BROWARD COUNTY LMS /Project Prioritization Matrix

Project Title:

Sponsor:

OFFICIAL USE ONLY
PROJECT
Reviewer:

MEASURED CRITERIA	POINTS AVAILABLE	POINTS AWARDED
Community Benefit	50	
Project Implementation	25	
Community Commitment	25	
PROJECT / INITIATIVE FINAL	SCORE	

COMMUNITY BENEFIT	AVAILABLE POINTS	SCORING INSTRUCTION	AWARDED POINTS
Hazard Mitigation - Does the proposed project or initiative mitigate against one or more of the hazards identified in the Enhanced Local Mitigation Strategy as hazards of most significant concern?	5	Hazard Activity Category Flood, Wind (from Tropical Cyclone), Sea Level Rise, Coastal Storm Surge, Coastal Erosion Damage Reduction =5 Severe Storm/Tornado, Wildfire, Pandemic/Infectious Disease, Mass Migration, Terrorism, HazMat = 4 Flood Preparedness = 3 Public Information = 2 Other = 1	
Project Benefit - Does the project address critical elements of the community infrastructure?	10	Primary critical facilities = 10 Storm water/flooding = 8 Secondary critical facilities = 6 Public convenience facilities = 4 Residential Structures = 2	
Area Benefit – How many people stand to benefit from the project implementation?	5	Multiple Jurisdictions = 5 Community = 3 Neighborhood = 1	
Community Exposure - Does the project mitigate a frequently occurring problem or a problem to which a community is particularly vulnerable? H = High M = Medium L = Low E = Exposure F = Frequency of occurrence	10	HE + HF = 10 HE + MF = 8 HE + LF = 6 ME + HF = 9 ME + MF = 7 ME + LF = 4 LE + HF = 5 LE + MF = 2 LE + LF = 1	
Cost Effectiveness - What is the benefit/cost ratio of the project applying the following Benefit/Cost ratio formula: (Loss Exposure ($) Before Project **-** Loss Exposure ($) After Project) ÷ Cost of the Project	20	Benefit/cost ratio = 4.0 or greater = 20 points Benefit/cost ratio = 3.0 to 3.9 = 16 points Benefit/cost ratio = 2.0 to 2.9 = 12 points Benefit/cost ratio = 1.0 to 1.9 = 8 points Benefit/cost ratio = < 1.0 = 0 points	

TOTAL COMMUNITY BENEFIT POINTS	50	POINTS AWARDED	

PROJECT IMPLEMENTATION	AVAILABLE POINTS	SCORING INSTRUCTION	AWARDED POINTS
Containment Within the Existing Comprehensive Growth Management Plan or Equivalent Plan – Is the project or initiative consistent with or incorporated within the existing Comprehensive Growth Management Plan or equivalent document?	10	Contained within a specific Policy/Plan = 10 Contained in "Goal" with proposed Policy/Plan amendment = 8 Contained within a broad "Goal" = 5 Contained in a proposed Amendment = 3 Not in conflict with any Policy/Plan = 1	
Containment Within an Existing Emergency Management Plan / Other Functional Plan Developed by an Official Local Governmental Entity/Organization - Has this project or initiative already been proposed as a management initiative or structural improvement in any emergency plan or proposed or adopted by County\local jurisdictions or entity?	10	Officially adopted = 10 Proposed/Not officially adopted = 6 Not in conflict with any plan = 2	
Consistency with Existing Regulatory Framework - Is the project consistent with existing legal and regulatory and environmental/cultural framework?	5	No regulatory issues = 5 Local issues = 4 Regional issues = 3 State issues = 2 Federal issues = 1	
TOTAL PROJECT IMPLEMENTATION POINTS	25	TOTAL POINTS AWARDED	

BROWARD COUNTY LMS /Project Prioritization Matrix

COMMUNITY COMMITMENT	AVAILABLE POINTS	SCORING INSTRUCTION	AWARDED POINTS
Public Support - Is there demonstrated public support for this project or recognition of this problem?	5	Has this project or problem been the subject of: A) An Advertised Public Meeting = 3 B) Written evidence of public support = 2 Both A and B = 5	
Funding Availability – Is there a funding source readily available?	10	Funds available Now = 10 1 year = 8 2 years = 6 3 years = 4 4 years = 2 5 years = 1	
Matching Funds - Are matching funds or in-kind services available for this project?	5	50 % or more = 5 40 to 49 % = 4 30 to 39 % = 3 20 to 29 % = 2 1 to 20 % = 1	
Timeframe for Accomplishing Objectives - How long will it take for the proposed mitigation project to accomplish its stated goals?	5	1 year = 5 2 years = 4 3 years = 3 4 years = 2 5 years+ = 1	
TOTAL COMMUNITY COMMITMENT POINTS	25	POINTS AWARDED	

(Revised 1/20/15)

NOTES:

User Guide for the Broward County Screening Tool
Wind and Flood Hazards

Introduction

This screening tool was developed for the Broward County Emergency Management Division and is applicable to wind and flood projects in Broward County, Florida. The screening tool includes various factors that are highly influential in determining cost effectiveness for potential wind and flood mitigation projects. Factors presented in the tool are based on a pre-defined scoring system and are weighted relative to their importance in terms of cost-effectiveness. Because projects with high cost effectiveness are more likely to be funded, this tool also is designed to provide a general indication of project viability.

Once the user goes through and assigns a reasonable rating for each of the applicable quantitative factors, the tool will then generate an overall project rating score based on the user's input. The tool will allow the user to interpret the project rating score by establishing a threshold, or target score for comparison. Resulting scores that are above the "threshold" score would indicate that the proposed mitigation project would have a high likelihood of cost-effectiveness. Building specific data would then be used to evaluate potential damages and losses using the Federal Emergency Management Agency (FEMA) Benefit Cost Analysis (BCA) Tool Version 4.5.5 [1].

How to use the project screening tool:

1. Open excel file and **enable macros.**
2. Choose the appropriate worksheet, depending on the hazard type: wind or flood.
3. Fill out the project name, the applicant's name and a brief description of the proposed project.
4. Fill out relevant project and building information.
5. Choose the appropriate project-specific option for each of the factors in the tool.
6. Compare the final score to the threshold score ranges.

If both wind and flood hazard mitigation is proposed in the same project, evaluate the hazards separately in the screening tool and include a comment in the field after the scores.

Project Type Alternatives

The initial part of the tool is intended to outline various mitigation options and aid the user with initial project type selection. A description of mitigation options that are potentially eligible under FEMA's Hazard Mitigation Assistance programs is included. Mitigation projects are designed to reduce or eliminate long-term risk to people and property from hazards and their effects.

Project and Building Information

This section of the tool documents selected project-specific information that will be provided to the County. This information can later be used in the FEMA Benefit Cost Analysis Tool.

User Guide for the Broward County Screening Tool
Wind and Flood Hazards

Project Cost - The project cost should reflect all the work components associated with the proposed mitigation project. The cost should include pre-construction costs (e.g., design, permits, appraisal fees), construction costs (e.g., labor, materials, equipment rental, and other direct costs), application costs, project management costs, and other fees or costs associated with the project.

Building Replacement Value (BRV) - This factor applies to projects that protect buildings. The BRV is the cost to replace the building with a functionally equivalent building, based on the current cost of labor and materials. The BRV is not the same as the current market value of the building.

Contents Value - The contents value is the cost of the contents in the building. Contents do not include items that are permanent parts of the building, such as electrical and plumbing systems. Contents value should be based on building specific data, if available. Content value can also be estimated as 50-150% of the structure value, depending on occupancy class (see FEMA BCA Tool Version 4.5.5 software and reference guide [1], summarized below).

Building Construction Date (or Year) - This factor applies to projects that protect buildings. The building construction date or year indicates the time the building was constructed. Also indicate if there was major reconstruction and provide the year and nature of the reconstruction.

Building Area - This factor applies to projects that protect buildings. The total size of the building consists of the enclosed area within the building, including finished and unfinished basements, and the entire living space; however, it does not include porches, garages, or other outside areas. For projects that protect more than one building (e.g., drainage improvement and stormwater management projects), please provide the average BRV and building size and indicate the number of buildings that would be protected by the proposed project.

Project Screening Factors

This section of the tool is provides scores for each of the individual factors evaluated in the screening tool. In general, higher scores indicate increased mitigation effectiveness, benefits, or building vulnerability.

Mitigation Effectiveness Factors

Project Useful Life - The project useful life is the estimated amount of time that the mitigation action will be effective. FEMA has determined standard values and acceptable useful life limits for a variety of mitigation projects. Standard values for typical wind and flood mitigation projects are listed in the FEMA BCA Tool and are included below:

- Acquisition – 100 years
- Residential Building Elevation or Retrofit – 30 years (retrofit limit: 30-50 years)
- Non-Residential Building Elevation or Retrofit – 25 years (limit: 25-50 years)
- Public Building and Historic Building elevation or Retrofit – 50 years (limit: 50-100 years)
- Roof Diaphragm Retrofit – 30 years
- Hurricane Storm Shutters – 15 years (limit: 15-30 years)
- Pump stations, substations, wastewater systems (structures) – 50 years
- Culverts with end treatment – 30 years (limit: 25-50 years)
- Culverts without end treatment – 10 years (limit: 5-20 years)

User Guide for the Broward County Screening Tool
Wind and Flood Hazards

Project Type - The project type option selected should represent the proposed mitigation and reflect the project type description at the top of the tool. Note that "shutter" mitigation includes projects that strengthen building openings (e.g., windows, skylights, entry doors, garage doors).

Wind Hazard

Type of Construction - The type of construction refers to the primary building material of the structure (e.g., the structural elements that hold up the roof). See figures on the ***Worksheet Tab "Construction Type"*** for more information. Some wind mitigations projects are only allowed for certain construction types. For example, only shutter and acquisition mitigation project types are allowed for manufactured homes. The selection of the type of construction will limit options for project type, causing invalid project types to become gray and unable to be selected.

Project Effectiveness – Because of major changes in building codes and wind load specifications, project effectiveness for wind mitigation projects is scored separately for buildings that are constructed prior to September 1994 (the effective date for the 1994 South Florida Building Code), and for buildings constructed after September 1994.

