Safe Rooms and Storm Shelters for Life-Safety Protection from Hurricanes

Purpose and Intended Audience

The purpose of this advisory is to identify the design guidance, code requirements, and other criteria for safe rooms that will provide protection during extreme-wind events such as hurricanes. The intended audience for this Recovery Advisory is anyone involved in the planning, policymaking, design, construction, or approval of safe rooms and storm shelters. This includes designers, emergency managers, public officials, policy- or decision-makers, building officials, and home- or building owners.

Key Issues

1. To provide life-safety protection for individuals during extreme-wind events, such as hurricanes, the design and construction of purpose-built structures or portions thereof (i.e. safe rooms or storm shelters) is needed to resist high wind speeds and wind-borne debris.
2. Few, if any, public safe rooms or storm shelters have been constructed in Puerto Rico. Interested stakeholders should consider funding and constructing safe rooms or storm shelters to provide life-safety protection via purpose-built spaces in new schools, police and fire stations, or other applicable public buildings (Figure 1).
3. Many existing buildings being used as hurricane evacuation shelters, best available refuge areas, post-event shelters, etc., were likely not designed to provide life-safety protection from hurricanes. Prior to using existing buildings to provide best available refuge areas during a hurricane, these buildings and structures should be evaluated by a registered design professional using guidance from FEMA P-361 and FEMA P-431 to identify the best available refuge area(s) to be used.

Figure 1. FEMA funding was used to construct this safe room at Picayune High School, Picayune, Mississippi. As part of the Mississippi Post-Katrina Safe Room Initiative, it was constructed with financial assistance from the FEMA Hazard Mitigation Grant Program (HMGP).

Safe Rooms and Storm Shelters

FEMA defines "safe rooms" as buildings or portions thereof that comply with the criteria described in *Safe Rooms for Tornadoes and Hurricanes: Guidance for Community and Residential Safe Rooms, 3rd Edition* (FEMA P-361, 2015a) for the purpose of providing near-absolute life-safety protection from extreme-wind events. The International Code Council (ICC) defines "storm shelters" as buildings or portions thereof that comply with the ICC and National Storm Shelter Association (NSSA) *ICC/NSSA Standard for the Design and Construction of Storm Shelters* (ICC 500, 2014). All safe room criteria in FEMA P-361 meet or exceed the storm shelter requirements of ICC 500.

This Recovery Advisory Addresses

- Safe Rooms and Storm Shelters
- Hurricane Evacuation Shelters and Post-Event Shelters used in Puerto Rico.
- Selecting Best Available Refuge Areas in Buildings.
- Design Professional Liability Concerns.
- Operational Considerations for Safe Rooms and Storm Shelters During Events.

Safe Rooms and Storm Shelters

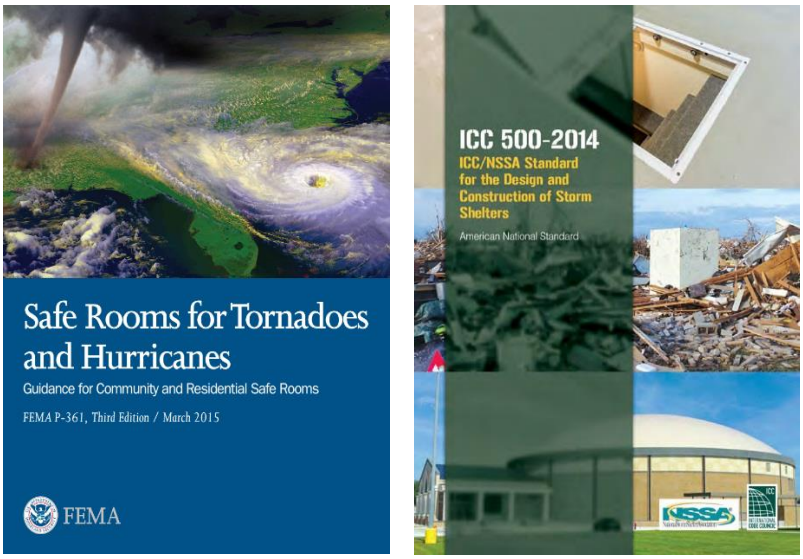

Figure 2. The technical design criteria for safe rooms (FEMA P-361) and storm shelters (ICC 500). Links are given in the references.

