Recommended Revisions for
US Green Building Council
Leadership in Energy and Environmental Design Version 3

IEQ PREREQUISITE: RODENTPROOFING 2

IEQ PREREQUISITE: RADON MITIGATION 4

MR PREREQUISITE: DESIGN OF STORAGE AND COLLECTION AREAS 11

MR PREREQUISITE: ENHANCED RESISTANCE TO FIRE DAMAGE – INTERNAL BARRIERS 13

MR PREREQUISITE: ENHANCED RESISTANCE TO FIRE DAMAGE – CONTAINMENT 17

MR PREREQUISITE: ENHANCED STRUCTURAL RESISTANCE TO FIRE DAMAGE 20

MR PREREQUISITE: ENHANCED RESISTANCE TO EXTERIOR FIRE DAMAGE 22

MR PREREQUISITE: ENHANCED RESISTANCE TO FIRE DAMAGE – AUTOMATIC SPRINKLER SYSTEMS 26

MR PREREQUISITE: DESIGN FOR ENHANCED RESISTANCE TO WIND DAMAGE 28

MR Prerequisite: DESIGN OF EXTERIORS FOR ENHANCED WIND DAMAGE RESISTANCE 30

MR PREREQUISITE: STORM SHELTERS 32

MR PREREQUISITE: DESIGN OF EXTERIORS FOR ENHANCED HAIL DAMAGE RESISTANCE 35

MR PREREQUISITE: DESIGN FOR ENHANCED RESISTANCE TO DAMAGE FROM SNOW LOADS 38

MR PREREQUISITE: DESIGN FOR ENHANCED RESISTANCE TO SEISMIC DAMAGE 40

MR PREREQUISITE: DESIGN FOR ENHANCED FLOOD DAMAGE RESISTANCE 42

MR PREREQUISITE: ENHANCED RESISTANCE TO FIRE DAMAGE – WILDFIRES 44

IEQ Prerequisite: Rodentproofing

Required

This prerequisite applies to:

- New Construction
- Core & Shell
- Interior Design & Construction
- Schools
- Retail
- Data Centers
- Hospitality

Intent

Assuring adequate provisions for rodent infestation resistance reduces the potential to use pesticides over the life of the building. The use of pesticides may have a negative impact on occupant comfort and health. Adequate rodentproofing will minimize the amount of energy and resources required over the life of the building if means other than pesticides are required to eliminate infestations. Adequate rodentproofing also reduces the amount of energy and resources required to repair, remove, dispose and replace materials when damage from rodents occurs.

Requirements

Buildings shall be provided with rodentproofing in accordance with Appendix F of the *International Building Code* or the Code of local jurisdiction, whichever is more stringent.

Recommendations, suggestions, or other ideas for improvement

The amount of energy and resources required for repair and replacement when rodent infestations occur can be significant. In addition, the use of pesticides and other measures to eradicate infestations can have a negative impact on human health and comfort. To provide for increased safety to occupants and minimize the negative impact on the built environment from rodents requires buildings to be designed and constructed in a manner that at least satisfies the minimum requirements of the Appendix F of the *International Building Code*. Currently, the use of Appendix F is optional and, thus it is not required in many jurisdictions. A green building should not be readily susceptible to rodent infestations and following these criteria should be a mandatory prerequisite for green buildings.

Resources

PCA HPBRS http://www.cement.org/codes/pdf/HPBRS%20&%20Commentary%20v2.0.pdf

International Code Council (ICC) *International Building Code* (IBC) Appendix F – *Rodentproofing*

IEQ PREREQUISITE: RADON MITIGATION

Required

This prerequisite applies to:

- New Construction
- Core & Shell
- Interior Design & Construction
- Schools
- Retail
- Data Centers
- Hospitality

Intent

Assuring adequate indoor environmental quality by requiring radon mitigation systems for buildings in high radon potential areas. While radon mitigation is not a mandatory requirement for many building codes provisions to minimize the exposure of occupants of green buildings to radon is an important part of providing an appropriate minimum level on indoor environmental quality.

Requirements

Buildings in high Radon Potential (Zone 1) locations as determined by Table 1 shall:

1. be designed in accordance with Chapter 2 of EPA 625-R-92-016;
2. be designed in accordance Appendix F of the International Residential Code;
3. be equipped with an active soil depressurization systems; or
4. be equipped with a passive soli depressurization system

Active Soil Depressurization (ASD) shall meet the requirements for Passive Soil Depressurization and the following requirements:

1. Radon Suction Pit – Install a radon suction pit that is a minimum 4 foot (1.2 m) by 4 foot (1.2 m) by 8 inch (200 mm) deep under the slab. The pit shall be filled with materials that satisfy the requirements for the gas permeable layer.
2. Vent Pipe – Install a minimum 6 in (150 mm) diameter vent pipe from the radon suction pit to the outdoors. Exhaust vents shall be located no less than 25 feet (7.5 m) from all entrances, air intakes, operable windows, and exterior public access areas.
3. Fan – Install a suction fan designed for use in ASD systems.

Passive Soil Depressurization (PSD) shall meet the following requirements:

1. Gas permeable layer – A layer of gas-permeable material shall be placed under all concrete slabs and other floor systems that directly contact the ground and are within the walls of the occupied spaces of the building. The gas permeable layer be one of the following:
   a. A minimum 4-inch (100 mm) thick layer of clean aggregate consisting of materials that will pass through a 2-inch (50 mm) sieve and be retained by a $^{1}/_{4}$-inch (6 mm) sieve.

b. A layer or strips of geotextile drainage matting designed to allow lateral flow of soil gases placed over a minimum 4-inch (100 mm) thick layer of sand.
c. Other materials, systems or floor designs with demonstrated capability to permit depressurization across the entire sub-floor area.

2. Soil-gas-retarder – A ultraviolet protected minimum 6-mil (0.15 mm) polyethylene, 3-mil cross-laminated polyethylene, or equivalent flexible sheet material that conforms to ASTM E1643 shall be placed over the gas permeable layer. The sheeting shall cover the entire floor area and fit closely to perimeter walls, and around any penetrations. All laps in the sheeting shall be at least 12 inches (300 mm) and all punctures shall be sealed or lapped.
3. Penetrations – All penetrations, including those for pipe, conduit, wiring sump pit and ejection pump pits, through the floor assembly or below grade wall shall be filled with a polyurethane sealant or other elastomeric sealant applied in accordance with the manufacturer's recommendations.
4. Perimeter joints **–** Joints between floor and wall assemblies shall be sealed with a caulk or sealant. Joints shall be cleared of loose material and filled with polyurethane sealant or other elastomeric sealant applied in accordance with the manufacturer's recommendations.
5. Condensate drains – Condensate drains shall be trapped or routed through non-perforated pipe to daylight.
6. Sumps – Sump pits open to soil or serving as the termination point for sub-slab or exterior drain tile loops shall be covered with a gasketed or otherwise hermetically sealed lid. Sumps used as the suction point in a sub-slab depressurization system shall have a lid designed to accommodate the vent pipe. Sumps used as a floor drain shall have a lid equipped with a trapped inlet
7. Concrete masonry foundation walls – Hollow concrete masonry foundation walls shall be constructed the top of the wall is sealed. This shall be provided with one course of solid masonry units, one course of fully grouted masonry, solid concrete beam, bond beam, sealed through wall flashing, sealed termite shield, sealed sill plate or other details that prevent soil gas from entering the building through the cores of the concrete masonry units at the tops of walls. Details requiring sealing shall be sealed with polyurethane sealant or other elastomeric sealant applied in accordance with the manufacturer's recommendations.
8. Dampproofing – The exterior surfaces of portions of concrete masonry walls below the ground surface shall be dampproofed.
9. Air-handling units – Where placed in crawl spaces, Air-handling units in crawl spaces shall be sealed to prevent air from being drawn into the unit unless units have gasketed seams or units that are otherwise sealed by the manufacturer to prevent leakage.
10. Ductwork – where placed in crawlspaces, ductwork passing through or beneath a slab shall be of seamless material or hermetically sealed. Joints in ductwork shall be hermetically sealed ,
11. Crawl spaces – Crawlspaces shall comply with the following:
    a. Ventilation - Crawl spaces shall be provided with vents to the exterior of the building.
    b. Soil-gas-retarder – The soil in the crawl space shall be covered with a continuous layer of minimum 6-mil (0.15 mm) polyethylene soil gas retarder that conforms to ASTM E1643 or equivalent. Joints in the sheets of soil cover shall be lapped a minimum 12 in (300 mm) and shall extend to the foundation walls enclosing the crawl space. The soil cover shall be continuously taped or adhered to the perimeter wall.

12. Radon vent systems shall comply with the following:
    a. Vent pipe – Vent pipe shall be a minimum 3in. (75 mm) diameter ABS, PVC or equivalent gas-tight pipe.
    b. Vent intake – The intake shall be a tee or other approve connection placed either beneath the sheeting in crawl spaces or embedded in the gas-permeable layer in slab construction.
    c. Vent exhaust – The vent pipe shall be extended up through the building floors, terminate at least 12 inches (300 mm) above the roof. The vent pipe termination location shall be at least 10 feet (3.0 m) away from any window or other opening into the conditioned spaces of the building that is less than 2 feet (600 mm) below the exhaust point, and at least 10 feet (3.0 m) from any window or other opening in adjoining or adjacent buildings
    d. Multiple vent pipes – Where interior footings or other barriers separate the sub-slab aggregate or other gas-permeable material, each area shall be vented.
    e. Vent pipe drainage – All components of the vent pipe system shall be installed to provide positive drainage.
    f. Vent pipe accessibility - Vent pipes shall be accessible for future fan installation repair or replacement.
    g. Vent pipe identification – All exposed and visible interior radon vent pipes shall be identified with at least one label on each floor and in accessible attics. The label shall read: "Radon Mitigation System."
13. Power source **-** To provide for future installation of an active sub-membrane or sub-slab depressurization system, an electrical circuit terminated in an *approved* box shall be installed during construction in the *attic* or other anticipated location of vent pipe fans. An electrical supply shall also be accessible in anticipated locations of system failure alarms.