Roof deck and covering - Either (1) Securing the roof deck and replacing the roof covering, installing and improving secondary underlayments, and improving roof coverings or (2) Securing roof deck attachment/providing secondary water barrier using foam adhesive.

- *For information on securing the Roof Deck – see FEMA P-499 [2] Technical Fact Sheet No. 7.1*
- *For information on replacing the Roof Covering – see FEMA P-499 [2] Technical Fact Sheets No. 5.2, 7.3, 7.4, and 7.6*
- *For information on installing Secondary Water Barriers – see FEMA P-499 [2] Technical Fact Sheet No. 7.2*
- *Additional information can be found in FEMA guidance manuals (listed below in the Additional Resources section).*

Soffit/vent - Strengthening vents and soffits (e.g., strengthening attic ventilation openings that are not capable of resisting failure from high-wind forces).

- *For information on strengthening Vents and Soffits – see FEMA P-499 [2] Technical Fact Sheet No. 7.5 and FEMA guidance manuals (listed below in the Additional Resources section).*

Roof overhangs - Strengthening overhangs by ensuring that there are adequate connections between end walls and roof framing.

- *For information on connections between end walls and roof framing – see FEMA P-499 [2] Technical Fact Sheet No. 4.3and FEMA guidance manuals (listed below in the Additional Resources section).*

Shutters or laminated glaze - Window and entry door protection from windborne debris, garage door protection from wind pressure, and garage door glazing protection from windborne debris (if located within the windborne debris region).

- *For information on Shutters and Glazing – see FEMA P-499 [2] Technical Fact Sheet No. 6.2 and FEMA guidance manuals (listed below in the Additional Resources section).*

Door replacement - Replacing entry doors, garage doors, or bay doors.

- *For information on Door replacements – see FEMA P-499 [2] Technical Fact Sheet No. 6.1*

Window assembly - Replacing of the window assembly.

- *For information on Window replacements – see FEMA P-499 [2] Technical Fact Sheet No. 6.1*

Gable end-wall strengthening - Bracing gable end walls over 4 feet tall.

- *For example, this may involve: (1) Strengthening vertical framing members of the gable end using retrofit studs, (2) Bracing the top and bottom of the gable end with horizontal braces to allow lateral loads to transfer to the roof and ceiling diaphragms, (3) Making connections between horizontal braces and retrofit studs using metal straps and fasteners, and (4) Connecting the bottom of the gable end to the wall below using metal bracket connectors.*

Component attachment - Strengthening connections of attached structures (e.g., exterior equipment, carports).

- *For information on attachment of decks and accessory structures – see FEMA P-499 [2] Technical Fact Sheet No. 8.2*
- *Additional information can be found in FEMA guidance manuals (listed below in the Additional Resources section).*

Continuous load path - Developing a continuous load path. An example of a continuous load path is provided on ***Figure 1 on Worksheet Tab "Figures"***.

- *For information on continuous load path – see FEMA P-499 [2] Technical Fact Sheets No. 4.1 and 4.3 and FEMA guidance manuals (listed below in the Additional Resources section).*

Other protection measures - This scoring factor allows for other protection measures, such as strengthening exterior wall coverings (e.g., vinyl siding, brick veneer, fiber-cement siding, and wood and hardboard siding) or protecting utilities.

- *For information on vinyl or wood siding and brick veneer – see FEMA P-499 [2] Technical Fact Sheets No. 5.3 and 5.4*
- *For information on protecting utilities – see FEMA P-499 [2] Technical Fact Sheet No. 8.3*
- *Additional information can be found in FEMA guidance manuals (listed below in the Additional Resources section).*

Flood Hazard

Flood Event that Caused Damage to Proposed Facility – This property is used to indicate the storm event that has frequently caused flooding at the proposed facility.

Damaging Flood Event after Post-Mitigation Protection – This property indicates the proposed level of protection for the facility (e.g., flood barrier height, elevated First Floor Elevation [FFE])

Cost Benefit Factors

BRV and Project Costs – Please see above for descriptions.

Contents Value – The value of the building contents is used to calculate this measure. Contents do not include items that are permanent parts of the building, such as electrical and plumbing systems. If contents value is unknown, standard values from Hazards U.S. Multi-Hazard (HAZUS) can be used (see FEMA BCA Tool and below).

- Residential - 50% BRV
- Commercial (e.g., retail, professional/technical business services, banks) – 100% BRV
- General government services – 100% BRV
- Heavy and light industrial – 150% BRV
- Hospitals , medical offices , or emergency response services – 150% BRV

User Guide for the Broward County Screening Tool
Wind and Flood Hazards

Note: Building content value based on building specific data may be higher than HAZUS estimates, particularly for hospitals, medical offices, and emergency response services.

Building Vulnerability Factors

The building vulnerability factors selected for the tool should represent the pre-mitigation properties for the proposed project. Before-mitigation properties consist of the existing building features and properties. After-mitigation properties are determined by the proposed mitigation project.

Building Type – The appropriate building type should be selected. Indicate if the proposed mitigation is for a residential, commercial, industrial, public service building, or historic building. Multiple building types may be selected for stormwater management/drainage projects.

Wind Hazard

Exposure - The two categories of exposure considered include Exposure Type B - Urban/Dense Suburban and Exposure Type C – Open. The exposure category is distinguished based on topography, vegetation, and constructed facilities within the vicinity of the specific project site. Typically, the most common exposure category that applies most of the time is Exposure Type B - Urban/Dense Suburban. Alternatively, Exposure Type C – Open includes areas with only scattered obstructions less than 30ft tall, flat open country, grasslands, hurricane prone shorelines, and areas adjacent to water surfaces in hurricane prone regions.

- *Exposure Type C should only be selected for projects located in areas along the shoreline, adjacent to water surfaces, in flat open country, grassland areas or areas that have only scattered obstructions less than 30 feet tall. Otherwise exposure Type B should be selected.*

Roof Shape - This property indicates the shape of the roof. A Gable Roof is a ridged roof that slopes up from only two sides of a building. A Hip Roof is a roof that slopes up from all four sides of a building.

Roof Cover Type - This property identifies the type of roof covering. The roof cover is the external water shedding material on the roof, not the structural components of the roof decking.

Roof Cover Quality - This property refers to the quality of the roof cover.

Roof Deck Age - This property indicates the age of the roof deck (not roof cover). The roof deck is the structural substrate of the roof.

Roof Deck Attachment Nail Size and Spacing – This property refers to the spacing of the nails that support the roof decking for wood-frame roofs.

Metal Roof Deck Attachment - This property refers to the quality of the roof deck attachment for metal roofs. A "standard" metal roof deck attachment generally consists of an arc spot weld connection or screws that are most often #12 or ¼ inch diameter when fastening the roof deck to structural members. A "superior" metal roof deck attachment has increased fastener schedules to handle higher design pressures.

Secondary Water Resistance Barrier - This property identifies whether there is a secondary water resistance barrier that would prevent water penetration through the roof decking after the loss of the roof covering.

Roof-Wall Connection - This property indicates if the structural system of a building can transfer loads from the roof to the foundation. For example, a strap would provide positive connection from the roof framing to the walls and from the wall framing to the foundation system. A toenail system would also provide a roof-wall connection, but a toenail connection is less secure than a strap.

Masonry Reinforcing (Masonry Walls) – This property applies to masonry buildings only and indicates if the structure has reinforced masonry walls.

User Guide for the Broward County Screening Tool
Wind and Flood Hazards

Tie Downs (Manufactured Homes) – This property is for manufactured homes only and refers to straps utilized to secure manufactured homes to anchors during high winds.

Shutters - This property indicates if a structure has reinforced openings prior to mitigation.

Window Area - This property refers to the amount of openings in the structure. Openings in the wall and roof include windows, doors, sliding glass doors, skylights, and garage or bay doors.

Type of Wind Debris - This property indicates the typical characteristics associated with debris in the area surrounding the structure (e.g., residential versus residential/commercial mix).

Flood Hazard

First Floor Elevation (FFE), Flood Level Equivalent - The FFE is the elevation of the top of the lowest finished floor of the structure. It is the bottom of the lowest horizontal structural member in V Zones.

Number of Prior Damaging Events - This factor indicates the number of documented events that have caused damages.

Properties in 100-yr Floodway – This scoring factor indicates the number of buildings in the FEMA-designated floodway, as shown on the Flood Insurance Rate Map (FIRM) for the community[3]. Higher scores are possible for projects that protect more than one building.

Properties in "Coastal" Zone V and A – This scoring factor indicates the number of buildings shown on the FIRM to be in Coastal Zone V (the 1% annual chance floodplain in an area subject to the additional hazards posed by wave heights greater than 3 feet) and "Coastal" Zone A (the 1% annual chance floodplain in a coastal area where waves are less than 3 feet in height). Examples of Zone V and Coastal Zone A are provided on ***Figures 2 through 4 on Worksheet Tab "Figures"***.

Properties with 3 or more damage events - This scoring factor indicates the number of buildings with multiple damage events. Higher scores are possible for projects that protect more than one building.

Additional Benefits

Although these types of benefits could apply to several project types, these benefits are typically associated stormwater management type projects.

Physical Damages Avoided

Number of Buildings – This property indicates the number of buildings that would avoid physical damage due to the proposed mitigation. Higher scores are possible for projects that protect more than one building.

Non-Building Infrastructure – This property indicates the level of physical damages that would be avoided to infrastructure. This accounts for physical damages other than building/contents (e.g., physical damage to roads, water supply, sewers, electrical grids, telecommunications lines). Loss of services is described below.

Loss of Services Avoided

Number of Public Services – This property indicates the number of public services where loss of services would be avoided because of the proposed mitigation.

Roads Impacted – This property indicates the severity of road/traffic impacts that would be avoided by the proposed mitigation. The approximate amount of time that a road or bridge would be closed and traffic would be detoured should be estimated based on historical road closures.

User Guide for the Broward County Screening Tool
Wind and Flood Hazards

Utilities Impacted - This property indicates the severity of utility impacts that would be avoided by the proposed mitigation. Utility services are electricity, natural gas, potable water, or wastewater. Utility service interruptions should be estimated based on historical events.

Critical Services – This property indicates if the building protected is an emergency medical service facility, hospital with surgery or emergency services, police station, or fire station.

