

Severe Storm Protection: Regulation Guidance for Local Governments



**Ordinance guidance
for local jurisdictions
considering severe storm
protection regulation**

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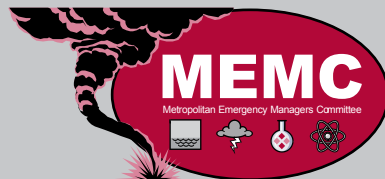


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from the Federal Emergency Management Agency.*

Acknowledgements

Hazard Mitigation Task Group

Over the course of 10 months, members of the Hazard Mitigation Task Group shared their expertise in the creation of this guidance document. Their guidance and feedback was invaluable. Task Group members included:

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Project Team

The Project Team included representatives from the Mid-America Regional Council (MARC), the Missouri State Emergency Management Agency (SEMA) and legal counsel.

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Introduction

Following high impact tornadic events, local governments are often asked to provide guidance and additional protection for their citizens. Increasingly, local jurisdictions are implementing policy to regulate the degree of severe storm protection that is mandatory in their communities.

With this trend growing in the region, the Mid-America Regional Council (MARC) and the Metropolitan Emergency Managers Committee (MEMC) set out to examine the multitude of considerations that must be made as local jurisdictions approach this issue.

Understanding that a number of disciplines could be potentially impacted by this type of regulation, MARC and the MEMC began with a thorough process of information collection. During the first phase of this process, surveys were conducted to gain an understanding of the current degree of regulation in the region. The results of those surveys are included in this report.

MARC invited numerous stakeholders from the community to participate in a Hazard Mitigation Task Group. This group compiled and reviewed the information and feedback included in this document. The members of the Hazard Mitigation Task Group came from diverse backgrounds and represented many of the disciplines impacted by this type of regulation.

Through work of the task group, we outlined many of the issues which local governments need to consider if they wish to regulate severe storm protection in their communities. These considerations are included in this report. There are strong cases to be made on both sides of the issue — public safety and economic viability — and costs and benefits must be weighed in each community.

Through this document, the Hazard Mitigation Task Group hopes to provide planning guidance and consistent language for local governments regulating the degree of severe storm protection in their jurisdictions.

I would like to personally thank the individuals who volunteered their time and expertise to serve on the Hazard Mitigation Task Group. It was a difficult task, but through dedication to this initiative we have produced a quality product of value to local communities.

Sincerely,



John Pinch
Chair, Hazard Mitigation Task Group
Deputy City Manager, Independence, Mo.

Threat Depiction

Tornadoes and Severe Winds

In 2004, the Mid-America Regional Council (MARC), working with the Metropolitan Emergency Managers Committee (MEMC), prepared a Regional Natural Hazard Mitigation Plan for the Missouri counties in the MARC region. This analysis concluded that the natural hazards most threatening to residents of this region are tornadoes and severe winds.

The National Weather Service defines tornadoes as violently rotating columns of air extending from a thunderstorm to the ground. Missouri's State Hazard Analysis describes a tornado as "a funnel shaped cloud that is 'anchored' to a cloud, usually a cumulonimbus, which is also in contact with the earth's surface."

Over the past 56 years, tornadoes have caused an average of one death and 7.8 injuries every 14.5 months in the Kansas City metropolitan area according to data collected by the National Oceanic and Atmospheric Administration (NOAA).

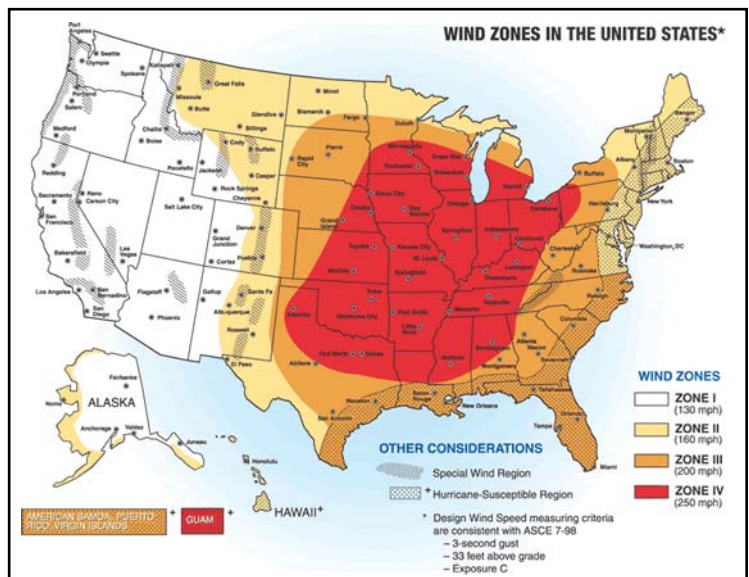
In *The Determinants of Tornado Casualties and the Benefits of Tornado Shelters*, authors Merrell, et al. found residents of motels, hotels, mobile home communities and single family dwellings without basements to be at the most significant risk from

these storms. These populations are at an even greater risk considering that most tornadic activity occurs between 3:00 and 9:00 p.m., a time of day when many people are likely to be at home.

The Federal Emergency Management Agency (FEMA) classifies the Kansas City metropolitan area in Wind Zone IV. This is the highest classification of wind zones, signifying the greatest threat. The damage associated with tornadoes is primarily caused by wind speed; in general, the greater the wind speed, the greater the potential damage a tornado can cause. Wind Zone IV indicates a threat of winds up to 250 miles per hour during a severe storm. *See Figure 1.*

In addition to strong winds, the Kansas City region tends to have violent storms on a more frequent basis than many other areas in the nation. FEMA ranks the region in its highest category for storm intensity per square mile. Missouri's State Hazard Analysis indicates that the average time of ground contact for a tornado in the region is 30 minutes, and the average distance covered by a tornado is 15 miles. *See Figure 2.*

Figure 1: Wind Zones



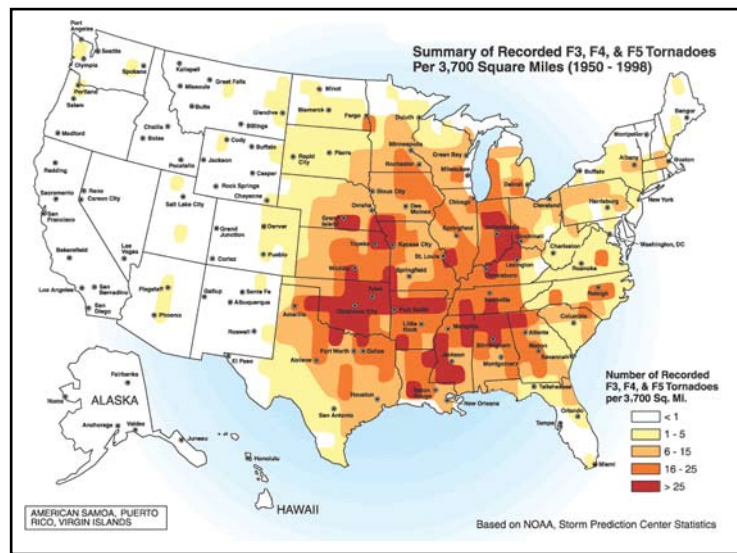
Source: FEMA Publication 361

From January 1950 through October 2006, the National Climactic Data Center has documented 191 tornadoes in the Kansas City metro area, listed by county in Table 1. These tornadoes have resulted in a total of 46 deaths and 363 injuries.

Tornadoes pose a significant threat to the region and warrant serious consideration in both planning and mitigation efforts.

For more information about tornado occurrence and magnitude in the Greater Kansas City region, see Attachment 1.

Figure 2: Tornado Activity



Source: FEMA Publication 361

Table 1: Events and Impact By County

County	Tornadic Events	Deaths	Injuries
Johnson County	27	0	12
Wyandotte County	10	2	47
Leavenworth County	28	2	27
Cass County	27	3	26
Clay County	25	0	30
Jackson County	30	37	183
Platte County	18	0	17
Ray County	26	2	21
TOTALS	191	46	363

Source: National Climactic Data Center

Occurrence

When are Tornadoes Most Likely to Happen?

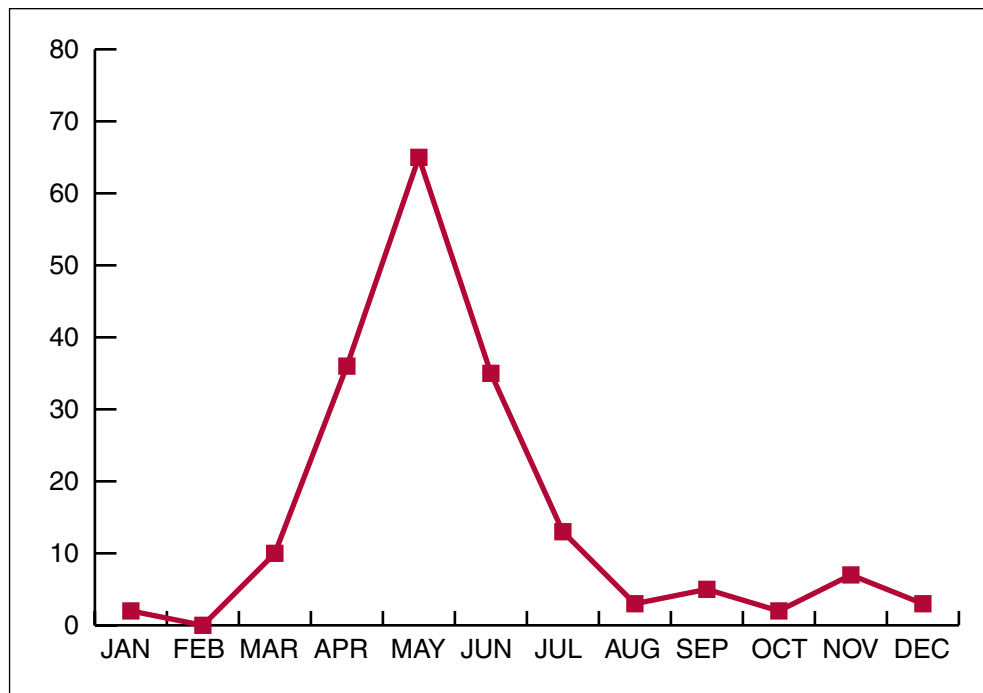
Tornadoes can occur at any time of the year, although the peak season for tornadoes in the Kansas City area is the spring and summer.

Figure 3, based on NOAA data, shows the number of tornadoes that occurred in each calendar month in the Greater Kansas City region, 1950–2006. As the graph illustrates, the period with the greatest probability of tornado activity extends approximately from late March through mid-June.

Weather conditions conducive to the formation of tornadoes often produce a variety of other dangerous storm-related weather conditions, such as severe thunderstorms, downbursts, straight line winds, lightning, hail and heavy rains.

For more information about tornado occurrence and magnitude in the Greater Kansas City region, see Attachment 1.

Figure 3: Number of Tornadoes in the Kansas City Region by Month, 1950–2006



Source: National Climactic Data Center

Research and Community Feedback

The Pros and Cons of Regulating Severe Storm Protection

The MARC region lies in a location which is prone to high impact tornadic activity. Even though the occurrence of these storms is common, the chance that any one person would be impacted by any one storm is relatively low. The Hazard Mitigation Task Group found this to be the one of the most difficult challenges in severe storm mitigation.

In *Risk Perception and the Value of Safe Rooms as a Protective Measure*, authors Kruse and Ozdemir found that “The probability that a damaging tornado will strike a given location is miniscule, even in ‘high’ tornado risk areas. However, the prospect of injury or loss of life from a tornado is frightening.” Tornadoes are considered low-probability, high-consequence events.

Tornadoes can vary widely in their intensity and the destruction they cause. The most powerful tornado is rated F5 on the Fujita scale. In an F5 tornado, wind speeds can reach 300 miles per hour, a force that few conventional structures could withstand.