Table 1

Radon Potential (Zone 1)

ALABAMA
Calhoun
Clay
Cleburne
Colbert
Coosa
Franklin
Jackson
Lauderdale
Lawrence
Limestone
Madison
Morgan
Talladega

CALIFORNIA
Santa Barbara
Ventura

COLORADO
Adams
Arapahoe
Baca
Bent
Boulder
Chaffee
Cheyenne
Clear Creek
Crowley
Custer
Delta
Denver
Dolores
Douglas
El Paso
Elbert
Fremont
Garfield
Gilpin
Grand
Gunnison
Huerfano
Jackson
Jefferson
Kiowa
Kit Carson
Lake
Larimer
Las Animas
Lincoln
Logan
Mesa
Moffat
Montezuma
Montrose
Morgan
Otero
Ouray
Park
Phillips
Pitkin
Prowers
Pueblo
Rio Blanco
San Miguel
Summit
Teller
Washington
Weld
Yuma

CONNECTICUT
Fairfield
Middlesex
New Haven
New London

GEORGIA
Cobb
De Kalb
Fulton
Gwinnett

IDAHO
Benewah
Blaine
Boise
Bonner
Boundary
Butte
Camas
Clark
Clearwater
Custer
Elmore
Fremont
Gooding
Idaho
Kootenai
Latah
Lemhi
Shoshone
Valley

ILLINOIS
Adams

Boone
Brown
Bueau
Calhoun
Carroll
Cass
Champaign
Coles
De Kalb
De Witt
Douglas
Edgar
Ford
Fulton
Greene
Grundy
Hancock
Henderson
Henry
Iroquois
Jersey
Jo Daviess
Kane
Kendall
Knox
La Salle
Lee
Livingston
Logan
Macon
Marshall
Mason
McDonough
McLean
Menard
Mercer
Morgan
Moultrie
Ogle
Peoria
Piatt
Pike
Putnam
Rock Island
Sangamon
Schuyler
Scott
Stark
Stephenson
Tazewell
Vermilion
Warren
Whiteside
Winnebago
Woodford

INDIANA
Adams
Allen
Bartholomew
Benton
Blackford
Boone
Carroll
Cass
Clark
Clinton
De Kalb
Decatur
Delaware
Elkhart
Fayette
Fountain
Fulton
Grant
Hamilton
Hancock
Harrison
Hendricks
Henry
Howard
Huntington
Jay
Jennings
Johnson
Kosciusko
Lagrange
Lawrence
Madison
Marion
Marshall
Miami
Monroe
Montgomery
Noble
Orange
Putnam
Randolph
Rush
Scott
Shelby
Steuben
St. Joseph
Tippecanoe
Tipton
Union
Vermillion
Wabash
Warren
Washington
Wayne
Wells
White
Whitley

Iowa
All counties

Kansas
Atchison
Barton
Brown
Cheyenne
Clay
Cloud
Decatur
Dickinson
Douglas
Ellis
Ellsworth
Finney
Ford
Geary
Gove
Graham
Grant
Gray
Greeley
Hamilton
Haskell
Hodgeman
Jackson
Jewell
Johnson
Keary
Kingman
Kiowa
Lane
Leavenworth
Lincoln
Logan
Marion
Marshall
McPherson
Meade
Mitchell
Nemaha
Ness
Norton
Osborne
Ottawa
Pawnee
Phillips
Pottawatomie
Pratt
Rawlins
Republic
Rice
Riley
Rooks
Rush
Russell
Saline
Scott
Sheridan
Sherman
Smith
Stanton
Thomas
Trego
Wallace
Washington
Wichita
Wyandotte

KENTUCKY
Adair
Allen
Barren
Bourbon
Boyle
Bullitt
Casey
Clark
Cumberland
Fayette
Franklin
Green
Harrison
Hart
Jefferson
Jessamine
Lincoln
Marion
Mercer
Metcalfe
Monroe
Nelson
Pendleton
Pulaski
Robertson
Russell
Scott
Taylor
Warren
Woodford

Maine
Androscoggin
Aroostook
Cumberland
Franklin
Hancock
Kennebec
Lincoln
Oxford
Penobscot
Piscataquis
Somerset
York

MARYLAND
Baltimore
Calvert
Carroll
Frederick
Harford
Howard
Montgomery
Washington

MASSACHUSETTS
Essex
Middlesex
Worcester

Michigan
Branch
Calhoun
Cass
Hillsdale
Jackson
Kalamazoo
Lenawee
St. Joseph
Washtenaw

Minnesota
Becker
Big Stone
Blue Earth
Brown
Carver
Chippewa
Clay
Cottonwood
Dakota
Dodge
Douglas
Faribault
Fillmore
Freeborn
Goodhue
Grant
Hennepin
Houston
Hubbard
Jackson
Kanabec
Kandiyohi
Kittson
Lac Qui Parle
Le Sueur
Lincoln
Lyon

Mahnomen
Marshall
Martin
McLeod
Meeker
Mower
Murray
Nicollet
Nobles
Norman
Olmsted
Otter Tail
Pennington
Pipestone
Polk
Pope
Ramsey
Red Lake
Redwood
Renville
Rice
Rock
Roseau
Scott
Sherburne
Sibley
Stearns
Steele
Stevens
Swift
Todd
Traverse
Wabasha
Wadena
Waseca
Washington
Watonwan
Wilkin
Winona
Wright
Yellow Medicine

MISSOURI
Andrew
Atchison
Buchanan
Cass
Clay
Clinton
Holt
Iron
Jackson
Nodaway
Platte

MONTANA
Beaverhead
Big Horn
Blaine
Broadwater
Carbon
Carter
Cascade
Chouteau
Custer
Daniels
Dawson
Deer Lodge
Fallon
Fergus
Flathead
Gallatin
Garfield
Glacier
Granite
Hill
Jefferson
Judith Basin
Lake
Lewis and Clark
Liberty
Lincoln
Madison
McCone
Meagher
Mineral
Missoula
Park
Phillips
Pondera
Powder River
Powell
Prairie
Ravalli
Richland
Roosevelt
Rosebud
Sanders
Sheridan
Silver Bow
Stillwater
Teton
Toole
Valley
Wibaux
Yellowstone
National Park

NEBRASKA
Adams
Boone
Boyd
Burt
Butler
Cass
Cedar
Clay
Colfax
Cuming
Dakota
Dixon
Dodge
Douglas
Fillmore
Franklin
Frontier
Furnas
Gage
Gosper
Greeley
Hamilton
Harlan
Hayes
Hitchcock
Hurston
Jefferson
Johnson
Kearney
Knox
Lancaster
Madison
Nance
Nemaha
Nuckolls
Otoe
Pawnee
Phelps
Pierce
Platte
Polk
Red Willow
Richardson
Saline
Sarpy
Saunders
Seward
Stanton
Thayer
Washington
Wayne
Webster
York

NEVADA
Carson City
Douglas
Eureka
Lander
Lincoln
Lyon
Mineral
Pershing
White Pine

NEW HAMPSHIRE
Carroll

NEW JERSEY
Hunterdon
Mercer
Monmouth
Morris
Somerset
Sussex
Warren

NEW MEXICO
Bernalillo
Colfax
Mora
Rio Arriba
San Miguel
Santa Fe
Taos

NEW YORK
Albany
Allegany
Broome
Cattaraugus
Cayuga
Chautauqua
Chemung
Chenango
Columbia
Cortland
Delaware
Dutchess
Erie
Genesee
Greene
Livingston
Madison
Onondaga
Ontario
Orange
Otsego
Putnam
Rensselaer
Schoharie
Schuyler
Seneca
Steuben
Sullivan
Tioga
Tompkins
Ulster
Washington
Wyoming
Yates

NORTH CAROLINA
Alleghany
Buncombe
Cherokee
Henderson
Mitchell
Rockingham
Transylvania
Watauga
North Dakota
All Counties

OHIO
Adams
Allen
Ashland
Auglaize
Belmont
Butler
Carroll
Champaign
Clark
Clinton
Columbiana
Coshocton
Crawford
Darke
Delaware
Fairfield
Fayette
Franklin
Greene
Guernsey
Hamilton
Hancock
Hardin
Harrison
Holmes
Huron
Jefferson
Knox
Licking
Logan
Madison
Marion
Mercer
Miami
Montgomery
Morrow
Muskingum
Perry
Pickaway
Pike
Preble

Richland
Ross
Seneca
Shelby
Stark
Summit
Tuscarawas
Union
Van Wert
Warren
Wayne
Wyandot

PENNSYLVANIA
Adams
Allegheny
Armstrong
Beaver
Bedford
Berks
Blair
Bradford
Bucks
Butler
Cameron
Carbon
Centre
Chester
Clarion
Clearfield
Clinton
Columbia
Cumberland
Dauphin
Delaware
Franklin
Fulton
Huntingdon
Indiana
Juniata
Lackawanna
Lancaster
Lebanon
Lehigh
Luzerne
Lycoming
Mifflin
Monroe
Montgomery
Montour
Northampton
Northumberland
Perry
Schuylkill
Snyder
Sullivan
Susquehanna
Tioga
Union
Venango
Westmoreland
Wyoming
York
Rhode Island
Kent
Washington

SOUTH CAROLINA
Greenville

SOUTH DAKOTA
Aurora
Beadle
Bon Homme
Brookings
Brown
Brule
Buffalo
Campbell
Charles Mix
Clark
Clay
Codington
Corson
Davison
Day
Deuel
Douglas
Edmunds
Faulk
Grant
Hamlin
Hand
Hanson
Hughes
Hutchinson
Hyde
Jerauld
Kingsbury
Lake
Lincoln
Lyman
Marshall
McCook
McPherson
Miner
Minnehaha
Moody
Perkins
Potter
Roberts
Sanborn
Spink
Stanley
Sully
Turner
Union
Walworth
Yankton