Environmental Benefits and Emergency Response Cost Avoided

Environmental and Cultural Benefits – This property indicates the level of indirect environmental or cultural benefits from the mitigation project (e.g., an acquisition project that provides connection to a greenway, protection of a registered historic building).

Indirect Protection of Nearby Hazardous Material Sites with... - This property indicates if there are indirect benefits associated with protection of nearby hazardous material sites.

Emergency Response Costs – This property indicates the severity of the emergency response costs that would be avoided by the mitigation project. These costs include labor, equipment, and materials to perform emergency work (e.g., sandbagging before the event, costs to evacuate residents, costs to close roads, costs to provide a temporary by-pass service).

Interpretation of Results

After the scoring factors in the screening tool are selected, a cumulative score will be calculated at the bottom of the wind or flood worksheet. Comments can be included in the box next to the score. This score represents the overall cost effectiveness rating of the proposed project. For example, a score of less than 40 indicates that it is unlikely that the project is cost effective as currently proposed and that the project that would likely have a benefit-cost ratio (BCR) less than 1.0. A project with a score between 40 and 50 may benefit from slight modifications, such as increasing the project effectiveness. Projects with scores greater than 50 are likely to be cost effective and have a BCR greater than 1.0.

Projects that have a high likelihood of being cost effective should proceed to evaluating project-specific information using the FEMA BCA Tool. Projects that are unlikely to be cost effective should consider changes, such as improvements to mitigation effectiveness. For example, shutter mitigation for buildings with a weak roof may not be as effective as combining shutter and roof improvements.

Notes:

[1] FEMA BCA Tool Version 4.5.5 software and reference guide can be downloaded from the FEMA website at http://www.fema.gov/library/viewRecord.do?id=4830

[2] FEMA P-499 Technical Fact Sheets can be downloaded at http://www.fema.gov/library/viewRecord.do?id=2138

[3] Flood Insurance Rate Maps are published by FEMA to support the National Flood Insurance Program. The maps show Special Flood Hazard Areas, which are those areas subject to inundation during a flood that has a 1-percent chance of being equaled or exceeded in a given year (also referred to as the base flood or 100-year flood).

User Guide for the Broward County Screening Tool
Wind and Flood Hazards

Additional Resources

FEMA Technical Fact Sheets

FEMA P-499. Home Builder's Guide to Coastal Construction. Technical Fact Sheet Series. December 2010.
http://www.fema.gov/library/viewRecord.do?id=2138

General
- Fact Sheet No. 1.2, Summary of Coastal Construction Requirements and Recommendations
- Fact Sheet No. 1.3, Using a Digital Flood Insurance Rate Map (DFIRM)
- Fact Sheet No. 1.4, Lowest Floor Elevation
- Fact Sheet No. 1.5, V-Zone Design and Construction Certification

Foundations
- Fact Sheet No. 3.1, Foundations in Coastal Areas
- Fact Sheet No. 3.5, Foundation Walls

Load Paths
- Fact Sheet No. 4.1, Load Paths
- Fact Sheet No. 4.2, Masonry Details
- Fact Sheet No. 4.3, Use of Connectors and Brackets

Wall Systems
- Fact Sheet No. 5.2, Roof-to-Wall and Deck-to-Wall Flashing
- Fact Sheet No. 5.3, Siding Installation in High-Wind Regions
- Fact Sheet No. 5.4, Attachment of Brick Veneer In High-Wind Regions

Openings
- Fact Sheet No. 6.1, Window and Door Installation
- Fact Sheet No. 6.2, Protection of Openings – Shutters and Glazing

Roofing
- Fact Sheet No. 7.1, Roof Sheathing
- Fact Sheet No. 7.2, Roof Underlayment for Asphalt Shingle Roofs
- Fact Sheet No. 7.3, Asphalt Shingle Roofing for High-Wind Regions
- Fact Sheet No. 7.4, Tile Roofing for High-Wind Areas
- Fact Sheet No. 7.5, Minimizing Water Intrusion through Roof Vents in High-Wind Regions
- Fact Sheet No. 7.6, Metal Roof Systems in High-Wind Regions

Attachments
- Fact Sheet No. 8.2, Decks, Pools, and Accessory Structures

FEMA Guidance Manuals

FEMA P-762. Local Officials Guide for Coastal Construction. Design Considerations, Regulatory Guidance, and Best Practices for Coastal Communities. February 2009.
http://www.fema.gov/library/viewRecord.do?id=3647

- *Includes information on load path, foundations, building framing systems, roof coverings, exterior wall coverings, and window and door protections.*

FEMA 348. Protecting Building Utilities from Flood Damage. November 1999.
http://www.fema.gov/library/viewRecord.do?id=1750

FEMA 543. Design Guide for Improving Critical Facility Safety from Flooding and High Winds. January 2007.
http://www.fema.gov/library/viewRecord.do?id=2441

FEMA 577. Design Guide for Improving Hospital Safety in Earthquakes, Floods, and High Winds. June 2007.
http://www.fema.gov/library/viewRecord.do?id=2739

FEMA 361. Design and Construction Guidance for Community Safe Rooms. August 2008.
http://www.fema.gov/library/viewRecord.do?id=1657

FEMA P-424. Design Guide for Improving School Safety in Earthquakes, Floods, and High Winds. December 2010.
http://www.fema.gov/library/viewRecord.do?id=1986

FEMA 582 - Design Guide for Improving Commercial Buildings Safety in Earthquakes, Floods, and High Winds (future publication)

Note: Although the following publications focus on retrofit/construction of residential structures, most of the construction principles also apply to non-residential structures.

FEMA P-55. Coastal Construction Manual. Principles and Practices of Planning, Siting, Designing, Constructing, and Maintaining Residential Buildings in Coastal Areas. August 2011.
http://www.fema.gov/library/viewRecord.do?id=1671

- Help identify and evaluate practices that will improve the quality of construction in coastal areas and reduce the economic losses associated with coastal disasters.

FEMA P-259. Engineering Principles and Practices for Retrofitting Flood-Prone Residential Structures. January 2012.
http://www.fema.gov/library/viewRecord.do?id=1645

- Engineering design and economic guidance on what constitutes feasible and cost-effective retrofitting measures for flood-prone residential and non-residential structures are presented.
- Elevation, relocation, dry floodproofing, wet floodproofing, and the use of levees and floodwalls to mitigate flood hazards are discussed.

FEMA P-804. Wind Retrofit Guide for Residential Buildings. December 2010.

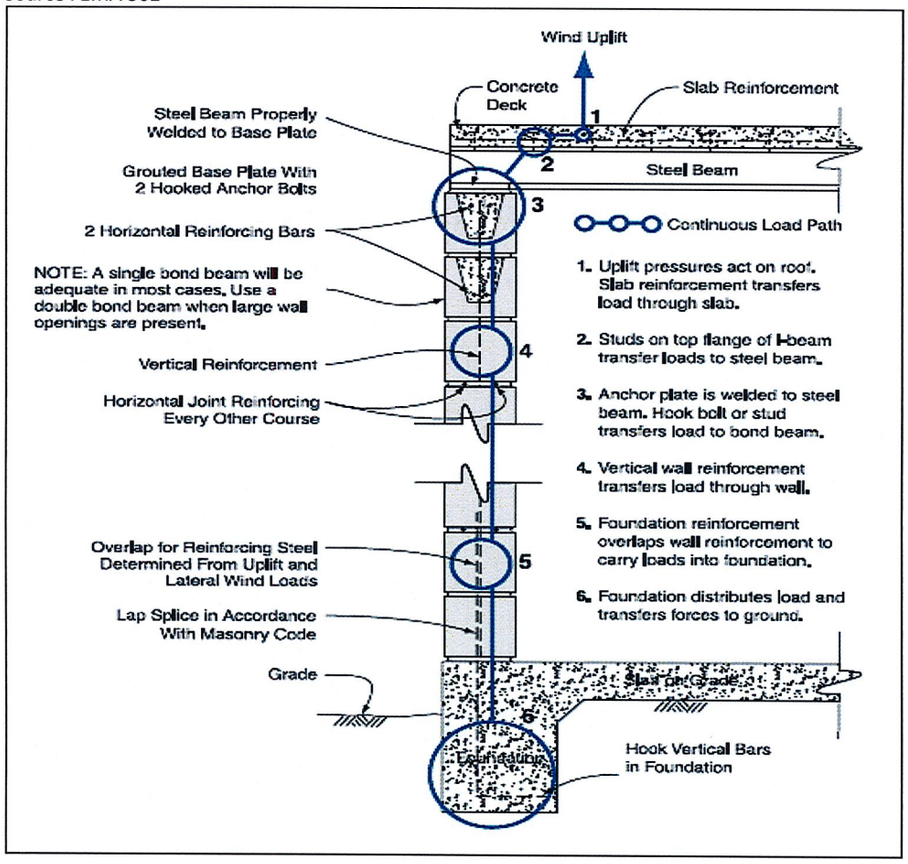
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=4569

- Guidance on how to improve the wind resistance of existing buildings.