The most famous F5 tornado to impact the Kansas City metro area was the Ruskin Heights Tornado in 1957. This tornado left a path of destruction 71 miles long, and resulted in 44 deaths and hundreds of injuries. Though rare, this is the type of hazard the region could face again in the future. As Bob Franke, of the Federal Emergency Management Agency, says, “Since we can’t predict where an F5 tornado will strike, everyone should prepare. An F5 is a hazard that can be expected in the metro area.”

Saferooms Offer Protection

One way to minimize the impact tornadoes might have on human life is to incorporate severe storm protection into the construction of dwelling units. This type of protection is commonly referred to as a saferoom. Incorporation of a saferoom into a structure can, in most cases, ensure the protection and safety of the individuals within.

“We know that lives can be saved under almost all conditions if there is at least one room properly encased and protected with concrete in a house.”

— Richard Monastersky, *Science News*

Not only does a saferoom offer physical protection, but it also offers peace of mind. According to Kruse and Ozdemir, “The safe room provides a haven that is consistent with human behavior because it is accessible from the home. People demonstrate a tendency to shelter inside their homes.”

A saferoom in the home greatly diminishes the feeling of vulnerability that humans experience in events such as tornadoes. Ernst W. Kiesling, Ph.D., executive director of the National Storm Shelter Association, said, “The peace of mind in knowing a safe place is available is the greatest advantage of having a storm shelter. Based on a study done several years ago, we would estimate that the number of person-hours spent annually under severe weather watches and warnings is above five billion (hours). Besides the anxiety, the loss in productivity and emotional trauma are significant.”

Because of the potential benefits — not only in protecting human life, but also in greatly lessening the emotional trauma associated with severe storms — many local jurisdictions have adopted or are considering regulations that govern the incorporation of saferooms into dwelling units. At present, the incorporation of saferooms into dwelling units is voluntary in most communities in metropolitan Kansas City. Throughout the region, however, there is an increasing trend for local governments to mandate these structures.

Current regulations focus on three facility types: single family dwellings without basements, multi-family dwellings and mobile home communities. A study done by the National Storm Prediction Center in 2000 found that 40.29 percent of the nation’s tornado fatalities between 1985 and 1999 occurred in mobile homes.

During the same time period, 28.50 percent (237 of 829) tornado deaths occurred in permanent homes.

Multiple studies support the incorporation of saferooms into these facility types as a means to protect the public from tornadic events. These studies indicate that saferooms would enhance the overall level of protection for residents and greatly reduce the impact these storms would have on human life.

“Residents of the motel and hotel industry, mobile home communities and single family dwellings without basements are at the most significant risk.”

— Merrell, Simmons and Sutter, *Taking Shelter: Estimating the Safety of Safe Rooms*

Weighing the Costs and Benefits

Though a strong case can be made for the incorporation of saferooms into dwelling units, the Hazard Mitigation Task Group noted significant concerns that jurisdictions should consider.

Because of the nature of tornadoes, it is very difficult to justify saferoom regulation by cost-benefit analysis. Consider, for example, a 2002 study of shelter associations in Oklahoma City, which took into account multiple variables to determine the costs and benefits of incorporating storm shelters community wide. “We estimate a cost per-fatality-avoided of about \$29 million for single-family homes and \$2.6 million for mobile homes. Many empirical studies have estimated the value of statistical life, and they typically produce values in the range of \$1-10 million, with an average of about \$5 million.”

Clearly, the costs are difficult to justify even in Oklahoma City, which has one of the highest tornado rates in the nation, higher than the Kansas City region. This study is one example of the challenging data presented by performing a cost-benefit analysis and the striking differences between facility types and value.

FEMA’s Bob Franke conducted an analysis for a residential shelter in Jackson County, Mo. “In this example, the shelter would save .03 lives and avoid .08 injuries over a 50-year period. Not exactly a strong endorsement for shelter construction. But this isn’t purely an economic decision.”

Determining the value of storm shelters in single family dwellings strictly by costs and benefits will not generally result in a positive value. The Task Group found this to be a significant area for consideration by local government.

Another issue which generated much discussion among Task Group members is whether insurance premiums would be reduced as a result of the inclusion of a storm shelter in a facility. According to Mel Scott of the Kansas Insurance Department, “We are not aware of any company that has submitted a rate filing giving any rate consideration to structures containing a ‘safe room.’ Property Insurance will not be impacted because one is not doing much to change the

outcome of destruction of the rest of the house or structure in the event of a tornado by making a small part of the home less prone to damage. The statistical data to support that a person carrying life insurance would be protected in such a room during a storm, and thus more likely to live longer, is probably too weak a link for an actuary to take in to account in formulating premiums for life insurance. For hotels, safe rooms are designed to protect against what is considered an ‘Act of God’ for which it is difficult to assert negligence or other claim against a property owner.” It seems the likelihood that a reduction in insurance premium would result from construction of a storm shelter is minimal given current understanding.

The costs associated with mandating this type of protection in dwelling units was another significant area of discussion. The inclusion of saferooms in dwelling units adds additional costs for the builder, which will then be passed to the consumer. “Right now, in Kansas City, 4,000 finished, unoccupied, new homes are on the market,” said Dave Holtwick with the Greater Kansas City Home Builders Association. “This additional cost is going to be a significant consideration for builders.”

Local Jurisdictions Should Consider Options Carefully

Given the multitude of concerns associated with regulating severe storm protection, it is important that local communities carefully weigh their options, considering both statistics and perceptions.

Statistics show that tornadoes are low-probability, high-impact events, and, as Merrell, et al. state, “People typically treat low-probability events as zero-probability events.”

But perceptions do make a difference, particularly in communities that have recently experienced a damaging tornado. In *Case for Enhanced In-Home Protection from Severe Winds*, authors Reinhold, et al. found that “Within the local communities surrounding disaster, the perception of risk, and in fact death-rate statistics, may well jump for a period of time. At these levels, people are inclined to spend money to reduce the risk.” And, as Kruse and Ozdemir note, “People respond to hazards they perceive, not the underlying probabilities of the hazards.”

With this document, the Hazard Mitigation Task Group hopes to provide information that will help each local jurisdiction make an informed decision about the regulation of severe storm protection.

Survey of Current Local Regulations

In order to assess the current status of severe storm shelter facilities in the region, MARC conducted a survey in 2006. The intent of this survey was to establish a better understanding of the region's current storm preparedness capabilities and identify existing public storm shelters. The survey was distributed in a phased approach. The initial phase was sent to eight county governments, 194 hotels and motels, and 80 mobile home communities in the region. In the second phase, surveys were sent to 114 local governments in the region.

Phase 1 Survey Results

In April 2006, the survey on storm shelter space and emergency notification procedures was to 282 recipients as follows:

- 191 hotel/motel operators in Missouri and three in Kansas
- 49 mobile home park operators in Missouri and 31 in Kansas
- Five county governments in Missouri and three in Kansas

Of the 282 surveys mailed, 17 were returned to sender and MARC was unable to reach the intended contact. Of the remaining 265 surveys, 23 (or 9 percent) were completed. These included four surveys completed by mobile home operators, 11 from the motel/hotel industry, and eight from local governments. The results of these surveys are shown below.

Local Governments

Kansas

- Johnson County, Kan., does not currently regulate severe storm protection in single-family homes, multi-family dwellings, mobile home parks, or motels or hotels. However, the county expressed interest in learning more about this topic.
- Leavenworth County, Kan., currently has a local ordinance requiring storm shelters in mobile home parks. This ordinance requires a minimum of 10 square feet per resident.
- Wyandotte County, Kan., currently has a local ordinance requiring storm protection in all residential structures. In addition, the county requires severe storm protection in all facilities intended to house individuals over the age of 55.

Missouri

- Cass County, Mo., does not currently have any regulation on severe storm protection in single-family homes, multi-family dwellings, mobile home parks, or motels or hotels. However, the county is considering such initiatives and expressed interest in learning more.
- Clay County, Mo., currently regulates severe storm protection for single-family dwellings, but does not have any such regulations in place for multi-family dwellings, mobile home parks, or motels or hotels. The county is interested in learning more about this topic.

- Jackson County, Mo., currently has a local ordinance requiring storm shelters in mobile home parks.
- Platte County, Mo., does not currently have any regulation on severe storm protection in single-family homes, multi-family dwellings, mobile home parks, or motels or hotels. However, the county is considering such initiatives and expressed interest in learning more.
- Ray County, Mo., does not currently have any regulation on severe storm protection in single-family homes, multi-family dwellings, mobile home parks, or motels or hotels. However, the county is considering such initiatives and expressed interest in learning more.

Motel/ Hotel Industry

Responses from the motel-hotel industry comprised 45 percent of the surveys received. The results of these surveys are compiled below.

- On average each facility surveyed has 109 rooms.
- Each facility surveyed had approximately nine staff persons working at any given time.
- 60 percent offer an advanced storm warning system to their guests.
- 70 percent offer shelters to their guests to protect them from inclement weather.
- None of the facilities that responded have worked with or spoken to local emergency management staff about severe storm preparedness.
- 78 percent indicated they would like to learn more about protecting their guests during severe weather.

Motel/ Hotel Shelters

Of those respondents that indicated they offer storm shelters for their guests:

- The average shelter size was 774 square feet.
- The average size per resident was 46 square feet.
- 71 percent of these shelters are located within the facility.
- Only 10 percent of the respondents understood and applied FEMA guidelines to their shelters.
- All of these facilities offered emergency lighting.
- None of these facilities offered appropriate signage to designate the shelter area.
- 66 percent made efforts to ensure that their employees and guests were familiar with the shelter space.
- All of the facilities regularly inspected their shelters to ensure readiness for operation.

Mobile Home Communities

Response from the mobile home community comprised 18 percent of the surveys returned. The results of these surveys are listed below.

- On average each mobile home facility surveyed was filled to 91 percent of total capacity.

- All of the facilities that responded offer access to shelters.
- 75 percent offer a severe storm warning system.
- 75 percent offer sheltering facilities which comply with current FEMA regulation.
- 25 percent of the facilities surveyed work with local emergency managers on preparedness.

Mobile Home Shelters

- 75 percent of the facilities surveyed provide emergency lighting.
- 50 percent indicated the shelter is designated by appropriate signage.
- 25 percent conduct regular drills with the shelter facility.
- All of the facilities surveyed regularly inspect their shelters for operational readiness.

Phase 2

In Phase 2 of the survey, city governments in the MARC region were surveyed about their current levels of severe storm protection. Local governments returned 32 percent of the surveys distributed. Figure 3 below illustrates local jurisdictions’ combined responses. Table 2 on the following page provides details by jurisdiction.

