameters. Some

owners or operators may use other categorizations of maintenance and capital improvement work. The purpose of this discussion is not to impose any particular categorization of work, but simply to demonstrate the characteristics of a given item of planned work that may make it particularly suitable for integration with particular incremental seismic rehabilitation measures. These pairings of seismic rehabilitation measures with other categories of work are referred to in this section as "integration opportunities." Owners, operators, and facility managers using this manual are encouraged to modify the work categories to suit their own practices.

Work Descriptions and Matrices of Seismic Performance Improvement Opportunities

Nine sections, C.2.1 through C.2.9, provide the facility manager with information used to identify incremental seismic rehabilitation opportunities that can be combined with maintenance and capital improvement projects. The information becomes a tool, a technical framework or basis for action, that can be communicated to the architect or engineer selected to work on any project resulting from an integration opportunity.

These sections present the expanded descriptions of each of the work categories defined above in a consistent format. Each category is described in terms of:

- General description
- Physical description
- Associated incremental rehabilitation work
- Performance of the work
- Special equipment
- Impact on building use

Matrices of possible specific integration opportunities, one matrix for each work category (Tables C-1 through C-5), accompany the descriptions of the first five categories of maintenance and capital improvement projects. These include:

- Roofing maintenance and repair/re-roofing
- Exterior wall and window maintenance/façade modernization
- Fire and life safety improvements
- Public and service area modernization
- Underfloor and basement maintenance and repair

The integration opportunities for the next two categories of work are defined by reference to one or more of these five matrices. An additional matrix of integration opportunities (Table C-6) is provided for the work category "guestroom finishing, furniture, and equipment (FF&E)," and the integration opportunities for the final work category, "public area FF&E," are defined by reference to one of the six matrices.

Note that "hotel and motel building additions" are a category of typical capital improvement that is not included among the nine categories listed at the beginning of this section. Additions may have been constructed on hotel and motel buildings over the course of their useful lives. Current additions will be designed to meet the seismic requirements of the building code. Additions may also offer opportunities to strengthen an adjacent building or buildings. These opportunities require careful design and analysis, and they are not

Generalized Maintenance and Capital Improvement Data

Whitestone Research (a private market research organization) indicates that expenditures for maintenance and repairs over a building's life exceed replacement costs for most building types and configurations, including hotels and motels.

The predominant categories of maintenance and repair activities for small motels (the only category reported) are, first, mechanical systems, followed by plumbing systems, interior finishes, and interior construction. All these activities offer opportunities for integration with incremental seismic rehabilitation work.

The timing of the work is also highly predictable. The top 6 years of expense account for about 52% of building replacement. With regularity, years 10, 20, 25, 30, 40, and 50 are the highest expense years, in roughly increasing order, with year 50 incurring about 15% of replacement costs for outsourced repair and renovation expenses.

These patterns suggest significant opportunity (and tendency) to implement strategies like incremental rehabilitation at specific points over the service life of a hotel or motel building. They also imply specific target periods when the strategies could most likely be considered and implemented. Building age becomes a very important characteristic for incremental seismic rehabilitation.

specifically identified in the integration opportunities matrices (Tables C-1 through C-6). Furthermore, inadequately designed additions, without proper joints or connections to the existing building, could actually cause damage in an earthquake as different sections of the building pound against each other.

The seismic performance improvements shown in the matrices fall into three categories:

- ■ Indicates improvements that can be implemented when the integration opportunity arises, on the basis of a quick evaluation by a design professional. These types of improvements address deficiencies that may be identified in an ASCE 31, *Seismic Evaluation of Existing Buildings*, Tier 1 analysis.
- □ Indicates improvements that can be implemented when the integration opportunity arises and that require engineering design. These types of improvements address deficiencies that may be identified in an ASCE 31 Tier 1 or Tier 2 analysis.
- ☒ Indicates improvements that require engineering analysis to determine if they should be implemented when the integration opportunity arises to avoid unintentionally increasing the seismic vulnerability by redistributing loads to weaker elements of the structural system (sequencing requirements).

The absence of any of these symbols in a matrix cell indicates that the improvement in question is not applicable to the particular structural type. The specific placement of each of these symbols (■, □, ☒) or the absence of a symbol is based on professional judgment considering typical construction. However, exceptions leading to changes in these categories may arise in specific buildings.

Integration opportunities for incremental seismic rehabilitation are a function of three levels of seismicity: low, moderate, and high. The definitions of these levels are those used in ASCE 31, *Seismic Evaluation of Existing Buildings,* and FEMA 356, *Seismic Rehabilitation of Buildings.* They include both seismic zonation and soil conditions. The soil conditions at the site may affect the level of seismicity and must be taken into account. For example, soft soil may amplify seismic forces on some buildings. The method for determining the level of seismicity is given in Section 2.5 of ASCE 31. Significantly fewer seismic improvements are recommended for low levels of seismicity than for the higher levels because seismic vulnerability is lower. The seismic improvements recommended for moderate and high levels of seismicity are the same in number, but differ in the details of the improvements to reflect the different magnitudes of seismic loads encountered in the two levels.

Incremental seismic rehabilitation integration opportunities for each category of work are a function of building structural type. This manual uses five broad structural types, selected to be meaningful to hotel and motel facility managers. The materials used for the building's vertical load-resisting system can be used to categorize the following structural types:

- wood
- unreinforced masonry
- reinforced masonry
- concrete
- steel

The latter two structural types, concrete and steel, are broken down further into those with wood floors and roofs (flexible diaphragms) and concrete

floors and roofs (rigid diaphragms). This breakdown covers an important parameter that determines how lateral loads are distributed to load-resisting elements of the structures. Structures with flexible diaphragms distribute earthquake loads based on proportional or tributary area between shear-resisting elements (shear walls or frames). Flexible diaphragms allow a straightforward analysis of loads in each shear element. Structures with rigid diaphragms distribute earthquake loads based on the relative rigidity of the individual shear-resisting elements. Rotational (twisting) forces may be introduced that must also be resisted by these and other elements. Rigid diaphragms require more detailed analysis that may have to be conducted for each increment of the proposed strengthening program.

The facility manager using this section to identify incremental seismic rehabilitation integration opportunities in a particular building should use Sections C.2.1 through C.2.9 and the matrices therein as follows:

- Determine the category of maintenance or capital improvement under consideration, and go to the section that corresponds most closely to that category.
- Determine the level of seismicity applicable to the building by considering the seismic map and the soil conditions, and identify the applicable rows of the matrix.
- Determine which of the seven structural categories most closely fits the building, and identify the applicable column of the matrix.
- List all the nonstructural and structural seismic improvements identified in the matrix column and rows.
- Note the category of each improvement (■, □, ☒).

The facility manager should present to the architect or engineer the annotated list of all the nonstructural and structural seismic improvements identified for consideration and inclusion in the respective scope of design work. The architect or engineer should design the project using the companion document, *Engineering Guideline for Incremental Seismic Rehabilitation,* FEMA 420, which includes more detailed guidance on incremental seismic design. The architect or engineer designing the incremental seismic rehabilitation program will most likely break down the seven structural type categories into further subcategories, as used in ASCE 31 or FEMA 356. These categories and subcategories are discussed in detail in FEMA 420.

Definitions of Seismic Performance Improvements

The seismic performance improvements, both nonstructural and structural, that are included in the matrices of integration opportunities described in the preceding paragraphs and included in Sections C.2.1 through C.2.5 and Section C.2.8, are all extracted from a generic list of seismic performance improvements. The generic list is presented in Section C.2.10, which includes brief related explanations for each item on the list. The user of this manual can identify specific seismic performance improvements in the respective project category matrices and may then refer to these definitions for additional explanation of the involved activities.

The generic nonstructural improvements in C.2.10 are numbered from 1 to 22 for ease of reference. The improvements selected from this list for inclusion in each of the matrices in C.2.1 through C.2.5 and C.2.8 are presented in the same order and retain their respective number. This explains the occasional skipping of a number when a specific nonstructural improvement is omitted because it is not applicable in the particular matrix.

The generic structural improvements in C.2.10 are arranged in the order of structural subsystems and elements. The improvements selected from this list for inclusion in each of the matrices in C.2.1 through C.2.5 and C.2.8 are presented in the same order.

Simplified Information on Integration Opportunities

Small organizations or individual owners or franchisees with limited facility management support may wish to concentrate initially on integration opportunities for incremental seismic rehabilitation that can be identified on the basis of a quick evaluation by a design professional (i.e., those opportunities designated in the integration opportunity matrices by the symbol ■). Appendix II, Integration Opportunities for Incremental Seismic Rehabilitation for Small Organizations and Individual Owners, includes a simplified matrix that displays these opportunities for all categories of maintenance and capital improvement projects.

Owners using this appendix should retain the services of an earthquake engineer to identify other integration opportunities as well as to determine the applicable seismicity.

Category 1

Roofing Maintenance and Repair/Re-roofing

C.2.1 Roofing Maintenance and Repair/Re-roofing

General Description of the Work: This category of work, usually outside escrow, includes repair or replacement of any or all of the following elements:

- Roof drainage system
- Eaves and fascias
- Flashing and vents
- Roofing membrane
- Insulation
- Walking surface and ballast
- Parapets and caps
- Roof-mounted equipment
- Roof deck

Most roof maintenance and repair work is done either in response to a failure or as scheduled periodic maintenance or preventive maintenance work. Most seismic rehabilitation integration opportunities for this work category will relate to either scheduled or preventive maintenance. Placement of roof-mounted equipment usually relates to other work categories such as HVAC upgrade.

In some jurisdictions an application for a re-roofing permit triggers a code requirement to implement specific seismic rehabilitation such as parapet bracing.

Physical Description of the Work: Work on the roof may be localized to specific areas, may extend to the entire perimeter of the roof, or may involve the complete roof surface or large portions of it. Work may be limited to the roofing membrane or may include work on the substrate, deck, and supporting system.

Associated Incremental Seismic Rehabilitation Work: Incremental seismic rehabilitation associated with roofing maintenance and repair may include strengthening diaphragms, improving diaphragm/wall connections,

bracing parapets and chimneys, and improving equipment attachment and bracing. All of this work is also likely to be outside escrow.

Performance of the Work: Repair work on the roof is often performed by hotel operator maintenance staff. Outside contractors may be used for more extensive work.

This category of work may be subject to a business agreement between the operator and owner that addresses the owner's needs for capital funds.

An architecture/engineering (A/E) firm is typically used in connection with the installation of mechanical, electrical, telecommunication, or similar equipment. Also, building owners often use the services of an A/E for preparation of re-roofing specifications and bid documents. Sometimes owners hire the operator's A/E, while some owners prefer to do their own work.

Special Equipment: Scaffolding is sometimes used in connection with roof work. Cranes or hoists may be used to lift materials or equipment.

Impact of Work on Building Use: Work on the roof generally does not interrupt building use, except for complete re-roofing including the deck, which will affect upper floor guestrooms and public spaces.

Table C-1: Roofing Maintenance and Repair/Re-roofing

	Level of Seismicity						Vertical Load Carrying Structure						
							Wood	Masonry[1]		Concrete		Steel	
Number*	L	M	H	Building Structural Element	Structural Sub-System	Seismic Performance Improvement		Unreinforced Masonry	Reinforced Masonry	Wood Diaphragm	Concrete Diaphragm	Wood Diaphragm	Concrete Diaphragm
Nonstructural													
1	✓	✓	✓	n/a	n/a	Anchorage of Canopies at Exits	■	■	■	■	■	■	■
2		✓	✓	n/a	n/a	Anchorage and Detailing of Rooftop Equipment	■	■	■	■	■	■	■
5	✓	✓	✓	n/a	n/a	Bracing of Parapets, Gables, Ornamentation, and Appendages	■	■	■	■	■	■	■
8		✓	✓	n/a	n/a	Attachment and Bracing of Large Ductwork	■	■	■	■	■	■	■
18		✓	✓	n/a	n/a	Bracing or Removal of Chimneys	■	■	■	■	■	■	■
Structural													
n/a		✓	✓	All Elements		Load Path and Collectors	□	□	□	□	☒	□	☒
n/a		✓	✓	Horizontal Elements	Diaphragms	Attachment and Strengthening at Boundaries	■	■	■	■	☒	■	☒
n/a		✓	✓	Horizontal Elements	Diaphragms	Strength/Stiffness	■	■	■	■	☒	■	☒
n/a		✓	✓	Horizontal Elements	Diaphragms	Strengthening at Openings	□	□	□	□		□	
n/a		✓	✓	Horizontal Elements	Diaphragms	Strengthening at Re-entrant Corners	□	□	□	□	☒	□	☒
n/a		✓	✓	Horizontal Elements	Diaphragms	Topping Slab for Precast Concrete		□	□		☒		☒
n/a	✓	✓	✓	Vertical Elements	Load Path	Lateral Resisting System to Diaphragm Connection	■	■	■	■	☒	■	☒
n/a	✓	✓	✓	Vertical Elements		Out-of-Plane Anchorage of Concrete or Masonry Wall		■	■	■	□	■	□

* Nonstructural improvements are numbered for ease of use.
Structural improvements are not numbered, but rather, organized by structural element and sub-system.

■ Work that may be included in the building rehabilitation/maintenance/repair project on the basis of a quick evaluation by a design professional.

□ Work requiring engineering design.

☒ Work requiring detailed engineering analysis and evaluation of sequencing requirements. The "x" designates work that could redistribute loads, overstressing some elements.

Note 1: Masonry buildings with a concrete roof should use the concrete building, concrete diaphragm for options.

Category 2

Exterior Wall and Window Maintenance/Façade Modernization

C.2.2 Exterior Wall and Window Maintenance/Façade Modernization

General Description of the Work: Exterior wall and window maintenance may involve the following activities:

- Pointing
- Patching
- Painting
- Caulking

This category of work, usually outside escrow, may also include major projects such as:

- Window repair and replacement
- Refinishing with new cladding or material

Most exterior wall maintenance and repair work is done in response to failure or as scheduled periodic maintenance or preventive maintenance work. Caulking and window repair and replacement are also often linked to energy conservation/weatherization work.

Façade modernization is often done as redevelopment work following an acquisition. The extent and nature of the work is likely to be a function of the operator's or franchiser's hotel or motel brand standards.

Physical Description of the Work: Work is usually carried out throughout an entire hotel or motel building as a scheduled maintenance activity, although localized patching work is possible. Work may include:

- Repainting brick exterior walls
- Repairing balconies
- Replacing windows
- Improving energy conservation

Associated Incremental Seismic Rehabilitation Work: Strengthening of shear walls and improvement of diaphragm/wall connections. This work is also likely to be outside escrow.

Performance of the Work: Exterior wall and window work may be performed by skilled construction personnel on the operator's staff or by an outside contractor.

This category of work may be subject to a business agreement between the operator and owner that addresses the owner's needs for capital funds.

In many cases, an A/E may be involved to provide design, specifications, bid process, and construction administration services. Sometimes owners hire the operator's A/E, while some owners prefer to do their own work.

Special Equipment: Access to higher exterior areas may require scaffolding or swing stages. This access may provide economical opportunities for the integration of seismic rehabilitation measures.

Impact on Building Use: Since most of the work is being performed from the building exterior, it may be possible to accomplish the work throughout the year. However, some of the seismic rehabilitation measures may be noisy or require access from the interior, so this work may have to be done when guestrooms are vacant, which would affect occupancy.

