

Questions to be Answered Before Final Selection

Often the "Best-Available" spaces in the building cannot be occupied during emergencies due to various legitimate reasons. These questions should help identify potential conflicts before an emergency occurs.

- What portion of the space is usable? Permanent equipment, furniture, etc. reduce the usable space.
- Which good spaces are often inaccessible? Many excellent spaces are locked with few people having keys.
- Which good spaces are unsuitable for use due to operational reasons? Many security areas offer excellent protection but are operationally not good due to the need to retain security over records, equipment or money.
- Where is the building first-aid kit, AED, fire extinguisher, or medical supplies? This equipment should be in one of the "Best-Available" spaces.
- Would protection levels increase significantly (and time to shelter decrease significantly) if people were "jammed" in at lower square foot per person ratios? This is a valid alternative to lower quality protection with more adequate space per person.

A plan is worthless if it is not tested and understood by the people it is intended to protect. A good plan has the following features:

- Recorded, published, and distributed so that all know what to do
- Identifies one or more "Spotters" who are responsible for prompt, accurate visual identification of an approaching storm (National Weather Service provides training)
- Prompt a clear warning alarm that is readily understood by all
- Don't forget to have a portable radio or TV available with fresh batteries to receive weather updates

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**This brochure offers advice on selecting the best shelter and is not meant to be all inclusive.*



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Oakland County HOMELAND SECURITY

SEEKING THE BEST AVAILABLE SHELTER AGAINST TORNADOES AND HIGH WINDS



Tornado Shelter Survey Tips

The following “tips” are intended to help you avoid making serious errors while trying to assess the “Best-Available” tornado shelter spaces in your facility.

Never “survey” a building from drawings alone!!! Why???...

- Buildings are frequently modified. Sometimes modifications improve the shelter capability. However, sometimes the changes reduce potential shelter quality.
- A floor plan cannot show everything that is in the space. Even the architect’s “blueprint” floor plan is an incomplete document. It “cuts” the building (usually on a plane that is 4’ above the floor) and cannot show everything that is above that plane.
- Detailed information about doors (swing directions, hardware, window size, material, etc.) will be incomplete.

Never attempt to “guarantee” that the “Best-Available” tornado shelter spaces are good enough to prevent serious injury or death. There are a number of reasons for this statement, including...

- It is impossible to know the direction or intensity of the storm.
- It is impossible to know the relationship of the path of the storm to the building.
- It is impossible to predict how much warning the building occupants will have before the storm arrives.
- It is impossible to know whether procedural directives (such as closing doors, etc.) will be followed.



Interior Survey (poor spots in generally good locations)

It is essential that the spaces selected be refined to the very best possible. Often poor (relatively hazardous) spaces exist within generally safe areas. These poor spaces must be avoided or occupied as a last resort.

- Avoid spaces that are opposite doorways or openings into rooms that have south or west facing exterior walls. This is particularly critical if these exterior walls contain glass.
- Avoid interior locations that contain glass. Examples are display cases, transom glass, door sidelights, etc.
- Avoid interior locations under or near skylights or an outside wall of a room or building that rises above an adjoining roof and contains windows.
- Avoid locations where interior doors swing. When the storm hits, the doors are likely to swing violently.
- Avoid spaces within the “falling radius” of higher building elements (chimneys, walls enclosing higher roof areas). Assume that the falling radius is equal to the height of the high element above the roof.



Interior Survey

(portions of the building to consider – but not necessarily select)

Examination of building failures after high winds reveal a pattern of spaces still remaining after the storm. These are the spaces to consider for occupancy.

Consider the LOWEST FLOOR

If the building has a basement, or a partial basement, it is probably the safest space in the structure.

Consider INTERIOR SPACES

These are spaces that have no walls on the outside of the building. Do NOT select interior spaces that have large spans.

Consider spaces having SHORT SPANS

It is difficult to find one space that will offer a high degree of protection to all of the building occupants (exception: basement). Therefore, seek out a number of smaller spaces.

Consider portions of THE BUILDING that have structural frames (steel, concrete or wood) rather than those portions that have load-bearing walls.

The space per person depends on the age of the people and their degree of mobility. Small children require only four square feet per person. Six square feet per person is adequate for adults. However, nursing home or hospital patients will require much more.