Figure 3: Local Government Regulation of Severe Weather Protection

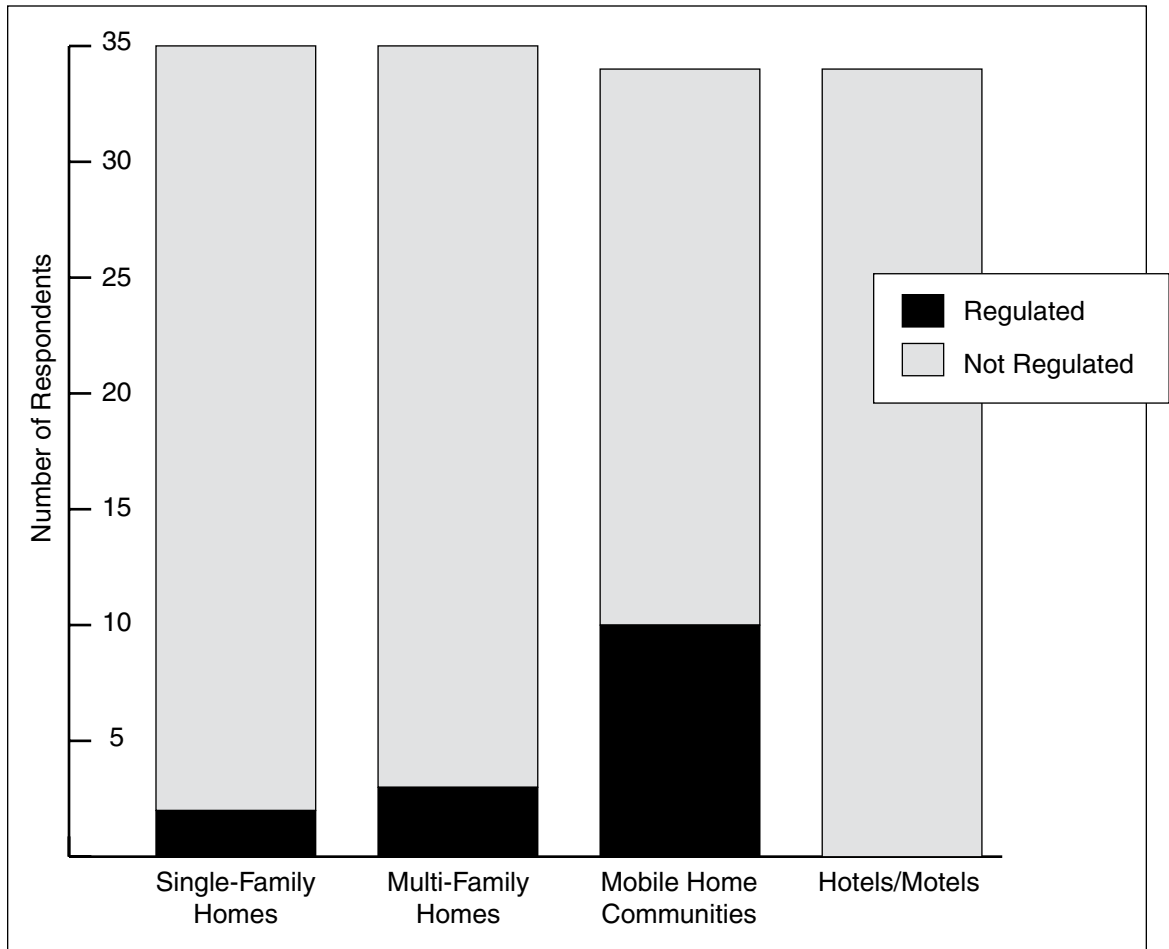


Table 2: Local Governments Regulation of Severe Weather Protection

City	Single Family Homes	Multi-Family Homes	Mobile Home Communities	Hotels/Motels
Archie, Mo.	No	No	No	No
Belton, Mo.	Yes	Yes	Yes	No
Bonner Springs, Kan.	No	No	Yes	No
Camden Point, Mo.	No	No	No	No
Cleveland, Mo.	No	No	No	No
Creighton, Mo.	No	No	No	No
East Lynne, Mo.	No	No	No	No
Elmira, Mo.	No	No	No	No
Fairway, Kan.	No	No	No	No
Harrisonville, Mo.	No	No	Yes	No
Henrietta, Mo.	No	No	No	No
Holt, Mo.	-	-	-	-
Lake Waukomis	No	No	No	No
Lake Winnebago, Mo.	No	No	No	No
Lansing, Kan.	No	No	Yes	No
Leavenworth, Kan.	No	No	No	No
Lee's Summit, Mo.	No	No	No	No
Linwood, Kan.	No	No	No	No
Merriam, Kan.	No	No	No	No
Mission, Kan.	No	No	No	No
Oak Grove, Mo.	No	No	-	No
Oakwood, Mo.	No	No	No	No
Olathe, Kan.	No	No	Yes	No
Peculiar, Mo.	No	No	No	No
Pleasant Hill, Mo.	Yes	Yes	Yes	No
Prairie Village, Kan.	No	No	No	No
Raymore, Mo.	No	No	Yes	No
Raytown, Mo.	No	No	Yes	No
Rayville, Mo.	No	No	No	No
Richmond, Mo.	No	Yes	Yes	No
Roeland Park, Kan.	No	No	No	No
Smithville, Mo.	No	No	No	No
Spring Hill, Kan.	No	No	Yes	-
Strasburg, Mo.	No	No	No	No
Tonganoxie, Kan.	No	No	No	No
Westwood, Kan.	No	No	No	No

Memorandum from Legal Counsel

February 26, 2007

We would like to express our gratitude to MARC, the Metropolitan Emergency Managers Committee (MEMC) and to all of the individuals and industry representatives that provided valuable input on the Model Ordinance component of the severe storm protection project.

In August of last year, MARC in conjunction with the MEMC began work on a project under a federal grant to enhance safety of persons during severe storm events. In the Midwest, the most likely form of severe weather to have devastating, and perhaps catastrophic, effects, is the tornado. Tornadoes have affected the Midwest and the Kansas City metropolitan area on a number of occasions, resulting in loss of life and enormous physical damage to structures and property. One of the tasks under this initiative was to draft a model regulation that could speak to the protection of persons from these storms, through a directive that certain new construction be equipped with or accommodated by shelter facilities that are accessible in the event of severe weather.

I. SUBSTANCE OF THE MODEL ORDINANCE

The focus of the Model Ordinance is the implementation of storm shelters, sometimes also referred to as safe rooms (“Safe Rooms”), into new construction intended for habitable use. Thus, the intent of the Model Ordinance is to provide guidance on when Safe Rooms should be incorporated into the construction of new homes, condominiums, apartments, hotels, motels, etc. The Model Ordinance is not intended to cover commercial structures.

During the drafting process, it was determined that attempting to incorporate technical standards into the Model Ordinance might lead to confusion with other locally adopted codes. In December of 2006, a focus group meeting was held with area code officials to determine how the document might be harmonized with local building codes, with Federal Emergency Management Agency (“FEMA”) guidance documents regarding Safe Rooms, and with a proposed International Code Council (ICC) standard that is in draft form relating to Safe Rooms. The determination was made that the focus of the Model Ordinance should be on when and to which structures to apply the Model Ordinance, rather than attempting to implement technical standards for precisely how a Safe Room should be constructed.

The documents that are suggested for incorporation by reference into the Model Ordinance are FEMA publication 320, Taking Shelter from the Storm: Building a Safe Room Inside Your House; FEMA publication 361, Design and Construction Guidance for Community Shelters; and ICC-500, International Code Council & National Storm Shelter Association Standard on the Design and Construction of Storm Shelters (Public Comment Draft October 2006).

When we initially began drafting the Model Ordinance, we envisioned a single, stand-alone ordinance that could be easily adopted by a MARC member community after the community made the decision that regulations should be implemented to address the protection of life from severe weather during the construction of new habitable structures. However, during the thoughtful process that was used in developing the Model Ordinance, it became clear that a single, stand alone document without alternatives as to a number of issues would not properly serve MARC’s member communities, as it would not adequately address all of the issues that

were raised by focus groups and members of The Hazard Mitigation Task Group (each group's input is discussed in further detail below) during the drafting of the Model Ordinance. What we arrived at in finalizing the Model Ordinance is a product that is representative of the issues that were raised and addressed by three (3) different focus groups, and several meetings of the Hazard Mitigation Task Group.

The Model Ordinance contains a series of provisions, many of which are interchangeable, that collectively form a complete, adoptable document once an appropriate provision in a given section or subdivision is selected and the remaining provisions on the same matter are removed. The alternative provisions are provided to alert MARC member communities to various issues that were raised during the Model Ordinance drafting process and that will need to be individually considered by a local government. Examples of variable Model Ordinance provisions include alternative definitions, alternative triggering mechanisms relating to when to apply the Model Ordinance, and various performance and other standards.

II. STAKEHOLDER PARTICIPATION AND COMMENT

From the outset, MARC working with the MEMC placed strong emphasis on community input from "stakeholders," meaning the people who will be affected by the adoption of an ordinance regulating Safe Rooms by a local government. Prior to any efforts at drafting the Model Ordinance, and at the direction of MARC, two (2) focus group meetings were held to gain input from stakeholders regarding the benefits and costs of implementation of an ordinance that requires Safe Rooms, or other alternative forms of protection for the type of new construction addressed above.

A number of stakeholders were invited to participate in the focus groups, including representatives from the motel and hotel industry, the apartment complex industry, the manufactured housing industry, the residential real estate sales industry, the insurance industry, and the Home Builders Association of Greater Kansas City. Later, as mentioned above, a third focus group meeting was conducted with code officials for additional input regarding implementation of a regulation based upon the Model Ordinance in harmony with other adopted codes.

While all of the representative stakeholders that were invited to participate did not do so, many representatives did, and through this process a significant number of opinions regarding the proposed Model Ordinance were heard. In total, more than a dozen individuals from a variety of stakeholder groups provided input on the Model Ordinance.

MARC also created the Hazard Mitigation Task Group, which consists of representatives from the stakeholder groups and various government entities to oversee the code drafting and other portions of the MARC severe storm protection project. This group did not consist solely of local government officials, but also various other representatives of the community. The Hazard Mitigation Task Group reviewed each of three (3) drafts of the Model Ordinance before the final product was completed.

The comments and alternative provisions embedded in the Model Ordinance are intended to address the opinions of the stakeholders and various representatives of the Hazard Mitigation Task Group. Through the process, many suggestions were made regarding the substance and need for the Model Ordinance. Some stakeholders and members of the Hazard Mitigation Task Group emphasized the strong public policy of taking action to alleviate the known danger of tornadoes in the Kansas City metropolitan and outlying areas, relying on specific examples of recent situations in which inadequate storm protection resulted in the loss of life. An additional argument is that,

if performed thoughtfully, the cost of incorporating Safe Rooms into new construction is not excessive. Last, as to certain classifications of persons who do not own the habitable structures in which they reside, accommodations should be made for tenants and temporary residents to be informed by the persons who do own those structures.

Other stakeholders and members of the Hazard Mitigation Task Group expressed that the benefits of implementation of a regulation based upon the Model Ordinance 1) do not outweigh the costs to developers and property owners, and 2) could distress the residential construction industry. Some of these representatives expressed that if a person wishes to implement a Safe Room into new construction, the FEMA and ICC guidance documents referenced above provide the technical guidance on how to construct the Safe Room, and suggest that these Safe Rooms are therefore available on the market right now in the absence of regulations mandating the same.

Ultimately, these arguments will need to be weighed by each legislative local government body, and the decision to adopt a regulation based upon the Model Ordinance will need to be made by a given community based upon a number of factors specific to that community.

The Model Ordinance is by no means the sole component to safety from severe weather events. Also extremely important is public education regarding how persons can maximize their safety, whether that person is at home or somewhere else. Communities are encouraged to present, and MARC along with the MEMC is an advocate of, greater public awareness of safety measures that can be taken to prevent the occurrence of injury and loss of life during severe storms.

Again, the Model Ordinance project has been a pleasure to work on. The issue of severe storm protection merits serious consideration by all of MARC's member communities.