A safe room is a hardened structure designed to provide near-absolute life-safety protection for its occupants against both wind pressures and wind-borne debris impacts associated with tornadoes and hurricanes. Most safe rooms are planned with one purpose: protecting the occupants from hurricanes and tornadoes. This singular objective, however, should not divert the designers' and local decision-makers' attention from the all-too-real presence of other hazards. FEMA guidance and ICC criteria address wind and other hazards associated with hurricanes, such as storm surge, flooding, siting issues, progressive collapse hazards, laydown hazards, and fire. For this reason, designers and local officials should consider adopting a multi-hazard approach from the very beginning of their safe room planning process. To be designated a safe room a building, or portion thereof, must meet or exceed the criteria in FEMA P-361 as described in following sections.

Storm shelters are buildings or portions thereof that comply with the ICC 500 standard. All safe room criteria in FEMA P-361 meet the ICC 500 standard, but FEMA P-361 includes recommended guidance that is more conservative than that in ICC 500. These differences are outlined in a table at the beginning of each chapter in Part B of FEMA P-361, and summarized in Appendix D. For safe room projects built using FEMA Hazard Mitigation Assistance (HMA) grants, the recommendations in P-FEMA 361, Appendix D, become requirements. Safe rooms and storm shelters may provide different levels of protection, depending on the design criteria used. It is important to note that both safe rooms and storm shelters, unlike typical construction or other designated shelter spaces, have been designed and constructed to provide life-safety protection for the individuals who seek refuge inside these structures during extreme-wind events, such as hurricanes or tornadoes.

The level of protection provided by a safe room or storm shelter is a function of design wind speed (and resulting wind pressures) and wind-borne debris impact criteria. The FEMA safe room criteria and ICC 500 storm shelter standards are similar, with a few differences, such as siting with respect to flood hazards and the FEMA recommendation to use the 250-mile-per-hour (mph) design wind speed for all residential safe rooms, regardless of their location. FEMA P-361 references ICC 500 for much of the design and construction criteria of a safe room, but it also has additional guidance on conducting risk assessments, benefit-cost analyses for constructing safe rooms, and guidance on the operations and maintenance of safe rooms. Prescriptive safe room plans that comply with the criteria of FEMA P-361 and ICC 500 are available in *Taking Shelter from the Storm: Building a Safe Room for Your Home or Small Business* (FEMA P-320, 2015b). These plans are intended for residential safe room use but can be used for small community safe rooms if the community safe room requirements are also met.

Safe Rooms versus Typical Building Construction

Designing a facility to meet the siting and design parameters, including the design wind speed, wind pressures, and wind-borne debris impact resistance criteria of FEMA P-361 will provide a building that can provide near-absolute protection from extreme-wind events. By contrast, typical building construction complies with minimum building code requirements, which have much lower design parameters. Such buildings are not hardened or designed to protect occupants and provide life-safety protection from extreme-wind events such as hurricanes and tornadoes. Taking refuge in a building of typical construction during an extreme-wind event could result in injury or death.

International Building Code Requirements for Storm Shelters

The 2009 *International Building Code* (ICC IBC, 2009a) was the first consensus building code to have design and construction requirements for storm shelters. When a storm shelter is designed and constructed for the purposes of life-safety protection in any jurisdiction where the 2009 IBC (or later editions) is adopted, the code references the 2008 edition of ICC 500 for the design criteria that must be used for the storm shelter. Starting with the 2015 IBC, storm shelters are now required to be included as part of the construction of a subset of new buildings of typical construction; the storm shelters must meet given parameters in the code in tornado-prone areas where the storm shelter design wind speed is 250 mph[1]. Currently, there is no requirement for storm shelters to be included when constructing new buildings in hurricane-prone regions.