Table C-2: Exterior Wall and Window *Maintenance/Façade Modernization*

	Level of Seismicity						Vertical Load Carrying Structure						
							Wood	Masonry[1]		Concrete		Steel	
Number*	L	M	H	Building Structural Element	Structural Sub-System	Seismic Performance Improvement		Unreinforced Masonry	Reinforced Masonry	Wood Diaphragm	Concrete Diaphragm	Wood Diaphragm	Concrete Diaphragm
Nonstructural													
1	✓	✓	✓	n/a	n/a	Anchorage of Canopies at Exits	■	■	■	■	■	■	■
5	✓	✓	✓	n/a	n/a	Bracing of Parapets, Gables, Ornamentation, and Appendages	■	■	■	■	■	■	■
10		✓	✓	n/a	n/a	Shut-Off Valves	■	■	■	■	■	■	■
14	✓	✓	✓	n/a	n/a	Cladding Anchorage		□	□	□	□	□	□
15		✓	✓	n/a	n/a	Anchorage of Masonry Veneer	■	■	■	■	■	■	■
16	✓	✓	✓	n/a	n/a	Glazing Selection and Detailing	■	■	■	■	■	■	■
17		✓	✓	n/a	n/a	Anchorage of Exterior Wythe in Cavity Walls		■	■	■	■	■	■
19		✓	✓	n/a	n/a	Anchorage of Steel Stud Backup		■	■	■	■	■	■
Structural													
n/a		✓	✓	All Elements		Collector and Drag Element Improvement	□	□	□	□	☒	□	☒
n/a		✓	✓	Foundation		Anchor Bolts	■						
n/a		✓	✓	Foundation		Cripple Stud Bracing	■						
n/a		✓	✓	Horizontal Elements	Diaphragms	Attachment and Strengthening at Boundaries	■	■	■	■	☒	■	☒
n/a	✓	✓	✓	Vertical Elements	Load Path	Lateral Force-Resisting System to Diaphragm Connection	■	■	■	■	☒	■	☒
n/a		✓	✓	Vertical Elements	Braced Frames	Capacity/Stiffness	□	□	□	□	☒	□	☒
n/a		✓	✓	Vertical Elements	Braced Frames	Continuity	□	□	□	□	☒	□	☒
n/a		✓	✓	Vertical Elements	Braced Frames	Connections	□	□	□	□	□	□	□
n/a		✓	✓	Vertical Elements	Moment Frames	Beam Column Capacity/Stiffness	□	□	□	□	☒	□	☒
n/a		✓	✓	Vertical Elements	Moment Frames	Beam Column Connection	□	□	□	□	□	□	□
n/a		✓	✓	Vertical Elements	Shear Walls	Capacity	■	□	□	□	☒	□	☒
n/a		✓	✓	Vertical Elements	Shear Walls	Continuity	■	□	□	□	☒	□	☒
n/a		✓	✓	Vertical Elements	Shear Walls	Lateral Stability		■	■	□	□	□	□
n/a	✓	✓	✓	Vertical Elements		Out-of-Plane Anchorage of Concrete or Masonry Wall		■	■	■	□	■	□

* Nonstructural improvements are numbered for ease of use.
Structural improvements are not numbered, but rather, organized by structural element and sub-system.

■ Work that may be included in the building rehabilitation/maintenance/repair project on the basis of a quick evaluation by a design professional.

□ Work requiring engineering design.

☒ Work requiring detailed engineering analysis and evaluation of sequencing requirements. The "x" designates work that could redistribute loads, overstressing some elements.

Note 1: Masonry buildings with a concrete roof or floors should use the concrete building, concrete diaphragm for options.

Category 3

Fire and Life Safety Improvements

C.2.3 Fire and Life Safety Improvements

General Description of the Work: Fire and life safety improvements may involve the following building elements:

- Corridors and doors
- Stairs
- Lobbies
- Exits
- Alarm systems
- Standpipes
- Automatic fire sprinkler systems

In hotel and motel buildings, this work, typically outside escrow, will usually be identified as part of due diligence at the time of acquisition or change of management. Only if the work is in response to a disaster, such as a fire, will the work be unplanned. However, repairs following a disaster may provide an opportunity to integrate seismic safety improvements.

This category of work may be mandated by a fire marshal inspection, but some operators may adopt their own fire safety standards that exceed code requirements. Some codes may also require seismic rehabilitation when a building experiences a significant amount of damage in a disaster such as fire, flood, or earthquake.

Physical Description of the Work: Fire and life safety improvements usually involve the building's means of egress, which will affect specific internal spaces. Often the work is near the center of the building, such as in the corridors and stairwells. In some cases, it may affect spaces on the building perimeter, such as lobbies, entrances, and stairways. Items include:

- Removing and replacing corridor wall finishes, doors, transoms, and equipment (e.g., cabinets) to provide access to walls and ceilings
- Installing new walls or altering existing walls at fire separations and stairway enclosures
- Installing new stairways within the building or on the exterior, which may require removing part of a floor and constructing new walls
- Installing alarms, standpipes, or sprinklers which may provide access to concealed spaces

Associated Incremental Seismic Rehabilitation Work: Incremental seismic rehabilitation work associated with fire and life safety improvements may include adding or strengthening shear walls and bracing, improving beam/column connections and diaphragm to wall anchorage, and adding or improving bracing and fastening of equipment. All of this work is also likely to be outside escrow, with the possible exception of equipment bracing.

Performance of the Work: Typically this work involves skilled construction personnel. These may be the operator's personnel or contractors. In some cases, an A/E may be involved to provide design, specifications, bid process, and construction administration services. Sometimes owners hire the operator's A/E, while some owners prefer to do their own work.

This category of work may be subject to a business agreement between the operator and owner that addresses the owner's needs for capital funds.

Special Equipment: No special equipment is required for this task except for scaffolding to provide access to the work areas.

Impact on Building Use: Typically this work, especially if extensive, is performed prior to occupancy.

Table C-3: Fire and Life Safety Improvements

Number*	Level of Seismicity L	M	H	Building Structural Element	Structural Sub-System	Seismic Performance Improvement	Vertical Load Carrying Structure: Wood	Masonry[1]: Unreinforced Masonry	Masonry[1]: Reinforced Masonry	Concrete: Wood Diaphragm	Concrete: Concrete Diaphragm	Steel: Wood Diaphragm	Steel: Concrete Diaphragm
Nonstructural													
3		✓	✓	n/a	n/a	Bracing and Detailing of Sprinkler and Piping	■	■	■	■	■	■	■
4		✓	✓	n/a	n/a	Fastening and Bracing of Equipment (Mechanical and Electrical)	■	■	■	■	■	■	■
6		✓	✓	n/a	n/a	Suspension and Bracing of Lights	■	■	■	■	■	■	■
7		✓	✓	n/a	n/a	Fastening and Bracing of Ceilings	■	■	■	■	■	■	■
8		✓	✓	n/a	n/a	Attachment and Bracing of Large Ductwork	■	■	■	■	■	■	■
9	✓	✓	✓	n/a	n/a	Anchorage and Bracing of Emergency Lighting	■	■	■	■	■	■	■
11	✓	✓	✓	n/a	n/a	Bracing of Reinforcing Masonry Walls at Interior Stairs		■	■	■	■	■	■
12		✓	✓	n/a	n/a	Bracing of Interior Partitions (Masonry and Wood)	■	■	■	■	■	■	■
13		✓	✓	n/a	n/a	Support and Detailing of Elevators		■	■	■	■	■	■
16	✓	✓	✓	n/a	n/a	Glazing Selection and Detailing	■	■	■	■	■	■	■
19		✓	✓	n/a	n/a	Anchorage of Steel Stud Backup		■	■	■	■	■	■
20		✓	✓	n/a	n/a	Restraint of Hazardous Materials Containers	■	■	■	■	■	■	■
21		✓	✓	n/a	n/a	Attachment and Bracing of Cabinets and Furnishings	■	■	■	■	■	■	■
Structural													
n/a		✓	✓	All Elements		Collector and Drag Element Improvement	☐	☐	☐	☐	☒	☐	☒
n/a		✓	✓	Horizontal Elements	Diaphragms	Mezzanine Anchorage and Bracing		■	■	■	■	■	■
n/a	✓	✓	✓	Vertical Elements	Load Path	Lateral Force-Resisting System to Diaphragm Connection	■	■	■	■	☒	■	☒
n/a		✓	✓	Vertical Elements	Braced Frames	Capacity/Stiffness				☐	☒	☐	☒
n/a		✓	✓	Vertical Elements	Braced Frames	Continuity				☐	☒	☐	☒
n/a		✓	✓	Vertical Elements	Braced Frames	Connections				☐	☐	☐	☐
n/a		✓	✓	Vertical Elements	Moment Frames	Beam Column Capacity/Stiffness				☐	☒	☐	☒
n/a		✓	✓	Vertical Elements	Moment Frames	Beam Column Connection				☐	☐	☐	☐
n/a		✓	✓	Vertical Elements	Shear Walls	Capacity	■	☐	☐	☐	☒	☐	☒
n/a		✓	✓	Vertical Elements	Shear Walls	Continuity	■	☐	☐	☐	☒	☐	☒
n/a		✓	✓	Vertical Elements	Shear Walls	Extension of Wood Interior Walls to Roof	■	■	■				
n/a		✓	✓	Vertical Elements	Shear Walls	Lateral Stability		■	■	☐	☐	☐	☐
n/a	✓	✓	✓	Vertical Elements		Out-of-Plane Anchorage of Concrete or Masonry Wall		■	■	■	☐	■	☐

* Nonstructural improvements are numbered for ease of use.
Structural improvements are not numbered, but rather, organized by structural element and sub-system.

■ Work that may be included in the building rehabilitation/maintenance/repair project on the basis of a quick evaluation by a design professional.

☐ Work requiring engineering design.

☒ Work requiring detailed engineering analysis and evaluation of sequencing requirements. The "x" designates work that could redistribute loads, overstressing some elements.

Note 1: Masonry buildings with a concrete roof or floors should use the concrete building, concrete diaphragm for options.

Category 4

Public and Service Area Modernization

C.2.4 Public and Service Area Modernization

General Description of the Work: Public and related service area modernization is usually done by the owner soon after the acquisition of a new property or the change of an operator. It may also be done periodically thereafter, usually outside escrow, in order to keep up with the competition. The work is done with the guidance of the operator, and its extent and nature is likely to be a function of the operator's or franchiser's hotel or motel brand standards. It has the potential to involve any interior or exterior wall or element in the public areas, including lobbies, banquet rooms, ballrooms, dining rooms, kitchens, bars, specialty rooms, health clubs, swimming pools, etc. Where public and service areas are located in the basement, this work may include underfloor and basement work. This category may involve simple work on a single wall or the entire reconfiguration of the public areas. The installation of new equipment, ducts, pipes, conduit, cables, and wiring may involve the reconfiguration of concealed spaces under floors, above ceilings, and inside wall cavities and chases located throughout the building.

Physical Description of the Work: This work may include reconfiguration of spaces and creation of new spaces. Items include:

- Removing walls and ceilings
- Constructing new walls and partitions
- Installing replacement finishes
- Installing ductwork, piping, and communications equipment

Access to spaces behind finishes and construction of new walls provide various opportunities for seismic rehabilitation work.

Associated Incremental Seismic Rehabilitation Work: Incremental seismic rehabilitation associated with this work may include adding or strengthening shear walls and bracing, improving beam/column connections and diaphragm to wall anchorage, and adding or improving bracing and fastening of equipment. All of this work is also likely to be outside escrow with the possible exception of equipment bracing.

In the case of public and service areas located in the basement, this work may include incremental seismic rehabilitation work associated with C.2.5, Underfloor and Basement Work. See Table C-5 in addition to Table C-4.

Performance of the Work: This work is usually performed by skilled construction personnel. Usually A/E design or interior design is used for this type of work. Sometimes owners hire the operator's A/E, while some owners prefer to do their own work.

Special Equipment: Special equipment required for access to work areas for any seismic rehabilitation construction will typically be available during any remodeling work.

Impact on Building Use: Public and service area modernization is usually done prior to occupancy.

Table C-4: Public and Service Area Modernization

Number*	Level of Seismicity L	M	H	Building Structural Element	Structural Sub-System	Seismic Performance Improvement	Vertical Load Carrying Structure: Wood	Masonry[1]: Unreinforced Masonry	Masonry[1]: Reinforced Masonry	Concrete: Wood Diaphragm	Concrete: Concrete Diaphragm	Steel: Wood Diaphragm	Steel: Concrete Diaphragm
Nonstructural													
3		✓	✓	n/a	n/a	Bracing and Detailing of Sprinkler and Piping	■	■	■	■	■	■	■
4		✓	✓	n/a	n/a	Fastening and Bracing of Equipment (Mechanical and Electrical)	■	■	■	■	■	■	■
6		✓	✓	n/a	n/a	Suspension and Bracing of Lights	■	■	■	■	■	■	■
7		✓	✓	n/a	n/a	Fastening and Bracing of Ceilings	■	■	■	■	■	■	■
8		✓	✓	n/a	n/a	Attachment and Bracing of Large Ductwork	■	■	■	■	■	■	■
9	✓	✓	✓	n/a	n/a	Anchorage and Bracing of Emergency Lighting	■	■	■	■	■	■	■
11	✓	✓	✓	n/a	n/a	Bracing or Reinforcing Masonry Walls at Interior Stairs		■	■	■	■	■	■
12		✓	✓	n/a	n/a	Bracing of Interior Partitions (Masonry and Wood)	■	■	■	■	■	■	■
13		✓	✓	n/a	n/a	Support and Detailing of Elevators		■	■	■	■	■	■
16	✓	✓	✓	n/a	n/a	Glazing Selection and Detailing	■	■	■	■	■	■	■
19		✓	✓	n/a	n/a	Anchorage of Steel Stud Backup		■	■	■	■	■	■
20		✓	✓	n/a	n/a	Restraint of Hazardous Materials Containers	■	■	■	■	■	■	■
21		✓	✓	n/a	n/a	Attachment and Bracing of Cabinets and Furnishings	■	■	■	■	■	■	■
Structural													
n/a		✓	✓	All		Collector and Drag Element Improvemen	☐	☐	☐	☐	☒	☐	☒
n/a		✓	✓	Horizontal Elements	Diaphragms	Mezzanine Anchorage and Bracing		■	■	■	■	■	■
n/a		✓	✓	Horizontal Elements	Diaphragms	Strengthening at Openings	☐	☐	☐	☐		☐	
n/a		✓	✓	Horizontal Elements	Diaphragms	Strengthening at Re-entrant Corners	☐	☐	☐	☐	☒	☐	☒
n/a	✓	✓	✓	Vertical Elements	Load Path	Lateral Force-Resisting System to Diaphragm Connection	■	■	■	■	☒	■	☒
n/a		✓	✓	Vertical Elements	Braced Frames	Capacity/Stiffness				☐	☒	☐	☒
n/a		✓	✓	Vertical Elements	Braced Frames	Continuity				☐	☒	☐	☒
n/a		✓	✓	Vertical Elements	Braced Frames	Connections				☐	☐	☐	☐
n/a		✓	✓	Vertical Elements	Moment Frames	Beam Column Capacity/Stiffness				☐	☒	☐	☒
n/a		✓	✓	Vertical Elements	Moment Frames	Beam Column Connection				☐	☐	☐	☐
n/a		✓	✓	Vertical Elements	Shear Walls	Capacity	■	☐	☐	☐	☒	☐	☒
n/a		✓	✓	Vertical Elements	Shear Walls	Continuity	■	☐	☐	☐	☒	☐	☒
n/a		✓	✓	Vertical Elements	Shear Walls	Extension of Wood Interior Walls to Roof	■	■	■				
n/a		✓	✓	Vertical Elements	Shear Walls	Lateral Stability		■	■	☐	☐	☐	☐
n/a	✓	✓	✓	Vertical Elements		Out-of-Plane Anchorage of Concrete or Masonry Wall		■	■	■	☐	■	☐

* Nonstructural improvements are numbered for ease of use.
Structural improvements are not numbered, but rather, organized by structural element and sub-system.