Example of a Continuous Load Path

Figure 1. Continuous Load Path in a reinforced masonry building with a concrete roof deck

Source FEMA 361



Example of Coastal V and A Zone

Figure 2. Coastal Flood Hazard Zones as seen in older paper FIRMs

Source: FEMA P-424

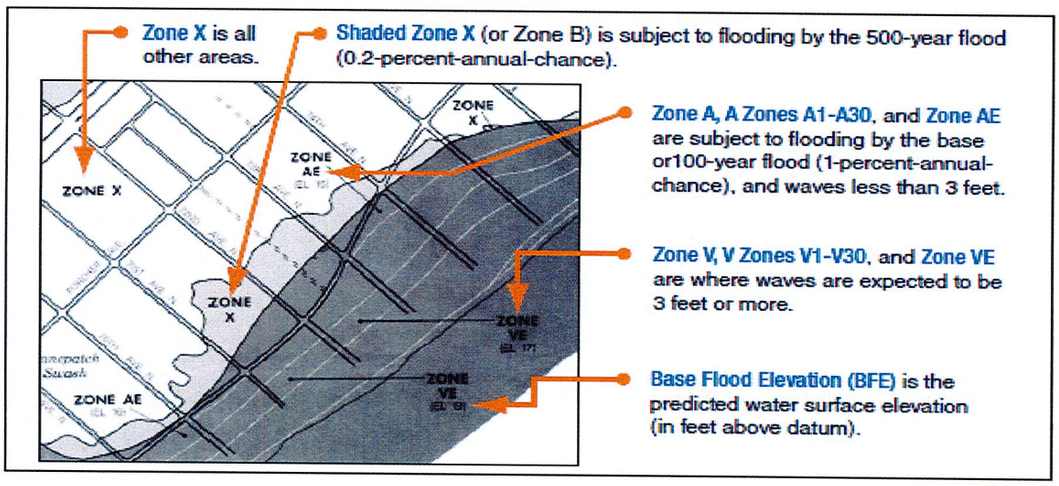
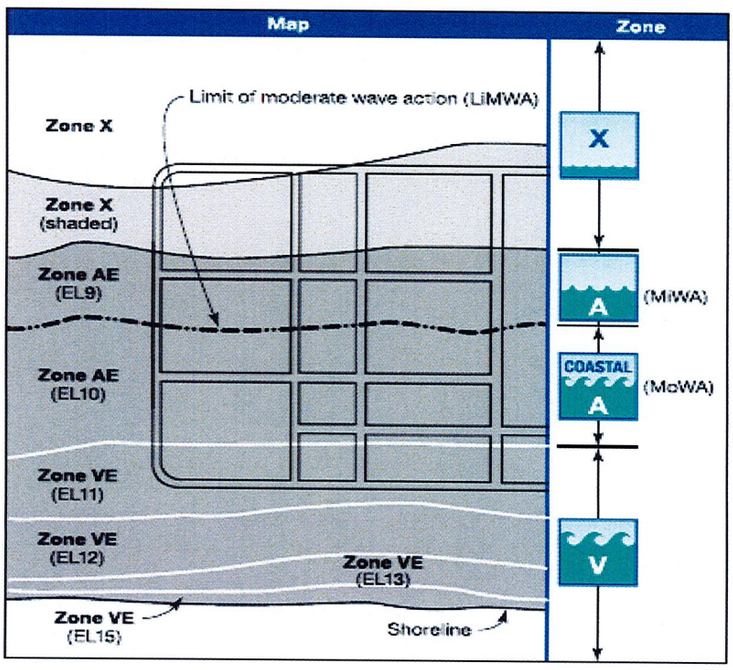


Figure 3. Coastal Flood Hazard Zones as seen on newer FIRMS and DFIRMS

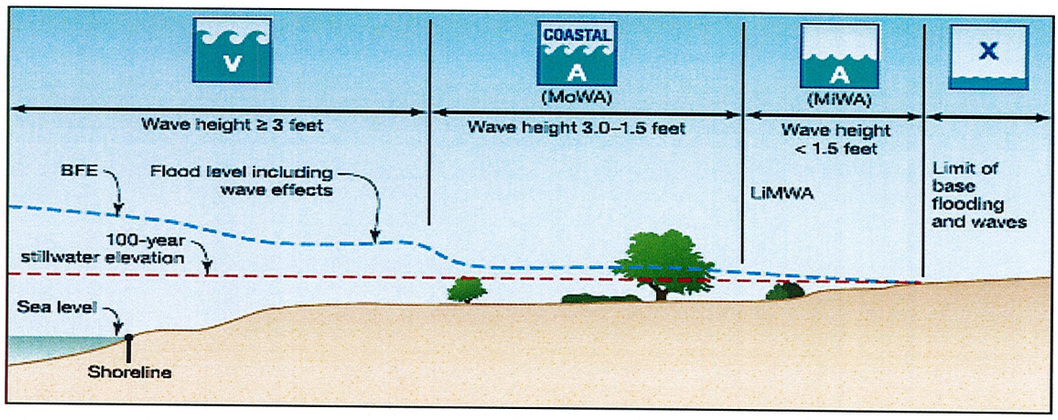
Source: FEMA P-55



Key:
MiWA - Minimal Wave Action
LiMWA - Limit of Moderate Wave Action
MoWA - Moderate Wave Action

Figure 4. Diagram of Zone V and Coastal Zone A

Source: FEMA P-55

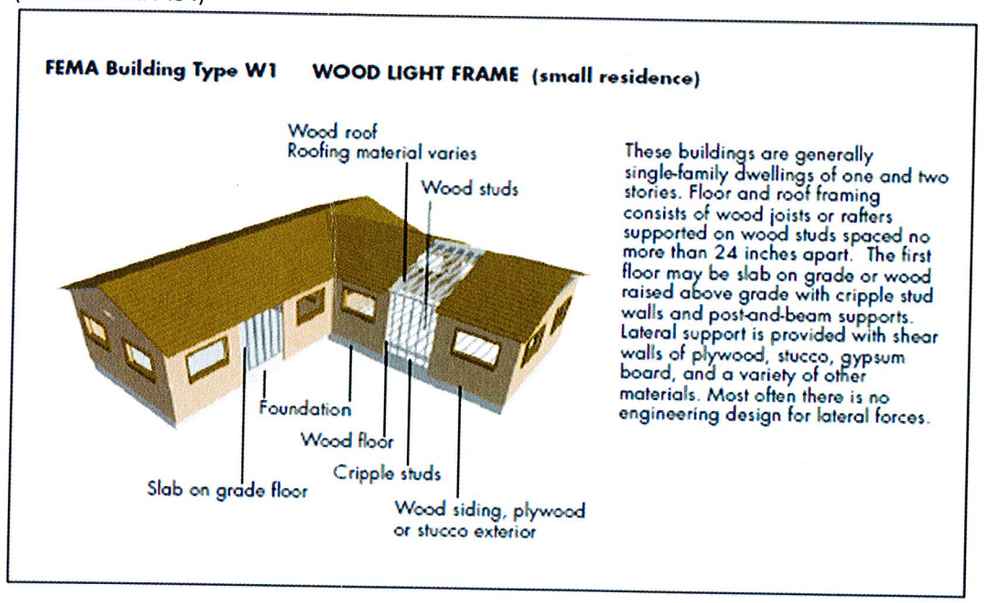


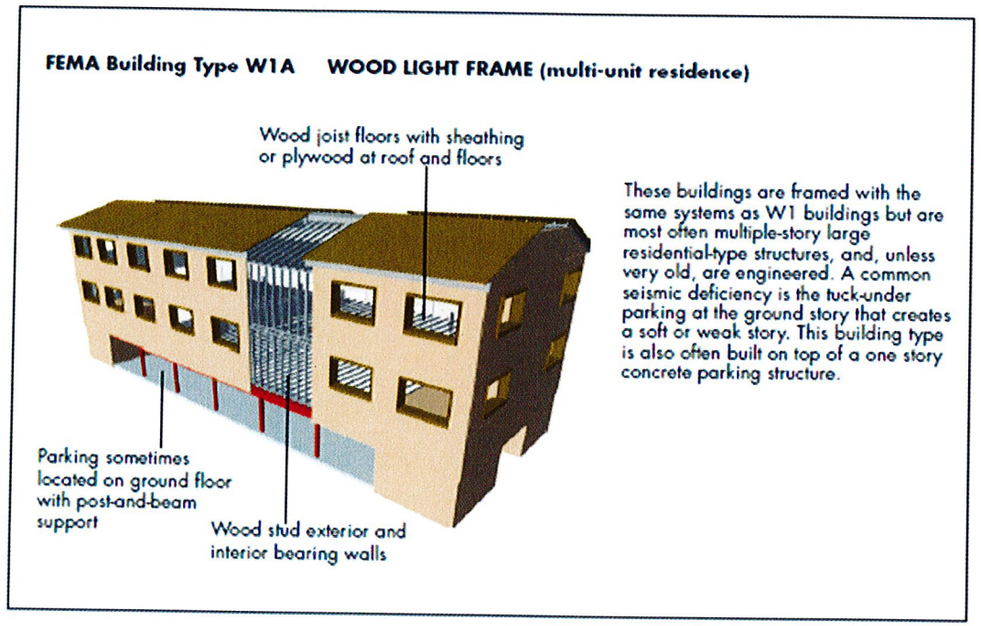
Type of Construction

Note: Although FEMA 454 is a manual for seismic design, the section on building types is also applicable to areas with low seismic hazard.

Examples of Wood Frame Construction

(Source: FEMA 454)

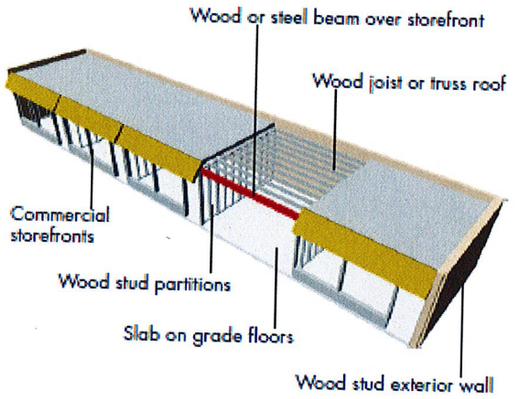




Examples of Masonry Construction

(Source: FEMA 454)

FEMA Building Type W2 WOOD FRAME (commercial and industrial)

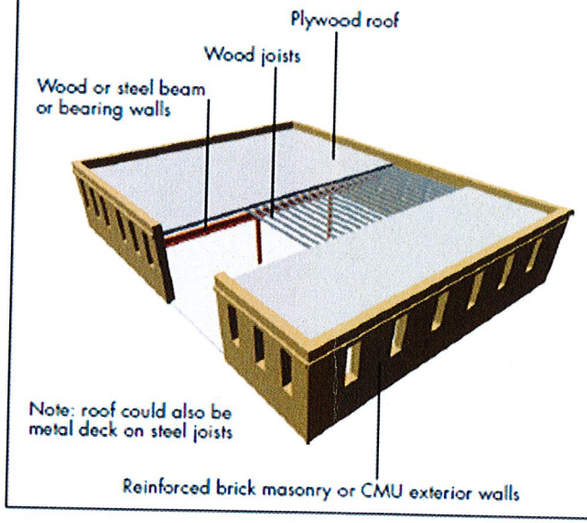


These buildings are commonly commercial or smaller industrial buildings and are constructed primarily of wood framing. The floor and roof framing consists of wood joists and wood or steel trusses, glulam or steel beams, and wood posts or steel columns. Lateral forces are resisted by wood diaphragms and exterior stud walls sheathed with plywood, stucco, or wood sheathing, or sometimes rod bracing or a spot steel-braced frame. Large wall openings are common for storefronts or garage openings. This building type is also often used for schools, churchs and clubhouses.