TENNESSEE
Anderson
Bedford
Blount
Bradley
Claiborne
Davidson
Giles
Grainger
Greene
Hamblen
Hancock
Hawkins
Hickman
Humphreys
Jackson
Jefferson
Knox
Lawrence
Lewis
Lincoln
Loudon
Marshall
Maury
McMinn
Meigs
Monroe
Moore
Perry
Roane
Rutherford
Smith
Sullivan
Trousdale
Union
Washington
Wayne
Williamson
Wilson

UTAH
Carbon
Duchesne
Grand
Piute
Sanpete
Sevier
Uintah

VIRGINIA
Alleghany
Amelia
Appomattox
Augusta
Bath
Bland
Botetourt
Bristol
Brunswick
Buckingham
Buena Vista
Campbell
Chesterfield
Clarke
Clifton Forge
Covington
Craig
Cumberland
Danville
Dinwiddie
Fairfax
Falls Church
Fluvanna
Frederick
Fredericksburg
Giles
Goochland
Harrisonburg
Henry
Highland
Lee
Lexington
Louisa
Martinsville
Montgomery
Nottoway
Orange
Page
Patrick
Pittsylvania
Powhatan
Pulaski
Radford
Roanoke
Rockbridge
Rockingham
Russell
Salem
Scott
Shenandoah
Smyth
Spotsylvania
Stafford
Staunton
Tazewell
Warren
Washington
Waynesboro
Winchester
Wythe

WASHINGTON
Clark
Ferry
Okanogan
Pen Orielle
Skamania
Spokane
Stevens

WEST VIRGINIA
Berkeley
Brooks
Grant
Greenbier
Hampshire
Hancock
Hardy
Jefferson
Marshall
Mercer
Mineral
Monongalia
Monroe
Morgan
Ohio
Pendleton
Pocahontas
Preston
Summers
Wetzel

WISCONSIN
Buffalo
Crawford
Dane
Dodge
Door
Fond du Lac
Grant
Green
Green Lake
Iowa
Jefferson
Lafayette
Langlade
Marathon
Menominee
Pepin
Pierce
Portage
Richland
Rock
Shawano
St. Croix

Vernon
Walworth
Washington
Waukesha
Waupaca
Wood

WYOMING
Albany
Bighorn
Campbell
Carbon
Converse
Crook
Fremont
Goshen
Hot Springs
Johnson
Laramie
Lincoln
Natrona
Niobrara
Park
Sheridan
Sublette
Sweetwater
Teton
Uinta
Washakie

Recommendations, suggestions, or other ideas for improvement

This proposal sets minimum requirements to help assure occupant health and safety through provisions for radon mitigation. Radon mitigation is not a mandatory requirement in many building codes. These requirements set design and construction criteria and allow multiple compliance paths including EPA Guidelines (EPA 625-R-92-016) and Appendix F of the International Residential Code. The use of either active and passive soil depressurization systems for radon mitigation is addressed. These requirements are important to assure appropriate indoor environmental quality.

Resources

- PCA HPBRS http://www.cement.org/codes/pdf/HPBRS%20&%20Commentary%20v2.0.pdf
- Environmental Protection Agency (EPA) EPA 625-R-92-016. *Guide to Radon Prevention in the Design and Construction of Schools and Other Large Buildings, 3rd Printing with Addendum,* June 1994
- ICC *International Residential Code* (IRC) Appendix F

MR Prerequisite: Design of Storage and Collection Areas

Required

This prerequisite applies to:

- New Construction
- Core & Shell
- Interior Design & Construction
- Schools
- Retail
- Data Centers
- Warehouses & Distribution Centers
- Hospitality

Intent

To assure adequate life safety and property protection in areas where large amounts of separated combustible materials are intended to be collected and stored.

Requirements

Design and construct areas intended for the storage and collection of recyclables to minimize the potential for jeopardizing life safety and to assure a minimum level of property protection for such storage and collection areas as they pose a larger hazard than traditional storage and collection areas within and around buildings.

1. Walls, floors and ceilings of interior collection or storage areas provided for recyclable materials shall be shall be completely separated from other parts of the building by noncombustible construction having a fire resistance rating of not less than 2-hours and constructed as fire walls or smoke partitions in accordance with the International Building Code.
2. These interior collections and storage areas shall also be equipped with automatic fire-extinguishing systems in accordance with NFPA 13
3. Exterior walls of buildings within 30 feet (measured horizontally and vertically) to exterior collection or storage areas provided for recyclable materials shall have a fire resistance rating of not less than 2-hours.

Recommendations, suggestions, or other ideas for improvement

Separated combustible materials pose much greater life safety and property protection risks than blended waste. The increased risk and danger to occupants and the potential for damage to structures when fires occur has not, as of yet, been addressed in the development of model building codes. To address this increased potential threat to occupants, the structure, and its contents, special criteria should be satisfied when providing collection or storage areas for separated combustibles in or adjacent to buildings. Areas for the collection and storage of recyclables must be designed and constructed in a manner are not to increase the danger occupants and service personnel and in a manner as not to increase the need for repair, removal, disposal and replacement of building materials and contents when a fire hazard occurs. No matter how idyllic we can envision recycle areas, they tend to become trash rooms.

Further consideration should be given to requiring smooth hard surfaces in these areas and attention should also be given to assuring these areas are rodentproof. Both are especially important for areas accepting liquid containers intended to be "empty".

Resources

PCA HPBRS http://www.cement.org/codes/pdf/HPBRS%20&%20Commentary%20v2.0.pdf
International Code Council (ICC) *International Building Code* (IBC)
National Fire Protection Association (NFPA) NFPA 13, *Standard for the Installation of Sprinkler Systems*

MR PREREQUISITE: ENHANCED RESISTANCE TO FIRE DAMAGE – INTERNAL BARRIERS

Required

This prerequisite applies to:

- New Construction
- Core & Shell
- Interior Design & Construction
- Schools
- Retail
- Data Centers
- Warehouses & Distribution Centers
- Hospitality

Intent

To reduce construction, renovation, and demolition waste; divert debris from disposal in landfills and incineration facilities; and reduce energy and resources expended to reconstruct, repair or replace materials in buildings from fire damage

Requirements

Fire walls are used to create separate building areas for large buildings. They shall:

- Be constructed entirely of noncombustible materials
- Have fire resistance ratings of at least 2-hours
- Be constructed in accordance with the *International Building Code*.

To further reduce the risk of fire spread within the building, provide internal fire barriers (walls and horizontal floor systems) to establish multiple fire area compartments. Fire barrier assemblies shall have fire resistance ratings of at least 1-hour and constructed in accordance with the *International Building Code*.

Recommendations, suggestions, or other ideas for improvement

Enhanced property protection is a crucial component of green construction and thus requirements for enhanced performance of interior fire walls, fire barriers and fire partitions above the minimum requirements in the IBC are necessary. Such requirements reduce the amount of energy and resources required for repair, removal, disposal and replacement of building components and contents damaged from fire. This proposal requires fire walls, fire barriers and fire partitions to be more robust and enhances fire containment within the building thereby limiting the damage due to fire or fire suppression operations.

Additional benefits are enhanced life safety, security and occupant comfort; potentially less demand on community resources required for emergency response; and allowing facilities to be more readily adapted for re-use if there is a change of occupancy in the future.

Minimum building requirements whether through energy codes, plumbing codes, mechanical codes, zoning codes, or basic building codes, do not encourage truly sustainable buildings. The proposal is one of several that attempt to integrate the concepts of the *Whole Building Design Guide* (WBDG) into the minimum design and construction criteria for "green" buildings. The WBDG, developed in partnership between the National Institute of Building Sciences (NIBS) and the Sustainable Building Industries Council (SBIC), has as its key concepts: accessible, aesthetics, cost-effective, functional/operational, historic preservation, productive, secure/safe, and sustainable.

There are numerous references about the economic, societal, and environmental benefits that result when enhanced functional resilience is integrated into building design and construction. Six examples demonstrating the importance and supporting the concepts are:

1. ***Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities*** National Institute of Building Sciences Multi-Hazard Mitigation Council - 2005
   One of the findings in this report is "The analysis of the statistically representative sample of FEMA grants awarded during the study period indicates that a dollar spent on disaster mitigation saves society an average of $4." The programs studied often addressed issues and strategies other than enhanced disaster resistance of buildings and other structures. However, more disaster-resistant buildings enhance life safety; reduce costs and environmental impacts associated with repair, removal, disposal, and replacement; and reduce the time and resources required for community recovery.

2. ***Five Years Later – Are we better prepared?*** Institute for Business and Home Safety - 2010

   This IBHS report states: "When Hurricane Katrina made landfall on Aug. 29, 2005, it caused an estimated $41.1 billion in insured losses across six states, and took an incalculable economic and social toll on many communities. Five years later, the recovery continues and some residents in the most severely affected states of Alabama, Louisiana and Mississippi are still struggling. There is no question that no one wants a repeat performance of this devastating event that left at least 1,300 people dead. Yet, the steps taken to improve the quality of the building stock, whether through rebuilding or new construction, call into question the commitment of some key stakeholders to ensuring that past mistakes are not repeated." This report indicates that there is a need to implement provisions to make buildings more disaster-resistant. Clearly this suggests that functional resilience should at least be integrated into the design and construction of sustainable buildings.

3. **National Weather Service Office of Climate, Water and Weather Services** National Oceanic and Atmospheric Administration (NOAA) – 2010

   Data provided on the NOAA website [www.weather.gov/os/hazstats.shtml] indicates that the average annual direct property loss due to natural disasters in the United States exceeds of $35,000,000,000. This does not include indirect costs associated with loss of residences, business closures, and resources expended for emergency response and management. These direct property losses also do not reflect the direct environmental impact due to reconstruction after the disasters. Functional resilience will help alleviate the environmental impact and minimize both direct and indirect losses from natural disasters.