■ Work that may be included in the building rehabilitation/maintenance/repair project on the basis of a quick evaluation by a design professional.

☐ Work requiring engineering design.

☒ Work requiring detailed engineering analysis and evaluation of sequencing requirements. The "x" designates work that could redistribute loads, overstressing some elements.

Note 1: Masonry buildings with a concrete roof or floors should use the concrete building, concrete diaphragm for options.

Category 5

Underfloor and Basement Maintenance and Repair

C.2.5 Underfloor and Basement Maintenance and Repair

General Description of the Work: Underfloor and basement maintenance may involve the following activities:

- Repair of deterioration
- Repair of termite damage
- Equipment replacement

This category of work is most likely to be applicable in smaller hotel or motel buildings. In larger buildings, basements are likely to contain public and service spaces, parking, storage, and mechanical areas. In the latter case, underfloor and basement work may therefore be much more extensive, closer in scope to public and service area modernization.

Most underfloor repair activities will be in response to a problem. The solution may be immediate or assigned to the capital improvements budget. For example, settlement and resulting underpinning repair may be the result of a floor problem and require immediate intervention.

Usually there are no mandates or code issues involved with underfloor repair work. Safety is the usual driving force.

Physical Description of the Work: Work includes:

- Replacing deteriorated wood elements
- Repairing cracked or bowed walls
- Repairing damaged or deteriorated floors, underpinning where buildings have settled
- Replacing basement equipment

Associated Incremental Seismic Rehabilitation Work: Incremental seismic rehabilitation work associated with underfloor and basement work may include adding cripple stud bracing, improving foundation anchorage, adding new foundations, and improving floor to wall anchorage.

In the case of larger hotel and motel buildings, this work may include the incremental seismic rehabilitation work associated with C.2.4, Public and Service Area Modernization. See Table C-4 in addition to Table C-5.

Performance of the Work: The work is often performed by operator staff or by outside contractors. Major design work will often require A/E services. Sometimes owners hire the operator's A/E, while some owners prefer to do their own work.

This category of work may be subject to a business agreement between the operator and owner that addresses the owner's needs for capital funds.

Special Equipment: Special equipment is usually not required for underfloor work. However, access to the area must be available.

Impact on Building Use: Except for equipment replacement, the work may be done at any time, independent of building use.

Table C-5: Underfloor and Basement Maintenance and Repair

Number*	Level of Seismicity L	M	H	Building Structural Element	Structural Sub-System	Seismic Performance Improvement	Vertical Load Carrying Structure: Wood	Masonry[1]: Unreinforced Masonry	Masonry[1]: Reinforced Masonry	Concrete: Wood Diaphragm	Concrete: Concrete Diaphragm	Steel: Wood Diaphragm	Steel: Concrete Diaphragm
Nonstructural													
4		✓	✓	n/a	n/a	Fastening and Bracing of Equipment (Mechanical and Electrical)	■	■	■	■	■	■	■
10		✓	✓	n/a	n/a	Shut-Off Valves	■	■	■	■	■	■	■
20		✓	✓	n/a	n/a	Restraint of Hazardous Materials Containers	■	■	■	■	■	■	■
Structural													
n/a		✓	✓	All Elements		Collector and Drag Element Improvement	□	□	□	□	☒	□	☒
n/a		✓	✓	Foundation		Anchor Bolts	■						
n/a		✓	✓	Foundation		Anchorage	■	□	□	□	□	□	□
n/a		✓	✓	Foundation		Cripple Stud Bracing	■						
n/a		✓	✓	Foundation		New Foundations	■	□	□	□	□	□	□
n/a		✓	✓	Foundation		Pile Cap Lateral Load		■	■	□	□	□	□
n/a		✓	✓	Foundation		Uplift	■	■	■	□	□	□	□
n/a	✓	✓	✓	Vertical Elements	Load Path	Lateral Force-Resisting System to Diaphragm Connection	■	■	■	■	☒	■	☒
n/a		✓	✓	Vertical Elements	Braced Frames	Connections						□	□
n/a		✓	✓	Vertical Elements	Moment Frames	Beam Column Connection						□	□
n/a		✓	✓	Vertical Elements	Shear Walls	Capacity	■	□	□	□	☒	□	☒
n/a		✓	✓	Vertical Elements	Shear Walls	Continuity	■	□	□	□	☒	□	☒
n/a	✓	✓	✓	Vertical Elements		Out-of-Plane Anchorage of Concrete or Masonry Wall		■	■	■	□	■	□

* Nonstructural improvements are numbered for ease of use.
Structural improvements are not numbered, but rather, organized by structural element and sub-system.

■ Work that may be included in the building rehabilitation/maintenance/repair project on the basis of a quick evaluation by a design professional.

□ Work requiring engineering design.

☒ Work requiring detailed engineering analysis and evaluation of sequencing requirements. The "x" designates work that could redistribute loads, overstressing some elements.

Note 1: Masonry buildings with a concrete roof or floors should use the concrete building, concrete diaphragm for options.

Category 6

HVAC Upgrade and Energy Conservation/ Indoor Air Quality Improvement

C.2.6 HVAC Upgrade and Energy Conservation/Indoor Air Quality Improvement

General Description of the Work: HVAC upgrade, energy conservation, and indoor air quality improvement projects may include the following items:

- Exterior envelope work
- Insulation
- Windows
- HVAC equipment
- Ducts and piping

Building elements affected may include exterior walls, ceilings, attic spaces, roofs, and basements.

These improvements, usually outside escrow, may be in response to the owner's or operator's long-range strategic plan or as part of other routine equipment replacement. In all cases the intent is not only to improve performance and reduce operating costs, but also to save energy and improve indoor air quality.

Federal or state mandates may be factors leading to energy conservation improvements. If special grants are available, they can be made part of a program. Local building code requirements may also encourage energy conservation improvements.

Physical Description of the Work: The physical work involved in HVAC upgrade and energy conservation may be localized or involve the entire building. Items include:

- Improving or replacing windows
- Installing new insulation in exterior walls
- Installing new insulation in the attic, which may permit access to the ceiling space
- Installing new insulation on the roof deck, which may be coordinated with other roof-top work
- Installing HVAC equipment, which should meet the anchorage requirements for seismic forces and may provide access to areas for other work
- Adding air conditioning, which may include the installation of ducts or piping to spaces throughout the building

Associated Incremental Seismic Rehabilitation Work: This work may include the incremental seismic rehabilitation work associated with the following other project categories discussed earlier:

- C.2.1 Roofing Maintenance and Repair/Re-roofing
- C.2.2 Exterior Wall and Window Maintenance/Façade Modernization
- C.2.4 Public and Service Area Modernization

See Tables C-1, C-2, and C-4 for integration opportunities.

Performance of the Work: The work may be performed by operator personnel or by outside contractors, depending on the project size or complexity. Major design work will often require A/E services. Sometimes owners hire the operator's A/E, while some owners prefer to do their own work.

This category of work may be subject to a business agreement between the operator and owner that addresses the owner's needs for capital funds. In some cases, owners prefer to place indoor air quality work in the escrow category of projects.

Special Equipment: Special equipment may be required to provide access to the work, including scaffolding or a crane or lift.

Impact on Building Use: Some of this work may be done at any time of year from the roof and in public spaces. Most window or interior work must be accomplished when guestrooms are vacant. Typically this work cannot be done easily around occupants.

C.2.7 Hazardous Materials Abatement

Category 7

Hazardous Materials Abatement

General Description of the Work: The presence of hazardous materials may involve abatement of:

- Asbestos
- Lead paint
- Radon

In hotel and motel buildings, this work, usually outside escrow, will usually be identified as part of due diligence at the time of acquisition or change of management.

Physical Description of the Work: Hazardous materials abatement may include the removal of finishes such as plaster, ceiling materials, and flooring throughout the guestrooms and public spaces. It may include removal of the adhesives used. Asbestos abatement may include the removal or encapsulation of insulation on pipes and ducts. Lead paint abatement may include removal of the paint and finishes or encapsulation of the component containing the lead paint. Radon abatement may require installation of ventilation systems or other work in the basement.

Associated Incremental Seismic Rehabilitation Work: In some cases, the extent of the work may provide access to interior spaces that will present a seismic rehabilitation opportunity. Seismic rehabilitation work could follow the hazard mitigation work before the finishes are reinstalled. This work may include the incremental seismic rehabilitation work associated with the following other project categories discussed earlier:

- C.2.3 Fire and Life Safety Improvements
- C.2.4 Public and Service Area Modernization

See Tables C-3 and C-4 for integration opportunities.

Performance of the Work: The work is typically performed by specialty contractors.

This category of work may be subject to a business agreement between the operator and owner that addresses the owner's needs for capital funds.

Special Equipment: Special equipment, such as scaffolding, would often be on the job as part of the abatement work. Other special equipment, such as fans and enclosures, are irrelevant to seismic work.

Impact on Building Use: Building use will be curtailed during any hazardous materials abatement work. The work cannot be done around occupants. It requires vacant spaces.

Category 8

Guestroom Finishing, Furniture, and Equipment (FF&E)

C.2.8 Guestroom Finishing, Furniture, and Equipment (FF&E)

General Description of the Work: Guestroom FF&E work, usually paid through a reserve fund escrow account, consists of the renovation of guestrooms on a fixed schedule. The replacement cycle for carpets, draperies, and other soft goods may be about seven years, and for finishes, built-ins, furniture, etc., it may be on the order of 12 years. Plumbing fixture replacement may be on a 12 to 15 year cycle. The work is usually done floor by floor, closing down three floors at a time.

Physical Description of the Work: This work usually does not include reconfiguration of spaces or creation of new spaces, but rather the removal and replacement of wall finishes and the installation of new fixtures and appliances. The installation of new piping and ductwork may also be involved. Access to spaces behind finishes may provide some opportunities for seismic rehabilitation work.

Associated Incremental Seismic Rehabilitation Work: Incremental seismic rehabilitation work associated with guestroom FF&E work may include adding or strengthening shear walls and bracing, improving beam/column connections and diaphragm to wall anchorage, and adding or improving bracing and fastening of equipment. Much of this work is likely to be outside escrow.

Performance of the Work: Typically this work involves skilled construction personnel. A/E design or interior design may be used.

This work is usually done by the operator, who retains the A/E, but a recent trend is for owners to seek a larger role in guestroom FF&E work.

The integration of incremental seismic rehabilitation with guestroom FF&E work is likely to entail the use of both escrow and non-escrow funds, and will be subject to financial planning and a special agreement between owner and operator.

Special Equipment: Special equipment required for access to work areas for any seismic rehabilitation construction will typically be available during any remodeling work.

Impact on Building Use: Guestroom FF&E work is often scheduled during the lowest occupancy months, usually between December and March.

Table C-6: Guestroom FF&E

Number*	Level of Seismicity L	M	H	Building Structural Element	Structural Sub-System	Seismic Performance Improvement	Vertical Load Carrying Structure: Wood	Masonry[1]: Unreinforced Masonry	Masonry[1]: Reinforced Masonry	Concrete: Wood Diaphragm	Concrete: Concrete Diaphragm	Steel: Wood Diaphragm	Steel: Concrete Diaphragm
Nonstructural													
3		✓	✓	n/a	n/a	Bracing and Detailing of Sprinkler and Piping	■	■	■	■	■	■	■
4		✓	✓	n/a	n/a	Fastening and Bracing of Equipment (Mechanical and Electrical)	■	■	■	■	■	■	■
7		✓	✓	n/a	n/a	Fastening and Bracing of Ceilings	■	■	■	■	■	■	■
12		✓	✓	n/a	n/a	Bracing of Interior Partitions (Masonry and Wood)	■	■	■	■	■	■	■
Structural													
n/a		✓	✓	All		Collector and Drag Element Improvement	□	□	□	□	☒	□	☒
n/a		✓	✓	Horizontal Elements	Diaphragms	Mezzanine Anchorage and Bracing		■	■	■	■	■	■
n/a		✓	✓	Horizontal Elements	Diaphragms	Strengthening at Re-entrant Corners	□	□	□	□	☒	□	☒
n/a	✓	✓	✓	Vertical Elements	Load Path	Lateral Force-Resisting System to Diaphragm Connection	■	■	■	■	☒	■	☒
n/a		✓	✓	Vertical Elements	Braced Frames	Capacity/Stiffness				□	☒	□	☒
n/a		✓	✓	Vertical Elements	Braced Frames	Continuity				□	☒	□	☒
n/a		✓	✓	Vertical Elements	Braced Frames	Connections				□	□	□	□
n/a		✓	✓	Vertical Elements	Moment Frames	Beam Column Capacity/Stiffness				□	☒	□	☒
n/a		✓	✓	Vertical Elements	Moment Frames	Beam Column Connection				□	□	□	□
n/a		✓	✓	Vertical Elements	Shear Walls	Capacity	■	□	□	□	☒	□	☒
n/a		✓	✓	Vertical Elements	Shear Walls	Continuity	■	□	□	□	☒	□	☒
n/a		✓	✓	Vertical Elements	Shear Walls	Extension of Wood Interior Walls to Roof	■	■	■				
n/a		✓	✓	Vertical Elements	Shear Walls	Lateral Stability		■	■	□	□	□	□
n/a	✓	✓	✓	Vertical Elements		Out-of-Plane Anchorage of Concrete or Masonry Wall		■	■	■	□	■	□

* Nonstructural improvements are numbered for ease of use.
Structural improvements are not numbered, but rather, organized by structural element and sub-system.

■ Work that may be included in the building rehabilitation/maintenance/repair project on the basis of a quick evaluation by a design professional.

□ Work requiring engineering design.

☒ Work requiring detailed engineering analysis and evaluation of sequencing requirements. The "x" designates work that could redistribute loads, overstressing some elements.

Note 1: Masonry buildings with a concrete roof or floors should use the concrete building, concrete diaphragm for options.

Category 9

Public Area Finishing, Furniture, and Equipment (FF&E)

C.2.9 Public Area Finishing, Furniture, and Equipment (FF&E)

General Description of the Work: Public area FF&E work, usually paid through a reserve fund escrow account, consists of the renovation of restaurants, bars, and meeting rooms on a fixed schedule. The replacement cycle for carpets, draperies and other soft goods may be about seven years, and for finishes, built-ins, furniture, etc., it may be on the order of 12 years. Plumbing fixture replacement may be on a 12 to 15 year cycle.

Physical Description of the Work: This work may include some reconfiguration of spaces or creation of new spaces in the public areas. It includes the removal and replacement of wall finishes and the installation of new fixtures and appliances. The installation of new piping and ductwork may also be involved. Access to spaces behind finishes may provide some opportunities for seismic rehabilitation work.

Associated Incremental Seismic Rehabilitation Work: This work may include some of the incremental seismic rehabilitation work associated with C.2.4, Public and Service Area Modernization. See Table C-4.

Performance of the Work: Typically this work involves skilled construction personnel. A/E design or interior design may be used.

This work is usually done by the operator, who retains the A/E, but a recent trend is for owners to seek a larger role in public area FF&E work.

The integration of incremental seismic rehabilitation with public area FF&E work is likely to entail the use of both escrow and non-escrow funds, and will be subject to financial planning and a special agreement between owner and operator.

Special Equipment: Special equipment required for access to work areas for any seismic rehabilitation construction will typically be available during any remodeling work.

Impact on Building Use: Public area FF&E work is often scheduled during the lowest occupancy months, usually between December and March, and entails closing down the areas for about three weeks.

C.2.10 Definitions of Seismic Performance Improvements

The seismic performance improvements included in the matrices of integration opportunities in Sections C.2.1–C.2.9 are all extracted from the generic list in the following tables. The tables contain additional information (description and purpose) that should be useful to hotel and motel facility managers using this section.