Examples of Masonry Construction

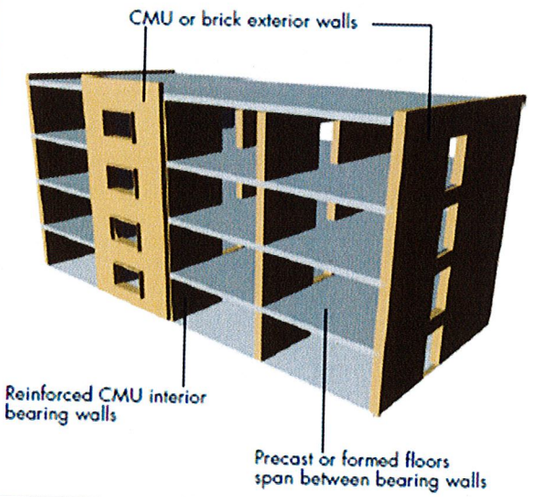
(Source: FEMA 454)

FEMA Building Type RM1 REINFORCED MASONRY WALLS with flexible diaphrams



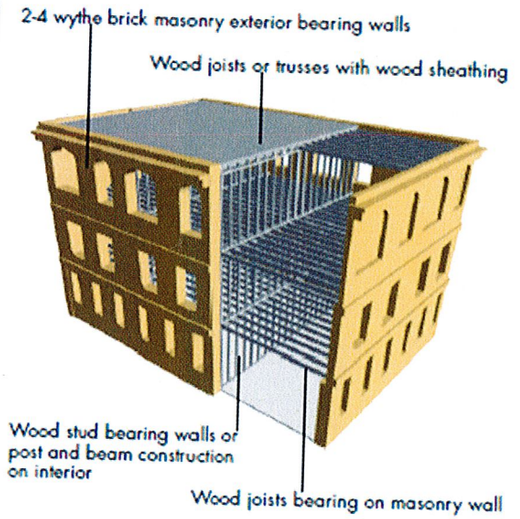
These buildings take a variety of configurations, but they are characterized by reinforced masonry walls (brick cavity wall or CMU) with flexible diaphragms, such as wood or metal deck. The walls are commonly bearing, but the gravity system often also contains post-and-beam construction of wood or steel. Older buildings of this type are generally small and were used for a wide variety of occupancies and are configured to suit. Recently, the building type is commonly used for one-story warehouse-type occupancies similar to tilt-up buildings.

FEMA Building Type RM2 REINFORCED MASONRY WALLS with stiff diaphrams



This building consists of reinforced masonry walls and concrete slab floors that may be either cast-in-place or precast. This building type is often used for hotel and motels and is similar to the concrete bearing-wall type C2.

FEMA Building Type URM UNREINFORCED MASONRY BEARING WALLS



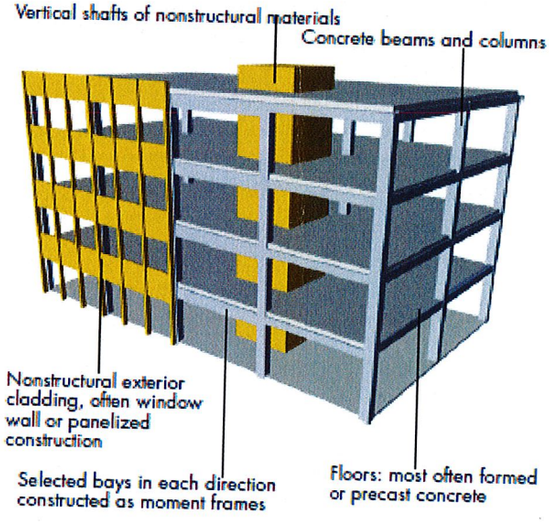
This building consists of unreinforced masonry bearing walls, usually at the perimeter and usually brick masonry. The floors are wood joists and wood sheathing supported on the walls and on interior post-and-beam construction or wood-stud bearing walls. This building type is ubiquitous in the U.S. and was built for a wide variety of uses, from one-story commercial or industrial occupancies, to multistory warehouses, to mid-rise hotels. Unfortunately, it has consistently performed poorly in earthquakes. The most common failure is an outward collapse of the exterior walls, caused by loss of lateral support due to separation of the walls from the floor/roof diaphragm.

The URMA building is similar, but features all floors and/or roof constructed of materials that form a rigid diaphragm, usually concrete slabs or steel joists with flat-arched unreinforced masonry.

Examples of Concrete Construction

(Source: FEMA 454)

FEMA Building Type C1 CONCRETE MOMENT FRAMES

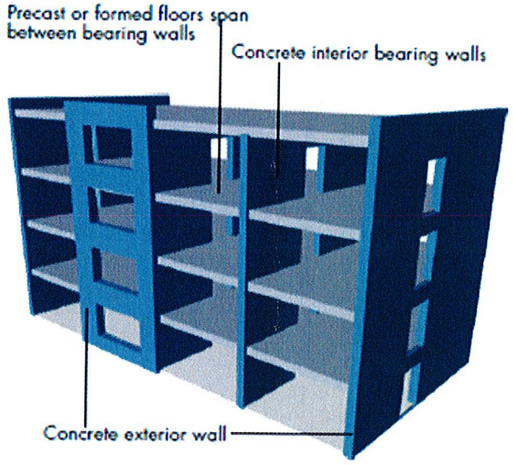


These buildings consist of concrete framing, either a complete system of beams and columns or columns supporting slabs without gravity beams. Lateral forces are resisted by moment frames that develop stiffness through rigid connections of the column and beams placed in a given bay. Moment frames may be developed on all framing lines or only in selected bays. It is significant that no structural walls are required. Floors are cast-in-place or precast concrete. Buildings with concrete moment frames could be used for most occupancies listed for steel moment frames, but are also used for multistory residential buildings.

The C1A building type is similar but has floors and roof that act as flexible diaphragms, such as wood or uptopped metal deck. This is a relatively unusual building type, but might be found as older warehouse-type buildings or small office occupancies.

FEMA Building Type C2 CONCRETE SHEAR WALLS

with bearing walls

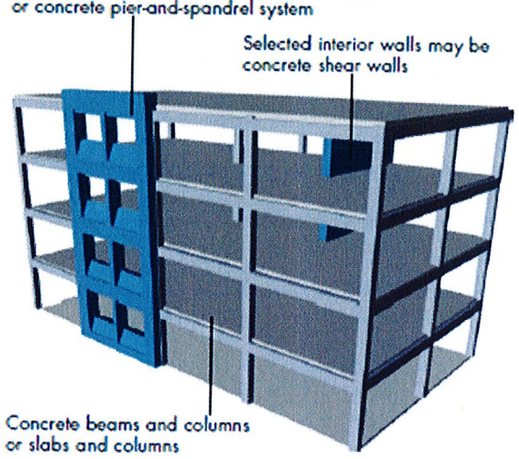


Concrete shear walls are concrete walls in a building design to provide lateral stiffness and strength for lateral loads. There are two main types of shear-wall buildings, those in which the shear walls also carry the gravity loads (with bearing walls), and those in which a column-supported framing system carries the gravity loads (with gravity frame).

In the **bearing wall** type, all walls usually act as both bearing and shear walls. The building type is similar and often used in the same occupancies as type RM2, namely in mid- and low-rise hotels and motels. This building type is also used in residential apartment/ condo-type buildings.

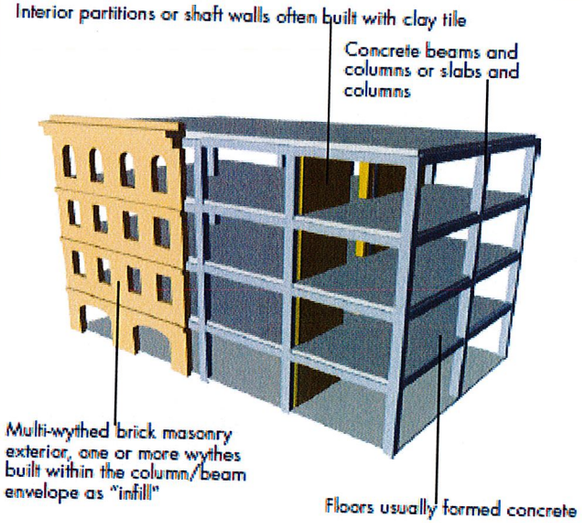
In **gravity frame** buildings, shear walls are either strategically placed around the plan, or at the perimeter. Shear-wall systems placed around the entire perimeter must contain the windows, and other perimeter openings are called punched shear walls. These buildings were commonly built in the 1950s and 1960s for a wide variety of most institutional occupancy types.

with gravity frames



The C2A building type is similar, but has floors and roof that act as flexible diaphragms such as wood, or uptopped metal deck. C2A buildings are normally bearing-wall buildings. These buildings are similar to building-type RM1 and are used for similar occupancies- such as small office or commercial and sometimes residential.

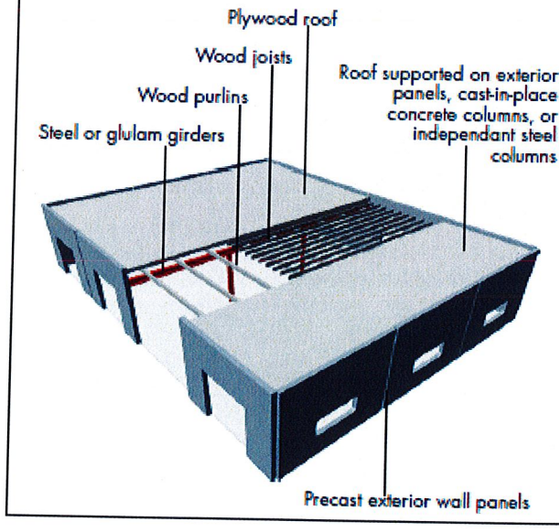
FEMA Building Type C3 CONCRETE FRAMES with infill masonry shear walls



These buildings consist of concrete framing, either a complete system of beams and columns or columns supporting slabs without gravity beams. Exterior walls and possibly some interior walls are constructed of unreinforced solid clay brick, concrete block, or hollow clay tile masonry infilling the space between columns and beams. Windows and doors may be present in the infill walls, but to act effectively as shear-resisting elements, the infill masonry must be constructed tightly against the columns and beams. The building type is similar to S5, but is more often used for industrial and warehouse occupancies.