4. ***Global Climate Change Impacts in the United States*** U.S. Global Change Research Program (USGCRP) - 2009

   The USGCRP includes the departments of Agriculture, Commerce, Defense, Energy, Health and Human Services, Interior, State and Transportation; National Aeronautic and Space Administration; Environmental Protection Agency, USA International Development, National Science Foundation and Smithsonian Institution

   The report identifies that: "Climate changes are underway in the United States and are projected to grow. Climate-related changes are already observed in the United States and its coastal waters. These include increases in heavy downpours, rising temperature and sea level, rapidly retreating glaciers, thawing permafrost, lengthening growing seasons, lengthening ice-free seasons in the ocean and on lakes and rivers, earlier snowmelt, and alterations in river flows. These changes are projected to grow." The report further identifies that the: "Threats to human health will increase. Health impacts of climate change are related to heat stress, waterborne diseases, poor air quality, extreme weather events, and diseases transmitted by insects and rodents. Robust public health infrastructure can reduce the potential for negative impacts." Key messages in the report on societal impacts include:

   > "City residents and city infrastructure have unique vulnerabilities to climate change. "
   >
   > "Climate change affects communities through changes in climate-sensitive resources that occur both locally and at great distances."
   >
   > "Insurance is one of the industries particularly vulnerable to increasing extreme weather events such as severe storms, but it can also help society manage the risks."

Sustainable building design and construction cannot be about protecting the natural environment without consideration of the projected growth in severe weather. Minimum codes primarily based on past natural events are not appropriate for truly sustainable buildings. Buildings expected to have long term positive impacts on the environment must be protected from these extreme changes in the natural environment. The provisions for improved property protections are necessary to reduce the amount of energy and resources associated with repair, removal, disposal, and replacement due to routine maintenance and damage from disasters. Further such provisions reduce the time and resources required for community disaster recovery.

5. ***Sustainable Stewardship - Historic preservation plays an essential role in fighting climate change ,*** *Traditional Building,* National Trust for Historic Preservation - 2008

   In the article *Richard Moe summarizes the results of a study by the* Brookings Institution which projects that by 2030 we will have demolished and replaced 82 billion square feet of our current building stock, or nearly 1/3 of our existing buildings, largely because the vast majority of them weren't designed and built to last any longer. Durability, as a component of functional resilience, can reduce these losses.

6. **Opportunities for Integrating Disaster Mitigation and Energy Retrofit Programs** Senate Environment and Public Works Committee Room, Dirksen Senate Office Building, Washington, D.C. - 2010

   During this panel discussion a representative of the National Conference of State Historic Preservation Officers noted that more robust buildings erected prior to 1950 tend to be more adaptable for reuse and renovation. Prior to the mid-1950s most local jurisdictions developed their own building code requirements that uniquely addressed the community's needs, issues and concerns. Pre-1950 building codes typically resulted in more durable and robust construction that lasts longer.

The total environmental impact of insulation, high efficiency equipment, components, and appliances, low-flow plumbing fixtures, and other building materials and contents are relatively insignificant when rendered irreparable or contaminated and must be disposed of in landfills after disasters. The US Army Corps of Engineers estimated that after Hurricane Katrina nearly 1.2 billion cubic feet of building materials and contents ended up in landfills. This is analogous to stacking enough refrigerators a fifth of the way to the moon or placing them end to end around the equator of the Earth twice.

Resources

PCA HPBRS http://www.cement.org/codes/pdf/HPBRS%20&%20Commentary%20v2.0.pdf

International Code Council (ICC) *International Building Code* (IBC)

MR Prerequisite: Enhanced Resistance To Fire Damage – Containment

Required

This prerequisite applies to:

- New Construction
- Core & Shell
- Interior Design & Construction
- Schools
- Retail
- Data Centers
- Warehouses & Distribution Centers
- Hospitality

Intent

To reduce construction, renovation, and demolition waste; divert debris from disposal in landfills and incineration facilities; and reduce energy and resources expended to reconstruct, repair or replace materials in buildings damaged from fire events

Requirements

Building shall be designed to the heights in feet, heights in stories and floor areas in square feet based on the following:

1. All structural load-bearing elements (i.e. walls, columns, beams, girders, floors and roofs) shall satisfy the criteria of the *International Building* Code but shall not have a fire resistance rating of less than 1-hour.
2. No increases in allowable floor area, according to *International Building Code*, are permitted for open space around the perimeter of the building.
3. No increases in height in feet or number of stories, according to *International Building Code*, are permitted for the presence of automatic sprinkler systems.

Recommendations, suggestions, or other ideas for improvement

Requiring increased fire resistance for building elements, as buildings increase in size, reduces the amount of damage to the building and its contents. This enhances sustainability by minimizing how much building materials will be required to restore the building. This also reduces the amount of materials entering landfills, positively impacts the demand on community resources required for emergency response, and allows facilities to be more readily adapted for re-use if there is a change of occupancy in the future.

Minimum building requirements whether through energy codes, plumbing codes, mechanical codes, zoning codes, or basic building codes, do not encourage truly sustainable buildings. The proposal is one of several that attempt to integrate the concepts of the *Whole Building Design Guide* (WBDG) into the minimum design and construction criteria for "green" buildings. The WBDG, developed in partnership between the National Institute of Building Sciences (NIBS) and the Sustainable Building Industries Council (SBIC), has as its key concepts: accessible, aesthetics, cost-effective, <u>functional/operational</u>, historic preservation, productive, <u>secure/safe</u>, and sustainable.

There are numerous references about the economic, societal, and environmental benefits that result when enhanced functional resilience is integrated into building design and construction. Six examples demonstrating the importance and supporting the concepts have been previously mentioned. See discussion on the following topics starting on page 14.

1. ***Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities***
2. ***Five Years Later – Are we better prepared?***
3. **National Weather Service Office of Climate, Water and Weather Services**
4. ***Global Climate Change Impacts in the United States***
5. ***Sustainable Stewardship - Historic preservation plays an essential role in fighting climate change ,***
6. **Opportunities for Integrating Disaster Mitigation and Energy Retrofit Programs**

Resources

PCA HPBRS http://www.cement.org/codes/pdf/HPBRS%20&%20Commentary%20v2.0.pdf

International Code Council (ICC) *International Building Code* (IBC)

MR Prerequisite: Enhanced Structural Resistance To Fire Damage

Required

This prerequisite applies to:

- New Construction
- Core & Shell
- Interior Design & Construction
- Schools
- Retail
- Data Centers
- Warehouses & Distribution Centers
- Hospitality

Intent

To reduce construction, renovation, and demolition waste; divert debris from disposal in landfills and incineration facilities; and reduce energy and resources expended to reconstruct, repair or replace materials in buildings damaged from fire events.

Requirements

Building shall be designed so that all structural load-bearing elements (i.e. walls, columns, beams, girders, floors and roofs) shall satisfy the criteria of the *International Building* Code but shall not have a fire resistance rating of less than 1-hour.

Recommendations, suggestions, or other ideas for improvement

Fire Losses in the United States During 2009 by the National Fire Protection Association, August 2010 shows that property loss due to structure fires in buildings other than one and two family dwellings was approximately 4.5 billion dollars. Increased fire resistance of building elements reduces the amount of damage to the building and its contents. This enhances sustainability by minimizing how much building materials will be required to restore the building and reduces the amount of materials entering landfills. Additional benefits are enhanced life safety, potentially less demand on community resources required for emergency response, and allowing facilities to be more readily adapted for re-use if there is a change of occupancy in the future.

Minimum building requirements whether through energy codes, plumbing codes, mechanical codes, zoning codes, or basic building codes, do not encourage truly sustainable buildings. The proposal is one of several that attempt to integrate the concepts of the *Whole Building Design Guide* (WBDG) into the minimum design and construction criteria for “green” buildings. The WBDG, developed in partnership between the National Institute of Building Sciences (NIBS) and the Sustainable Building Industries Council (SBIC), has as its key concepts: accessible, aesthetics, cost-effective, functional/operational, historic preservation, productive, secure/safe, and sustainable.

There are numerous references about the economic, societal, and environmental benefits that result when enhanced functional resilience is integrated into building design and construction. Six examples demonstrating the importance and supporting the concepts have been previously mentioned. See discussion on the following topics starting on page 14.

1. ***Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities***
2. ***Five Years Later – Are we better prepared?***
3. **National Weather Service Office of Climate, Water and Weather Services**
4. ***Global Climate Change Impacts in the United States***
5. ***Sustainable Stewardship - Historic preservation plays an essential role in fighting climate change ,***
6. **Opportunities for Integrating Disaster Mitigation and Energy Retrofit Programs**

Resources

PCA HPBRS http://www.cement.org/codes/pdf/HPBRS%20&%20Commentary%20v2.0.pdf
International Code Council *International Building Code*

MR PREREQUISITE: ENHANCED RESISTANCE TO EXTERIOR FIRE DAMAGE

Required

This prerequisite applies to:

- New Construction
- Core & Shell
- Schools
- Retail
- Data Centers
- Warehouses & Distribution Centers
- Hospitality

Intent

To reduce construction, renovation, and demolition waste; divert debris from disposal in landfills and incineration facilities; and reduce energy and resources expended to reconstruct, repair or replace materials in buildings damaged from fire events

Requirements

Building shall be designed so the exterior of buildings are less susceptible to exposure to fire by the following measures:

1. Exterior wall coverings of vinyl siding conforming to the requirements of the *International Building Code* and Exterior insulation_and finish systems (EIFS) conforming to the requirements of the *International Building Code* shall only be permitted to be installed on exterior walls of buildings with a minimum separation distance of 30 feet to other buildings or to property lines.
2. Combustible exterior wall coverings shall not be installed on exterior walls of buildings with a separation distance of 5 feet or less to other buildings or to property lines.
3. Limiting openings in the exterior walls in accordance with Table 1
4. Unclassified roof coverings shall not be permitted.