The *Puerto Rico Building Code (PRBC)*

The 2011 *PRBC* adopted the 2009 IBC, along with the 2009 *International Residential Code* (ICC IRC, 2009b), and maintained the language incorporating the ICC 500 Storm Shelter Standard to provide design and construction criteria for hurricane storm shelters. Therefore, should a municipality in Puerto Rico wish to permit the design and construction of a hurricane storm shelter to provide life-safety protection, the building, or portion thereof, identified for use as the shelter space would be required to comply with ICC 500.

States, territories, or local jurisdictions within the hurricane prone regions defined by the building code may consider implementing criteria that new building construction require a hurricane storm shelter for populations that cannot effectively evacuate from the path of a hurricane in a timely fashion. Puerto Rico, and other hurricane-prone island geographies, should consider evaluating the benefits of developing criteria and implementing them through local building code amendments, plans or other documents as needed for requiring the design and construction of safe rooms and storm shelters in select buildings based on their functions or occupancies (similar to the tornado requirement noted above). This would enable local governments to address the immediate, life-safety shelter needs of their residents in locations where it is not practical or possible for all or portions of their residents to evacuate prior to a land falling hurricane. Developing criteria, plans or enacting such local code amendments would help provide an opportunity to require purpose-built safe rooms or storm shelters to be included in new construction or other prudent projects for certain building types. Recently, the State of Florida amended their building code to require the incorporation of an ICC 500 storm shelter into the design and construction of all new K-12 schools. Given the inherent vulnerability of the island states and territories, providing immediate life-safety protection for a limited population that cannot effectively evacuate out of harm's way before an event is an option that safe rooms and shelters can potentially address in appropriate locations.

Structural Systems Criteria for Safe Rooms and Storm Shelters

Buildings are designed to withstand a certain wind speed (termed the "design wind speed") based on historic wind speeds documented for different geographic areas. The design wind speed determines the wind pressure the structure is designed to withstand. In Puerto Rico, the 2018 IBC is being considered for adoption in response to the recent hurricanes. The American Society of Civil Engineers *Minimum Design Loads and Associated Criteria for Buildings and Other Structures*, (ASCE 7-16, 2017) provides wind speed maps used for the design of buildings and other structures. The required design wind speed presented in ASCE 7-16 for most coastal areas ranges from 110 mph to 200 mph. This standard is referenced by the 2018 IBC, which is being considered for adoption in Puerto Rico in response to the recent hurricanes. It defines the design wind speeds for new buildings in Puerto Rico between 150 mph to 170 mph. The 2011 Puerto Rico Building Code wind maps require a design wind speed of 145 mph (based on a different mean recurrence interval) Previously adopted building codes and standards required even lower design wind speeds.

By contrast, design wind speeds for safe rooms and storm shelters in hurricane-prone regions in the 2018 IBC are 190 to 235 mph along the Atlantic Coast, 200 to 250 mph for the Gulf Coast, and 200 mph for Puerto Rico. Because wind pressures acting on buildings increase in proportion to the square of the design wind speed, structural systems of a safe room or storm shelter in many coastal areas are designed for wind pressures from two to three times higher than those used for typical building construction. Structures designed to these higher wind pressures provide much greater resistance to wind loads and are less likely to be damaged or collapse from wind forces experienced during hurricanes.

Besides having a higher design wind speed, a safe room or storm shelter must also be resistant to wind-borne debris and falling debris from laydown and collapse hazards. Flood, landslide, and seismic hazards must also be considered when

[1] All wind speeds referred to in this Recovery Advisory are 3-second gust wind speeds.

siting, designing, and constructing safe rooms and storm shelters. Consequently, the structural systems and envelope (building exterior) of a safe room or storm shelter, as well as the connections between the building elements, are very robust. Criteria related to these additional hazards are presented in the following sections.