The C3A building type is similar but has floors and roof that act as flexible diaphragms, such as wood, or uptopped metal deck. Thisbuilding type not often found except as one-story industrial buildings.

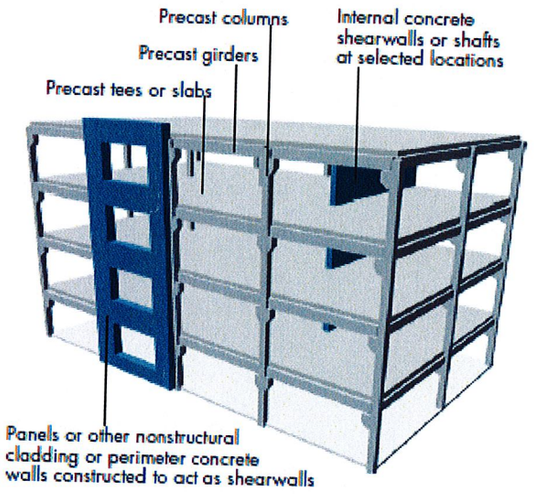
FEMA Building Type PC1 TILT-UP CONCRETE shear walls



These buildings are constructed with perimeter concrete walls precast on the site and tilted up to form the exterior of the buildings, to support all or a portion of the perimeter roof load, and to provide seismic shear resistance. These buildings are commonly one-story with a wood joist and plywood roof or sometimes with a roof of steel joists and metal deck. Two-story tilt-ups usually have a steel-framed second floor with metal deck and concrete and a wood roof. Tilt-up walls that support roof load are very common on the West Coast; due to economical construction cost, they are used for many occupancies, including warehouses, retail stores, and offices. In other parts of the country, these buildings more often have an independent load-carrying system on the inside face of the walls.

The PC1A building is similar but features all floors and/or roof constructed of materials that form a rigid diaphragm, normally concrete. This building type is similar to PC2.

FEMA Building Type PC2 **PRECAST CONCRETE FRAMES with shear walls**



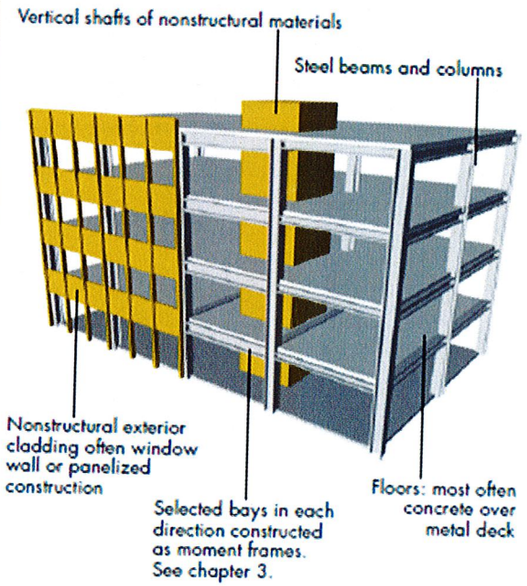
These buildings consist of concrete columns, girders, beams and/or slabs that are precast off the site and erected to form a complete gravity-load system. Type PC2 has a lateral force-resisting system of concrete shear walls, usually cast-in-place. Many garages have been built with this system The building type is most common in moderate and low seismic zones and could be used for many different occupancies in those areas.

The PC2A building is similar but obtains lateral support from specially connected precast girders and columns that form moment frames. Until recently, precast moment frames have not been allowed in regions of high seismicity, and these buildings will essentially only be found in moderate or low seismic zones.

Examples of Steel Construction

(Source: FEMA 454)

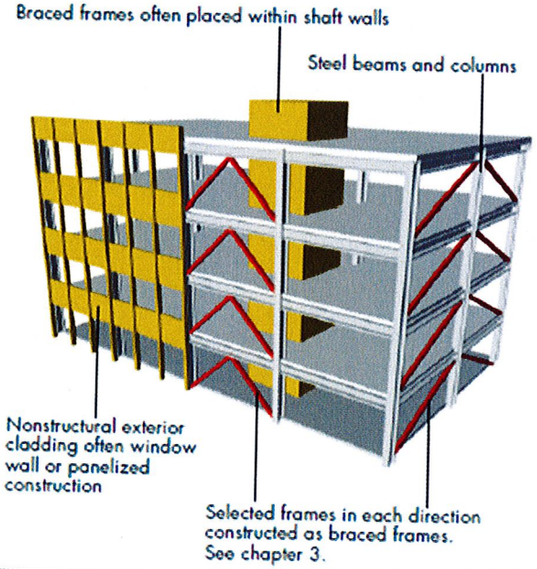
FEMA Building Type S1 STEEL MOMENT FRAMES



These buildings consist of an essentially complete frame assembly of steel beams and columns. Lateral forces are resisted by moment frames that develop stiffness through rigid connections of the beam and column created by angles, plates and bolts, or by welding. Moment frames may be developed on all framing lines or only in selected bays. It is significant that no structural walls are required. Floors are cast-in-place concrete slabs or metal deck and concrete. This building is used for a wide variety of occupancies such as offices, hospitals, laboratories, and academic and government buildings.

The S1A building type is similar but has floors and roof that act as flexible diaphragms, such as wood or uptopped metal deck. One family of these buildings are older warehouse or industrial buildings, while another more recent use is for small office or commercial buildings in which the fire rating of concrete floors is not needed.

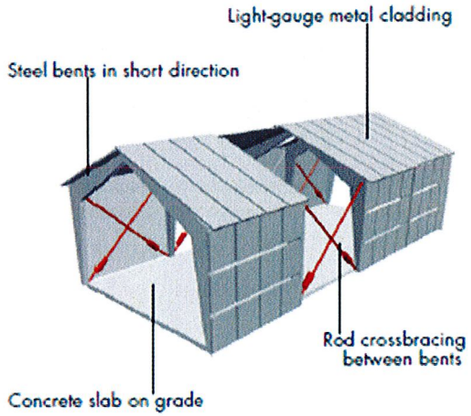
FEMA Building Type S2 STEEL-BRACED FRAMES



These buildings consist of a frame assembly of steel columns and beams. Lateral forces are resisted by diagonal steel members placed in selected bays. Floors are cast-in-place concrete slabs or metal deck and concrete. These buildings are typically used for buildings similar tos teelmoment frames, although are more often low rise.

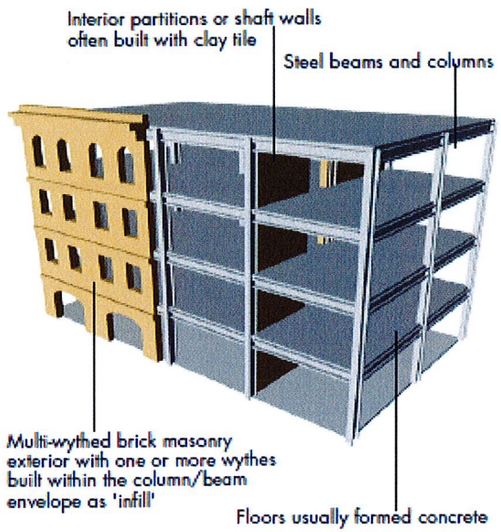
The S2A building type is similar but has floors and roof that act as flexible diaphragms such as wood, or uptopped metal deck. This is a relatively uncommon building type and is used mostly for smaller office or commercial buildings in which the fire rating of concrete floor is not needed.

FEMA Building Type S3 STEEL LIGHT FRAMES



These buildings are one story, pre-engineered and partially prefabricated, and normally consist of transverse steel bents and light purlins. The roof and walls consist of lightweight metal, fiberglass, or cementitious panels. Lateral forces are resisted by the transverse steel bents acting as moment frames, and light rod diagonal bracing in the longitudinal direction. The roof diaphragm is either metal deck or diagonal rod bracing. These buildings are mostly used for industrial or agricultural occupancies.

FEMA Building Type S5 STEEL FRAMES with infill masonry walls

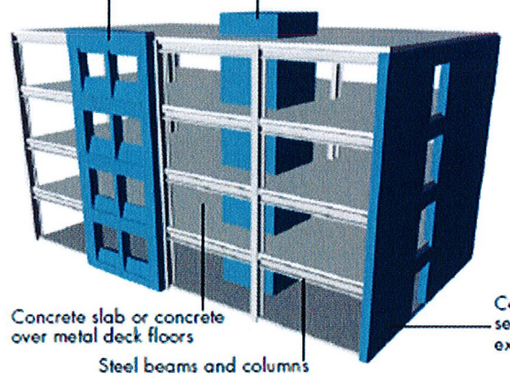


This is normally an older building that consists of an essentially complete frame assembly of steel floor beams or trusses and steel columns. The floor consists of masonry flat arches, concrete slabs or metal deck, and concrete fill. Exterior walls and possibly some interior walls, are constructed of unreinforced solid clay brick, concrete block, or hollow-clay tile masonry infilling the space between columns and beams. Windows and doors may be present in the infill walls, but to act effectively as shear-resisting elements, the infill masonry must be constructed tightly against the columns and beams. Although relatively modern buildings in moderate or low seismic regions are built with unreinforced masonry exterior infill walls, the walls are generally not built tight against the beams and columns and therefore do not provide shear resistance. The buildings intended to fall into this category feature exposed clay brick masonry on the exterior and are common in commercial areas of cities with occupancies of retail stores, small offices, and hotels.

The S5A building type is similar but has floors and roof that act as flexible diaphragms, such as wood or uptopped metal deck. These buildings will almost all date to the 1930s and earlier, and were originally warehouses or industrial buildings.