Best regards,

Stephen P. Chinn
STINSON MORRISON HECKER LLP

Model Ordinance and Guidance

Model Ordinance with Alternative Provisions

ORDINANCE NO. _____

AN ORDINANCE AMENDING CHAPTER XX OF THE CITY OF

_____ CODE OF ORDINANCES BY IMPLEMENTING NEW ARTICLE X ENTITLED SEVERE STORM PROTECTION AND ADDING NEW PROVISIONS RELATING TO CONSTRUCTION OF SAFE ROOMS IN CERTAIN NEW CONSTRUCTION WITHIN THE CITY

WHEREAS, the City of _____ (“City”) is located in the Midwestern region of the United States; and

WHEREAS, the City desires to protect its residents to the greatest extent possible with up-to-date codes responsive to known threats of danger; and

WHEREAS, responsiveness to these known threats is a life safety issue and is imperative to the health, safety and welfare of the City; and

WHEREAS, among the potential weather events that might be experienced by the City due to its geographic location in the United States are tornadoes; and

WHEREAS, tornadoes move across a broad area and frequently damage real property, and have resulted in injuries and death; and

WHEREAS, the destructive capacity of tornadoes is categorized by the Fujita scale from F0 to F5, with an F0 causing the least amount of damage based upon its destructive force and an F5 causing the greatest amount of damage based upon its destructive force; and

WHEREAS, according to the Federal Emergency Management Agency, the Kansas City Metropolitan Area is in a region that has experienced among the highest number of recorded F3, F4 and F5 tornadoes in the United States between 1950 and 1998, with greater than

Guidance

The ordinance title is designed for codification in the appropriate location in the local government code of ordinances. Insert the city’s name and the correct chapter and article numbers where indicated.

The “Whereas” clauses consist of a series of general statements that lend legislative support to the enactment of the Mid-America Regional Council (“MARC”) Severe Storm Protection Model Ordinance (hereinafter “Model Ordinance”) by local governments. These clauses may be read in conjunction with the “Purpose” statement of the Model Ordinance (Section X.1) and the authority of local government to regulate land use and construction for the general health, safety and welfare of the community through legislative action. Legislative action of local governments is ordinarily entitled to a presumption of validity.

25 of these tornadoes within that time occurring in the 3,700 square miles for which Kansas City is a statistical part; and

WHEREAS, according to the Federal Emergency Management Agency, the Kansas City Metropolitan Area is in wind Zone IV, which zone is capable of generating wind speeds in excess of 250 miles per hour; and

WHEREAS, the Federal Emergency Management Agency places the Kansas City Metropolitan Area in a “High risk” zone for severe damage as a result of tornadoes; and

WHEREAS, local building codes consider minimum, “code approved” design wind loads; and

WHEREAS, a “design” wind load is not equivalent to the winds caused by tornadoes, and a residential structure built to code does not mean that the structure can withstand wind from any event, certainly from a high risk wind zone; and

WHEREAS, high winds can additionally cause debris to become airborne and become an airborne missile capable of penetrating structures otherwise undamaged by high winds; and

WHEREAS, testing has been conducted to determine that certain combinations of materials and construction can be utilized in new construction of habitable structures to create cost effective safe rooms that will save lives in instances where those habitable structures are situated in path of destructive tornadoes; and

WHEREAS, it is not necessary that the entirety of the habitable structure be fortified in the interest of protecting against the loss of life as a result of tornadoes; and

WHEREAS, the addition of a safe room in to habitable structures is an improvement that may potentially add value to New Construction; and

WHEREAS, some habitable structures are not amenable to the incorporation of a safe room within the structure and therefore safe rooms should be provided adjacent to or in easily accessible proximity to the structures they serve to provide safety to the inhabitants of these structures.

BE IT ORDAINED BY THE GOVERNING BODY OF THE CITY OF _____, KANSAS/MISSOURI (“CITY”):

Section 1. Incorporation of New Article.

Chapter XX, of the _____ City Code is hereby amended by inserting new Article X to read as follows:

Section X.1. Purpose.

The purpose of this Article is to ensure life safety in the City in the event of severe weather events, and specifically tornadoes, by specifying minimum code requirements applicable to New Construction, defined below, and to safeguard the public health, safety and welfare. These code requirements specify parameters for the design, construction, and installation of Safe Rooms constructed for protection from high winds associated with tornadoes and other severe storm events.

Section X.2. Definitions.

As used in this Article, the terms used in this article not otherwise herein defined have the meaning ascribed to them in the International Building Code (International Code Council, Inc. 2000 Ed.)

Alternative Section X.2. Definitions.

Section X.2. Definitions.

As used in this Article, the following terms have the below meanings:

Above Grade — that area of New Construction that is above the grade of earth on which the New Construction is developed.

If the third alternative of the Design Guidelines provision (Section X.4.) is not used, the definition for Above Grade may be eliminated.

Apartment Complex — a group of Apartments with one or more common walls combined to create a Habitable Structure and rented to persons for the purpose of residing therein.

The definition for Apartment Complex is used in order to define the scope of Habitable Structure, which is a defined term and the basis of the application of the Model Ordinance.

This ordaining clause is acceptable in both Missouri and Kansas. However, local ordinance provisions and state statute should be referenced for up-to-date form prior to adoption of this regulation.

Section X.2. is intended for adoption by local government entities that intend to adopt the International Code Council and National Storm Shelter Association Standard on the Design and Construction of Storm Shelters. As of the date of the completion of this Model Ordinance Document, ICC-500 was still undergoing public comment; It is anticipated that local government units that have adopted the International Code Council system of Codes, including the International Building Code and the International Residential Code, will choose to adopt this standard for the purpose of continuity of the applicable local codes. Definitions are adopted by reference in order to minimize confusion.

The term “ALTERNATIVE” is used frequently in this Model Ordinance. An ALTERNATIVE for a given provision denotes that: (A) the provision in question must be assessed by the local government considering adopting the Model Ordinance, with the issues relating to the extent to which the Model Ordinance should be applicable; or (B) the provision in question was discussed at length with MARC and its contractors, members of the Hazard Mitigation Task Group that oversaw development of the Model Ordinance, or participants in one of three focus group meetings that MARC and its contractor conducted regarding the Model Ordinance; or (C) a determination was made that options should be provided in light of the effect of other variable provisions in the Model Ordinance.

This is the International Code Council's definition of "Basement." See Chapter 2, Definitions, International Building Code (International Code Council, 2000) (hereinafter referred to as the "IBC"). A City adopting the ICC definitions across the board need not insert this definition, since the Model Ordinance envisions a local government adopting definitions used by the ICC in the IBC.

It should be noted that the ICC definition of "Basement" extends to all structures, and the intent of the Model Ordinance is that these will apply only to Habitable Structures — essentially structures one might sleep in, whether for a night or for an extended period of time. A municipality adopting this Model Ordinance might elect to adopt the term Habitable Structure and other definitions specific to this Model Ordinance and still utilize the ICC's definition of "Basement."

Apartment — an individual Habitable Unit within a Habitable Structure and used for residence on a temporary to full-time basis under a written arrangement with the owner of the Unit within an Apartment Complex.

The definition for Apartment is used in order to define the scope of Habitable Structure, which is a defined term and the basis of the application of the Model Ordinance.

Applicable Codes — the Codes adopted by the City relating to the regulation of construction, including architectural, building, electrical, maintenance, mechanical, structural and planning and zoning codes within the City.

• **Basement** — That portion of a building that is partly or completely below grade.

Alternative Definition of "Basement" (A)

Basement — the substructure or foundation of a Habitable Structure, which is prominently Below Grade, is anchored to the Below Grade surface of real property by concrete or cement piers or footings, is accessible via a stairway from the interior or exterior of the Habitable Structure, has at least fifty (50) percent of its exterior walls constructed of cement, concrete or other masonry material, and has a finished concrete or cement floor.

Alternative Definition of "Basement" (B)

Basement — That portion of a Habitable Structure below the first or ground-floor level and having less than four feet of clearance from its ceiling to the average finished grade of the building perimeter.

Alternative Definition of "Basement" (C)

Basement — That portion of a Habitable Structure between the floor and ceiling which is wholly or partly Below Grade and having more than one-half of its height Below Grade.

The term "Basement" is defined in the International Building Code and a local government may wish NOT to incorporate the term "Basement" in to the Model Ordinance in order to add continuity to its regulatory scheme if it believes the ICC definition better fits. The three alternative definitions above are less technical.

Alternative definitions B and C are borrowed from “A Planner’s Dictionary” (American Planning Association Planning Advisory Service, 2004). Definition A was derived from a review of various City Codes that were reviewed while drafting of this document.

Basement, walkout — That portion of a Habitable Structure located partly underground and having an exterior door, where the finished grade at that exterior door is lower than the finished floor.

Below Grade — that area of New Construction, and ordinarily part of a Basement, that is below the grade of earth on which New Construction is developed.

Code Official — the City official responsible for enforcing Applicable Codes within the City. The person designated by the City Administrator as the person primarily responsible for the implementation and enforcement of Building Codes in the City.

Community Safe Room — A Safe Room designed for use by inhabitants of one or multiple Habitable Units, either within an existing Habitable Structure or within 1,000 feet of the Habitable Units that the Community Safe Room serves if exterior to the Habitable Structure. Any Safe Room designed (1) with an occupancy load in excess of ten persons or (2) to accommodate individuals from more than one Habitable Unit, regardless of whether the Safe Room is located within a Habitable Structure, is a Community Safe Room.

Condominium — An individual Habitable Unit, whether owned or leased, within a Habitable Structure, in which the Habitable Units are not under one common ownership, but are owned individually.

The definition for Condominium is used in order to define the scope of Habitable Structure, which is a defined term and the basis of the application of the Model Ordinance.

Crawl Space — That portion of a Habitable Structure with a height between ceiling and floor of less than six feet which does not have an interior finish or is not utilized as a part of the livable space of the Habitable Structure. (Not currently defined, currently the term Crawl Space is used jointly with the term Construction.)

Alternative Definition of “Crawl Space” (A)

Crawl Space — The unimproved area located beneath the first floor of a Habitable Structure

This definition is not currently used in the Model Ordinance. However, what constitutes a “Walkout Basement” was the subject of considerable discussion during the implementation of this project, with the issue turning on whether to exempt structures with walkout basements from the requirement of the regulatory provisions envisioned by the Model Ordinance. The consensus among Code officials was that some level of protection from a severe storm event is likely to be achieved from a walkout basement. Significant discussion was undertaken regarding the application of this Model Ordinance to Habitable Structures that do not have a basement or that have a Walkout Basement. The Model Ordinance is silent on the issue.

A Community Safe Room is a subset of a Safe Room. The Community Safe Room design could be governed by ICC-500 or FEMA 361. The FEMA 361 document is less technical and might be more suitable to a local government unit that has not adopted ICC codes.

Community Safe Rooms are regulated in the Model Ordinance both by the provisions applicable to Safe Rooms and by the more encompassing provisions relating to Community Safe Rooms.

The term “Crawl Space” might be better defined in terms of its description in conjunction with its incorporation as a construction method. Thus, the terms “Crawl Space Construction” are offered as alternatives, given that use of this term is descriptive of the construction method used in Habitable Construction.

which may contain plumbing, ductwork, and similar items. This space serves as an access area to the various utilities and lines that are distributed throughout the Habitable Structure.

Alternative Definition of “Crawl Space” (B)

Crawl Space Construction — New Construction in which an enclosed area below the first usable floor of a Habitable Structure, generally less than five feet in height, is incorporated and used for limited access to plumbing and electrical utilities serving the Habitable Structure.

Alternative Definition of “Crawl Space” (C)

Crawl Space Construction — New Construction in which the Habitable Structure is supported by cement, concrete or other masonry structure situated to elevate the Habitable Structure Above Grade, but not constituting a Basement or slab on grade.

The Term “Duplex Structure” would fall within the IBC’s definition of a Dwelling.

- **Duplex Structure** — a Habitable Structure designed with one or more common walls, separate ingress and egress from an exterior door and containing two Habitable Units.

Effective Date — The date this ordinance takes effect.

Federal Act — The National Manufactured Housing Construction and Safety Standards Act of 1974 (42 U.S.C. § 5401 et seq. and amendments thereto).

FEMA 320 — the Federal Emergency Management Agency Guidance Document “Taking Shelter From the Storm: Building a Safe Room Inside Your House, (Second Ed. March 2004).

FEMA 361 — the Federal Emergency Management Agency Guidance Document “Design and Construction Guidance for Community Shelters” (1st Ed. July 2000).