Laydown, Collapse, and Rain Load Criteria for Safe Rooms and Storm Shelters

In addition to the loads from the wind pressures, the structural systems of the safe room or storm shelter must consider impacts and loads from heavy falling debris, collapsing structures, and long periods of rainfall. Storm shelters should be sited outside of the laydown or fall zone of large structures, such as tall chimneys; cell phone, light, and communication towers; and other tall slender structures. Laydown hazards from tall trees should also be considered.

To account for laydown hazards that cannot be avoided, or other debris that may fall onto the storm shelter (e.g. collapse of connected or nearby buildings), design professional are required to adequately address impact loads through increased roof live loads or other loads as needed.

Wind-Borne Debris Resistance Criteria for Safe Rooms

Wind-borne debris causes many of the injuries and much of the damage from hurricanes and tornadoes. In addition to resisting wind pressures, all exterior components of a safe room, including the roof, walls, glazing, doors, and impact-protective systems, should meet wind-borne debris impact criteria as listed in FEMA P-361, Chapter B8. For a hurricane safe room in the 235-mph wind speed zone, this would require passing missile impact testing using a 9-pound 2 in. x 4 in. board traveling at 118 mph for vertical surfaces and 24 mph for horizontal surfaces, respectively. In Puerto Rico, the design wind speed is slightly less at 200 mph, and therefore the missile test speeds are 100 mph and 20 mph for impacting vertical and horizontal test specimens, respectively. Table 1 presents the range of test missile speeds that a safe room would need to resist for different design wind speeds in a hurricane-prone region. The values applicable to Puerto Rico are circled in red. More information on the testing criteria and methods can be found in FEMA P-361, Chapter B8, and ICC 500, Chapter 8.

Glazing

ASCE 7-16 defines glazing as "glass or transparent or translucent plastic sheet used in windows, doors, skylights, or curtain walls."

If glazing is present on the exterior walls, roof, or building envelope of a hurricane safe room, it should be protected by an impact-protective system, such as storm shutter meeting the requirements of ICC 500, Section 306.4. Otherwise, the glazing system itself needs to be designed to resist the wind-borne debris impact and wind pressure tests cited in FEMA P-361 Chapter B8 and as prescribed in ICC 500 Chapter 8.

Table 1. Hurricane Safe Room Wind-borne Debris Impact Testing Criteria and Momentum at Impact. From FEMA P-361 and ICC 500.

Design Wind Speed (mph)	Debris Test Speed (mph)	Missile Specimen	Momentum at Impact (lbf-s)
235	118 (vertical surface) 24 (horizontal surface)	9 lb 2 in. x 4 in.	48 10
230	115 (vertical surface) 23 (horizontal surface)	9 lb 2 in. x 4 in.	47 9
220	110 (vertical surface) 22 (horizontal surface)	9 lb 2 in. x 4 in.	45 9
210	105 (vertical surface) 21 (horizontal surface)	9 lb 2 in. x 4 in.	43 9
200	100 (vertical surface) 20 (horizontal surface)	9 lb 2 in. x 4 in.	41 8
190	95 (vertical surface) 19 (horizontal surface)	9 lb 2 in. x 4 in.	39
180	90 (vertical surface) 18 (horizontal surface)	9 lb 2 in. x 4 in.	

Safe room design wind speed and wind-borne debris impact missile speed/size requirements for Puerto Rico in FEMA P-361 and ICC 500

Table Notes:
lbf-s – Pounds (force) seconds
Criteria for tornado safe rooms is provided in FEMA P-361 and ICC 500

Siting, Storm Surge, and Flood Hazard Criteria and Considerations for Safe Rooms

Hurricanes bring not only the threats and hazards associated with high winds, but also those related to landslides, storm surge, and flooding. Designing for these other hazards is as important as designing the safe room for high winds and wind-borne debris. The mountainous geography of Puerto Rico adds a unique aspect to the siting of safe rooms and storm shelters on the islands. Care must be taken to understand the risk of landslides, which are not uncommon during severe rain events such hurricanes and tropical cyclones. Designers and contractors should consider the potential hazards of slope instability and failure prior to designing, siting, and constructing safe rooms and storm shelters.