Nonstructural Seismic Performance Improvements

MFam Number*	Level of Seismicity			Definitions and Purpose		
	L	M	H	Seismic Performance Improvement	Description	Purpose
1	✓	✓	✓	Anchorage of Canopies at Exits	Canopies or roofs over exits.	Prevent collapse of canopies that would block exits and possibly cause injuries.
2		✓	✓	Anchorage and Detailing of Rooftop Equipment	Equipment should be properly attached, and restrained if isolation-mounted.	Prevent equipment from sliding or falling off platforms due to connection failure or nonfunction.
3		✓	✓	Bracing and Detailing of Sprinkler and Piping	Sprinkler pipes should be braced in each direction.	Prevent sprinkler lines from breaking and flooding the building.
4		✓	✓	Fastening and Bracing of Equipment (Mechanical and Electrical)	Equipment above ceilings.	Prevent fans and other equipment from swaying and falling on occupants; connections could fail resulting in equipment no longer functioning.
5	✓	✓	✓	Bracing of Parapets, Gables, Ornamentation, and Appendages	Construct parapet bracing on the roof side of the parapet. Gables are braced in the attic space. Other elements are anchored in a positive manner.	Prevent parapets, gables, and ornamentation from falling outward.
6		✓	✓	Suspension and Bracing of Lights	Lights may swing or otherwise fall in an earthquake.	Prevent lights from falling and injuring occupants. Lights should not be supported by a suspended ceiling in a high or moderate seismic zone. Pendent lights should have their sway limited.
7		✓	✓	Fastening and Bracing of Ceilings	Diagonal bracing of ceiling.	Suspended ceilings should be braced against sidesway to reduce the chance of elements falling.
8		✓	✓	Attachment and Bracing of Large Ductwork	Large ducts.	Prevent ducts from falling on occupants.
9	✓	✓	✓	Anchorage and Bracing of Emergency Lighting	Positive attachment of emergency lights.	Prevent heavy battery packs from falling.
10		✓	✓	Shut-Off Valves	Installation of a shut-off device.	Gas and water lines could break and should have a means of turning them off.
11	✓	✓	✓	Bracing or Reinforcing Masonry Walls at Interior Stairs	Interior exit stairs may have unreinforced masonry enclosure walls that could collapse.	Prevent collapse of walls that could block stairways.
12		✓	✓	Bracing of Interior Partitions (Masonry and Wood)	Bracing may be vertical or diagonal braces.	Interior partitions must be braced to prevent falling/collapse.
13		✓	✓	Support and Detailing of Elevators	Elevator guides have become dislodged in earthquakes. Applies to cable lift elevators.	Keep elevators functioning.
14	✓	✓	✓	Cladding Anchorage	Heavy cladding (concrete) must be connected to the structure.	Prevent cladding from falling. Careful design is required so the cladding does not limit the structure s lateral movement.
15		✓	✓	Anchorage of Masonry Veneer	Veneer over exterior wood or masonry walls or over other materials in steel or concrete structure. Materials may be brick, terra cotta, stone, or similar materials.	Prevent inadequately anchored veneer from falling outward onto pedestrians.
16	✓	✓	✓	Glazing Selection and Detailing	Glass above a walking surface.	Prevent exterior or interior glass from falling onto the walking surface and causing injuries.
17		✓	✓	Anchorage of Exterior Wythe in Cavity Walls	A masonry wall separated from the veneer by a hollow space.	Prevent veneer from falling outward. Existing anchorage should be checked for rust damage and loss of strength.
18		✓	✓	Bracing or Removal of Chimneys	Chimneys should be braced to the structure.	Prevent chimneys from toppling into yards or through roofs.
19		✓	✓	Anchorage of Steel Stud Backup	Steel studs behind veneer or other cladding.	Prevent steel studs used as a backup to support veneer or other cladding from becoming detached or falling.
20		✓	✓	Restraint of Hazardous Materials Containers	Chemical labs, shops, etc. may have materials that could, when combined, create a fire or chemical hazard.	Reduce danger of breakage and mixing of chemicals.
21		✓	✓	Attachment and Bracing of Cabinets and Furnishings	Anchorage to structural walls or other elements.	Prevent cabinets and other furnishings from toppling or moving and causing damage. Fallen file cabinets may block exit doors.
22 (n/a)		✓	✓	Underfloor Bracing of Computer Access Floor	Raised floors for cabling.	Prevent floors from collapsing and damaging equipment.

* Items numbered for ease of reference.

Structural Seismic Performance Improvements

Level of Seismicity			Building Element	Structural Sub-System	Definitions and Purpose		
L	M	H			Seismic Performance Improvement	Description	Purpose
	✓	✓	Foundation		Anchor Bolts	Connection between the foundation and the building.	Improve load path. Prevent building from sliding off foundation.
	✓	✓	Foundation		Anchorage	Connection between the foundation and the building for larger buildings.	Improve load path. Provide adequate connection between building and foundation.
	✓	✓	Foundation		Cripple Stud Bracing	Short wood studs between the foundation and the first floor.	Cripple studs are usually not braced. Prevent them from toppling and causing the building to fall off the foundation.
	✓	✓	Foundation		New Foundations	New foundations to convey loads.	Additional foundations may be the preferred solution in some cases.
	✓	✓	Foundation		Pile Cap Lateral Load	Piles supporting buildings may try to move laterally from building loads during earthquakes.	Brace piles at their top to eliminate the chance of lateral movement and reduce chance of foundation failure.
	✓	✓	Foundation		Uplift	Under overturning type loads foundations may be pulled upward.	Reduce the uplift chance by improving foundation system; engineer should evaluate the effects of uplift.
Definition			Horizontal Elements			Floors, mezzanines, and roofs.	
Definition			Horizontal Elements	Diaphragms		Floors and roofs connecting walls and lateral force-resisting elements.	Diaphragms are the roof and floors of a building. They must be of adequate strength to transfer the earthquake loads to the walls and other elements. The connection from the diaphragm to the wall or other lateral force-resisting element is part of the load path.
	✓	✓	Horizontal Elements	Diaphragms	Attachment and Strengthening at Boundaries	Improving the connection of the diaphragm to the edge/boundary elements with nails, bolts, or welding.	This is part of the load path and conveys the diaphragm forces into the walls or other lateral force-resisting elements.
	✓	✓	Horizontal Elements	Diaphragms	Mezzanine Anchorage and Bracing	Anchor the mezzanine to the wall. Where there is an open side of the mezzanine, bracing may be necessary.	Make sure the mezzanine is attached to the building to provide a load path for the mezzanine diaphragm and to reduce any pounding of the mezzanine against the building's walls or columns. A large mezzanine may require bracing on the open sides.
	✓	✓	Horizontal Elements	Diaphragms	Strength/Stiffness	Strengthen the diaphragm to limit its lateral deflection.	Control the movement of the diaphragm to reduce the damage due to drift and to control the out-of-plane loads on vertical elements.
	✓	✓	Horizontal Elements	Diaphragms	Strengthening at Openings	Strapping around diaphragm openings.	Openings may create a weak point in the diaphragm. Straps will provide additional strength to wood diaphragms.
	✓	✓	Horizontal Elements	Diaphragms	Strengthening at Re-entrant Corners	"L" and "U" shaped buildings have stress concentrations at the interior corners.	Reduce damage from cracking and failures caused by stress concentration.
	✓	✓	Horizontal Elements	Diaphragms	Topping Slab for Precast Concrete	Concrete slab over precast concrete roof to create a continuous diaphragm. Connect to the vertical elements as part of a load path.	Strengthen the roof to act as a lateral force element. Control drift of the roof or floor.
Definition			Vertical Elements	Braced Frames		Steel or concrete beams and columns with diagonal bracing.	Braced frames act as a lateral force-resisting element. They are often used as the lateral force-resisting element on open sides of buildings. They must be connected to the horizontal element as part of the load path.
	✓	✓	Vertical Elements	Braced Frames	Capacity/Stiffness	Frame capacity improvements for adequate load resistance.	Capacity and stiffness assure the adequacy of the frame elements to resist loads.
	✓	✓	Vertical Elements	Braced Frames	Continuity	Braced frames should be continuous from the foundation to the roof.	Discontinuities of lateral force-resisting elements create load transfer demands. Design standards may impose higher loads for this condition.
	✓	✓	Vertical Elements	Braced Frames	Connections	The details of the connections (bolts or welds) must be adequate. Improvements to strength will not have a negative effect on the phased construction.	Braced frame connections assure the adequacy of the frame elements to resist loads. Improvements may be made by the addition of steel plates with bolting or welding.
✓	✓	✓	Vertical Elements	Load Path	Lateral Force-Resisting System to Diaphragm Connection	Connections between roof/floor and wall or other element.	Permit earthquake loads to be conveyed to the foundation—develop a load path. This is the key element in seismic safety.

Structural Seismic Performance Improvements (continued)

Level of Seismicity			Building Element	Structural Sub-System	Definitions and Purpose of Structural Performance Improvements		
L	M	H			Seismic Performance Improvement	Description	Purpose
Definition			Vertical Elements	Moment Frames		A steel or concrete system of beams and columns.	Moment frames act as a lateral force-resisting element and brace the structure. They are often used as the lateral force-resisting element on open sides of buildings. They must be connected to the horizontal element as part of the load path.
	✓	✓	Vertical Elements	Moment Frames	Beam Column Capacity/Stiffness	Frame capacity improvements for adequate load resistance.	Capacity and stiffness assure the adequacy of the frame elements to resist loads.
	✓	✓	Vertical Elements	Moment Frames	Beam Column Connection	Steel or concrete with improved connections to increase strength. Improvements will not have a negative effect on the phased construction.	Beam column connections assure the adequacy of the frame elements to resist loads. Improvements may be made by the addition of steel plates with bolting or welding.
Definition			Vertical Elements	Shear Walls		Walls that brace the building against earthquakes.	Shear walls brace the structure. Building walls can act as lateral load-resisting elements. They must be connected to the horizontal elements as part of the load path.
	✓	✓	Vertical Elements	Shear Walls	Capacity	Capacity equals strength.	Capacity assures the adequacy of walls to resist loads.
	✓	✓	Vertical Elements	Shear Walls	Continuity	Shear walls should be continuous from the foundation to the roof.	Discontinuities of lateral force-resisting elements create load transfer demands. Design standards may impose higher loads for this condition. This is one of the most cost-effective improvements in buildings.
	✓	✓	Vertical Elements	Shear Walls	Extension of Wood Interior Walls to Roof	Extending interior wood walls to diaphragms in unreinforced masonry and other buildings.	Permit walls that were not constructed full height to be used as shear walls in buildings with wood interior walls.
	✓	✓	Vertical Elements	Shear Walls	Lateral Stability	Tall walls may buckle and need bracing.	Prevent buckling and possible wall collapse. Walls must be anchored at the top or may have other bracing elements such as diagonal or vertical braces.
✓	✓	✓	Vertical Elements		Out-of-Plane Anchorage of Concrete or Masonry Wall	Connections from the walls to the floors and roof.	Prevent walls from falling outward due to inadequate connections between the wall and the diaphragms. A cost-effective mitigation measure for bearing wall buildings.
✓	✓	✓	All Elements		Load Path and Collectors	Distribute loads from diaphragms into lateral force-resisting elements.	These are straps of steel or wood that "collect" load and distribute it into the vertical lateral force-resisting elements. Connections may be with bolts, nails, or welding, depending on the material and location.

Summary of Part C

Part C consists of recommended tools to enable the facility manager to implement incremental seismic rehabilitation.

- Engineering services should be retained for three specific phases: seismic screening and evaluation, incremental seismic rehabilitation planning and design, and construction period support.
- Continuity of building documentation is of special importance.
- Opportunities to add seismic rehabilitation increments exist within most major maintenance and capital improvement activities.
- Incremental seismic rehabilitation opportunities are suggested for nine specific maintenance and capital improvement categories.

Recommended Actions

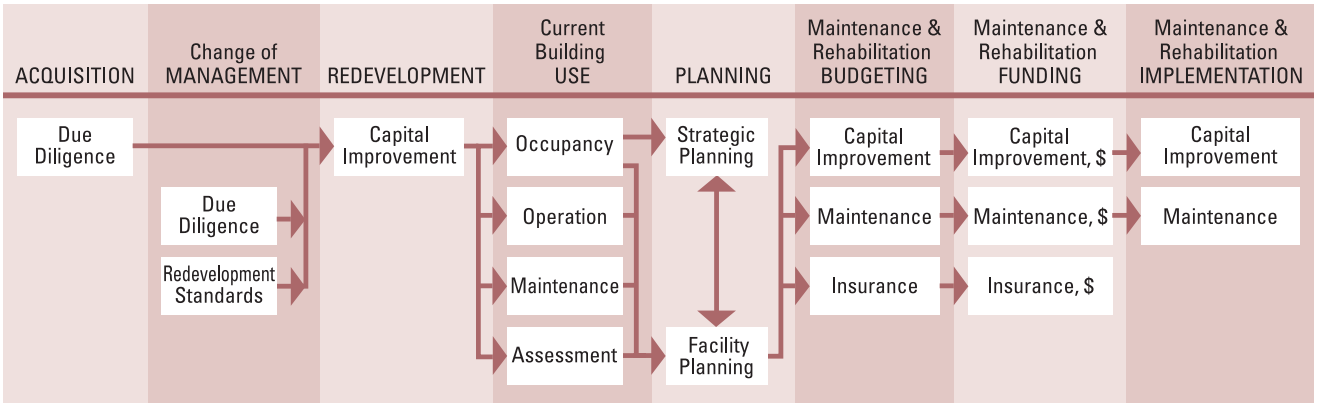
1. Determine the category of maintenance or capital improvement under consideration.
2. Determine the level of seismicity applicable to the building.
3. Determine which of the seven structural categories most closely fits the building.
4. List all the nonstructural and structural seismic improvements identified as integration opportunities.
5. Note the category of each improvement (■, □, ☒).
6. Present to the architect or engineer the annotated list of all the nonstructural and structural seismic improvements identified for consideration and inclusion in the respective scope of design work.
7. The architect or engineer should design the project using the companion document, *Engineering Guideline for Incremental Seismic Rehabilitation,* FEMA 420.

Appendix I. Additional Information on Hotel and Motel Building Facility Management

Introduction: Typical Facility Management for Hotel and Motel Buildings

The typical facility management process for existing hotel and motel buildings consists of eight phases of activities: Acquisition, Change of Management, Redevelopment, Current Building Use, Planning, Maintenance & Rehabilitation Budgeting, Maintenance & Rehabilitation Funding, Maintenance & Rehabilitation Implementation, as diagrammed in Figure 1. This process is sequential, except that the first two—acquisition and change of management—can occur in either order, or simultaneously. Furthermore, change of management can occur any time in the process during the current building use phase. The process progresses from acquisition or change of management through implementation of rehabilitation in any given building. An owner or operator of a large inventory of buildings is likely to have ongoing activities in all of these phases in different buildings.