Table 1 Maximum Area of Exterior Wall Opening Based on Distance to Property Lines or Other Buildings and Degree of Opening Protection		
Distance to Property Lines or Other Buildings (feet)	**Degree of Opening Protection**	**Allowable Areas**
0 to less than 3	Unprotected (UP)	Not Permitted
	Protected (P)	Not Permitted
3 to less than 5	Unprotected (UP)	Not Permitted
	Protected (P)	15%
5 to less than 10	Unprotected (UP)	10%
	Protected (P)	25%
10 to less than 15	Unprotected (UP)	15%
	Protected (P)	45%
15 to less than 20	Unprotected (UP)	25%
	Protected (P)	75%
20 to less than 25	Unprotected (UP)	45%
	Protected (P)	No Limit
25 to less than 30	Unprotected (UP)	70%
	Protected (P)	No Limit
30 or greater	Unprotected (UP)	No Limit
	Protected (P)	Not Required
For SI: 1 foot = 304.8 mm UP = Unprotected openings in buildings P = Openings protected with an opening protective assembly in accordance with the ICC *International Building Code*		

Recommendations, suggestions, or other ideas for improvement

Enhanced property protection is a crucial component of green construction and thus requirements for enhanced performance of exterior walls and roofs above the minimum requirements in the International Building Code are necessary. Such requirements reduce the amount of energy and resources required for repair, removal, disposal and replacement of building components and contents damaged from fire. This proposal requires exterior walls to be more robust and limits openings when located in close proximity to other buildings.

Also strengthening roof coverings to resist the affect of fire reduces the amount of damage to the building and its contents. *Fire Losses in the United States During 2009* by the National Fire Protection Association, August 2010 shows that property loss due to structure fires in buildings other than one and two family dwellings was approximately 4.5 billion dollars.

Additional benefits are enhanced life safety, security and occupant comfort; potentially less demand on community resources required for emergency response; and allowing facilities to be more readily adapted for re-use if there is a change of occupancy in the future.

Minimum building requirements whether through energy codes, plumbing codes, mechanical codes, zoning codes, or basic building codes, do not encourage truly sustainable buildings. The proposal is one of several that attempt to integrate the concepts of the *Whole Building Design Guide* (WBDG) into the minimum design and construction criteria for "green" buildings. The WBDG, developed in partnership between the National Institute of Building Sciences (NIBS) and the Sustainable Building Industries Council (SBIC), has as its key concepts: accessible, aesthetics, cost-effective, functional/operational, historic preservation, productive, secure/safe, and sustainable.

There are numerous references about the economic, societal, and environmental benefits that result when enhanced functional resilience is integrated into building design and construction. Six examples demonstrating the importance and supporting the concepts have been previously mentioned. See discussion on the following topics starting on page 14.

1. ***Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities***
2. ***Five Years Later – Are we better prepared?***
3. **National Weather Service Office of Climate, Water and Weather Services**
4. ***Global Climate Change Impacts in the United States***

5. ***Sustainable Stewardship - Historic preservation plays an essential role in fighting climate change ,***
6. **Opportunities for Integrating Disaster Mitigation and Energy Retrofit Programs**

Resources

PCA HPBRS http://www.cement.org/codes/pdf/HPBRS%20&%20Commentary%20v2.0.pdf
International Building Code *International Building Code*

MR Prerequisite: Enhanced Resistance To Fire Damage – Automatic Sprinkler Systems

Required

This prerequisite applies to:

- New Construction
- Core & Shell
- Interior Design & Construction
- Schools
- Retail
- Data Centers
- Hospitality

Intent

To reduce construction, renovation, and demolition waste; divert debris from disposal in landfills and incineration facilities; and reduce energy and resources expended to reconstruct, repair or replace materials in buildings damaged from fire events.

Requirements

Buildings shall be provided with automatic sprinkler protection in accordance with the NFPA 13. Standpipe and fire alarm system features shall not be reduced or modified based on the presence of automatic sprinkler protection.

Recommendations, suggestions, or other ideas for improvement

Robustness of the building is enhanced by requiring most buildings to be provided with sprinkler protection. Sprinkler protection combined with established fire compartments can reduce damage to the building and its contents from a fire event which in turn enhances sustainability by minimizing how much building materials will be required to restore the building and reduces the amount of materials entering landfills. Appropriate levels of combined containment with automatic fire sprinkler systems minimize damage from fire, smoke, steam and water used for suppression and control, Further, the combination reduces that amount of toxic smoke that may be generated by some building materials and building contents when fires occur. Additional benefits are enhanced life safety, potentially less demand on community resources required for emergency response and allowing facilities to be more readily adapted for re-use if there is a change of occupancy in the future.

Additional benefits are enhanced life safety, security and occupant comfort; potentially less demand on community resources required for emergency response; and allowing facilities to be more readily adapted for re-use if there is a change of occupancy in the future.

Minimum building requirements whether through energy codes, plumbing codes, mechanical codes, zoning codes, or basic building codes, do not encourage truly sustainable buildings. The proposal is one of several that attempt to integrate the concepts of the *Whole Building Design Guide* (WBDG) into the minimum design and construction criteria for "green" buildings. The WBDG, developed in partnership between the National

Institute of Building Sciences (NIBS) and the Sustainable Building Industries Council (SBIC), has as its key concepts: accessible, aesthetics, cost-effective, functional/operational, historic preservation, productive, secure/safe, and sustainable.

There are numerous references about the economic, societal, and environmental benefits that result when enhanced functional resilience is integrated into building design and construction. Six examples demonstrating the importance and supporting the concepts have been previously mentioned. See discussion on the following topics starting on page 14.

1. ***Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities***
2. ***Five Years Later – Are we better prepared?***
3. **National Weather Service Office of Climate, Water and Weather Services**
4. ***Global Climate Change Impacts in the United States***
5. ***Sustainable Stewardship - Historic preservation plays an essential role in fighting climate change ,***
6. **Opportunities for Integrating Disaster Mitigation and Energy Retrofit Programs**

Resources

PCA HPBRS http://www.cement.org/codes/pdf/HPBRS%20&%20Commentary%20v2.0.pdf

International Code Council *International Building Code*

MR Prerequisite: Design for Enhanced Resistance to Wind Damage

Required

This prerequisite applies to:

- New Construction
- Core & Shell
- Schools
- Retail
- Data Centers
- Warehouses & Distribution Centers
- Hospitality

Intent

To assure enhanced life safety and to minimize property damage the minimum design wind loads are increased. The significant environmental impact that results is reduced energy and resources for repair, removal, disposal and replacement of materials damaged during high wind events.

Requirements

Wind loads shall be determined in accordance with ASCE 7 or the *International Building Code* (IBC). The design wind pressure, *p*, and design wind force, *F*, determined in accordance with ASCE 7 or IBC shall be based on a design wind speed equal to the basic wind speed (or locally adopted basic wind speed in special wind zones, if higher) plus 20-mph. Component and cladding loads shall be determined for the design wind speed defined assuming terrain Exposure C, regardless of the actual local exposure. Wind shall be assumed to come from any horizontal direction and wind pressures shall be assumed to act normal to the surface considered.

Recommendations, suggestions, or other ideas for improvement

The last significant hurricane season in the United States was in 2005. The American Society of Civil Engineers reported in *Normalized Hurricane Damage in the United States*, *1900 – 2005,* National Hazard Review, ASCE 2008, that property damage from hurricanes was 81 billion dollars in 2005. Increasing the stringency of the design criteria of buildings for wind hazards results in more robust buildings. The sustainability benefit from reduced damage minimizes how much building materials will be required to restore the building. A further benefit is a reduction in the amount of damaged building materials and content entering landfills.

Additional benefits are enhanced life safety, security and occupant comfort; potentially less demand on community resources required for emergency response; and allowing facilities to be more readily adapted for re-use if there is a change of occupancy in the future.

Above photographs are of Greensburg, KS (left) and after Hurricane Katrina (right)

Minimum building requirements whether through energy codes, plumbing codes, mechanical codes, zoning codes, or basic building codes, do not encourage truly sustainable buildings. The proposal is one of several that attempt to integrate the concepts of the *Whole Building Design Guide* (WBDG) into the minimum design and construction criteria for "green" buildings. The WBDG, developed in partnership between the National Institute of Building Sciences (NIBS) and the Sustainable Building Industries Council (SBIC), has as its key concepts: accessible, aesthetics, cost-effective, functional/operational, historic preservation, productive, secure/safe, and sustainable.

There are numerous references about the economic, societal, and environmental benefits that result when enhanced functional resilience is integrated into building design and construction. Six examples demonstrating the importance and supporting the concepts have been previously mentioned. See discussion on the following topics starting on page 14.

1. ***Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities***
2. ***Five Years Later – Are we better prepared?***
3. **National Weather Service Office of Climate, Water and Weather Services**
4. ***Global Climate Change Impacts in the United States***
5. ***Sustainable Stewardship - Historic preservation plays an essential role in fighting climate change ,***
6. **Opportunities for Integrating Disaster Mitigation and Energy Retrofit Programs**

Resources

PCA HPBRS http://www.cement.org/codes/pdf/HPBRS%20&%20Commentary%20v2.0.pdf

American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI) 7 *Minimum Design Loads for Buildings and Other Structures*

International Code Council (ICC) *International Building Code* (IBC)

MR Prerequisite: DESIGN OF EXTERIORS FOR ENHANCED WIND DAMAGE RESISTANCE

Required

This prerequisite applies to:

- New Construction
- Core & Shell
- Schools
- Retail
- Data Centers
- Warehouses & Distribution Centers
- Hospitality

Intent

To minimize property damage during high wind events. The significant environmental impact that results is reduced energy and resources for repair, removal, disposal and replacement of materials damaged during high wind events.