Group Housing Facility — a fraternity or sorority house, scholarship house, retirement home, nursing home, group home, assisted living facility, convent or other similar type facility where three (3) or more unrelated persons reside.

The definition for Group Housing Facility is used to define the scope of Habitable Structure, which is a defined term and the basis of the application of the Model Ordinance.

Alternative Definition of “Group Housing Facility” (A)

Group Housing Facility — a Habitable Structure for occupancy by groups of people not defined as a family (would need to define, and would define as related by blood or marriage), on a weekly or longer basis. Typical uses include fraternity or sorority houses, dormitories, scholarship halls, retirement homes, nursing homes, residence halls, boarding/lodging houses, convents, monasteries, and assisted living facilities.

Habitable Structure — any building which is also an Apartment, Apartment Complex, Condominium, Duplex Structure, Group Housing Facility, Hotel, Manufactured Home, Mobile Home, Modular Home, Motel, Multiple Family Structure, or Single Family Structure or other structure where individuals reside.

Alternative Definition of “Habitable Structure” (A)

Habitable Structure — Any building with a use as defined in Section 310.1-310.3, Residential Group R, of the IBC.

Note that use of the alternate definition for a Habitable Structure eliminates the need to define a number of other terms that are used solely for the purpose of defining the scope of what is a Habitable Structure under the first alternative to the term Habitable Structure in this Model Ordinance. The downside to this latter definition is that it requires cross-reference to the IBC which, if not adopted by the local government unit is cumbersome. It also is not quite as expansive – for example it does not appear that it would cover mobile or modular homes or homes that are exempt from the provisions of building and other codes pursuant to the Federal Act.

Habitable Unit — An individual unit of living space within a Habitable Structure, such as a separate Apartment Unit or an individual Condominium.

Hotel — a public establishment, with rooms intended for the temporary or transient overnight use of persons in exchange for payment, which rooms typically have a means of ingress and egress through the interior of the structure.

The definition for Hotel is used in order to define the

Chapter 2 of the IBC, titled “Definitions,” contains a similar definition for “Dwelling.” It states, “A building that contains one or two dwelling units used, intended, or designed to be used, rented, leased, let or hired out to be occupied for living purposes.” This definition could be used instead of “Habitable Structure.” However, “Dwelling” is not as far reaching and for purposes of implementation of this Model Ordinance the adopting local government must take into consideration the adoption of additional definitions covering those structures that do not fall within the ICC’s definition of “Dwelling” if the purpose is to cover apartments, motels, hotels, etc.

The IBC does define “Building.” It is defined as, “Any structure used or intended for supporting or sheltering any use or occupancy.” A “Structure” is defined by the IBC as “That which is built or constructed.”

Section 310.2 Definitions, of the IBC contains a definition of the term “Dwelling Unit” – a single unit providing complete, independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking and sanitation.” “Dwelling Unit” is identically defined in Chapter 2, Definitions, of the International Residential Code (International Code Council, Inc. 2000) (hereinafter the “IRC”).

scope of Habitable Structure, which is a defined term and the basis of the application of the Model Ordinance.

ICC-500 — the adopted storm shelter standard of the International Codes Council, as first proposed in draft form in October 2006.

Motel — a public establishment with rooms intended for the temporary or transient overnight use of persons in exchange for payment that rooms typically have a means of ingress and egress to the exterior of the structure.

The definition for Motel is used in order to define the scope of Habitable Structure, which is a defined term and the basis of the application of the Model Ordinance.

Multiple Family Structure — a Habitable Structure designed with one or more common walls, containing more than two Habitable Units and having separate ingress and egress from an exterior door for each Habitable Unit.

The definition for Multiple Family Structures is used in order to define the scope of Habitable Structure, which is a defined term and the basis of the application of the Model Ordinance.

Manufactured Home — A Habitable Unit that is subject to the Federal Act and which is transportable in one or more sections, which, in traveling body mode, is 8 body feet or more in width or 40 body feet or more in length, or, when erected on site, is 320 or more square feet and which is built on a permanent chassis and designed to be used as a Habitable Unit, with or without permanent foundation, when connected to the required utilities and includes the plumbing, heating, air conditioning and electrical systems contained therein, and this term shall include any structure that meets all the requirements of this subsection, except the size requirements, and with respect to which the manufacturer voluntarily files with the United States department of housing and urban development a certification required by the secretary of housing and urban development and complies with the standards established under the federal act, except that this term shall not include any self-propelled recreational vehicle.

Manufactured Home Community — A community of Manufactured Homes in which parcels of real property are sold or leased to owners of Manufactured Homes for the placement thereof on this real property.

Mobile Home — a Habitable Unit that is not subject to the federal act and which is transportable in one or more sections which, in the traveling mode, is 8 body feet or more in width and 36 body feet or more in length and is built on a permanent chassis and designed to be used as a dwelling, with or without a permanent foundation, when connected to the required utilities, and includes the plumbing, heating, air conditioning and electrical systems contained therein.

Modular Home — a Habitable Unit that is: (1) Transportable in one or more sections; (2) designed to be used as a dwelling on a permanent foundation when connected to the required utilities, and includes the plumbing, heating, air conditioning and electrical systems contained therein; and (3) certified by its manufacturer as being constructed in accordance with a nationally recognized building code.

Occupant Load — the occupant load intended for a Safe Room or Community Safe Room when used for its intended purpose as a storm shelter.

New Construction — New development for which an application for building permit has been submitted to the City with the intent of constructing or erecting a Habitable Structure, or if the Habitable Structure is exempt from the City’s permitting regulations or Applicable Codes by virtue of state or federal regulation, the platting, planned development or site planning of the real property on which the new development is situated.

Safe Room — A room as described in this Article, whether interior or exterior to a Habitable Structure and whether Above Grade or Below Grade, for the protection of life during severe weather events, including but not limited to tornadic events.

Single Family Structure — a Habitable Structure designed as a single Habitable Unit.

This definition for Single Family Structure is largely used in order to define the scope of Habitable Structure, which is a defined term and the basis of the application of the Model Ordinance. It serves additional purposes in the Model Ordinance, as well, though, and it is recommended that this term be incorporated regardless of which definition of Habitable Structure is used.

Slab on Grade Construction — New Construction in which a Habitable Structure is constructed atop a slab of

There was discussion among the Task Group as to whether the ordinance requirements should be imposed at the building permit phase or at the development planning, platting phase. Arguments in support of each alternative were advanced. Specifically, when platting a large subdivision or when constructing a large apartment or other group living complex, it was felt that the condition should be imposed early so as to eliminate surprise, to potentially pass the cost on to the developer (rather than the builder), and because some Community Safe Rooms will require advanced planning as to when they will be constructed.

This provision contemplates that if New Construction is undertaken, and is not exempt from application of the Model Ordinance, a Safe Room should be incorporated in to the structure; or, if this is not possible, a Safe Room should be made available within 1,000 feet thereof. Examples of each include, with respect to the former — a slab on grade patio home might satisfy the requirements of this ordinance through the reinforcement of a first floor bathroom pursuant to FEMA 320; a two-story apartment complex might be constructed with a two-story reinforced concrete tower which becomes a lavatory on each floor or the laundry room, in order to achieve compliance pursuant to FEMA 320; with respect to the latter, an apartment complex might achieve compliance by reinforcing its club house pursuant to FEMA 361; a mobile home park might achieve compliance by placing underground prefabricated Safe Room units intermittently throughout the Manufactured Home Community or by constructing a Safe Room or club house compliant with FEMA 361.

cement or concrete that is poured directly to the surface of the earth and a portion of which is Above Grade.

• **Section X.3. Application.**

This Article is applicable after the Effective Date to all New Construction. All code requirements specified herein will be applied at the building permit phase.

Alternative Section X.3. Application.

Section X.3. Application.

This Article is applicable to after the Effective Date to all New Construction. The requirements of compliance with this Article must be noted on preliminary plats and development plans for New Construction, and will be applied to the approval of a final plat or development plan to which the New Construction is subject.

• **Section X.4. Design Guidelines.**

All New Construction shall be equipped with or be within 1,000 feet of a Safe Room. The Safe Room shall be a room or space complying with FEMA 320, or FEMA 361, as applicable and shall meet the design and performance standards specified in the applicable standard.

Alternative Section X.4. Design Guidelines. (A)

Section X.4. Design Guidelines and Performance Standards.

All New Construction shall be equipped with or be within 1,000 feet of a Safe Room. The Safe Room shall be room or space complying with ICC-500 and shall meet the design performance standards specified therein.

As stated previously, the ICC-500 standard is currently in draft. However, the ICC-500 document is more technically detailed and is appropriate for a community that has adopted the ICC codes.

A licensed Architect or Professional Engineer may present an alternative Safe Room design to the City Code Official for incorporation in to New Construction if that design uses materials and construction and is of a sizing standard that satisfies the spirit and intent of FEMA Publications 320 or 361, as applicable.

This provision could be optionally inserted under the above Section X.4. Alternative (A) in order to offer

flexibility in the implementation of the Model Ordinance for those communities adopting the before mentioned ICC-500 standard.

Alternative Section X.4. Design Guidelines. (B)

Section X.4. Design Guidelines.

All New Construction shall be equipped with or be within one thousand (1,000) feet of a Safe Room. Certain minimum standards apply to all Safe Rooms. Specific standards apply to various types of Safe Rooms, generally dependent upon whether the Safe room (1) is interior to and an integral part of the Habitable Structure, or (2) serves a Habitable Structure, but is exterior to the Habitable Structure. Under either scenario, an additional consideration must be made as to whether the Safe Room is a Community Safe Room under this Article, in which case additional design considerations apply.

A. Minimum Standards for all Safe Rooms.

1. Safe Rooms must be naturally ventilated to allow for the proper circulation of air under normal Occupancy Loads. Natural ventilation is passive ventilation, not requiring a power source, resulting from convection of heated air, movement of inside air and movement of outside air over and around the Safe Room resulting in air exchange through vent openings.
2. Each Safe Room must be capable of accommodating an Occupancy Load of two point five (2.5) persons per Habitable Unit served, whether one or more Habitable Units.
3. The minimum square footage for each Safe Room is five (5) square feet of space per person.

B. Standards specific to Safe Rooms within Habitable Structures.

1. Design Guidelines for Above Grade Safe Rooms incorporated in to Habitable Structures using Slab on Grade Construction or Crawlspace foundations.

In addition to the minimum Design Guidelines, the following additional standards apply.

The design guidelines specified in the Model Ordinance were questioned by a focus group of code officials. Their concern was that confusion might arise regarding application of design standards versus application of the FEMA 320, FEMA 361 and ICC-500 standards. The consensus was that the Model Ordinance should clearly state what is required. The difficulty in addressing the issue, which is a valid one, is that the FEMA documents are more explanatory regarding what a Safe Room might look like, but are less technical; while the ICC-500 document is more technical and less descriptive. Because a provision exists in the Model Ordinance stating that the more burdensome regulation applies, the provisions can be harmonized and issue is resolved to some extent. Nevertheless, it is possible that Section X.4 Alternative B should not be adopted.

The Task Group discussed the flexibility of items A.2. and A.3. relating to Occupancy Load and the number of persons a Safe Room should be designed to accommodate. The Occupancy Load and the minimum square footage of space per person is subject to debate. MARC has relied upon FEMA numbers from Residential Safe Rooms, Background and Research — March 2003, Page 10. Representatives from the apartment and manufactured housing industries suggest that data exists to support treating specific types of Dwelling Units differently, perhaps according to intensity based upon a schedule in the ordinance. For example, the Kansas Manufactured Housing Authority cites a study showing that 2.5 persons per Habitable Unit is an excessive proposed Occupancy Load for a Manufactured Home. An apartment industry representative advises similar data exists for apartment occupancy. The Home Builder's Association advises the average occupancy for a single family home is 2.1 persons per Dwelling Unit.