Figure 1: Typical Management Process

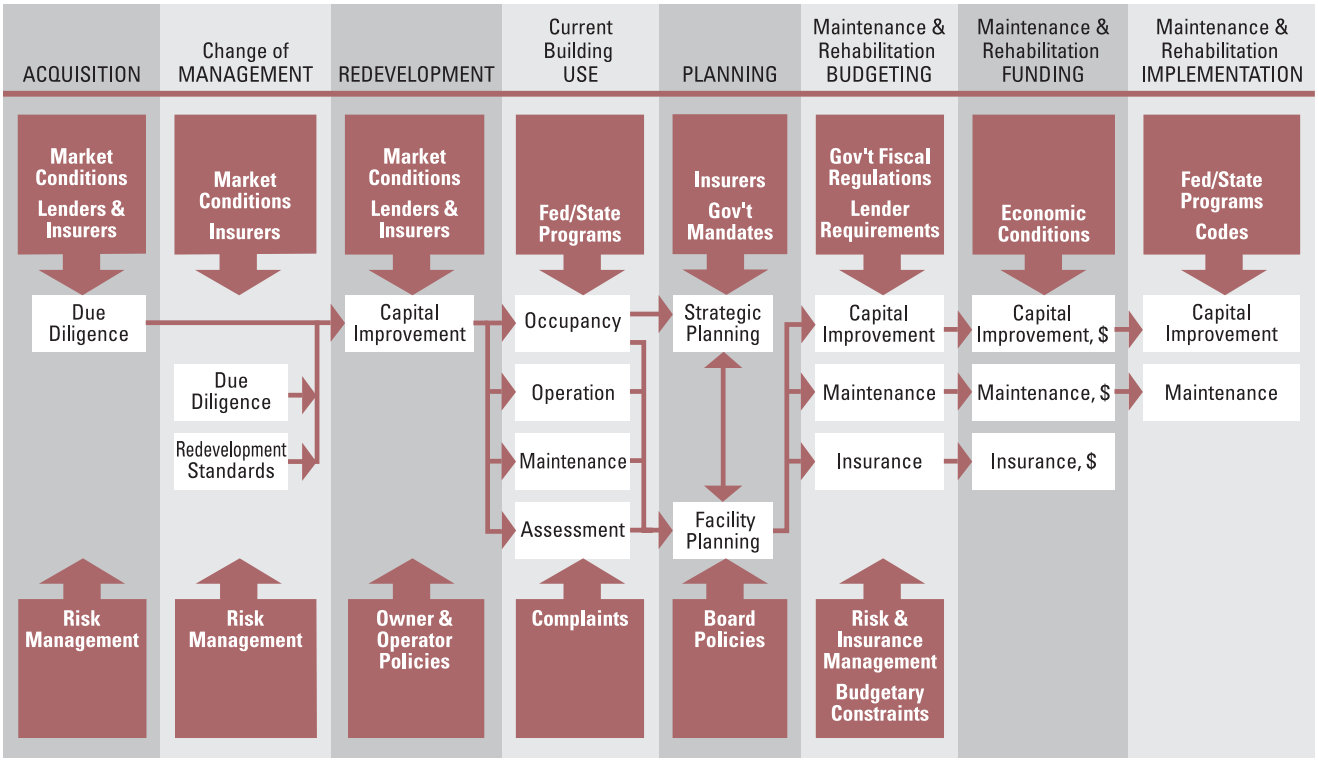


This process is generic and, while variations may occur, it is generally followed by hotel and motel building owners and operators, either explicitly or implicitly.

Both internal and external factors typically influence the hotel and motel facility management process in its various phases. Internal factors (represented by up arrows in Figure 2) are generated within the owner and/or operator organizations. External factors (down arrows) are imposed on owners and operators by outside entities. This classification of factors may be oversimplified, however, in that it considers the owner and operator of a hotel or motel facility a cohesive team subject to the same internal and external factors. In reality, there are a multitude of possible relationships between hotel owners and operators. A more sophisticated analysis may consider the owner's internal factors as external to the operator, and vice versa. In any case, it is likely that the owner/operator agreement will assign responsibilities for activities required in response to these factors.

This Appendix describes the activities and influences within each phase.

Figure 2: Management Process Influences



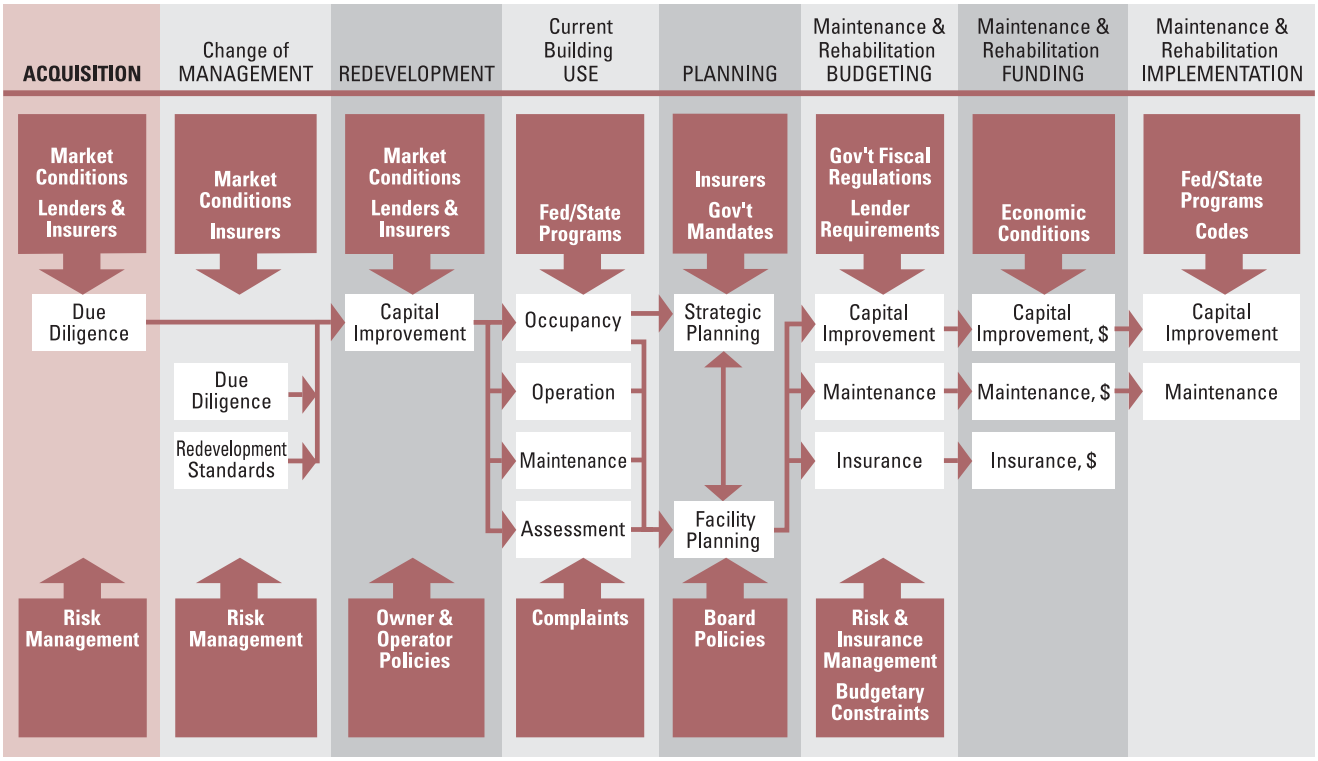
1. The ACQUISITION Phase of Hotel and Motel Facility Management

Typical Process

The acquisition of a hotel or motel may retain the current operator or it may include a new operator at the time of acquisition or soon thereafter. The acquisition phase of the typical hotel and motel facility management process consists of due diligence activities and is influenced by significant internal and external pressures, as depicted in Figure 3.

Hotel and motel building acquisitions initiate the facility management process for all owners who are not also developers or merchant builders. The **due diligence** process that precedes an acquisition is intended to identify, and

Figure 3: Acquisition



quantify if possible, all the liabilities or potential liabilities related to the asset being acquired.

For a given acquisition there may be several due diligence processes carried out by the various participants in the deal:

- Owner (buyer)
- Lender (if there is one)
- Insurer

A multi-discipline team that includes legal, risk management, and engineering experts carries out the due diligence. Specialty consultants may be used. Because of the potential professional liabilities, legal questions are often the driving force in the process. The due diligence process also involves a walk-through of the building. Environmental risks, such as the presence of asbestos, are identified in the due diligence process.

Influences and Related Seismic Considerations

As indicated in Figure 3, two external factors (down arrow) and one internal factor (up arrow) influence acquisition phase decision making.

Market Conditions: External local conditions of the hospitality market are the principal factor governing hotel and motel building acquisition, regardless of the short-term or long-term strategic objectives of the purchaser. This is true for all types of owners, be they real estate investment trusts (REITs), pension fund or other fiduciary institutions, partnerships, or individuals.

Seismic Consideration

Studies in California suggest that regional and local earthquake hazards (presence of faults and their proximity, regional earthquake history,

geological and local site factors, etc.) have little if any influence on the hospitality industry and levels of guestroom rates. Earthquake risk, in general, does not appear to translate into financial cost in the hospitality industry.

Lenders and Insurers: Lenders and insurers are important external participants in many hotel and motel building acquisitions, and each carry out due diligence functions to determine the risks and potential liabilities in any given deal. By their nature, lenders and insurers spread their risks over a wider range of investments than that presented to an owner in a specific acquisition. Lenders often have extensive influence on hotel and motel acquisitions. In doing so, they interact with the operator (who is not their customer) as well as the buyer.

The insurers' role in acquisition of hotels and motels is more complex and depends on whether the properties are franchised or managed by the operator. In franchised properties the owner's liability is primary, and it is the owner who procures the insurance. In managed properties the operator's liability is primary, and it is the operator who procures the insurance. The insurability of the acquired property and the cost of insurance are of great concern to hotel and motel owners and operators, but large owners and operators can spread the cost over a large number of properties.

Seismic Consideration

Lenders and insurers usually employ engineering consultants to perform the seismic portion of the due diligence, and they use proprietary programs to carry out the analysis. The most common analysis used is the Probable Maximum Loss (PML) analysis, which quantifies the percentage of the property that will be lost in a major earthquake. Such an analysis is referred to as deterministic, and it does not consider the damages and losses that could result from more moderate but more frequent earthquakes. Lenders and insurers establish their own proprietary criteria for acceptable PML. Lenders often require seismic due diligence in California and the Pacific Northwest, and the extent to which it is done in other seismic regions is not known.

While insurers have recently been quite concerned about hurricane risks and have influenced hurricane mitigation investments, their pressure on seismic mitigation is negligible. Seismic insurance is driven by availability rather than cost, and large owners and operators can acquire insurance even for buildings on fault lines because the insurance is based on a blanket number of exposures and the modeling takes into account the total inventory of buildings.

Risk Management: Many hotel and motel building owners have formally established internal risk management functions within their organizations. These risk managers participate in the due diligence analyses carried out prior to acquisition. The rigor of internal due diligence varies from owner to owner.

Seismic Consideration

The owners' internal seismic due diligence, whether carried out by in-house staff or consultants, is the PML analysis. Owners establish their own proprietary criteria for acceptable PML. Some large owners limit their PML analysis to California, Oregon, and Washington. Depending on the deal, the PML leads to one of three decisions about the acquisition:

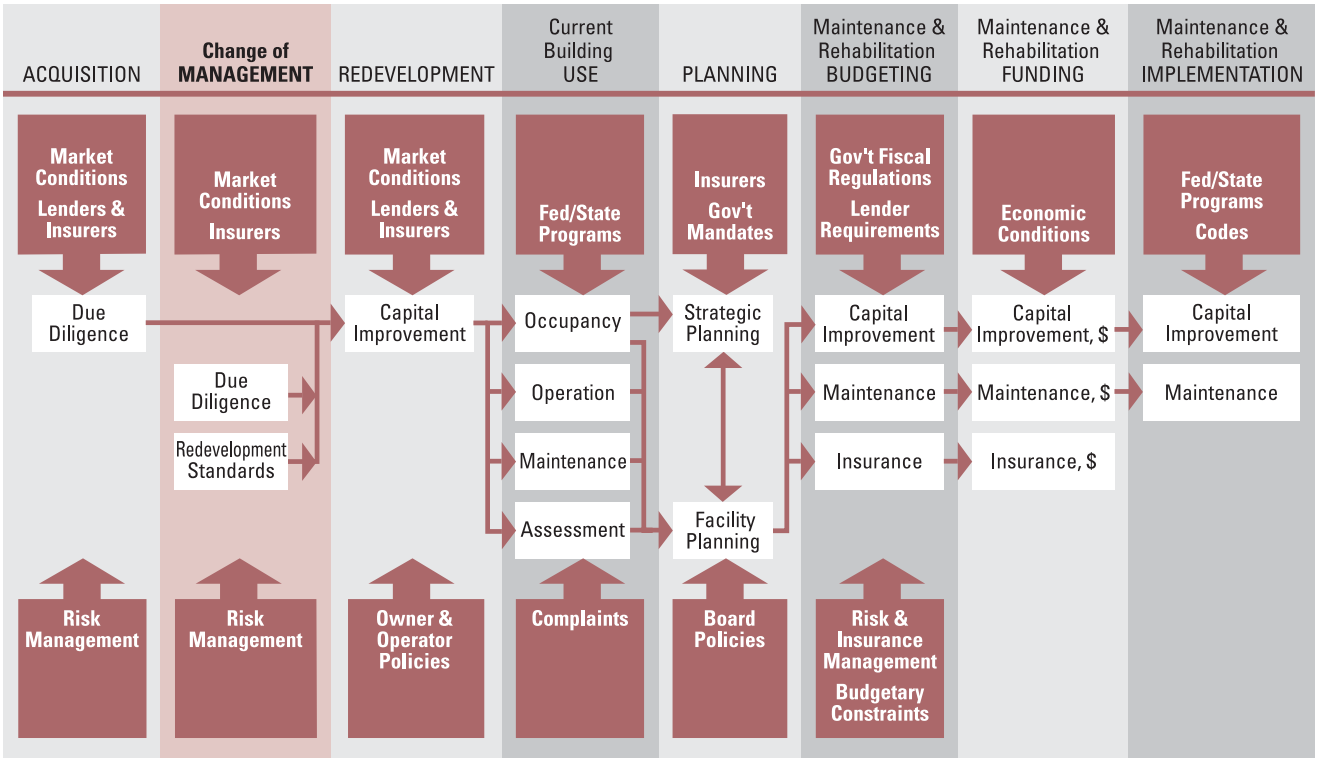
- Reject the deal if the PML exceeds a preset threshold,
- Accept the deal with an initial rehabilitation, or
- Accept the deal without rehabilitation.

2. The CHANGE OF MANAGEMENT Phase of Hotel and Motel Facility Management

Typical Process

A change of management occurs when the current owner enters into an agreement with a new operator for one or more properties, or it may be part of an acquisition. The change of management phase of the typical hotel and motel facility management process consists of due diligence activities and the application of the new operator's risk reduction standards. It is influenced by significant internal and external pressures, as depicted in Figure 4.

Figure 4: Change of Management



Hotel and motel change of management initiates the facility management process for all new operators. The **due diligence** process that precedes a change of management, whether part of an acquisition or not, is intended to identify, and quantify if possible, all the liabilities or potential liabilities related to the asset in question.

For a given change of management there may be several due diligence processes carried out by the various participants in the deal:

- Operator
- Owner
- Insurer

A multi-discipline team that includes legal, risk management, and engineering experts carries out the due diligence. Specialty consultants may be used. Because of the potential professional liabilities, legal questions are often the driving force in the process. The due diligence process also involves a walk-through of the building. Environmental risks, such as the presence of asbestos, are identified in the due diligence process.

The new operator is likely to have in place **risk reduction standards** applied to all its managed properties. These may be articulated in the owner-operator agreement.

Influences and Related Seismic Considerations

As indicated in Figure 4, two external factors (down arrow) and one internal factor (up arrow) influence change of management phase decision making.

Market Conditions: External local conditions of the hospitality market are the principal factor governing hotel and motel building change of management.

Seismic Consideration

Studies in California suggest that regional and local earthquake hazards (presence of faults and their proximity, regional earthquake history, geological and local site factors, etc.) have little if any influence on the hospitality industry and levels of guestroom rates. Earthquake risk, in general, does not appear to translate into financial cost in the hospitality industry.