“A plan is worthless if not tested and understood by the people it is intended to protect.”

**Don't pretend to be a structural engineer or an architect. Don't try to guess about the building's structural system or whether windows will resist tornado blown debris. However, it should be possible for you to clearly identify those locations that are likely to be very dangerous and to also identify many of the safer locations.*

Tornado Shelter Survey

- Identify tornado spotting locations. Even with the technological communication advances there is “no guarantee” that the storm will be spotted, a warning issued and heard by those in a building.
- Remember that many facilities are intensely used after 5:00 pm
Don't limit planning to 8:00 am – 5:00 pm
- Some of the very best shelter spaces are rejected due to “unpleasant odors,” possibility of fire, or due to limited access. Those decisions should be questioned remembering that...
 - the time of occupancy may be very short
 - fires during tornadoes are almost non-existent
 - many rescuers will appear very shortly after a storm hits
- Don't get involved with operational decisions (unless you are the building manager or administrator), however, the “route to shelter” is an important topic. Encourage clear posting of shelter locations.
- Some organizations may wish to consider a “staged” shelter procedure. For this, some people are moved from dangerous locations to somewhat comfortable “staging areas.” When the condition deteriorates or a storm is spotted, they move into nearby shelter locations. This procedure might be considered when all of the following conditions are present...
 - building spotter has a clear, unobstructed view of the storm
 - an extremely quick, totally reliable, relay of information to the building occupants is present
 - the final destination shelter is easily and quickly accessible
- Identify obviously dangerous spaces.
- Make a note of spaces that “look good” but are really dangerous. These include locations where a high, heavy wall or chimney might collapse into an interior space or there is overhead heavy mechanical equipment that might fall.

Best Available Shelter Against High Winds

This checklist procedure is designed to assist in a systematic review of a building to find the locations of the “Best Available Shelter Space Against High Winds.” It is not intended to infer that these spaces guarantee safety during a severe storm, but that they are the safest available in the building.

Advance Preparation

- Obtain the following equipment: compass, flashlight, tape measure and soft tipped rod (pool cue)
- Know the tornado history for the geographic area. Consult the nearest National Weather Service Office.
- Obtain plans of the building for each floor. Ideal plans are small, to-scale with sufficient detail. If the drawings aren’t available, have someone prepare a simple, yet accurate drawing of each floor. Check the drawings against the actual building. Do not assume accuracy.

Exterior Survey

Establish “true” (magnetic) north. Use a compass or compare the building to an accurate map of the locality. Place a north arrow on the floor plans of the building. Do not confuse “true” north with “building north,” a direction used by architects to simplify the drawings.

Observe completely around the building looking for and recording the location of:

- Potential missiles (site equipment, nearby buildings, debris, etc.), especially on the south and west sides of the building
- Ground embankment against the building
- Mechanical equipment on roof
- Electrical service entrance
- High building elements (chimneys, higher portions of the bldg)
- Changes in roof level
- Take a look from the south and west noting building entrances and construction

Interior Survey (portion of the building to avoid)

Using the understanding of tornado behavior and its effects on buildings to predict what the tornado would do to a building, carefully identify the following spaces as the most hazardous locations/spaces to avoid! Predict which portions of the roofs are most likely to be removed.

- Windward sides (usually south and west)
- Long spans
- Non-framed construction (roofs on load bearing walls)
- Roof with overhangs

Avoid locations where roofs are likely to be removed. The roof may fall on the occupants. Missiles also have a direct access to interior spaces.

Avoid exterior walls that are most likely to be partially or completely destroyed. Examination of damaged buildings shows that any side of a building can be destroyed but that the most likely damage occurs in the following order:

1. south wall
2. west wall
3. east wall
4. north wall

Avoid corridors (if any) that may become “wind tunnels.” Examination of corridors after tornadoes revealed much debris and evidence of high speed winds. This evidence was found in corridors whose exterior doors exited directly (no turns) to the following direction (in order of severity):

1. to the south
2. to the west
3. to the east
4. to the north

Avoid those locations with glass facing the likely storm direction. Assume that the glass will blow in on the south, west, and occasionally on the east sides of the building. Some buildings are built using various types of construction.