Storm surge and flooding should also be considered when designing and constructing safe rooms and storm shelters. Both FEMA P-361 and ICC 500 have design criteria to address flood hazards and risk; however, the criteria presented in FEMA P-361 are more restrictive than those set forth in ICC 500. Furthermore, if any HMA grant funding is used for the design and construction of a safe room or storm shelter, the more restrictive siting and elevation requirements presented in FEMA P-361 must be met in addition to the corresponding ICC 500 criteria.

HMA grants have specific flood hazard siting limitations as described in FEMA P-361, Section B4.2.2. Additionally, the planning and design of community safe rooms funded with HMA grants must be conducted according to the considerations outlined by *Floodplain Management and Protection of Wetlands*, Title 44 of the Code of Federal Regulations (CFR) Part 9 (1977). Refer to FEMA P-361, Section B4.2.2 for additional discussion on FEMA siting requirements. For rainfall, storm shelters must be designed to resist the loads associated with precipitation rates as set forth in ICC 500, Chapter 3, plus 6 inches, or the rainfall rate set forth in the 2011 *PRBC* plus 6 inches.

Hurricane Evacuation Shelters and Post-Event Shelters used in Puerto Rico

The Puerto Rico Department of Housing (DOH) manages and maintains the primary program for identifying and managing hurricane evacuation shelters across the Commonwealth. The program evaluates and tracks buildings and facilities to be used as “event-specific” shelters and post-event shelters. Assessments are conducted on a yearly basis by representatives from DOH, the Puerto Rico Department of Education (DOE), and the Puerto Rico Emergency Management Agency (PREMA).

When a storm threatens, DOH, DOE, and PREMA work together to confirm the designations of event-specific shelters and post-event facilities; municipalities then open and operate the facilities. After Hurricane Maria made landfall, 257 event-specific shelters were open and in operation across all 78 municipalities to provide available refuge during the storm to residents who evacuated their homes.

Selecting Best Available Refuge Areas in Buildings

It is not uncommon to find that there are many locations within hurricane-prone regions where community safe rooms or storm shelters designed to the FEMA criteria and ICC 500 are not available. Consequently, FEMA recommends that potential buildings be evaluated for use as a best available refuge area (BARA) prior to using any facility during a hurricane or other high wind event. Building owners who consider offering their building for use as a refuge area may also wish to consider adding a safe room or rooms. However, design, construction and installation of a safe room take time and funding to accomplish. Until a safe room can be installed, one available option is to identify the BARAs in select buildings of interest.

Best Available Refuge Area (BARA)

A BARA is an area in an existing building that has been deemed by a registered design professional as likely to protect building occupants during an extreme-wind event better than other areas in the building when a safe room is not available. The BARA should be regarded as only an interim measure until a safe room can be made available to building occupants.

FEMA developed the BARA concept and checklist for the first edition of FEMA P-361 to help assess a building’s susceptibility to damage from extreme-wind events such as tornadoes and hurricanes. The checklist evaluation process guides registered design professionals (i.e., architects and engineers) in identifying potential refuge areas at a site with one or more buildings.

During severe weather, building occupants should utilize the location in the building that is least susceptible to collapse or failure. It is important to note that these areas do not provide near-absolute life-safety protection like a safe room would. There are several approaches or methods that may be used to identify the BARA within an existing building.

FEMA recommends that licensed design professionals (i.e. engineers or architects) lead or are included in any team that is evaluating vulnerabilities of buildings to wind, flood, and seismic events. Due to their specialized knowledge; understanding of how building materials react to various hazard loads (wind, seismic, flood, etc.); and engineering expertise and judgement, these design professionals are the ones most qualified to evaluate the inherent vulnerabilities of existing buildings for use as shelters. Design professionals who evaluate buildings for use as BARAs should be familiar with FEMA P-361 and *Tornado Protection: Selecting Refuge Areas in Buildings* (FEMA P-431, 2009).