Insurers: Insurers are important external participants in many hotel and motel changes of management, and they carry out due diligence functions to determine the risks and potential liabilities in any given deal. By their nature, insurers spread their risks over a wider range of investments than that presented to an owner and operator in a specific property. The insurers' role in hotels and motels properties is complex and depends on whether the properties are franchised or managed by the operator. In franchised properties the owner's liability is primary, and it is the owner who procures the insurance. In managed properties the operator's liability is primary, and it is the operator who procures the insurance. The insurability of the acquired property and the cost of insurance are of great concern to hotel and motel owners and operators, but large owners and operators can spread the cost over a large number of properties.

Seismic Consideration

Insurers usually employ engineering consultants to perform the seismic portion of the due diligence, and they use proprietary programs to carry out the analysis. The most common analysis used is the Probable Maximum Loss (PML) analysis, which quantifies the percentage of the property that will be lost in a major earthquake. Such an analysis is referred to as deterministic, and it does not consider the damages and losses that could result from more moderate but more frequent earthquakes. Insurers establish their own proprietary criteria for acceptable PML.

While insurers have recently been quite concerned about hurricane risks and have influenced hurricane mitigation investments, their pressure on seismic mitigation is negligible. Seismic insurance is driven by availability rather than cost, and large owner and operators can acquire insurance even for buildings on fault lines because the insurance is based on a blanket number of exposures and the modeling takes into account the total inventory of buildings.

Risk Management: Many hotel and motel building owners, and most operators, have formally established internal risk management functions within their organizations. These risk managers participate in the due diligence analyses carried out prior to change of management. The rigor of internal due diligence varies from operator to operator. The operator's risk reduction standards will have been previously established by their risk management, and will be applied to the property.

Seismic Consideration

The operators' internal seismic due diligence, whether carried out by in-house staff or consultants, is the PML analysis. Operators establish their own proprietary criteria for acceptable PML. Some large operators limit

their PML analysis to California, Oregon, and Washington. Depending on the deal, the PML leads to one of three decisions about the change of management:

- Reject the deal if the PML exceeds a preset threshold,
- Accept the deal with an initial rehabilitation, or
- Accept the deal without rehabilitation.

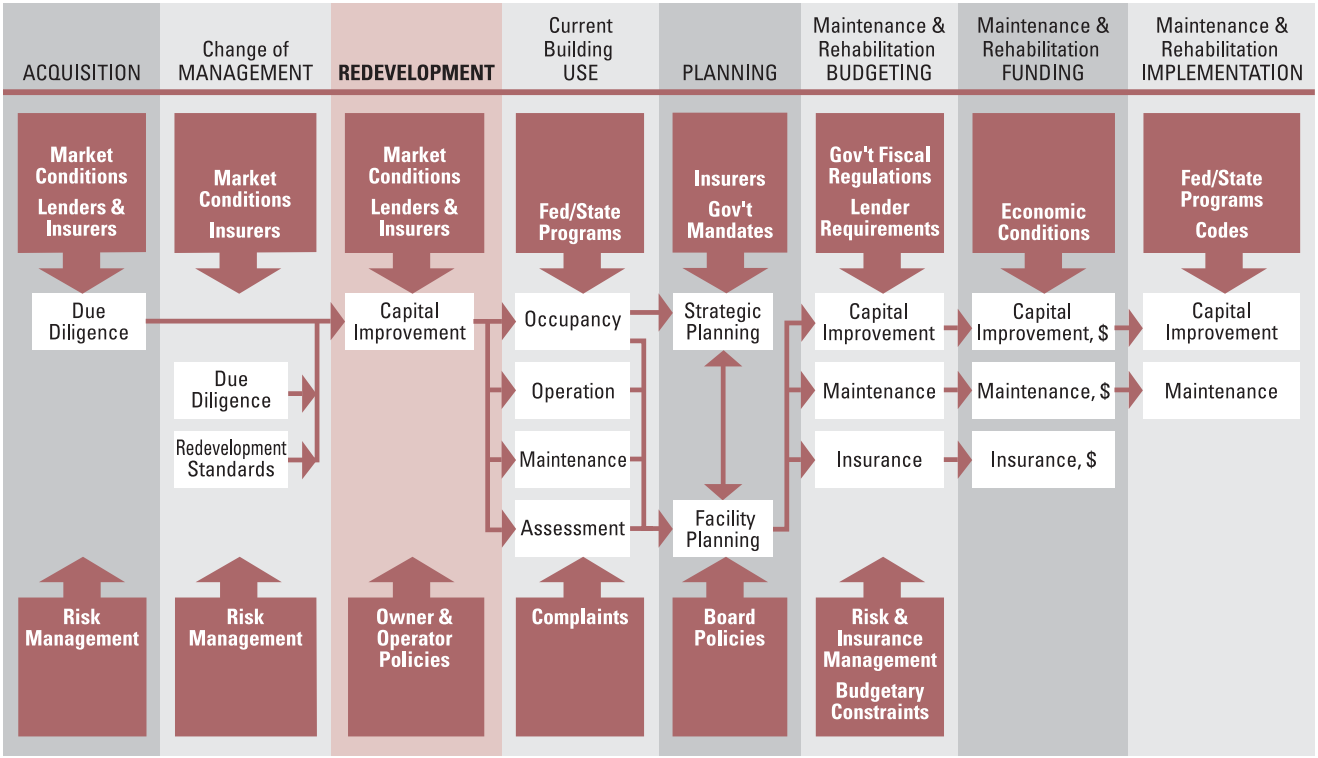
However, hotel and motel operators do not currently have seismic mitigation as part of their risk reduction standards.

3. The REDEVELOPMENT Phase of Hotel and Motel Facility Management

Typical Process

The redevelopment phase of the typical hotel and motel facility management process consists of various types of **capital improvements**, and is influenced by significant internal and external pressures, as depicted in Figure 5.

Figure 5: Redevelopment



The types of redevelopment phase capital improvement projects vary as a function of the hotel and motel brand standards. They generally consist of:

- Architectural upgrading of entrances, lobbies, and public areas.
- Architectural upgrading of façades.
- Upgrading of the HVAC systems.
- Modernization and upgrading of guestrooms.
- Environmental and other risk remediation work identified in the due diligence process.

Influences and Related Seismic Considerations

As indicated in Figure 5, two external factors (down arrow) and one internal factor (up arrow) influence redevelopment phase decision making.

Market Conditions: Hotel and motel properties in a brand class must compete with neighboring, similarly branded properties. Local architectural traditions and fashions and historic preservation are significant factors determining the specific nature of various capital improvement projects.

> **Seismic Consideration**
> **The extent of market-driven seismic improvement in hotel and motel buildings seems to be limited.**

Lenders and Insurers: External lenders and insurers may require specific capital improvements as a condition of loans or insurance coverage. These are generally the direct result of the due diligence analyses.

> **Seismic Consideration**
> **The extent to which lenders or insurers have required seismic rehabilitation in hotel and motel buildings is not known.**

Owner and Operator Policies: Owners' and operators' marketing and architectural policies are the principal internal factors governing capital improvement decisions in the redevelopment phase.

> **Seismic Consideration**
> **Hotel and motel owners and operators have not established marketing and architectural policies that feature seismic rehabilitation, even when operators have articulated risk reduction standards.**

4. The Current Building USE Phase of Hotel and Motel Facility Management

Typical Process

The current building use phase of the typical hotel and motel facility management process consists of four categories of activities and is influenced by significant internal and external pressures, as depicted in Figure 6.

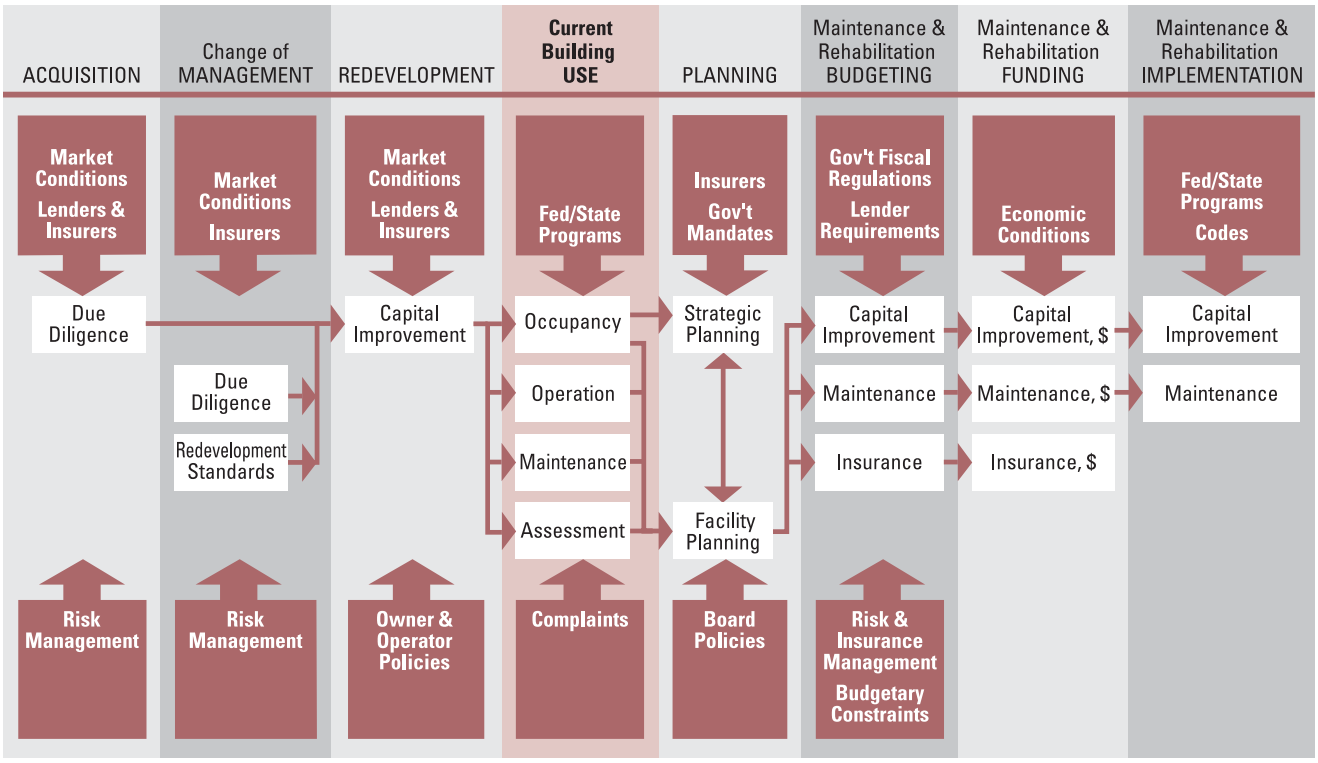
Occupancy: This category of activity consists of the primary function of occupancy of guestrooms and public rooms by hotel guests. Support functions are administrative and managerial, such as collecting payments, operating food and drink services, operating recreational services such as a health club, pool, or spa, operating social services such as lecture rooms, meeting rooms, and conference facilities, and addressing guests' concerns. The specific functions may vary depending on the hotel or motel brand standards.

Occupancy functions are carried out in each building by the guests and operators. Each of these functions is subject to seismic risk and can be disrupted by seismic damage.

Operation: Facility operation consists of all the activities and functions that the facility and its components must perform in order to support the occupancy. Examples are the mechanical functions (heating, cooling, and ventilation), electrical functions (lighting, communications, and alarm), and plumbing functions.

Operation functions may be carried out by the operator's staff and/or by contractors. Each of these functions is subject to seismic risk and can be disrupted by seismic damage.

Figure 6: Use



Maintenance: Maintenance includes all the activities required to enable the occupancy and operation of the building to be carried out continuously over time. They can be broken down into custodial maintenance, routine maintenance, and repair.

Maintenance functions may be carried out by the operator's staff and/or by contractors.

Facility Assessment: Facility assessment consists of the survey or inspection of the hotel and motel buildings on a scheduled basis. It may also include a review of documents, such as archival building plans, for retrieving specific information. The purpose of the surveys or inspections is to determine facility conditions in relation to one or more of the following categories:

- Guest and staff complaints
- Maintenance needs
- Preventive maintenance needs
- Specific environmental hazards
  - asbestos
  - lead paint
  - lead
  - radon
- Structural hazards
- Fire/life safety
- Environmental quality
- Energy use/conservation
- Accessibility
- Other

These surveys may or may not be coordinated as to schedule, content, personnel, etc. Facility managers may or may not use prepared inspection forms or checklists. Finally, facility managers may vary as to the extent and specific nature of their record keeping and reporting.

Influences and Related Seismic Considerations

As indicated in Figure 6, one external factor (down arrow) and one internal factor (up arrow) influence current building use phase decision making.

Federal and state programs: Various external programs may establish requirements affecting the use of hotel and motel buildings that have facilities implications (e.g., Americans with Disabilities Act [ADA] and Occupational Safety and Health Administration [OSHA] requirements).

> **Seismic Consideration**
> **Currently there are no seismic rehabilitation mandates or implications in any federal or state programs related to hotel and motel buildings, with the exception of California.**

Specific surveys or inspections may be mandated by state or local laws/programs. These surveys/inspections may be carried out by a variety of entities:

- Federal personnel (e.g., from OSHA, Environmental Protection Agency [EPA])
- State/city/county personnel (e.g., fire marshal, code enforcement, environmental, health)
- Hotel and motel operator personnel (custodial or facility managers)
- Hotel and motel contracted personnel (e.g., asbestos inspectors)
- Consultants

> **Seismic Consideration**
> **Currently there are no seismic survey or inspection mandates or implications in any federal or state programs related to hotel and motel buildings, with the possible exception of California.**

Complaints by Occupants: Internal complaints by guests and staff are a potentially significant pressure on the facility management process.

> **Seismic Consideration**
> **Rarely, if ever, have there been complaints about seismic vulnerability generated by hotel and motel building occupants, with the possible exception of California. This is because seismic risk and seismic damage are not routine experiences in most regions of the United States.**

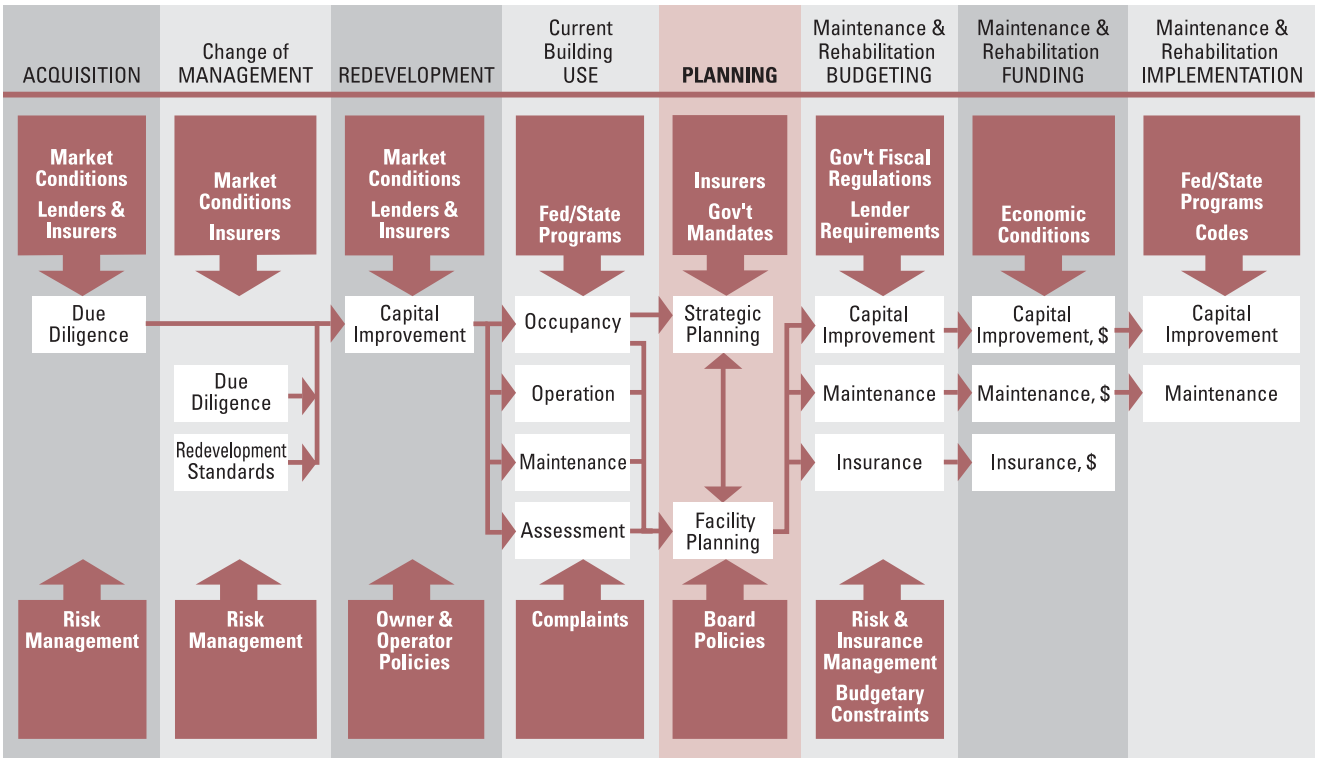
5. The PLANNING Phase of Hotel and Motel Facility Management

Typical Process

The planning phase consists of the projection and forecasting of future needs. It can be carried out periodically or continuously, and may vary as to the time period covered by the projections and forecasts. Planning functions may be carried out by the owner and/or operator, with or without the assistance of consultants. Planning consists of two separate but related activities—strategic planning and facility planning—and is affected by significant internal and external pressures, as depicted in Figure 7.