FEMA 320 has numerous examples of the Above Grade Safe Rooms contemplated herein, whether it be a reinforced restroom, laundry room or closet, and whether tied to a slab-on-grade foundation or a crawl space. Please refer to this document for more information.

- a. All Above Grade Safe Rooms must be properly anchored to the ground to resist the combined uplift and lateral forces of the design wind speed.
 - (1) If an Above Grade Safe Room is utilized in conjunction with Slab On Grade Construction, the Codes Official shall determine whether the Slab on Grade proposed for the Habitable Structure is sufficient to anchor the proposed Safe Room in accordance with the Performance Standards specified in X.5.
 - (2) If an Above Grade Safe Room is utilized in conjunction with a Crawl Space, the Safe Room must be separately anchored to the ground in accordance with the Performance Standards specified in X.5.
 - b. Above Grade Safe Rooms should, to the extent practical, be located centrally within the Habitable Structure and away from exterior walls.
 - c. When a bathroom, closet or utility room serves as the Above Grade Safe Room in a Habitable Structure, other Applicable Building Codes apply to construction of the room in addition to those specified in this Article.
2. Design Guidelines for Below Grade Safe Rooms incorporated into Habitable Structures using Slab on Grade Construction or Crawl Space foundations.

In addition to the minimum Design Guidelines, the following additional standards apply:

- a. Below Grade Safe Rooms may be utilized in Habitable Structures by excavating only a portion of ground sufficient to meet the minimum size standards enumerated above of 5sq feet of floor space per person;
- b. The minimum interior height of a Below Grade Safe Room shall be seven (7) feet, unless the Below Grade Safe Room is

equipped with permanent seating, in which case the minimum interior height is four (4) feet from the seat.

- c. Below Grade Safe Rooms may be accessed by stairs or ladders meeting Applicable Codes; and
3. Design Guidelines for Safe Rooms incorporated into Habitable Structures with Basements that are not exempt from this Article.

Safe Rooms constructed in Basements which are not otherwise exempt from this Article should follow the Design Guidelines for Above Grade Safe Rooms. Portions of Basement foundation walls constructed of concrete, cement or other reinforced masonry may be incorporated into the Safe Room. The Performance Standards enumerated in X.5. apply to these Safe Rooms.

C. Design Guidelines for Safe Rooms exterior to Habitable Structures.

In addition to the minimum Design Guidelines, the following additional standards apply.

- 1. Safe Rooms that are exterior to Habitable Structures and that are wholly or partially Above Grade may be constructed directly adjacent to a Habitable Structure to provide the appearance that the Safe Room is an integral part of the Habitable Structure. However, the Safe Room shall be independently anchored to the ground and shall share no common exterior walls with the Habitable Structure. This Safe Room shall be sheathed, painted and roofed with materials that are architecturally compatible with the Habitable Structure to provide an integrated appearance.
- 2. Safe Rooms that are exterior to Habitable Structures and that are wholly or partially Above Grade are not exempt from any design standards and accessory building and use standards of the zone in which the real property is situated.

This Provision is designed for use where a local government determines that certain basements do not provide sufficient protection to allow waiver of the Model Ordinance after adoption. The provision speaks to the question of walkout basements which do not meet the definition of "Basement" adopted by the local government. Inevitably, if a local government elects to soften the impact of adoption of the Model Ordinance by waiving it for Habitable Structures with basements, the question will arise as to whether a walkout basement meets the spirit and intent of the ordinance. If by definition it does not, then the Safe Room constructed in the Basement should meet the requirements specified in the standard (FEMA 320 or ICC-500) adopted by the local government).

D. Design Guidelines for Community Safe Rooms.

In addition to the minimum Design Guidelines, and regardless of whether a Community Safe Room is located within a Habitable Structure or exterior thereto, the following additional standards apply:

1. All Community Safe Rooms must (1) remain unlocked twenty-four hours, seven days a week, or (2) be managed by a permanent, on-site owner or manager representative of the Owner, which is available to unlock the Community Safe Room twenty-four hours a day, seven days a week, or (3) be accessible by all tenants by a keypad locking mechanism or community key.

Alternative D. 1. Access to Community Safe Rooms (A)

1. Access. Community Safe Rooms serving Habitable Structures must (1) remain unlocked twenty-four hours a day, seven days a week, or (2) be accessible by an agent or representative of the Owner, who shall be responsible for making the Community Safe Room accessible and usable during severe storm events.
2. All Community Safe Rooms must comply with the Americans with Disabilities Act.
3. All unfinished Community Safe Rooms must be posted with a sign that states “This is a COMMUNITY SAFE ROOM and is available for shelter in the event of severe weather. No Storage is allowed within this Community Safe Room.”
4. Community Safe Rooms must meet all Applicable Codes.
5. Community Safe Rooms must be equipped with a backup source of power. This backup power source should preferably be a battery backup power source and should be located interior to the Community Safe Room to prevent deterioration from the elements and

A FEMA representative has recommended that the generator and fuel supply should be protected to the same level as the shelter occupants.

damage as a result of severe storms.

A generator placed exterior to the Community Safe Room may be approved as an alternative Backup power source by the Code Official upon documentation that the generator will be sufficiently protected to minimize damage from severe weather. Generators approved by the Code Official as backup power sources shall additionally be equipped with an adequate fuel source exterior to the Community Safe Room, which fuel source shall be properly maintained and replenished in order to ensure proper and reliable use of the generator during severe weather events. Backup power sources shall meet Applicable Codes.

6. The route to Community Safe Rooms should be adequately marked and lit to allow the users thereof to reasonably locate the Community Safe Room.
7. Distance to Community Safe Rooms should be no greater than one thousand (1,000) feet to the Habitable Structure or Habitable Structures served.
8. Walkways and hallways into the Community Safe room should be free from obstructions.
9. Community Safe Rooms may be finished and incorporated in to the useful premises of Apartment Complexes, Condominiums, Group Housing Facilities, Hotels, Motels, and other Habitable Structures requiring a Community Safe Room. When incorporated therein, the following additional standards shall apply:
 - a. The calculation of square footage of the Community Safe Room shall discount space that is occupied by furniture other than couches and chairs. By way of example, and not by way of creating an exhaustive list, items such as pool tables, file cabinets, coffee tables, floor lamps, potted plants and trees, bars, and bookcases should be excluded from the calculation of the square footage of the Community Safe Room. Furniture

The Ordinance recommends that all Safe Rooms be located within 1,000 feet from the Habitable Structures served. This number is a proposal. A community should analyze the development that it believes will be served by Safe Rooms and make a determination, based upon factors such as development density, how far the Safe Room should be from Habitable Structures.

As an example, if a hotel or motel owner incorporates a Community Safe Room into the hotel or motel's breakfast room, which is 20 feet by 25 feet (500 sq. ft. total), and that room also contains a kitchen counter along the entire 20 ft. wall that is 2 ft. deep (40 sq. ft.), and six 3 ft. by 3 ft. square tables (9 sq. ft. each, or 54 sq. ft. total), the Community Safe Room would have 406 sq. ft., or Occupant Load of 81 persons.

[500 sq. ft. – 40 sq. ft. – 54 sq. ft. = 406 sq. ft.; 406 sq. ft. ÷ 5 sq. ft. per person = 81 persons.]

May be eliminated where a door assembly that provides the necessary level of protection is provided.

Because of the short duration that it is anticipated persons will need to remain in Community Safe Rooms during a severe weather event, it is believed that the need for restroom facilities should not be mandatory.

such as chairs and couches need not be discounted from the square footage calculation.

- b. At least two (2) points of ingress and egress shall be included in the Community Safe Room.
- c. Means of ingress and egress shall be protected by an alcove/baffled entry system.

10. Restroom facilities must be provided within Community Safe Rooms, and must have running water, be in good working condition, be connected to a sewage disposal system in accordance with Applicable Codes and afford privacy.

Alternative D. 10. "Restroom Facilities" (A)

10. Community Safe Rooms are exempt from Applicable Codes that require restrooms and running water.

11. Operators of Community Safe Rooms must prepare, update when situations dictate, and maintain an operation and maintenance plan for the Community Safe Room. Community Safe Rooms shall be equipped with emergency supplies including a first aid kit, one flashlight per ten occupants, at least one (1) liter of potable water for each person the Community Safe Room is designed to accommodate, and a weather band radio.

12. Community Safe Rooms shall be equipped with a forced ventilation system that meets Applicable Codes.

Section X.5. Performance Standards.

A. Ingress and Egress.

All Safe Rooms, including the means of ingress and egress thereto, must meet the performance standards specified in FEMA 320, or FEMA 361 if a Community Safe Room.

The Design Standards incorporate alternative avenues, whether adopting FEMA standards or the ICC-500 standard.

Alternative Ingress and Egress (A)

A. Ingress and Egress.

All Safe rooms, including the means of ingress and egress thereto, must meet the performance standards specified in ICC-500.

B. Compliance Assurance.

The design of all Safe Rooms must be sealed by a Kansas/Missouri licensed Professional Engineer as complying with this Article and other Applicable Codes.

Alternative Compliance Assurance (A)

B. Compliance Assurance.

The design of all Safe Rooms must be sealed by a Kansas/Missouri licensed Architect or Professional Engineer.

Section X.6. Timeframe of construction of Community Safe Rooms.

When a Community Safe Room is anticipated to be constructed to comply with this Article, the Community Safe Room must be completed and able to protect persons from a severe storm event prior to the issuance of any certificate of occupancy for the Habitable Structure or Habitable Units the Community Safe Room will serve.

Alternative Timeframe (A)

When a Community Safe Room is anticipated to be constructed to comply with this Article, the Community Safe Room must be completed and able to protect persons from a severe storm event upon the completion of fifty percent of the New Development that the Community Safe Room is intended to serve.

Alternative Timeframe (B)

When a Community Safe Room is anticipated to be constructed to comply with this Article, the Community Safe Room must be completed and able to protect persons from a severe storm event upon the completion of ten (10) Habitable Units within the New Development that the Community Safe Room is intended to serve.

With regard to each of the Alternatives relating to community Safe Rooms, an issue arose in the development of the Model Ordinance regarding the timing of the requirement that a Safe Room be implemented where phased development takes place. For example, should the developer of a 300-unit apartment complex be required to construct a Safe Room at the outset of development, prior to the issuance of any certificate of occupancy, or should a trigger be put in place, e.g., 50 percent completion, full build-out, first fully constructed building, etc.?

A similar issue was raised with regard to implementation of this Model Ordinance where a development is phased and has been partially implemented prior to the adoption of the Model Ordinance. For example, a phased development contemplates a hotel, with future expansion potential. When the expansion occurs, should the developer be required to make up for the on-site deficiency? While this appears at first to work a hardship on the developer and be counter to the general intent that the Model Ordinance does not apply to existing development, it raises the question of answering to the local government's residents when those residents seek shelter in a severe emergency. An apartment complex with storm shelter capacity for only half its residents will have difficulty explaining that there is insufficient room to accommodate persons in apartment units constructed prior to the date in which storm shelters were required to be provided for residents.

Section X.6.5. Developers to account for existing deficiencies in construction of certain Community Safe Rooms.

When a Community Safe Room is anticipated to be constructed in order to comply with this Article and the New Construction expands upon an existing land use being made on real property contiguous to the property on which the New Development is proposed and all of the real property is under one common ownership or is under the common control of a single individual or entity, the developer shall provide a plan for implementation of severe storm protection accommodation to the residents or users of the existing development within five (5) years of the completion of construction of the Community Safe Room.

Alternative Protection Deficiencies (A)

When a Community Safe Room is anticipated to be constructed in order to comply with this Article and the New Construction expands upon an existing land use being made on real property contiguous to the property on which the New Development is proposed and all of the real property is under one common ownership or is under the common control of a single individual or entity, the developer shall provide a plan for implementation of severe storm protection accommodation to the residents or users of the existing development upon completion of fifty percent of New Construction requiring the Community Safe Room.