FEMA Building Type S4 STEEL FRAMES with concrete shearwalls

"Punched" concrete exterior walls are an alternate shear-wall configuration



These buildings consist of an essentially complete frame assembly of steel beams and steel columns. The floors are concrete slabs or concrete fill over metal deck. The buildings feature a significant number of concrete walls effectively acting as shear walls, either as vertical transportation cores, isolated in selected bays, or as a perimeter wall system. The steel column-and-beam system may act only to carry gravity loads or may have rigid connections to act as a moment frame. This building type is generally used as an alternate for steel moment or braced frames in similar circumstances. These buildings will usually be mid- or low-rise.

DEFINITIONS

BFE – Base Flood Elevation. The base flood is the flood with a one percent chance of being equaled or exceeded in any given year. This is the regulatory standard also referred to as the "100-year flood." The base flood is the national standard used by the NFIP and all Federal agencies for the purposes of requiring the purchase of flood insurance and regulating new development. Base Flood Elevations (BFEs) are typically shown on Flood Insurance Rate Maps (FIRMs).

Building Type – Building types considered when evaluating the cost effectiveness of a mitigation project include residential and non-residential building types. Typically, mitigation projects implemented for non-residential buildings will yield more benefits when compared to a mitigation project for residential buildings.

Building Properties – The specific building properties that affect the cost effectiveness of an potential mitigation project are determined by the individual building type and mitigation activities.

Building Replacement Value – The building replacement value (BRV) is the cost or cost per square foot to completely replace the existing building with a functionally equivalent building. This is based on the current cost of labor and materials and not on the current market value of the building. The BRV can be obtained from a local building inspector, a construction contracting firm, or a standard cost reference manual. Higher BRV's typically correspond with higher benefits. Therefore, the loss estimation tool identifies/defines a number of BRV ranges (i.e. $50-$75 per square foot, $76-$125 per square foot, etc.) and reflects a higher score for higher BRVs.

Construction Type – The types of construction considered when evaluating potential mitigation projects for cost effectiveness include wood, masonry, steel, concrete and manufactured housing. The building type is based on the use, style, and structural components of the building. Typically, mitigation efforts designed to improve/strengthen the building characteristics of more vulnerable types of construction (i.e., Manufactured Home) yield more benefits than similar efforts involving the more durable types of construction (i.e., Steel). Therefore, the loss estimation tool will associate the least durable types of construction with a higher score.

Contents Value – The value of the building's contents can significantly affect the potential cost effectiveness of a proposed mitigation project. As such, the loss estimation tool identifies/defines a number of contents' value ranges in relation to the BRV (i.e. $50% BRV, 100% BRV, etc.) and reflects a higher score for higher values of contents.

Exposure – When evaluating potential mitigation projects for cost effectiveness, only two categories of exposure are considered. These categories include Exposure Type B - *Urban/Dense Suburban* and Exposure Type C – *Open*. The exposure category is based on the topography, vegetation, and constructed facilities encompassing the vicinity of the specific project site. Typically, the most common exposure category that applies most of the time is Exposure Type B - *Urban/Dense Suburban*. Alternatively, Exposure Type C – *Open* includes areas with only scattered obstructions less than 30ft tall, flat open country, grasslands, hurricane prone shorelines, and areas adjacent to water surfaces in hurricane prone regions. Buildings in Exposure Type B - *Urban/Dense Suburban* often yield marginally less benefits when compared to Exposure Type C – *Open*. As such, the loss estimation tool reflects a higher value for projects that are in areas meet the definition of Exposure Type C – *Open*.

FFE -- First Floor Elevation. This is the elevation of the top of the lowest finished floor in a building. It is the bottom of the lowest horizontal structural member in V Zones and Coastal A Zones.

Flood Insurance Rate Map -- The official map of a community on which FEMA has delineated both the special hazard areas and the risk premium zones applicable to the community. The FIRM is the most common map and most communities have this type of map. At a minimum, flood maps show flood risk zones and their boundaries, and may also show floodways and Base Flood Elevations (BFEs).

Project Useful Life – The user will need to determine the estimated amount of time that the proposed mitigation action will be effective. Mitigation projects that have a low project useful life (5-10 years) will often yield significantly less benefits when compared to a mitigation project that has a high (30-50 years) useful life. This component of the scoring system in the loss estimation tool will reflect a higher value for projects that have a high project useful life.

NFIP -- National Flood Insurance Program. A voluntary program created by Congress in 1968 and administered by FEMA to reduce the loss of life, property damage, and rising disaster relief costs due to flooding.

LOSS ESTIMATION TOOL - COST EFFECTIVENESS ANALYSIS
FLOOD HAZARD

Project Name:	Project Number:	
Organization Name/Dept./Division:		
Project Rep:	Email:	Phone No.:
Brief Description of Proposed Project:		

DEFINITION OF PROJECT TYPE ALTERNATIVES

Acquisition	The voluntary acquisition of an existing at-risk structure and, typically, the underlying land, and conversion of the land to open space through the demolition of the structure. The voluntary physical relocation of an existing structure to an area outside of a hazard-prone area, such as the Special Flood Hazard Area (SFHA) or a regulatory erosion zone and, typically, the acquisition of the underlying land.
Elevation	Physically raising an existing structure to the Base Flood Elevation (BFE) or higher if required by FEMA or local ordinance. Structure elevation may be achieved through a variety of methods, including elevating on continuous foundation walls; elevating on open foundations, such as piles, piers, posts, or columns; and elevating on fill.
Dry Floodproofing, Flood Barrier	Dry floodproofing techniques are applied to keep structures dry by sealing the structure to keep floodwaters out. Dry floodproofing is typically used in areas subject to short-duration, low-level flooding. A flood barrier is a man-made barrier between an asset and the flooding source that blocks floodwaters from coming into contact with the asset. Examples include earthen levees and concrete or masonry floodwalls.
Drainage Improvement, Stormwater Management	Projects to lessen the frequency or severity of flooding and decrease predicted flood damages, such as the installation or modification of culverts and stormwater management activities such as creating retention and detention basins. These projects must not duplicate the flood prevention activities of other Federal agencies and may not constitute a section of a larger flood control system.
Mitigation Reconstruction	The construction of an improved, elevated building on the same site where an existing building and/or foundation has been partially or completely demolished or destroyed. Mitigation reconstruction is only permitted for structures outside of the regulatory floodway or coastal high hazard area (Zone V). Activities that result in the construction of new living space at or above the BFE will only be considered when consistent with the Mitigation Reconstruction requirements.

PROJECT AND BUILDING INFORMATION

Total Project Cost[1] ($)	$ -	Note: -
Building Replacement Value (BRV)[2] ($)	$ -	Note: -

Contents Value ($)	$ -	Note: -
Building Construction Date (or Year)		
Building Area (Gross SF)	0 SF	

[1] The project cost should reflect all the work components associated with the proposed mitigation project. (See user guide for more information.)
[2] Building Replacement Value is the cost to replace the building with a functionally equivalent building, based on the current cost of labor and materials. This factor only applies to projects that protect buildings.

MITIGATION EFFECTIVENESS FACTORS

Project Useful Life	(●) 1-15 Years	( ) 16-25 Years	( ) 26-40 Years	( ) 41-60 Years	( ) 61-99 Years	( ) 100 Years	0
Project Type	(●) Dry Floodproofing	( ) Flood Barrier	( ) Drainage Imp./ SWM	( ) Mitigation Reconstruction	( ) Elevation	( ) Acquisition	1
Flood Event that Caused Damage to Proposed Facility	( ) <2-yr event	( ) 2 to 5-yr event	( ) 6 to 10-yr event	( ) 11 to 25-yr event	( ) 26 to 50-yr event	(●) >50-yr event	0
Damaging Flood Event after Post-Mitigation Protection	(●) <10-yr event	( ) 10 to 25-yr event	( ) 26 to 50-yr event	( ) 51 to 75-yr event	( ) 76 to 100-yr event	( ) >100-yr event	0

COST BENEFIT FACTORS

Building Replacement Value (BRV)	(●) < $75 per square foot	( ) $76-115 per square foot	( ) $116-150 per square foot	( ) $151-185 per square foot	( ) > $185 per square foot	( ) Not Applicable	1
Contents Value	( ) <50% BRV	( ) 50-100% BRV	( ) 101-150% BRV	( ) 151-250% BRV	( ) > 250% BRV	(●) Not Applicable	1
Project Cost	( ) <5% BRV	( ) 5-15% BRV	( ) 16-25% BRV	( ) 26-50% BRV	( ) > 50% BRV	(●) Not Applicable	0

BUILDING VULNERABILITY FACTORS

Building Type	☐ Residential	☐ Commercial	☐ Industrial	☐ Public Service Building	☐ Historic	☑ Unknown	0
First Floor Elevation (FFE), Flood Level Equivalent	○ <10-yr	○ 10 to 49-yr event	○ 50 to 99-yr event	○ 100 to 499-yr event	◉ >500-yr	○ Not Applicable	0
Number of Prior Damaging Events	○ 1-2 events	○ 3 events	○ 4 events	○ 5 events	○ >5 events	◉ Not Applicable	0
For stormwater management projects or for projects with more than one building...							
Properties in 100-yr Floodway	○ 1 Building	○ 2-5 Buildings	○ 6-10 Buildings	○ 11-30 Buildings	○ >30 Buildings	◉ Not Applicable	0
Properties in Coastal Zones V and A	○ 1 Building	○ 2-5 Buildings	○ 6-10 Buildings	○ 11-30 Buildings	○ >30 Buildings	◉ Not Applicable	0
Properties with 3 or more damage events	○ 1 Building	○ 2-5 Buildings	○ 6-10 Buildings	○ 11-30 Buildings	○ >30 Buildings	◉ Not Applicable	0
ADDITIONAL BENEFITS							
PHYSICAL DAMAGES AVOIDED							
Number of Buildings	○ 1 Building	○ 2-5 Buildings	○ 6-10 Buildings	○ 11-30 Buildings	○ >30 Buildings	◉ Not Applicable	0
Non-Building Infrastructure	○ Minor Impacts	○ Moderate Impacts	○ Major Impacts	○ Extensive Impacts	◉ Not Applicable		0
Physical Damage Factors				0			
LOSS OF SERVICES AVOIDED							
Number of Public Services	○ 1 Service	○ 2 Services	○ 3 Services	○ >3 Services	◉ Not Applicable		0