Strategic Planning: Strategic planning is carried out by both owners and operators of hotel and motel buildings. It attempts to formulate future business strategy by analyzing and forecasting financial trends as well as national, regional, and local hospitality markets. Many owners acquire properties for a limited period of time, and many have an exit strategy in place at the time of acquisition. Strategic planning addresses such issues as:

Figure 7: Planning



- Should the property brand be upgraded or downgraded?
- Should the exit strategy be accelerated or prolonged?
- Should trends in the insurance market revise current investment programs?
- Should specific major capital investments be considered?

Strategic planning is usually carried out at the owner's and operator's respective headquarters, and concerns itself with the owner's entire building portfolio and the operator's entire management portfolio, or large segments of these portfolios.

Facility Planning: Facility planning consists of preparing short- and long-range facility plans. It combines the products of two distinct activities—the strategic plan and the facility assessment (see Figure 7)—into a detailed projection of facility requirements. The projection may cover a defined time frame, such as five years.

Different owners and operators may use different classifications of projects in their facility plans, reflecting a variety of legal, administrative, jurisdictional, and other factors. Furthermore, the contractual agreement between the owner and operator is likely to classify facility projects in terms of escrow improvements and outside escrow improvements. However they may be classified, a comprehensive facility plan should include the following elements:

- New construction
- Additions to existing buildings
- Renovations of existing buildings

- Building systems replacements
- Building systems repairs
- Scheduled maintenance
- Preventive maintenance
- Building disposition (change of use, sale, demolition)

The plan will identify the time frames in which each project is to be accomplished, and may include cost estimates.

If effective, the facility plan will be used as a budgeting tool by both owners and operators, and will provide direct inputs into their budget processes. It should be updated on a routine basis to reflect:

- Changes in the strategic plans of both owners and operators (including market conditions)
- Revised facility assessments
- Budgeting and funding realities

Facility planning usually begins at the individual building or project level and entails the flow of information up the management hierarchy for final capital decision making and budgeting at the owner's and operator's respective headquarters.

Influences and Related Seismic Considerations

As indicated in Figure 7, two external factors (down arrow) and one internal factor (up arrow) influence current planning phase decision making.

Insurance Carriers and Brokers: External private property and casualty insurance companies often require surveys or inspections of hotel and motel buildings on an annual or other scheduled basis. Insurance carriers are more than willing, when asked, to provide building owners and operators with Loss Control and Prevention Reports that include recommendations for loss prevention. Insurance brokers also employ loss/risk specialists.

Seismic Consideration

Property insurers are unlikely to recommend extensive seismic improvements outside of California. In Utah, for example, they have recommended seismic bracing of sprinklers in hospitals as part of the life safety systems, but no other improvements.

Government Mandates: Federal, state, and local government agencies may establish external requirements affecting facility planning in the planning phase. These requirements may have facility rehabilitation implications.

Seismic Consideration

Currently there are no seismic rehabilitation mandates or implications in any federal or state programs, with the exception of California.

Board Policies: In terms of internal influences, boards of directors of both owner and operator organizations may occasionally adopt written policies on issues of business and social significance that can impact both strategic and facility planning. These policies guide the actions of both organizations. The coordination of owner and operator policies as they relate to specific facilities is variable.

Seismic Consideration

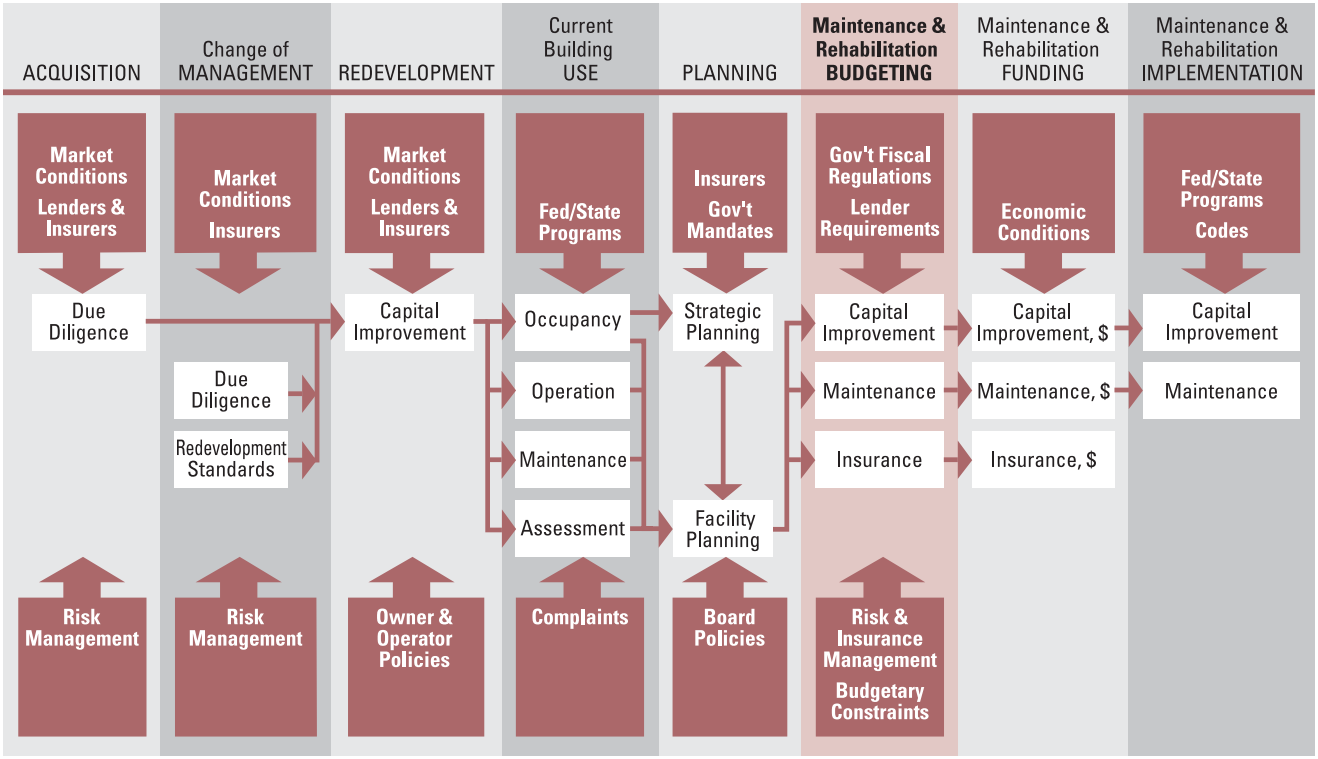
Hotel and motel owners and operators boards may adopt policies addressing seismic issues, including seismic performance objectives and rehabilitation of hotel and motel buildings, either as a one-time or recurring incremental program.

6. The Maintenance & Rehabilitation BUDGETING Phase of Hotel and Motel Facility Management

Typical Process

The budgeting phase consists of the projection of future financial resources required to meet future needs. It is carried out annually (covering a period of one or more years). Each local or regional hotel and motel operator's facility manager initiates it with input from his or her staff. Organization-wide, the vice president for facilities, or similarly titled position, oversees the budget development. The facility budget is a process that can be thought of as percolating up through the operator's organization and down through the owner's organization. Budgeting is clearly covered by the owner/operator agreement, and it is affected by external government fiscal regulations and lender requirements, and internal risk management policies and budget constraints, as depicted in Figure 8.

Figure 8: Budgeting



Three elements of the budget are relevant to the discussion of facility management:

- Capital
- Maintenance
- Insurance

Capital Budgets: Hotel and motel capital budgets are generally divided between escrow accounts and non-escrow accounts. Non-escrow accounts generally relate to the acquisition of buildings and major systems and to major reconstruction. Escrow accounts typically cover guestroom finishing, furniture, and equipment (FF&E) and public area FF&E. While FF&E improvements may be done on schedule every several years, the occurrence of improvements under either category is not annual or repetitive,

and they can therefore be amortized. The distinction between capital and maintenance budgets may vary among different hotel and motel building owners and operators. At one extreme is a total separation, mandated by law, labor jurisdiction, or other factors. At the other extreme is a rather unclear separation between the two funding mechanisms.

Maintenance Budgets: Maintenance budgets generally relate to recurring annual expenditures and address existing inventories of buildings and systems without adding to the inventories.

Insurance Budgets: Financial resources earmarked for insurance by owners and operators (subject to varying contractual arrangements between them) may be used in different ways, including the purchase of third-party insurance and/or the funding of a self-insurance reserve. Property and general liability insurance are relevant to facility management considerations.

Influences and Related Seismic Considerations

As indicated in Figure 8, two external factors (down arrow) and two internal factors (up arrow) influence budgeting phase decision making.

Government Fiscal Regulations: Federal, state, and local government agencies have historically established external requirements dealing with fiscal responsibility of commercial property owners. A variety of Securities and Exchange Commission (SEC) regulations apply to REITs. Pension funds are subject to a variety of fiduciary requirements. Partnerships are subject to a variety of state and federal regulations. One important objective of these regulations is to assure the responsible stewardship of someone else's resources. These requirements may have facility rehabilitation implications if resources are expended in an irresponsible manner. Additionally, these regulations may determine, directly or indirectly, the length of time that an acquired real estate asset must be held, and therefore what the owner's planning horizon should be.

Seismic Consideration

As far as is known, there have been no seismic considerations attendant to these fiscal regulations.

Lender Requirements: Commercial lenders impose requirements on building owners who use mortgage financing for capital improvements. Often, the lender requires the purchase of a particular type of insurance coverage.

Seismic Consideration

In California, lenders sometimes require the purchase of earthquake insurance as a condition of the loan. For some commercial office and multifamily apartment building loans, this requirement has been waived when the owner includes seismic improvements in the project that reduce the lender's risk below a defined threshold. The same consideration may apply to hotel and motel buildings.

Risk and Insurance Management: Internally, the owner and operator organizations' respective risk and insurance management may have a direct or indirect role in the budget phase of the process regarding the decisions related to insurance. The operator's risk management may also have a role regarding budget decisions related to capital improvement and maintenance.

Seismic Consideration

In areas of seismic hazard, the risks of building loss or damage, occupant death or injury, and hotel and motel building owner and operator liability must all be assessed. It must be decided whether to seek earthquake property and liability insurance coverage. Insurance companies that offer such coverage do not usually offer incentives to customers to undertake loss reduction measures in the form of seismic rehabilitation.

However, this situation might change, and insurance incentives for seismic rehabilitation may become subject to negotiation.

Budgetary Constraints: Internally, political and economic conditions may place limits on hotel and motel capital and maintenance budgets (consider the impact of 9/11 on the hospitality industry). The problem is often exacerbated by unfunded mandates imposed on hotel and motel buildings by federal and state agencies.

Seismic Consideration

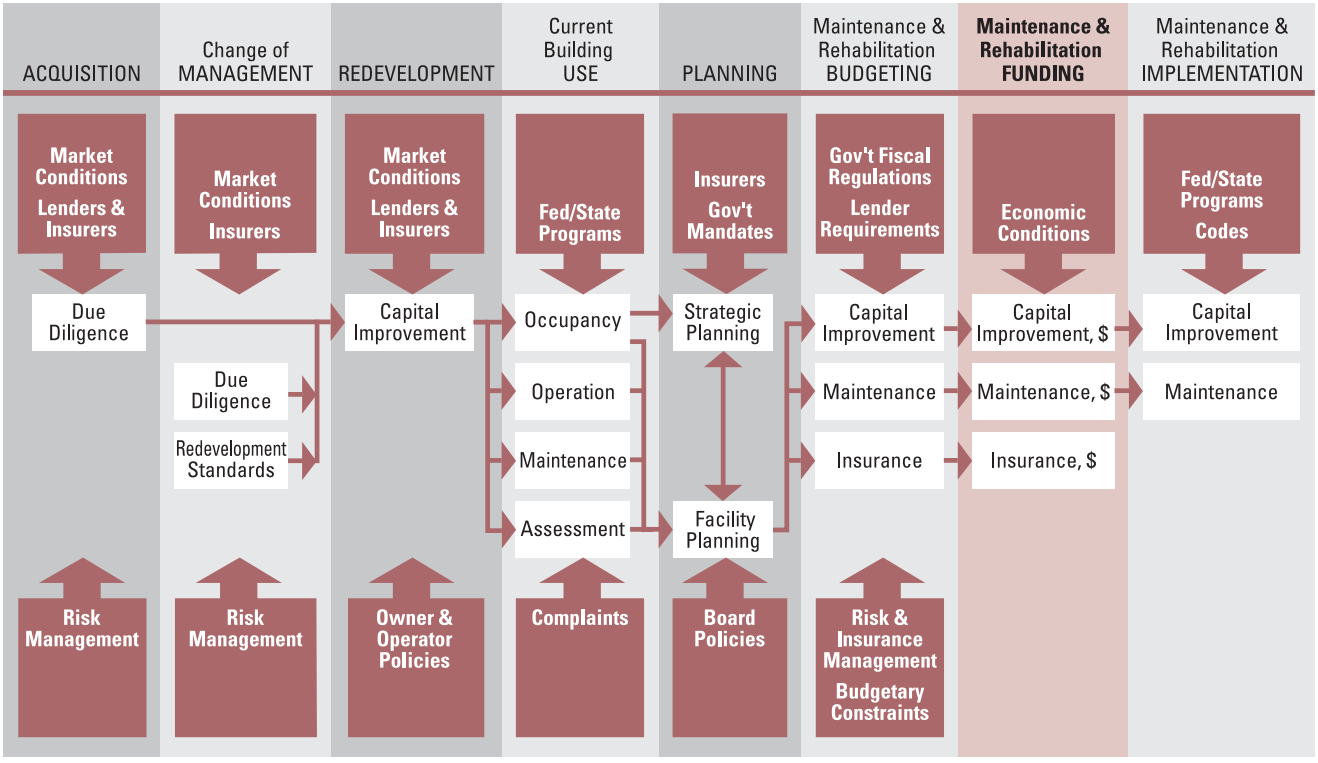
The strategy of integrating incremental seismic rehabilitation with other work, which is an integral part of this facility and financial management model, can provide a method for addressing seismic risk reduction within budget constraints. See full discussion of this opportunity under Recommended Activities in Part B.2.2.7, Seismic Rehabilitation Planning for Specific Buildings.