Alternative Protection Deficiencies (B)

When a Community Safe Room is anticipated to be constructed in order to comply with this Article and the New Construction expands upon an existing land use being made on real property contiguous to the property on which the New Development is proposed and all of the real property is under one common ownership or is under the common control of a single individual or entity, the developer shall construct the Community Safe Room to accommodate the existing development.

Section X.7. Exemptions and waivers from this Article.

A. Setback variances for exterior Above Grade Safe Rooms.

Nothing in this article shall be read to prevent the Board of Zoning Appeals/Adjustment from granting a waiver or variance of the City’s setback provisions relating to structures from front, side or rear lot lines or otherwise. The above notwithstanding, the Chapter X of the City’s regulations regarding the rules and procedure of the Board of Zoning Appeals apply to making application for and the granting of a waiver, variance or exception under this code.

B. Waiver of Article for certain repairs and reconstruction.

This Article does not apply to the repair, reconstruction, remodeling of or addition to existing Habitable Structures, unless that Habitable Structure is being one hundred percent (100%) reconstructed. [May need better definition; (replacement cost?)]

Alternative Waiver for Repairs and Reconstruction (A)

B. Waiver of Article for certain repairs and reconstruction.

This Article does not apply to the repair, reconstruction, remodeling of or addition to existing Habitable Structures, unless at least fifty (50) percent of the Habitable Structure is being reconstructed or an addition equal to fifty (50) percent of the existing square footage of the Habitable Structure is undertaken.

C. Waiver of Article for Habitable Structures with Basements.

This Article is not applicable to New Construction of Habitable Structures that are constructed with a Basement.

Alternative Waiver for Homes with Basements (A)

C. Waiver of Article for Habitable Structures with Basements.

This Article is not applicable to New Construction of Habitable Structures that are constructed with a Basement meeting the minimum standards specified in Section 1.5, Design Guidelines.

The alternatives for retroactivity both represent efforts to establish criteria for when the Model Ordinance applies. In this case, the Model Ordinance is responsive to partial reconstruction of a Habitable Structure.

These alternatives are intended to allow for varying degrees flexibility in waiving the requirements of the Model Ordinance.

**Alternative Waiver for Homes
with Basements (B)**

**C. Waiver of Article for Habitable Structures
with Basements.**

This Article is not applicable to New Construction of Habitable Structures that are constructed with a Basement with walls that are a minimum of eight (8) feet deep and which walls of the Basement are at least fifty (50) percent Below Grade, as measured by the surface area of the Basement walls that is exposed Above Grade from the exterior of the Habitable Structure.

**Alternative Waiver For Homes
With Basements (C)**

**C. Waiver of Article for Habitable Structures
with Basements.**

This Article is not applicable to New Development of Habitable Structures that are constructed with a basement with walls that are a minimum of eight (8) feet deep and which walls of the Basement are at least seventy-five (75) percent Below Grade as measured by the surface area of the Basement walls that is exposed Above Grade from the exterior of the Habitable Structure.

D. Design Guideline Exemptions.

Safe Rooms that are exterior to Habitable Structures and visible in any respect, whether Above Grade or Below Grade, are exempt from the City's design guidelines so long as the rooms meet the requirements of this code and the adopted Building Code.

Alternative Design Guideline Exemptions (A)

D. Aesthetic Code Exemptions.

Safe Rooms that are exterior to Habitable Structures and visible in any respect, whether Above Grade or Below Grade, must meet Applicable Codes regarding the use of exterior construction materials and other design guidelines that are now or may hereafter be established by the City.

E. Waiver of Article by Owner of Property.

The enforcement of this Article may be waived by a

The alternative provision for design guideline exemptions speaks to the use of prefabricated Safe Rooms which are external to the Habitable Structure and which will invariably be seen, at least to some extent. The concept is that, to the extent the local government has enacted aesthetic design guidelines, the local government must make a decision on whether to grant any waivers from the design guidelines relating to aesthetics.

purchaser for value of real property on which a Single Family Structure is intended to be built acknowledging that _____ City is in a high risk zone for severe weather, including tornadoes, and further acknowledging a waiver of this Article applicable to the construction of the structure. This waiver must be signed by the proposed purchaser, and must be presented to the City along with a copy of a fully executed construction contract signed by the proposed purchaser and the builder/developer. No licensed contractor engaged in the trade of constructing Single Family Structures may waive the application of this Article. After waiver of this Article, that waiver shall be noted on subsequent sales of the real property with a notation that the Single Family Structure does not comply with Applicable Codes or by specific reference to waiver of this Article.

Section X.8. Conflict.

Where any provision in this Article conflicts with any provision of another Applicable Code, the most restrictive provision shall govern.

Alternative X.8. Conflict. (A)

Section X.8. Conflict.

Where any provision in this Article conflicts with any provision of another Applicable Code, the more specific provision shall govern.

Alternative X.8. Conflict. (B)

Section X.8. Conflict.

Where any provision in this Article conflicts with any provision of another Applicable Code, the provisions of this Article shall govern.

Section X.9. Appeals.

Interpretations of provisions in this Article related to the design and construction of all Safe Rooms may be appealed to the Building Code Board of Appeals.

If a local government unit does not have a Building Code Board of Appeals it may be appropriate to assign appeals to the Board of Adjustment.

This provision would apply only in the single family or duplex or condominium dwelling context where no basement is being constructed. The provision was suggested during one of MARC's stakeholder focus groups. Enacting the Model Ordinance and then allowing a multi-family owner/ apartment complex owner to use this waiver might suggest that the owner would place those who are less financially capable at greater risk of bodily harm from severe storms.

Enacting this provision would create a number of opportunities not to follow the Model Ordinance. Feedback from the residential construction industry suggests that those engaged in construction would make use of this provision. Would the provision be used on speculatively built homes, in which no buyer yet exists to waive the construction of a safe room? Could a builder construct a home for personal use, waive the requirement that a safe room be incorporated therein, and then sell the home?

The upside to this provision is that it could make adoption of the Model Ordinance more politically palatable to the construction industry, as the Model Ordinance would be geared toward protecting those Habitable Structures that are not owner occupied and that presumably are inhabited by those with more limited financial means. Habitable Structures that are not owner occupied are traditionally also more densely populated.

These alternatives are designed to raise awareness that some specifics in the adopted standards (ICC-500 and FEMA 320 and FEMA 361) may vary from the Model Ordinance. The local government should determine whether it wishes to override more specific provisions with its own provisions.

Section 2. Effect on existing litigation.

The adoption of this Ordinance shall not have any effect on existing litigation and shall not operate as an abatement of any action or proceeding under or by virtue of existing ordinances of the City.

Section 3. Severability.

The provisions of this Ordinance are declared to be severable and if any section, sentence, clause, or phrase of this Ordinance shall for any reason be held to be invalid or unconstitutional, that decision shall not affect the validity of the remaining sections, sentences, clauses and phrases of this Ordinance but they shall remain in effect, it being the legislative intent that this Ordinance shall stand notwithstanding the invalidity of any part.

Section 4. Codification.

Section 1 of this Ordinance shall be codified in the Code of Ordinances of the City of _____, Kansas/Missouri.

Section 5. Effective Date.

This Ordinance shall take effect and be in force from and after publication as provided for by law.

PASSED by the Governing Body, the _____ day of _____, 2007.

APPROVED by the Mayor this _____ day of _____, 2007.

Mayor

ATTEST:

City Clerk

APPROVED AS TO FORM:

City Attorney

References

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Tarp, Kelly. *Clues from Climatology: When and Where Do Tornadoes Occur?* [online document] (Washington, D.C.: National Oceanic and Atmospheric Administration, 2001), http://www.oar.noaa.gov/spotlite/archive/spot_climatology.html

Additional Resources

Federal Emergency Management Agency:

Publication 320 — <http://www.fema.gov/plan/prevent/saferoom/fema320.shtm>

Federal Emergency Management Agency:

Publication 361 — <http://www.fema.gov/fima/fema361.shtm>

International Code Council:

<http://www.iccsafe.org>

International Code Council 500:

Standard on the Design and Construction of Storm Shelters — http://www.iccsafe.org/cs/standards/is-stm/draft_1/Oct_06_Ballot_Draft_prelims.pdf

National Storm Shelter Association:

<http://www.nssa.cc>

National Weather Service:

<http://www.nws.noaa.gov>

Attachment 1: Tornado Data

Tornadoes are classified according to the Fujita Tornado Damage Scale, commonly referred to as F-Scale. Developed by Dr. T. Theodore Fujita, a renowned severe storm researcher, the F-Scale is a damage scale for winds, including tornadoes. The F-Scale ranks tornadoes by relating the degree of damage to the intensity of the wind. Although wind speeds on the F-Scale have never been scientifically tested or proven, and despite the many variables affecting tornado damage (i.e., the sturdiness of a structure, wind direction, wind duration, battering by flying debris, etc.), the F-Scale is the only widely used method of rating tornadoes and measuring their potential for damage (NOAA SPC website, online data). Table 3 below lists the wind speed and potential damage associated with F-Scale ratings.

TABLE 3: FUJITA TORNADO DAMAGE SCALE		
Category	Speed (mph)	Potential Damage
F0	<73*	Light damage: some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; sign boards damaged
F1	73-112	Moderate damage: peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos blown off road
F2	113-157	Considerable damage: roofs torn off frame houses; mobile homes demolished; boxcars overturned; large trees snapped or uprooted; light-object "missiles" generated; cars lifted off ground
F3	158-206	Severe damage: roofs and some walls torn off well-constructed houses; trains overturned; most trees in forests uprooted; heavy cars lifted off ground and thrown
F4	207-260	Devastating damage: well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large "missiles" generated
F5	261-318	Incredible damage: strong frame houses lifted off foundations and swept away; automobile-sized "missiles" fly through the air in excess of 109 yards; bark removed from trees; incredible devastation may occur

* SEMA's State Hazard Analysis lists F0 as 40-72 mph

Source: NOAA

The tables on the following pages list each of the tornadic events on record during the past 56 years (01/01/1950- 10/31/2006) for the eight counties in the MARC region. Damage estimates from the Fujita scale (Table 3, above) provide a clear indication of the historical threat these storms pose to the region. Data is from NOAA's National Climactic Data Center.

Table 4: Historical Data, Cass County, Mo.

Date	Time	Type	Magnitude	Death	Injuries
05/27/1955	9:00 PM	Tornado	F1	0	0
09/24/1955	4:30 AM	Tornado	F1	0	0
04/15/1960	6:00 PM	Tornado	F3	0	0
04/22/1961	2:00 AM	Tornado	F1	0	0
04/23/1961	2:00 PM	Tornado	F1	0	0
04/12/1964	6:00 PM	Tornado	F3	0	0
04/12/1964	6:20 PM	Tornado	F3	1	10
04/10/1965	7:30 PM	Tornado	F1	0	0
05/26/1965	2:10 AM	Tornado	F1	0	0
06/04/1965	3:20 PM	Tornado	F0	0	0
04/16/1967	7:45 PM	Tornado	F0	0	0
04/16/1967	7:45 PM	Tornado	F0	0	0
08/18/1967	5:30 PM	Tornado	F1	0	0
05/15/1968	2:45 PM	Tornado	F3	0	0
04/04/1969	4:15 PM	Tornado	F0	0	0
05/04/1977	11:45 AM	Tornado	F3	2	15
06/19/1981	7:43 PM	Tornado	F0	0	0
06/19/1981	8:10 PM	Tornado	F0	0	0
06/21/1981	6:14 PM	Tornado	F0	0	0
06/21/1981	8:05 PM	Tornado	F0	0	0
05/30/2001	4:25 PM	Tornado	F0	0	0
05/04/2003	4:23 PM	Tornado	F1	0	0
05/04/2003	5:04 PM	Tornado	F2	0	0
05/09/2003	8:25 PM	Tornado	F1	0	1
05/09/2003	8:44 PM	Tornado	F0	0	0
06/04/2005	5:35 AM	Tornado	F0	0	0
03/12/2006	8:05 PM	Tornado	F2	0	0
			TOTALS	3	26

Table 5: Historical Data, Clay County, Mo.