BARAs are usually interior locations with short-span roof systems and reinforced masonry walls having no glazed openings (windows), including in doors. An exception is if the glazing is rated for impact resistance or the glazed system is protected with rated opening protection devices.

Although it is not required, it is advantageous for licensed design professionals to be involved with helping to select BARAs due to their expertise and judgement, as detailed above. Post-disaster assessments throughout the U.S. have demonstrated that, when licensed design professionals were not involved, many identified BARAs were in gyms or auditoriums or were near exterior windows and doors that were overly vulnerable to high wind pressures or impacts from wind-borne debris.

Opportunities for Best Available Refuge Areas and Safe Rooms in Puerto Rico

The Government of Puerto Rico, the U.S. Department of Housing and Urban Development, and the U.S. Department of Education are evaluating a number of facility programs after the 2017 hurricane season. One of these programs is related to the inventory of school buildings across the Commonwealth. Understanding the effects that floods, hurricanes, and earthquakes can have on the public-school facilities can help guide decisions related to future building use. School districts can use these program evaluations and facility assessments to help determine what grant programs may be available to them. Grant-funded mitigation projects that reduce vulnerabilities and impacts to these facilities can enable them to reopen more quickly after major events.

If facility assessments are performed as part of the program, some schools, or portions thereof, might be identified as BARAs or might be evaluated for retrofitting to either strengthen those areas or to comply with either ICC 500 requirements for storm shelters or FEMA 361 criteria for safe rooms providing life-safety protection.

Design Professional Liability Concerns

Licensed design professionals may have concerns about evaluating and assessing a building for use as a BARA during a hurricane. There are many factors about the nature of hurricanes and tropical storms that cannot be controlled or accounted for. There are also the unknowns of evaluating existing buildings without access to "As-Built" construction documents and with evaluations limited to visual assessments. Accordingly, design professionals should consider adding the information and qualifiers below to their contracts or assessment reports to help minimize their liability.

- The identified area should be considered *only* as a BARA. It is not a storm shelter nor a safe room. Occupants can still be injured or killed. Building owners and operators desiring far less vulnerability to risk of injury or death should consider funding an ICC-500-compliant storm shelter for greatly improved protection or a FEMA-P-361-compliant safe room for "near-absolute protection."
- Any renovation, alteration, major repair, addition, or other key change to the building may make the existing refuge area no longer the best available. In this case, a re-evaluation of the building's BARA should be considered.
- The BARA evaluation or assessment report should include at least the following:
    - The criteria and methodology used
    - The level of assessment completed to identify the area
    - The total number of occupants the area can hold.
    - The approximate maximum wind speed capability of the area
    - When the area should be re-evaluated
    - An outline of modifications that could be made to the structure to improve its performance in high wind events, for example, strengthening of structural systems, strengthening of wall and roof systems, protection of the openings from wind-borne debris, etc.

Operational Considerations for Safe Rooms and Storm Shelters During Events

A final element of providing life-safety protection and shelter for residents during storms is the operation and maintenance of the facility. FEMA provides useful guidance for consideration in numerous important areas helping to design, develop, provide and implement effective safe room operations and maintenance efforts.

Safe Room Operations and Maintenance Plans

Owners of buildings with safe rooms built to FEMA 361 criteria should develop and implement operations and maintenance plans. These plans are required if HMA grants are utilized to fund them. The items listed below should be covered in an operations and maintenance plan to enable effective functioning of a community safe room. FEMA P-361 guidance was written specifically to assist with the operations and maintenance of safe rooms, which is not covered in ICC 500. In general, FEMA P-361, Part A, recommends including the following topic areas when developing an operations plan for a safe room:

- Safe room Operations and Management Plan Objectives and Parameters
- Staffing and Personnel Considerations
- Community Outreach and Notification
- Emergency Provisions
- Access and Entry
- Operations During an Event
- Post-Event Operations
- Maintenance

Each of these items is elaborated upon in FEMA P-361, Part A. A list of recommended emergency provisions the safe room should contain is provided in Section A4.4. Additionally, in FEMA P-320, Section 4.4 “Emergency Planning and Emergency Supply Kit” has useful information and should be considered by those planning or developing their operations and maintenance plans.