Requirements

Vinyl siding conforming to the requirements of the *International Building Code* (IBC) and exterior insulation and finish systems (EIFS) conforming to the requirements of the IBC shall only be permitted to be installed on exterior walls of buildings located outside hurricane-prone regions as defined in the IBC

Recommendations, suggestions, or other ideas for improvement

Enhanced property protection is a crucial component of green construction and thus requirements for enhanced performance of exterior walls above the minimum requirements in the IBC are necessary. Such requirements reduce the amount of energy and resources required for repair, removal, disposal and replacement of exterior wall coverings damaged from wind. Property damage from wind was reported to be almost 2 billion dollars in 2009 according to the National Weather Service. This proposal requires exterior wall coverings most susceptible to wind damage be limited to non-hurricane prone regions.

Minimum building requirements whether through energy codes, plumbing codes, mechanical codes, zoning codes, or basic building codes, do not encourage truly sustainable buildings. The proposal is one of several that attempt to integrate the concepts of the *Whole Building Design Guide* (WBDG) into the minimum design and construction criteria for "green" buildings. The WBDG, developed in partnership between the National Institute of Building Sciences (NIBS) and the Sustainable Building Industries Council (SBIC), has as its key concepts: accessible, aesthetics, cost-effective, functional/operational, historic preservation, productive, secure/safe, and sustainable.

There are numerous references about the economic, societal, and environmental benefits that result when enhanced functional resilience is integrated into building design and construction. Six examples demonstrating the importance and supporting the concepts have been previously mentioned. See discussion on the following topics starting on page 14.

1. ***Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities***
2. ***Five Years Later – Are we better prepared?***
3. **National Weather Service Office of Climate, Water and Weather Services**
4. ***Global Climate Change Impacts in the United States***
5. ***Sustainable Stewardship - Historic preservation plays an essential role in fighting climate change ,***
6. **Opportunities for Integrating Disaster Mitigation and Energy Retrofit Programs**

Resources

PCA HPBRS http://www.cement.org/codes/pdf/HPBRS%20&%20Commentary%20v2.0.pdf

International Code Council (ICC) *International Building Code* (IBC)

MR Prerequisite: Storm Shelters

Required

This prerequisite applies to:

- New Construction
- Core & Shell
- Interior Design and Construction
- Schools
- Retail
- Data Centers
- Warehouses & Distribution Centers
- Hospitality

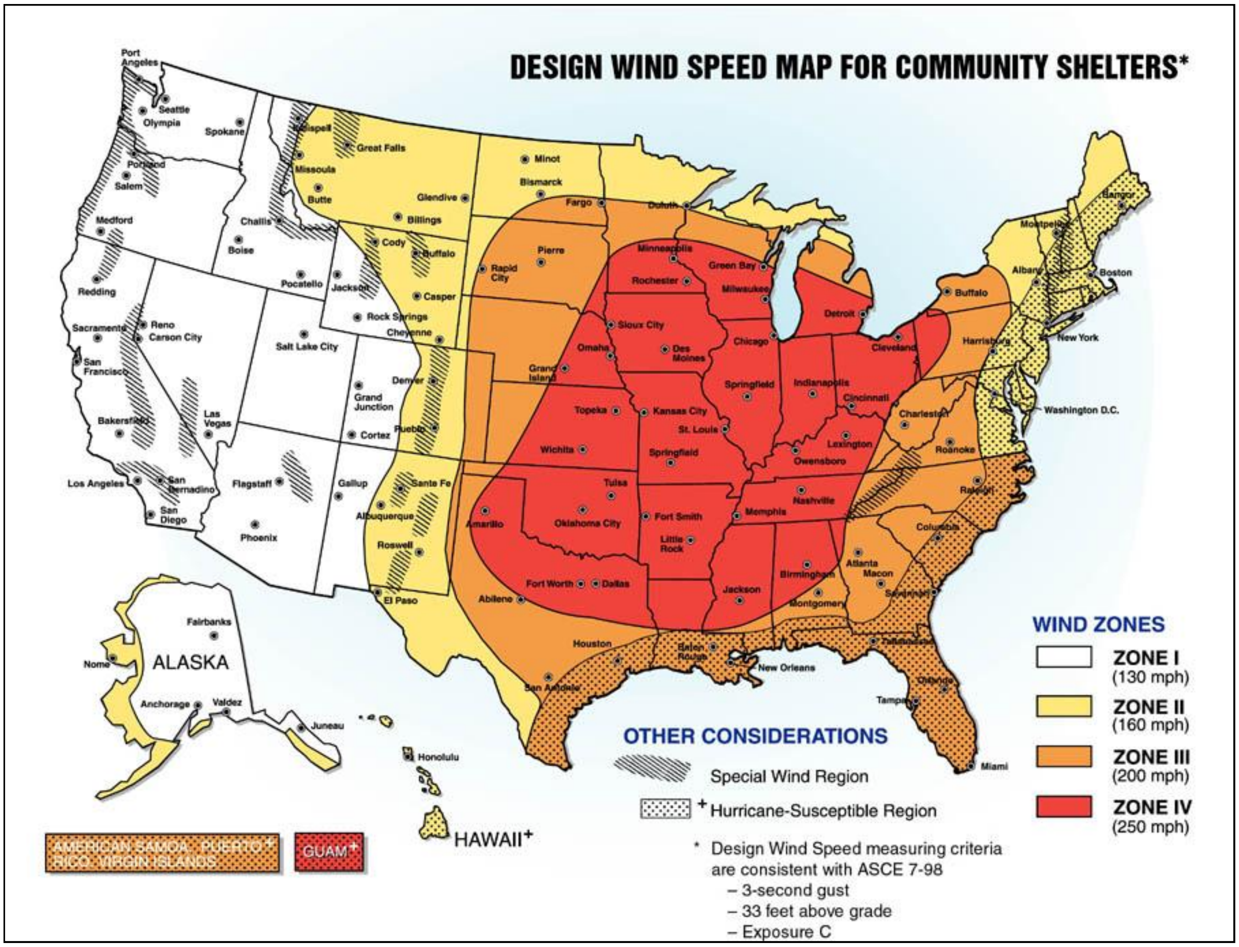
Intent

To require storm shelters for enhanced life safety of building occupants and permit more rapid recovery after disasters by minimizing injuries and preserving the human component of the community.

Requirements

Storm shelters complying with the requirements of ICC/NSSA 500 shall be provided for occupants of buildings according to the following:

1. **Hurricane-Prone Regions** – In hurricane-prone regions hurricane shelters shall be provided for occupants of buildings.
2. **Tornado-Prone Regions** – In areas where the shelter design wind speed for tornadoes is 160 mph or greater, tornado shelters shall be provided for occupants of buildings.
3. **Combined hurricane and tornado shelters –** Combined hurricane and tornado shelters shall comply with the more stringent requirements of ICC/NSSA-500 for both types of shelters.



Recommendations, suggestions, or other ideas for improvement

Incorporating storm shelters and community shelters into the design of buildings located in high wind regions enhances the living environment for the occupants. These shelters become havens for protecting people from injury or death due to structural collapse and windborne debris. Additional benefits are enhanced life safety, security and occupant comfort; potentially less demand on community resources required for emergency response and healthcare; and allowing facilities to be more readily adapted for re-use if there is a change of occupancy in the future.

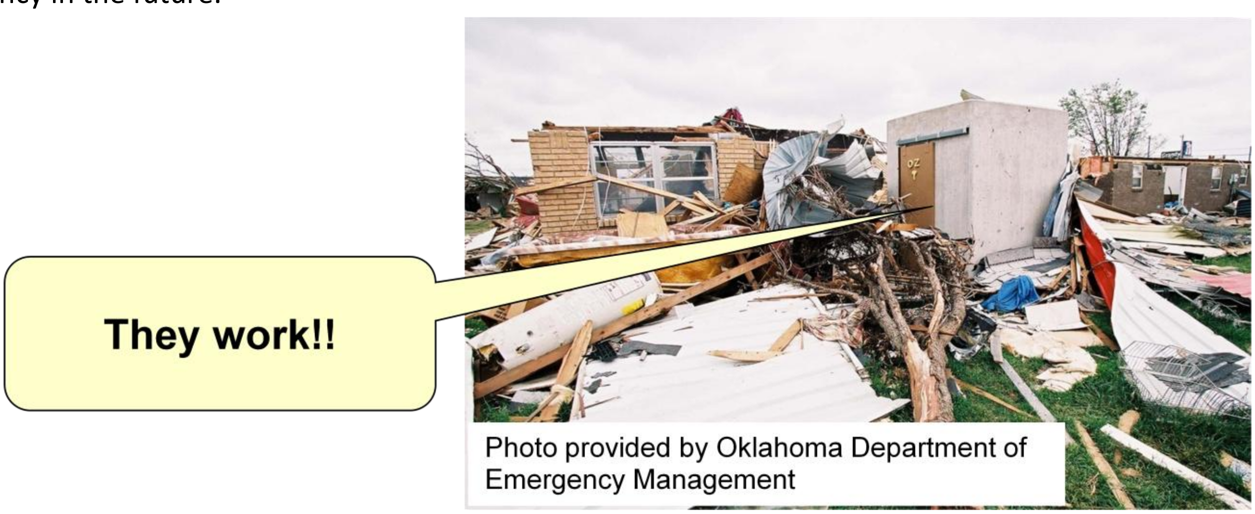


Photo provided by Oklahoma Department of Emergency Management

Minimum building requirements whether through energy codes, plumbing codes, mechanical codes, zoning codes, or basic building codes, do not encourage truly sustainable buildings. The proposal is one of several that attempt to integrate the concepts of the *Whole Building Design Guide* (WBDG) into the minimum design and construction criteria for “green” buildings. The WBDG, developed in partnership between the National Institute of Building Sciences (NIBS) and the Sustainable Building Industries Council (SBIC), has as its key concepts: accessible, aesthetics, cost-effective, functional/operational, historic preservation, productive, secure/safe, and sustainable.

There are numerous references about the economic, societal, and environmental benefits that result when enhanced functional resilience is integrated into building design and construction. Six examples demonstrating the importance and supporting the concepts have been previously mentioned. See discussion on the following topics starting on page 14.