7. The Maintenance & Rehabilitation FUNDING Phase of Hotel and Motel Facility Management

Typical Process

The funding phase consists of those activities required in order to obtain the financial resources to meet the budgets. It is influenced externally by regional and local economic conditions, as depicted in Figure 9.

Figure 9: Funding



The funding of hotel and motel building budgets in general, and of the three budget elements of capital improvement, maintenance, and insurance, varies as a function of the owner/operator agreement.

Hotel and motel building owners and operators can fund their budgets by various combinations of equity and debt. Bond financing is not usually used in the hospitality industry to fund capital improvements.

Influences and Related Seismic Considerations

As indicated in Figure 9, one external factor (down arrow) influences funding phase decision making.

Regional and Local Economic Conditions: Externally, the funding of hotel and motel building construction is subject to local and national socioeconomic conditions well beyond the control of the building owner and operator. It depends on interest rates, the owner's credit rating, and similar parameters.

Seismic Consideration

Even though seismic rehabilitation is clearly a risk reduction activity, there is no evidence that any building owner has improved its credit rating as the result of undertaking seismic mitigation activities of any kind.

8. The Maintenance & Rehabilitation IMPLEMENTATION Phase of Hotel and Motel Facility Management

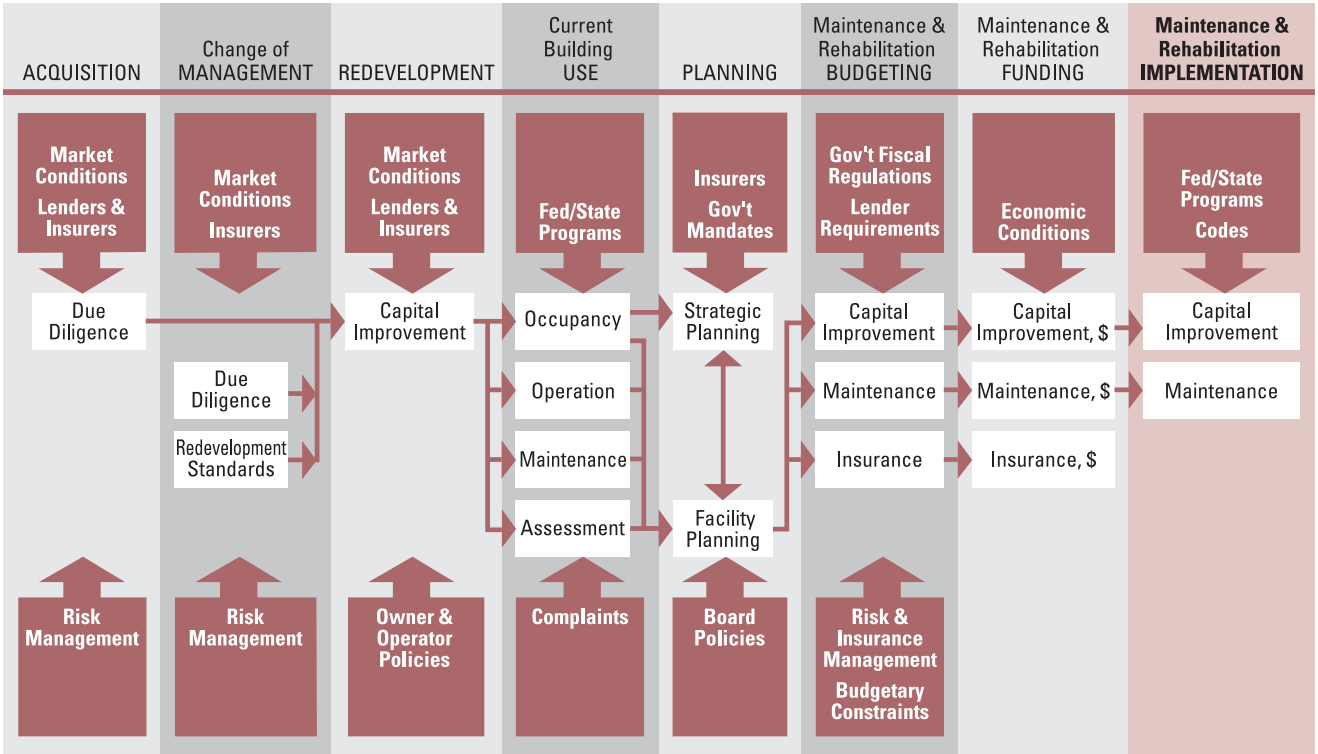
Typical Process

The implementation phase includes design and construction, and can be broken into three categories of projects, all of which are relevant to existing buildings:

- Building acquisition projects
- Capital improvement projects
- Maintenance projects

The implementation phase is primarily affected by external federal and state programs and building code requirements, as depicted in Figure 10.

Figure 10: Implementation



Acquisition includes new building construction and the acquisition of existing buildings. Acquisition of existing buildings is discussed above as the first phase of the facility management process.

Capital improvement and maintenance projects are managed by hotel and motel building operator's and owner's staffs, subject to the owner/operator agreement. The projects are carried out by these personnel and by contractors. The management of these two categories may be separated or combined, depending on issues of labor jurisdiction and legal authority, as well as the owner/operator agreement.

Influences and Related Seismic Considerations

As indicated in Figure 10, two external factors (down arrow) influence implementation phase decision making.

Federal and State Mandates and Programs: Externally, federal and state programs may establish requirements affecting the implementation phase (e.g., ADA and OSHA requirements).

Seismic Consideration

Currently there are no seismic rehabilitation mandates or implications in any federal or state programs related to hotel and motel buildings with the possible exception of California.

Codes and Code Enforcement: Also externally, building codes impose requirements on the implementation phase in cases of repair, alteration, or addition to existing buildings. These requirements may be enforced by a state or local agency. Such requirements can add costs to a project and jeopardize feasibility unless done incrementally.

Seismic Consideration

Codes do not mandate seismic rehabilitation in repair and alteration projects, though additions must comply with building code seismic requirements. Incremental seismic rehabilitation is consistent with most building code requirements applicable to existing buildings.

Appendix II. Integration Opportunities for Incremental Seismic Rehabilitation for Small Organizations and Individual Owners

Small organizations or individual owners with limited professional facility management may use the following matrix to identify opportunities to integrate incremental seismic rehabilitation with maintenance and capital improvement projects. These opportunities can be identified on the basis of a quick evaluation by a design professional.

The categories of maintenance and capital improvement projects included in the columns of this matrix are:

1. Roofing Maintenance and Repair/Re-roofing
2. Exterior Wall and Window Maintenance/Façade Modernization
3. Fire and Life Safety Improvements
4. Public and Service Area Modernization
5. Underfloor and Basement Maintenance and Repair
6. Guestroom Finishing, Furniture, and Equipment (FF&E)

These categories are the same as those included in Section C.2, described in detail in the text portions of Sections C.2.1 through C.2.5, and C.2.8, respectively. Three remaining categories of maintenance and capital improvement projects are not included in this matrix, but their respective integration opportunities can be identified by reference to several of the preceding six, as follows:

7. HVAC Upgrade and Energy Conservation/Indoor Air Quality Improvement—integration opportunities from 1, 2, and 4
8. Hazardous Materials Abatement—integration opportunities from 3 and 4
9. Public Area FF&E—integration opportunities from 4

Owners using this Appendix are encouraged to retain the services of a seismic engineer to identify additional incremental seismic improvements as discussed in Part C.

Simplified Matrix of Seismic Performance Improvements

Level of Seismicity (Low)	Level of Seismicity (Med or High)	Building Structure Element	Structural Sub-System	Seismic Performance Improvement	Purpose	Applicability*	1. Roofing Maintenance & Repair/Re-roofing	2. Exterior Wall & Window Work	3. Fire & Life Safety Improvements	4. Public & Service Area Modernization	5. Underfloor/Basement Maintenance & Repair	6. Guestroom FF&E
Nonstructural												
✓	✓			Anchorage of Canopies at Exits	Prevents collapse of canopies that could block exits and possibly cause injuries.	all	✓	✓				
	✓			Anchorage and Detailing of Rooftop Equipment	Prevent equipment from sliding or falling off platforms due to connection failure or nonfunction.	all	✓					
	✓			Bracing and Detailing of Sprinkler and Piping	Prevent sprinkler lines from breaking and flooding the building.	all			✓	✓		✓
	✓			Fastening and Bracing of Equipment (Mechanical and Electrical)	Prevent fans and other equipment from swaying and falling on occupants; connections could fail resulting in equipment no longer functioning.	all			✓	✓	✓	✓
✓	✓			Bracing of Parapets, Gables, Ornamentation, and Appendages	Prevent parapets, gables, and ornamentation from falling outward.	all	✓	✓				
	✓			Suspension and Bracing of Lights	Prevent lights from falling and injuring occupants. Lights should not be supported by a suspended ceiling in a high or moderate seismic zone. Pendent lights should have their sway limited.	all			✓	✓		
	✓			Fastening and Bracing of Ceilings	Suspended ceilings should be braced against sidesway to reduce the chance of elements falling.	all			✓	✓		✓
	✓			Attachment and Bracing of Large Ductwork	Prevent ducts from falling on occupants.	al	✓		✓	✓		
✓	✓			Anchorage and Bracing of Emergency Lighting	Prevent heavy battery packs from falling.	al			✓	✓		
	✓			Shut-Off Valves	Gas and water lines could break and should have a means of turning them off.	all		✓			✓	
✓	✓			Bracing of Reinforcing Masonry Walls at Interior Stairs	Prevent collapse of walls that could block stairways.	all buildings except wood			✓	✓		
	✓			Bracing of Interior Partitions (Masonry and Wood)	Interior partitions must be braced to prevent falling/collapse.	all			✓	✓		✓
	✓			Support and Detailing of Elevators	Keep elevators functioning.	all buildings, except wood, with cable elevators			✓	✓		
	✓			Anchorage of Masonry Veneer	Prevent inadequately anchored veneer from falling outward onto pedestrians.	all		✓				

* For NONSTRUCTURAL improvements: applicable to all wood, masonry, concrete, or steel buildings except as noted.
For STRUCTURAL improvements: applicable to all buildings (wood, masonry, concrete, and steel) with wood diaphragms (floors), except as noted.

Simplified Matrix of Seismic Performance Improvements (continued)

Level of Seismicity (Low)	Level of Seismicity (Med or High)	Building Structure Element	Structural Sub-System	Seismic Performance Improvement	Purpose	Applicability*	1. Roofing Maintenance & Repair/Re-roofing	2. Exterior Wall & Window Work	3. Fire & Life Safety Improvements	4. Public & Service Area Modernization	5. Underfloor/Basement Maintenance & Repair	6. Guestroom FF&E
Nonstructural (continued)												
✓	✓			Glazing Selection and Detailing	Prevent exterior or interior glass from falling onto the walking surface and causing injuries.	all		✓	✓	✓		
	✓			Anchorage of Exterior Wythe in Cavity Walls	Prevent veneer from falling outward. Existing anchorage should be checked for rust damage and loss of strength.	all buildings except wood		✓				
	✓			Bracing or Removal of Chimneys	Prevent chimneys from toppling into yards or through roofs.	all	✓					
	✓			Anchorage of Steel Stud Backup	Prevent steel studs used as a backup to support veneer or other cladding from becoming detached or falling.	all buildings except wood		✓	✓	✓		
	✓			Restraint of Hazardous Materials Containers	Reduce danger of breakage and mixing of chemicals.	all			✓	✓	✓	
	✓			Attachment and Bracing of Cabinets and Furnishings	Prevent cabinets and other furnishings from toppling or moving and causing damage. Fallen file cabinets may block exit doors.	all			✓	✓		
Structural												
	✓	Foundation		Anchor Bolts	Improve load path. Prevent building from sliding off foundation.	wood buildings only		✓			✓	
	✓	Foundation		Anchorage	Improve load path. Provide adequate connection between the building and the foundation.	wood buildings only					✓	
	✓	Foundation		Cripple Stud Bracing	Cripple studs are usually not braced. Prevent them from toppling and causing the building to fall off the foundation.	wood buildings only		✓			✓	
	✓	Foundation		New Foundations	Additional foundations may be the preferred solution in some cases.	wood buildings only					✓	
	✓	Foundation		Pile Cap Lateral Load	Brace piles at their top to eliminate the chance of lateral movement and reduce chance of foundation failure.	masonry buildings only					✓	
	✓	Foundation		Uplift	Reduce the uplift chance by improving foundation system; engineer should evaluate the effects of uplift.	wood and masonry buildings only					✓	
	✓	Horizontal Elements	Diaphragms	Attachment and Strengthening at Boundaries	This is part of the load path, and conveys the diaphragm forces into the walls or other lateral force-resisting elements.	all	✓	✓				

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For STRUCTURAL improvements: applicable to all buildings (wood, masonry, concrete, and steel) with wood diaphragms (floors), except as noted.

Simplified Matrix of Seismic Performance Improvements (continued)

Level of Seismicity (Low)	Level of Seismicity (Med or High)	Building Structure Element	Structural Sub-System	Seismic Performance Improvement	Purpose	Applicability*	1. Roofing Maintenance & Repair/Re-roofing	2. Exterior Wall & Window Work	3. Fire & Life Safety Improvements	4. Public & Service Area Modernization	5. Underfloor/Basement Maintenance & Repair	6. Guestroom FF&E
Structural (continued)												
	✓	Horizontal Elements	Diaphragms	Mezzanine Anchorage and Bracing	Make sure the mezzanine is attached to the building to provide a load path for the mezzanine diaphragm and to reduce any pounding of the mezzanine against the building's walls or columns. A large mezzanine may require bracing on the open sides.	all buildings except wood			✓	✓		✓
	✓	Horizontal Elements	Diaphragms	Strength/Stiffness	Control the movement of the diaphragm to reduce the damage due to drift and to control the out-of-plane loads on vertical elements.	all	✓					
✓	✓	Vertical Elements	Load Path	Lateral Force-Resisting System to Diaphragm Connection	Permit earthquake loads to be conveyed to the foundation—develop a load path. This is the key element in seismic safety.	all	✓	✓	✓	✓	✓	✓
	✓	Vertical Elements	Shear Walls	Capacity	Building walls can act as lateral load-resisting elements. They must be connected to the horizontal elements.	wood buildings only		✓	✓	✓	✓	✓
	✓	Vertical Elements	Shear Walls	Continuity	Discontinuities of lateral-resisting elements create load transfer demands. Design standards may impose higher loads for this condition. This is one of the most cost-effective improvements in buildings.	wood buildings only		✓	✓	✓	✓	✓
	✓	Vertical Elements	Shear Walls	Extension of Wood Interior Walls to Roof	Permit walls that were not constructed full height to be used as shear walls in buildings with wood interior walls.	wood and masonry buildings only			✓	✓		✓
	✓	Vertical Elements	Shear Walls	Lateral Stability	Prevent buckling and possible wall collapse. Walls must be anchored at the top or may have other bracing elements such as diagonal or vertical braces.	masonry buildings only		✓	✓	✓		✓
✓	✓	Vertical Elements		Out-of-Plane Anchorage of Concrete or Masonry Wall	Prevent walls from falling outward due to inadequate connections between the wall and the diaphragms. A cost-effective mitigation measure for bearing wall buildings.	all buildings except wood	✓	✓	✓	✓	✓	✓

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For STRUCTURAL improvements: applicable to all buildings (wood, masonry, concrete, and steel) with wood diaphragms (floors), except as noted.