Roads Impacted	○ Approx. 1-2 days closure	○ Between 1-2 weeks closure	○ Between 2-4 weeks closure	○ >4 weeks closure	◉ Not Applicable	0
Utilities Impacted	○ 1 day of interruption	○ 2-7 days interruption	○ 1-2 weeks interruption	○ >2 weeks interruption	◉ Not Applicable	0
Critical Services	○ Emergency Medical Center, Hospital with surgery or emergency services, Police or Fire				◉ Not Applicable	0
Loss of Service Factors					0	

ENVIRONMENTAL BENEFITS AND AVOIDED EMERGENCY RESPONSE COSTS

Environmental and Cultural Benefits	○ Connection to Greenway	○ Other Minor Benefit	○ Moderate Benefit	○ Major Benefit	○ Registered historic building	◉ Not Applicable	0
Indirect Protection of Nearby Hazardous Material Sites with…	○ Small quantity, good handling	○ More material, good handling	○ More material, poor handling	○ Historical contamination	○ Active remediation	◉ Not Applicable	0
Emergency Response Costs	○ Minor Impacts	○ Moderate Impacts	○ Major Impacts	○ Extensive Impacts	◉ Not Applicable		0
Environmental and Emergency Response Factors					0		
COST EFFECTIVENESS SCORE					**3**		

COMMENTS	

LOSS ESTIMATION TOOL - COST EFFECTIVENESS ANALYSIS
WIND HAZARD

Project Name:	Project Number:	
Organization Name/Dept./Division:		
Project Rep:	Email:	Phone No.:
Brief Description of Proposed Project:		

DEFINITION OF PROJECT TYPE ALTERNATIVES

Shutters	This mitigation option consists of hardening the building envelope by protecting all window, and door openings with shutters, or other systems that meet the debris impact and wind pressure design requirements of the adopted building codes.
Load Path	This mitigation option consists of upgrading/improving the actual structural system of a building allowing it to transfer loads from the roof to the foundation more effectively. This option is most commonly implemented by strengthening the roof-to-wall and wall-to-foundation connections. This option is applicable to buildings with masonry and wood frame construction.
Roof	This mitigation option consists of securing the building envelop and increasing the structural integrity during a wind event by upgrading/improving the roof deck and/or coverings. For wood framed roofs this upgrade includes strengthening the connection of the decking to the supporting rafters/trusses, typically by using larger nails at a closer spacing, and the replacement of any degraded deck panels. For all roof mitigation projects, increasing the size and amount of fasteners that connect the deck to the supporting members should be based on the appropriate building code guidance for the design wind speed at the project site. Additionally, all roof coverings (shingles, metal deck, wood panels, etc.) should be rated to resist the maximum design wind speeds at the project site. This option is applicable to manufactured homes.
Acquisition	This mitigation option consists of acquiring and demolishing a structure in order to avoid future hurricane wind damages.
Code Plus	This mitigation option is considered for new construction only and consists of designing a new building to a level that exceeds the local building codes (i.e. to a maximum wind speed of 140 mph instead 110 mph required by a local building code) in order to achieve a greater level of protection. This option is applicable to buildings with concrete, masonry, or steel construction.

PROJECT AND BUILDING INFORMATION

Total Project Cost[1] ($)	$ -	Note: -
Building Replacement Value (BRV)[2] ($)	$ -	Note: -

Contents Value ($)	$ -	Note: -
Building Construction Date (or Year)		
Building Area (Gross SF)	0 SF	

[1] The project cost should reflect all the work components associated with the proposed mitigation project (see user guide for more information).
[2] Building Replacement Value is the cost to replace the building with a functionally equivalent building, based on the current cost of labor and materials. This factor only applies to projects that protect buildings.

MITIGATION EFFECTIVENESS FACTORS

Project Useful Life	(•) 1-15 Years	( ) 16-25 Years	( ) 26-40 Years	( ) 41-50 Years	( ) 51-100 Years	( ) > 100 Years	0
Type of Construction (primary material)	(•) Steel	( ) Concrete	( ) Masonry	( ) Wood	( ) Manufactured Home	( ) Unknown	0
Project Type	(•) Shutter	( ) Load Path	( ) Roof	( ) Shutter-Load Path		( ) Shutter-Roof	1
	( ) Roof-Load Path	( ) Shutter-Roof-Load Path		( ) Code Plus		( ) Acquisition	
Project Effectiveness	(•) Building constructed before Sept 1994	[ ] Roof deck and covering	[ ] Soffit/vent	[ ] Roof overhangs	[ ] Shutters or laminated glaze	[ ] Door replacement	0
		[ ] Window assembly	[ ] Gable end-wall strengthening	[ ] Component attachment	[ ] Continous load path	[ ] Other protection measures	
	( ) Building constructed during or after Sept 1994	[ ] Roof deck and covering	[ ] Soffit/vent	[ ] Roof overhang	[ ] Shutters or laminated glaze	[ ] Door replacement	0
		[ ] Window assembly	[ ] Gable end-wall strengthening	[ ] Structure/porch attachment	[ ] Continuous load path	[ ] Other protection measures	

COST BENEFIT FACTORS

Building Replacement Value (BRV)	(•) < $75 per square foot	( ) $76-115 per square foot	( ) $116-150 per square foot	( ) $151-185 per square foot	( ) > $185 per square foot	( ) Not Applicable	1

Contents Value	○ <50% BRV	○ 50-100% BRV	○ 101-150% BRV	○ 151-250% BRV	○ > 250% BRV	◉ Not Applicable	0
Project Cost	○ <5% BRV	○ 5-15% BRV	○ 16-25% BRV	○ 26-50% BRV	○ > 50% BRV	◉ Not Applicable	0

BUILDING VULNERABILITY FACTORS*

* Its important to note that most of the building vulnerability factors listed below only apply to specific mitigation projects and certain building types. Additionally, some building properties are inclusive or exclusive of others. Only the building properties applicable to the individual mitigation type will be utilized. However, only building properties that will be addressed by proposed mitigation efforts should be selected.

Exposure**	◉ Type B - Urban/Dense Suburban			○ Type C - Open		0
Building Type	◉ Residential w/o Garage	○ Residential with Garage	○ Commercial	○ Industrial	○ Public Service Building	○ Historic	1

**Exposure type C should only be selected for projects located in areas along the shoreline, adjacent to water surfaces, in flat open country, grassland areas or areas that have only scattered obstructions less than 30 feet tall.

ROOF VULNERABILITY

Roof Shape	◉ Flat		○ Hip		○ Gable	0
Roof Cover Type	◉ Built Up Roof	○ Asphalt Shingles	○ Single Ply Membrane	○ Metal	○ Unknown	0
Roof Cover Quality	○ New	○ Good	○ Moderate	○ Poor	◉ Unknown	0
Roof Deck Age	◉ New (5 years or less)		○ Moderate (6-19 years)		○ Old (20 years or more)	0
Roof Deck Attachment Nail Size and Spacing	○ 8d at 6"/6"	○ 6d/8d mix at 6"/6"	○ 8d at 6"/12"	○ 6d at 6"/12"	○ Unknown	◉ Not Applicable	0

Metal Roof Deck Attachment	○ Superior	○ Standard	○ Unknown	◉ Not Applicable	0
Secondary Water Resistance Barrier	◉ Yes	○ No	○ Unknown	○ Not applicable	0
Roof Mitigation Factors			0		
LOAD PATH VULNERABILITY					
Roof-Wall Connection	◉ Strap	○ Toenail	○ Unknown		0
Masonry Reinforcing (Masonry Walls)	○ Yes	○ No	○ Unknown	◉ Not Applicable	0
Tie Downs (Manufactured Homes)	○ Yes	○ No	○ Unknown	◉ Not Applicable	0
Load Path Mitigation Factors			0		
WINDOW VULNERABILITY					
Shutters	◉ All openings reinforced	○ Some openings reinforced	○ No openings reinforced		0
Window Area (% openings in building)	◉ Low (<20%)	○ Medium (20-40%)	○ High (>40%)		2
Type of Wind Debris	○ No Missiles ○ Residential	○ Residential/ Commercial ○ Varies by Direction	◉ Unknown		0
Shutter Mitigation Factors			2		
ADDITIONAL BENEFITS					
PHYSICAL DAMAGES AVOIDED					

Number of Buildings	◉ 1 Building	○ 2-5 Buildings	○ 6-10 Buildings	○ 11-30 Buildings	○ >30 Buildings	○ Not Applicable	0
Non-Building Infrastructure	○ Minor Impacts	○ Moderate Impacts	○ Major Impacts	○ Extensive Impacts	◉ Not Applicable		0
Physical Damage Factors					0		
LOSS OF SERVICES AVOIDED							
Number of Public Services	○ 1 Service	○ 2 Services	○ 3 Services	○ >3 Services	◉ Not Applicable		0
Roads Impacted	○ Approx. 1-2 days closure	○ Between 1-2 weeks closure	○ Between 2-4 weeks closure	○ >4 weeks closure	◉ Not Applicable		0
Utilities Impacted	○ 1 day of interruption	○ 2-7 days interruption	○ 1-2 weeks interruption	○ >2 weeks interruption	◉ Not Applicable		0
Critical Services	○ Emergency Medical Center, Hospital with surgery or emergency services, Police or Fire				◉ Not Applicable		0
Loss of Service Factors					0		
ENVIRONMENTAL BENEFITS AND AVOIDED EMERGENCY RESPONSE COSTS							
Environmental and Cultural Benefits	○ Registered historic building			◉ Not Applicable			0
Indirect Protection of Nearby Hazardous Material Sites with…	○ Small quantity, good handling	○ More material, good handling	○ More material, poor handling	○ Historial contamination	○ Active remediation	◉ Not Applicable	0
Emergency Response Costs	○ Minor Impacts	○ Moderate Impacts	○ Major Impacts	○ Extensive Impacts	◉ Not Applicable		0
Environmental and Emergency Response Factors					0		

COST EFFECTIVENESS SCORE	5

COMMENTS	