1. ***Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities***
2. ***Five Years Later – Are we better prepared?***
3. **National Weather Service Office of Climate, Water and Weather Services**
4. ***Global Climate Change Impacts in the United States***
5. ***Sustainable Stewardship - Historic preservation plays an essential role in fighting climate change ,***
6. **Opportunities for Integrating Disaster Mitigation and Energy Retrofit Programs**

Resources

PCA HPBRS http://www.cement.org/codes/pdf/HPBRS%20&%20Commentary%20v2.0.pdf

International Code Council (ICC)/National Storm Shelter Association (NSSA) ICC/NSSA 500 *Standard on the Design and Construction of Storm Shelters*

MR PREREQUISITE: DESIGN OF EXTERIORS FOR ENHANCED HAIL DAMAGE RESISTANCE

Required

This prerequisite applies to:

- New Construction
- Core & Shell
- Schools
- Retail
- Data Centers
- Warehouses & Distribution Centers
- Hospitality

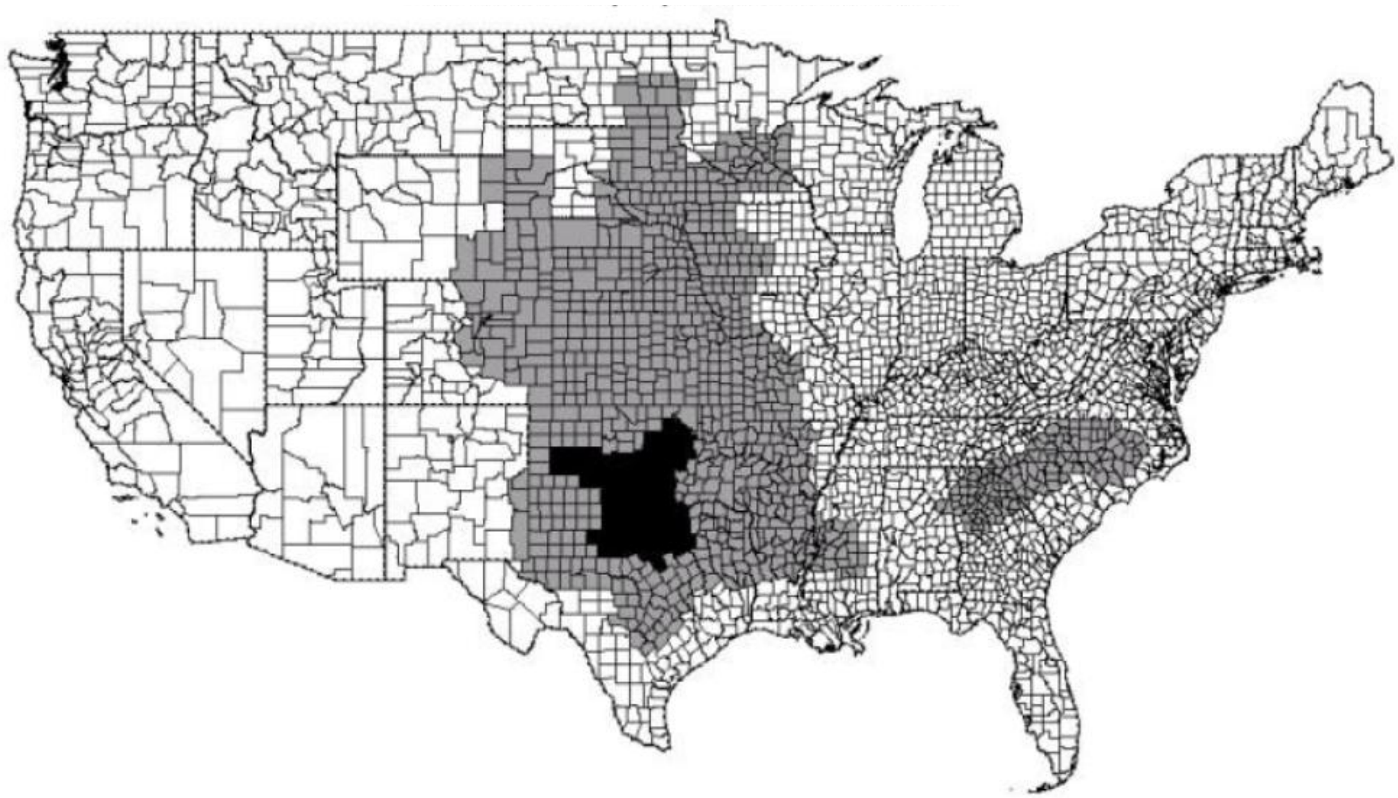
Intent

To minimize property damage during hail storms. The significant environmental impact that results is reduced energy and resources for repair, removal, disposal and replacement of materials damaged during high wind events.

Requirements

Vinyl siding conforming to the requirements of the *International Building Code* and exterior insulation and finish systems (EIFS) conforming to the requirements of the *International Building Code* shall only be permitted to be installed on exterior walls of buildings located outside moderate and severe hail exposure regions.

Roof coverings and exterior wall coverings of vinyl siding and EIFS used in regions where hail exposure is Moderate or Severe shall be tested, classified, and labeled in accordance with UL 2218 or FM 4473.



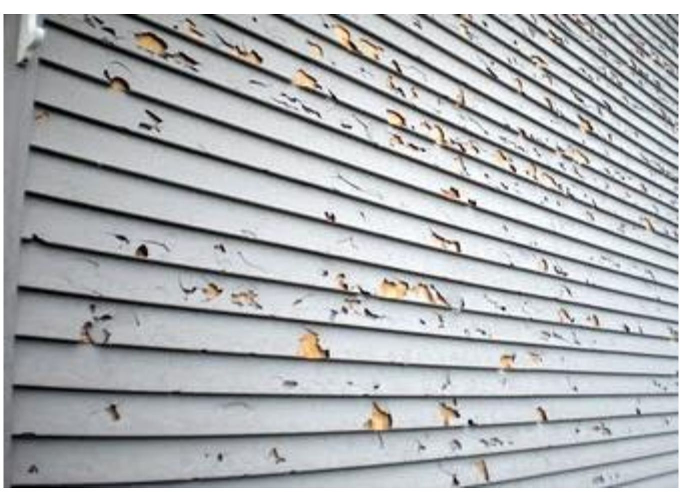
Moderate exposure - one or more days with hail diameter greater than 1.5 in. (38 mm) in a twenty (20) year period

Severe exposure - one or more days with hail diameter greater than 2.0 in. (50 mm) in a twenty (20) year period

Figure 1. Hail Exposure Map

Recommendations, suggestions, or other ideas for improvement

Enhanced property protection is a crucial component of green construction and thus requirements for enhanced performance of exterior walls above the minimum requirements in the IBC are necessary. Such requirements reduce the amount of energy and resources required for repair, removal, disposal and replacement of exterior wall coverings damaged from hail. Property damage from hail was reported to be approximately 1.3 billion dollars in 2009 according to the National Weather Service. This proposal requires exterior wall coverings most susceptible to damage from hail be tested, classified, and labeled in accordance with UL 2218 or FM 4473 to be more robust and limited in hail exposure areas.



Minimum building requirements whether through energy codes, plumbing codes, mechanical codes, zoning codes, or basic building codes, do not encourage truly sustainable buildings. The proposal is one of several that attempt to integrate the concepts of the *Whole Building Design Guide* (WBDG) into the minimum design and construction criteria for "green" buildings. The WBDG, developed in partnership between the National Institute of Building Sciences (NIBS) and the Sustainable Building Industries Council (SBIC), has as its key concepts: accessible, aesthetics, cost-effective, functional/operational, historic preservation, productive, secure/safe, and sustainable.

There are numerous references about the economic, societal, and environmental benefits that result when enhanced functional resilience is integrated into building design and construction. Six examples demonstrating the importance and supporting the concepts have been previously mentioned. See discussion on the following topics starting on page 14.

1. ***Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities***
2. ***Five Years Later – Are we better prepared?***
3. **National Weather Service Office of Climate, Water and Weather Services**
4. ***Global Climate Change Impacts in the United States***
5. ***Sustainable Stewardship - Historic preservation plays an essential role in fighting climate change ,***
6. **Opportunities for Integrating Disaster Mitigation and Energy Retrofit Programs**

Resources

PCA HPBRS http://www.cement.org/codes/pdf/HPBRS%20&%20Commentary%20v2.0.pdf

International Code Council (ICC) *International Building Code* (IBC)

Underwriters Laboratories (UL) UL 2218, *Impact Resistance of Prepared Roof Covering Materials. UL 2218, Impact Resistance of Prepared Roof Covering Materials*.

Factory Mutual (FM) FM 4473, *Specification Test Standard for Impact Resistance Testing of Rigid Roof Materials by Impacting With Freezer Ice Balls.*

MR Prerequisite: Design for Enhanced Resistance to Damage from Snow Loads

Required

This prerequisite applies to:

- New Construction
- Core & Shell
- Schools
- Retail
- Data Centers
- Warehouses & Distribution Centers
- Hospitality

Intent

To reduce construction, renovation, and demolition waste; divert debris from disposal in landfills and incineration facilities; and reduce energy and resources expended to reconstruct, repair or replace materials in buildings damaged from excessive snow loads

Requirements

The ground snowloads to be used in determining the design snow loads for roofs shall be equal to 1.2 times the ground snowloads determined in accordance with ASCE 7 or the *International Building Code*.