Date	Time	Type	Magnitude	Death	Injuries
03/14/1955	5:40 PM	Tornado	F2	0	0
03/14/1955	6:00 PM	Tornado	F1	0	0
07/02/1956	2:30 PM	Tornado	F1	0	0
05/28/1962	7:00 PM	Tornado	F1	0	0
05/15/1963	2:00 AM	Tornado	F1	0	0
06/12/1966	4:45 PM	Tornado	F0	0	0
06/07/1967	7:00 PM	Tornado	F1	0	0
06/12/1967	12:15 AM	Tornado	F1	0	0
06/26/1969	6:30 PM	Tornado	F3	0	3
06/26/1969	7:00 PM	Tornado	F1	0	0
07/07/1969	4:30 PM	Tornado	F1	0	0
05/07/1973	12:20 PM	Tornado	F2	0	0
05/04/1977	4:45 PM	Tornado	F4	0	5
04/11/1979	7:00 PM	Tornado	F2	0	9
10/08/1982	3:05 PM	Tornado	F1	0	0
05/26/1985	6:15 PM	Tornado	F0	0	0
07/09/1992	7:30 PM	Tornado	F0	0	0
09/05/1992	7:10 PM	Tornado	F0	0	0
5/11/2000	10:25 PM	Tornado	F1	0	0
05/04/2003	3:40 PM	Tornado	F4	0	0
05/04/2003	3:45 PM	Tornado	F4	0	13
05/04/2003	3:59 PM	Tornado	F2	0	0
04/24/2004	6:15 PM	Tornado	F0	0	0
07/16/2004	2:04 AM	Tornado	F0	0	0
11/27/2005	5:44 PM	Tornado	F1	0	0
			TOTALS	0	30

Table 6: Historical Data, Jackson County, Mo.

Date	Time	Type	Magnitude	Death	Injuries
05/22/1952	7:00 PM	Tornado	F2	0	1
05/20/1957	7:37 PM	Tornado	F2	0	0
05/20/1957	7:37 PM	Tornado	F5	37	176
06/22/1957	12:00 M	Tornado	F2	0	0
07/22/1961	9:00 PM	Tornado	F2	0	0
04/12/1964	6:25 PM	Tornado	F3	0	0
04/12/1964	6:30 PM	Tornado	F3	0	0
05/26/1964	3:00 PM	Tornado	F1	0	0
05/26/1965	2:15 AM	Tornado	F2	0	4
09/20/1965	10:30 PM	Tornado	F2	0	0
01/24/1967	12:40 PM	Tornado	F3	0	0
04/26/1969	6:10 PM	Tornado	F1	0	0
05/31/1971	7:35 PM	Tornado	F1	0	0
05/04/1977	4:40 PM	Tornado	F4	0	0
11/08/1977	8:55 PM	Tornado	F0	0	0
11/20/1977	9: 15 AM	Tornado	F0	0	0
04/05/1978	9:40 PM	Tornado	F1	0	0
06/15/1981	6:45 AM	Tornado	F1	0	1
06/21/1981	5:58 PM	Tornado	F0	0	0
06/21/1981	6:14 PM	Tornado	F0	0	0
06/21/1981	6:38 PM	Tornado	F0	0	0
06/29/1981	6:05 PM	Tornado	F0	0	0
04/02/1982	2:30 PM	Tornado	F1	0	0
04/02/1982	2:32 PM	Tornado	F1	0	0
05/28/1982	6:10 PM	Tornado	F0	0	0
09/20/1992	5:55 PM	Tornado	F1	0	1
09/20/1992	6:12 PM	Tornado	F0	0	0
06/13/1997	3:40 PM	Tornado	F0	0	0
04/21/2005	6:50 PM	Tornado	F0	0	0
03/12/2006	9:12 AM	Tornado	F0	0	0
			TOTALS	37	183

Table 7: Historical Data, Johnson County, Kan.

Date	Time	Type	Magnitude	Death	Injuries
05/22/1952	5:45 PM	Tornado	F4	0	1
05/31/1954	4:10 PM	Tornado	F2	0	0
06/30/1954	6:30 PM	Tornado	F0	0	0
06/11/1957	8:04 PM	Tornado	F1	0	0
06/21/1957	11:30 PM	Tornado	F1	0	2
07/11/1958	2:00 AM	Tornado	F1	0	0
04/22/1964	7:15 PM	Tornado	F1	0	0
04/26/1964	7:30 PM	Tornado	F	0	0
04/26/1964	7:40 PM	Tornado	F	0	0
04/26/1964	7:50 PM	Tornado	F	0	0
07/09/1965	3:00 PM	Tornado	F1	0	0
04/19/1966	3:25 PM	Tornado	F3	0	4
07/09/1969	5:00 PM	Tornado	F2	0	2
05/31/1971	7:00 PM	Tornado	F1	0	0
04/30/1972	10:16 PM	Tornado	F2	0	0
08/22/1972	12:15 AM	Tornado	F1	0	0
03/13/1973	6:20 PM	Tornado	F0	0	0
05/04/1977	7:00 PM	Tornado	F3	0	0
05/04/1977	7:00 PM	Tornado	F2	0	0
05/31/1980	4:40 PM	Tornado	F2	0	1
06/20/1981	5:58 PM	Tornado	F0	0	0
05/15/1982	10:25 PM	Tornado	F0	0	0
05/25/1982	3:30 PM	Tornado	F0	0	0
03/24/1988	2:37 PM	Tornado	F0	0	0
06/08/1990	7:10 PM	Tornado	F0	0	0
03/30/1993	6:18 PM	Tornado	F1	0	0
05/16/1995	8:50 PM	Tornado	F1	0	2
			TOTALS	0	12

Table 8: Historical Data, Leavenworth County, Kan.

Date	Time	Type	Magnitude	Death	Injuries
05/22/1952	5:25 PM	Tornado	F4	0	0
06/21/1952	7:00 PM	Tornado	F2	0	0
06/18/1956	6:20 AM	Tornado	F2	0	0
11/17/1958	10:20 AM	Tornado	F2	0	0
11/17/1958	11:15 AM	Tornado	F	0	0
05/07/1961	3:00 PM	Tornado	F	0	0
05/07/1961	3:15 PM	Tornado	F4	0	0
05/27/1962	3:45 PM	Tornado	F2	0	0
04/12/1964	4:00 PM	Tornado	F3	1	22
04/10/1965	2:15 PM	Tornado	F3	0	0
06/08/1966	7:15 PM	Tornado	F2	0	0
06/08/1966	8:00 PM	Tornado	F4	1	2
05/18/1971	1:45 PM	Tornado	F2	0	0
05/23/1981	3:15 PM	Tornado	F0	0	0
10/31/1984	7:40 PM	Tornado	F1	0	1
03/30/1993	6:19 PM	Tornado	F1	0	0
05/06/1993	7:26 PM	Tornado	F0	0	0
07/04/1995	2:35 PM	Tornado	F	0	0
06/05/1996	8:41 PM	Tornado	F0	0	0
06/05/1996	8:41 PM	Tornado	F1	0	0
05/11/2000	8:40 PM	Tornado	F1	0	0
05/08/2002	5:43 PM	Tornado	F0	0	0
05/08/2002	5:48 PM	Tornado	F1	0	0
05/04/2003	2:54 PM	Tornado	F1	0	0
05/04/2003	2:55 PM	Tornado	F2	0	2
03/12/2006	8:20 AM	Tornado	F0	0	0
04/15/2006	7:05 PM	Tornado	F0	0	0
04/15/2006	7:20 PM	Tornado	F0	0	0
			TOTALS	2	27

Table 9: Historical Data, Platte County, Mo.

Date	Time	Type	Magnitude	Death	Injuries
05/07/1961	3:45 PM	Tornado	F4	0	0
05/07/1961	3:55 PM	Tornado	F4	0	0
05/07/1961	4:45 PM	Tornado	F4	0	0
04/12/1964	4:30 PM	Tornado	F3	0	0
04/10/1965	1:30 PM	Tornado	F0	0	0
04/10/1965	2:30 PM	Tornado	F3	0	9
06/22/1969	1:00 AM	Tornado	F1	0	0
06/26/1969	6:30 PM	Tornado	F3	0	2
06/26/1969	6:35 PM	Tornado	F2	0	0
05/18/1971	1:55 PM	Tornado	F2	0	4
12/05/1975	1:40 AM	Tornado	F1	0	0
05/23/1981	3:53 PM	Tornado	F0	0	0
05/30/1985	6:24 PM	Tornado	F1	0	2
04/30/2003	6:15 PM	Tornado	F0	0	0
04/30/2003	6:35 PM	Tornado	F0	0	0
05/04/2003	2:56 PM	Tornado	F1	0	0
05/04/2003	3:35 PM	Tornado	F4	0	0
05/29/2004	5:22 PM	Tornado	F3	0	0
			TOTALS	0	17

Table 10: Historical Data, Ray County, Mo.

Date	Time	Type	Magnitude	Death	Injuries
07/08/1951	8:15 PM	Tornado	F2	0	0
07/17/1958	7:30 AM	Tornado	F2	0	0
06/11/1960	4:15 PM	Tornado	F1	0	0
12/04/1960	8:30 PM	Tornado	F2	0	0
12/04/1960	8:50 PM	Tornado	F2	0	0
05/07/1961	5:30 PM	Tornado	F2	0	0
05/07/1961	5:45 PM	Tornado	F2	0	2
07/15/1962	1:00 AM	Tornado	F1	0	0
05/15/1963	2:10 AM	Tornado	F1	0	0
06/11/1964	2:30 PM	Tornado	F1	0	0
05/11/1966	6:00 PM	Tornado	F1	0	0
01/24/1967	12:50 PM	Tornado	F3	2	18
04/21/1967	1:20 PM	Tornado	F3	0	0
05/15/1968	3:45 PM	Tornado	F1	0	0
06/26/1969	7:00 PM	Tornado	F1	0	0
07/23/1971	6:12 PM	Tornado	F0	0	0
08/03/1971	1:00 PM	Tornado	F0	0	0
07/18/1973	5:30 PM	Tornado	F1	0	0
11/29/1975	6:10 PM	Tornado	F0	0	0
05/04/1977	5:05 PM	Tornado	F4	0	0
05/04/1977	5:15 PM	Tornado	F4	0	1
05/30/2001	6:17 PM	Tornado	F0	0	0
06/12/2003	3:25 PM	Tornado	F0	0	0
11/27/2005	5:59 PM	Tornado	F1	0	0
03/12/2006	9:15 AM	Tornado	F1	0	0
04/15/2006	8:15 PM	Tornado	F0	0	0
			TOTALS	2	21

Table 11: Historical Data, Wyandotte County, Kan.

Date	Time	Type	Magnitude	Death	Injuries
06/22/1958	1:40 PM	Tornado	F1	0	0
06/11/1959	3:45 PM	Tornado	F1	0	0
04/15/1960	3:00 PM	Tornado	F	0	0
05/07/1961	3:20 PM	Tornado	F4	0	0
05/07/1961	3:25 PM	Tornado	F4	0	12
05/07/1961	3:30 PM	Tornado	F4	0	0
08/27/1965	3:30 AM	Tornado	F0	0	0
05/15/1966	5:40 PM	Tornado	F2	0	5
05/04/2003	3:18 PM	Tornado	F4	2	30
04/15/2006	7:25 PM	Tornado	F0	0	0
			TOTALS	2	47



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