Providing Standby Power, Communications, Water and Sanitation

Design criteria for safe rooms and storm shelters include requirements for when backup or standby (emergency) power sources are to be provided at these facilities. Safe room and storm shelter design criteria also provide specific minimum criteria for communications, water, and sanitary systems.

BARA Operations and Maintenance Plans

For BARAs, there are no specific operations and maintenance requirements. However, many of the elements described for safe room operations and maintenance plans above should be considered for developing and implementing for best available refuge areas, when applicable or appropriate for use during a hurricane event.

References and Resources

HMA Guidance

When developing plans for hurricane community safe rooms, licensed design professionals should consider other hazard-specific constraints that may be governed by local emergency management or law enforcement requirements, mandatory evacuations, or other related emergency plans that affect the movement of at-risk populations. For some communities, when there is sufficient warning time, a large portion of the population may be expected to leave the area of anticipated immediate impact and seek shelter outside the at-risk area. However, some people, such as required first responders or those who are physically unable to leave the area might remain in harm’s way. For hurricane hazards, FEMA only considers providing HMA grant funding for safe room projects that are designed for vulnerable populations that cannot evacuate from harm’s way during a hurricane. To obtain the current FEMA guidance on safe rooms, contact your FEMA regional office, or review and download the latest HMA Unified Guidance below:

FEMA. “Hazard Mitigation Assistance.” www.fema.gov/hazard-mitigation-assistance.

References

FEMA. 2009. Tornado Protection: Selecting Refuge Areas in Buildings, 2nd Edition. FEMA P-431. http://www.fema.gov/media-library/assets/documents/2246.

FEMA. 2015a. *Safe Rooms for Tornadoes and Hurricanes: Guidance for Community and Residential Safe Rooms, 3rd Edition.* FEMA P-361. https://www.fema.gov/media-library/assets/documents/3140.

FEMA. 2015b. Taking Shelter from the Storm: Building a Safe Room for Your Home or Small Business, 4th Edition. FEMA P-320. https://www.fema.gov/media-library/assets/documents/2009.

International Code Council. 2009a. *International Building Code*. ICC IBC. https://codes.iccsafe.org/public/document/details/toc/745.

International Code Council. 2009b. *International Residential Code*. ICC IRC. https://codes.iccsafe.org/public/document/details/toc/754.

International Code Council. 2018a. *International Building Code*. ICC IBC. https://codes.iccsafe.org/public/document/IBC2018.

International Code Council. 2018c. *International Residential Code*. ICC IRC. https://codes.iccsafe.org/public/document/IRC2018.

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International Code Council and National Storm Shelter Association. 2008. *ICC/NSSA Standard for the Design and Construction of Storm Shelters.* ICC 500. http://shop.iccsafe.org/icc-500-2008-icc-nssa-standard-for-the-design-and-construction-of-storm-shelters-2.html.

Useful Links

For information on FEMA safe room guidance and programs, see the FEMA Safe Room Resources web page:

FEMA. "Example Operations and Maintenance Plans for Community Safe Rooms." https://www.fema.gov/example-operations-and-maintenance-plans-community-safe-rooms.

The following contact information may be of most assistance to municipalities and entities considering a safe room:

FEMA. 2015. *FEMA Safe Room Resources CD*. FEMA P-388. https://www.fema.gov/media-library/assets/documents/23315.

For additional information about the design and construction of safe rooms, contact the Safe Room Helpline:

FEMA Safe Room Helpline. saferoom@fema.dhs.gov. *Contact by phone at (866) 927-2104.*

FEMA. "FEMA Puerto Rico." https://www.facebook.com/FEMAPuertoRico. Note, this Facebook page was created for the Hurricanes Irma and Maria recovery process and is regularly updated with useful information.

For more information, see the FEMA Building Science Frequently Asked Questions Web site at https://www.fema.gov/frequently-asked-questions-building-science.

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