Recommendations, suggestions, or other ideas for improvement

The National Weather Service reports that U.S. property damage due to winter storms and ice exceeded 1.5 billion dollars in 2009. Increasing the stringency of the design criteria for snow hazards results in more robust buildings with less risk of damage to the building and its contents. Enhanced sustainability is achieved by minimizing the amount of both replacement materials required to restore the building and damaged materials entering landfills

Minimum building requirements whether through energy codes, plumbing codes, mechanical codes, zoning codes, or basic building codes, do not encourage truly sustainable buildings. The proposal is one of several that attempt to integrate the concepts of the *Whole Building Design Guide* (WBDG) into the minimum design and construction criteria for "green" buildings. The WBDG, developed in partnership between the National Institute of Building Sciences (NIBS) and the Sustainable Building Industries Council (SBIC), has as its key concepts: accessible, aesthetics, cost-effective, functional/operational, historic preservation, productive, secure/safe, and sustainable.

There are numerous references about the economic, societal, and environmental benefits that result when enhanced functional resilience is integrated into building design and construction. Six examples demonstrating the importance and supporting the concepts have been previously mentioned. See discussion on the following topics starting on page 14.

1. ***Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities***
2. ***Five Years Later – Are we better prepared?***

3. **National Weather Service Office of Climate, Water and Weather Services**
4. ***Global Climate Change Impacts in the United States***
5. ***Sustainable Stewardship - Historic preservation plays an essential role in fighting climate change ,***
6. **Opportunities for Integrating Disaster Mitigation and Energy Retrofit Programs**

Resources

PCA HPBRS http://www.cement.org/codes/pdf/HPBRS%20&%20Commentary%20v2.0.pdf
American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI) 7 *Minimum Design Loads for Buildings and Other Structures*
International Code Council (ICC) *International Building Code* (IBC)

MR Prerequisite: Design for Enhanced Resistance to Seismic Damage

Required

This prerequisite applies to:

- New Construction
- Core & Shell
- Schools
- Retail
- Data Centers
- Warehouses & Distribution Centers
- Hospitality

Intent

To reduce construction, renovation, and demolition waste; divert debris from disposal in landfills and incineration facilities; and reduce energy and resources expended to reconstruct, repair or replace materials in buildings damaged from seismic events

Requirements

Building in high seismic risk areas shall be designed by a registered design professional and the seismic load applied to the building design, determined in accordance with International Building Code, shall be increased by a factor of 1.2 when located where the 0.2 sec spectral response acceleration parameter is equal to or greater than 0.4g. In addition, for high seismic risk buildings a site specific geotechnical report complying with the provisions of ASCE 7 is required.

Recommendations, suggestions, or other ideas for improvement

Increasing the stringency of the design criteria of high performance buildings for earthquakes enhances a buildings ability to respond to a ground motion event. This results in more durable buildings which reduces damage to the building and its contents from seismic events which in turn enhances sustainability by minimizing how much building materials will be required to restore the building and reducing the amount of materials entering landfills. Additional benefits are enhanced life safety, potentially less demand on community resources required for emergency response and allowing facilities to be more readily adapted for re-use if there is a change of occupancy in the future.

This proposal is consistent with the criteria of the Fortified Buildings program of the Institute for Business and Home Safety (IBHS)

Minimum building requirements whether through energy codes, plumbing codes, mechanical codes, zoning codes, or basic building codes, do not encourage truly sustainable buildings. The proposal is one of several that attempt to integrate the concepts of the *Whole Building Design Guide* (WBDG) into the minimum design and construction criteria for "green" buildings. The WBDG, developed in partnership between the National Institute of Building Sciences (NIBS) and the Sustainable Building Industries Council (SBIC), has as its key concepts: accessible, aesthetics, cost-effective, functional/operational, historic preservation, productive, secure/safe, and sustainable.

There are numerous references about the economic, societal, and environmental benefits that result when enhanced functional resilience is integrated into building design and construction. Six examples demonstrating the importance and supporting the concepts have been previously mentioned. See discussion on the following topics starting on page 14.

1. ***Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities***
2. ***Five Years Later – Are we better prepared?***
3. **National Weather Service Office of Climate, Water and Weather Services**
4. ***Global Climate Change Impacts in the United States***
5. ***Sustainable Stewardship - Historic preservation plays an essential role in fighting climate change ,***
6. **Opportunities for Integrating Disaster Mitigation and Energy Retrofit Programs**

Resources

PCA HPBRS http://www.cement.org/codes/pdf/HPBRS%20&%20Commentary%20v2.0.pdf

American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI) 7 *Minimum Design Loads for Buildings and Other Structures*

International Code Council (ICC) *International Building Code* (IBC)

MR Prerequisite: Design for Enhanced Flood Damage Resistance

Required

This prerequisite applies to:

- New Construction
- Core & Shell
- Schools
- Retail
- Data Centers
- Warehouses & Distribution Centers
- Hospitality

Intent

To minimize the amount of building materials and contents that become contaminated by flood water and must be disposed in landfills and to minimize the amount of energy and resources required to repair, remove, dispose and replace flood damaged and contaminated materials. Flood resistant buildings place less demand for material and natural resources for individual and community disaster recovery. Further, flood-resistant construction is less likely to generate debris and contaminants that pollute the environment when floods occur.

Requirements

The design and construction of buildings in flood hazard areas including flood hazard areas subject to high velocity wave action shall be designed and constructed in accordance with ASCE 7 and ASCE 24 and the following:

1. Floors required by ASCE 24 to be built above the base elevations shall have the floor and their lowest horizontal supporting members not less than the higher of:
    a. Design flood elevation
    b. Base flood elevation plus 3 feet (1 m)
    c. Advisory base flood elevation plus 3 feet (1 m) or
    d. 500-year flood if known
2. Levees and flood walls shall not be considered as providing flood protection.

Recommendations, suggestions, or other ideas for improvement

Flood resistant construction minimizes the amount of building materials and contents that become contaminated by flood water and must be disposed in landfills and to minimize the amount of energy and resources required to repair, remove, dispose and replace flood damaged and contaminated materials. Flood resistant buildings place less demand for material and natural resources for individual and community disaster recovery. Further, flood-resistant construction is less likely to generate debris and contaminants that pollute the environment when floods occur.


Minimum building requirements whether through energy codes, plumbing codes, mechanical codes, zoning codes, or basic building codes, do not encourage truly sustainable buildings. The proposal is one of several that attempt to integrate the concepts of the *Whole Building Design Guide* (WBDG) into the minimum design and construction criteria for "green" buildings. The WBDG, developed in partnership between the National Institute of Building Sciences (NIBS) and the Sustainable Building Industries Council (SBIC), has as its key concepts: accessible, aesthetics, cost-effective, functional/operational, historic preservation, productive, secure/safe, and sustainable.

There are numerous references about the economic, societal, and environmental benefits that result when enhanced functional resilience is integrated into building design and construction. Six examples demonstrating the importance and supporting the concepts have been previously mentioned. See discussion on the following topics starting on page 14.

1. ***Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities***
2. ***Five Years Later – Are we better prepared?***
3. **National Weather Service Office of Climate, Water and Weather Services**
4. ***Global Climate Change Impacts in the United States***
5. ***Sustainable Stewardship - Historic preservation plays an essential role in fighting climate change ,***
6. **Opportunities for Integrating Disaster Mitigation and Energy Retrofit Programs**

Resources

PCA HPBRS http://www.cement.org/codes/pdf/HPBRS%20&%20Commentary%20v2.0.pdf

American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI) 7 *Minimum Design Loads for Buildings and Other Structures*

American Society of Civil Engineers (ASCE) ASCE 24 *Flood Resistant Design and Construction*

MR Prerequisite: Enhanced Resistance To Fire Damage – Wildfires

Required

This prerequisite applies to:

- New Construction
- Core & Shell
- Schools
- Retail
- Data Centers
- Warehouses & Distribution Centers
- Hospitality

Intent

To reduce construction, renovation, and demolition waste; divert debris from disposal in landfills and incineration facilities; and reduce energy and resources expended to reconstruct, repair or replace materials in buildings damaged from wildland fire events.

Requirements

The construction, alteration, movement, repair, maintenance and use of any building, structure or premises within the wildland interface areas shall follow the provisions of the *International Wildland-Urban Interface Code.* The design and construction of exterior walls shall be based on the fire hazard severity value determined for the site.

Recommendations, suggestions, or other ideas for improvement

When buildings are built in areas subject to wildfires they are at risk to damage that may occur. According to the National Weather Service the property damage from wildland fires was 110 million in 2009. To reduce the likelihood of damage, this proposal requires sites for buildings to be reviewed for characteristics of the surrounding environment to see if they may contribute to wildfires. If found, the building design will incorporate features to enhance the robustness of the building to reduce risk of fire damage and production of toxic emissions. In turn this enhances sustainability by minimizing how much building materials will be required to restore the building and reduce the amount of materials entering landfills. Additional benefits are enhanced life safety, security and occupant comfort and potentially less demand on community resources required for emergency response.

Minimum building requirements whether through energy codes, plumbing codes, mechanical codes, zoning codes, or basic building codes, do not encourage truly sustainable buildings. The proposal is one of several that attempt to integrate the concepts of the *Whole Building Design Guide* (WBDG) into the minimum design and construction criteria for "green" buildings. The WBDG, developed in partnership between the National Institute of Building Sciences (NIBS) and the Sustainable Building Industries Council (SBIC), has as its key concepts: accessible, aesthetics, cost-effective, functional/operational, historic preservation, productive, secure/safe, and sustainable.

There are numerous references about the economic, societal, and environmental benefits that result when enhanced functional resilience is integrated into building design and construction. Six examples demonstrating the importance and supporting the concepts have been previously mentioned. See discussion on the following topics starting on page 14.

1. ***Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities***
2. ***Five Years Later – Are we better prepared?***
3. **National Weather Service Office of Climate, Water and Weather Services**
4. ***Global Climate Change Impacts in the United States***
5. ***Sustainable Stewardship - Historic preservation plays an essential role in fighting climate change ,***
6. **Opportunities for Integrating Disaster Mitigation and Energy Retrofit Programs**

Resources

PCA HPBRS http://www.cement.org/codes/pdf/HPBRS%20&%20Commentary%20v2.0.pdf

International Code Council (ICC) *International Wildland-Urban Interface Code (*IWUIC)