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Assessing the Interior Design of Storm Shelters on a University Campus

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Abstract

The purpose of this study is to assess whether the current design and space plan of a primary storm shelter in an educational building located on a large mid-western university campus in “Tornado Alley” is safe according to suggested safety standards established by Americans with Disabilities Act (ADA) and Federal Emergency Management Agency (FEMA). The buildings and shelters included in the study were chosen based on construction dates, shelter occupant loads, type of building, and access to buildings. An assessment tool was developed and used as the primary means of evaluating the spaces in regards to hazardous elements and obstacles to accessibility requirements. The findings show that the shelter spaces did not comply overall with the standards developed by industry leaders. Therefore, the occupants of the shelters could potentially be at risk from hazardous elements when in these spaces.

Definition of Terms

Americans with Disabilities Act (ADA) – four-part federal civil law enacted on July 26, 1990 and became enforceable beginning in 1992 that prohibits discrimination against people with disabilities (Harmon and Kennon, 2008).

Atmospheric pressure – the pressure exerted by the earth's atmosphere at any given point, determined by taking the product of the gravitational acceleration at the point and the mass of the unit area column of air above the point (http://www.nws.noaa.gov/glossary/index.php?letter=a).

Barriers – any obstruction; anything which hinders approach or attack (http://www.dictionary.net/barrier).

Built-up roof – a continuous roof covering made up of laminations or plies of saturated or coated roofing felts, alternated with layers of asphalt or coal-tar pitch, and surfaced with a layer of gravel or slag in a heavy coat of asphalt or coal-tar pitch or finished with a cap sheet; generally used on flat or low-pitched roofs (Harris, 2008).

Catchment vestibule – a room used for capturing or seizing located between the outer door and the interior (http://www.merriam-webster.com/dictionary/catch) and (http://www.merriam-webster.com/dictionary/vestibule).

Chord – a principal member of a truss which extends from one end to the other, primarily to resist bending, usually one of a pair of such members (Harris, 2006).

Clerestory – an upper zone of wall pierced with windows that emit light to the center of a lofty room (Harris, 2006).

Cloud base – the lowest level in the atmosphere at which the air contains a perceptible quantity of cloud particles (http://www.pmel.org).

Collateral damage – any damage incidental to any activity (http://dictionary.reference.com/browse/collateral+damage).

Concrete blocks – larger porous bricks made of concrete with air pockets that make the material lightweight to handle but somewhat fragile during handling (Nielson & Taylor, 2007).

Concrete masonry unit – a block or brick cast of Portland cement and suitable aggregate, with or without admixtures, and intended for lying up with other units as in normal stone masonry construction (Harris, 2006).

Connector – a mechanical device for fastening together two or more pieces, members, or parts including anchors, fasteners, or wall ties (Harris, 2006).

Cumuliform cloud – generally descriptive of all clouds, the principal characteristic of which is vertical development in the form of rising mounds, domes, or towers (http://amsglossary.allenpress.com/glossary/search?p=1&query=cumuliform).

Cyclonic – having a sense of rotation about the local vertical the same as that of the earth's rotation (http://amsglossary.allenpress.com/glossary/search?p=1&query=cyclonic).

Debris impact – the remains of something that is broken down or destroyed with forcefully striking (http://www.merriam-webster.com/dictionary/debris) and (http://www.merriam-webster.com/dictionary/impact).

Door hardware – commonly includes hinges, latches and lockers, pulls, and closers (Harmon & Kennon, 2008).

Eave – the lower part of the roof that projects from the wall (Jefferis & Madsen, 2004).

Educational institutions – used for public and private schools and childcare centers, trade and vocational schools, and institutions of higher education (http://libweb.uoregon.edu/dc/dlc/geolevel.html).

Emergency lighting – lighting designed to supply illumination which is essential to safety in the event of failure of the normal electric power supply (Harris, 2006).

Enhanced Fujita Scale (EF-scale) – a set of wind estimates (not measurements) based on tornado damage (http://www.spc.noaa.gov/faq/tornado/ef-scale.html).

Face brick – brick especially made or selected to give an attractive appearance when used without rendering or plaster or other surface treatment of the wall; made of selected clays, or treated, to produce the desired color (Harris, 2006).

Federal Emergency Management Agency (FEMA) – an agency of the United States government employing a comprehensive emergency management system of preparedness, protection, response, and mitigation (http://www.fema.gov/about/index.shtm).

Flat roof – a roof with a minimal roof pitch, usually about ¼ of an inch per 12 inches (Jefferis and Masen, 2004)

Fujita Scale (F-Scale) – relates tornado intensity indirectly to structural and/or vegetative damage (http://amsglossary.allenpress.com/glossary/search?p=1&query=fujita+scale). A scale of wind *damage* intensity in which wind speeds are inferred from an analysis of wind damage (http://www.nws.noaa.gov/glossary/index.php?word=fujita+scale).

Funnel cloud – a condensation cloud, typically funnel-shaped and extending outward from a cumuliform cloud, associated with a rotating column of air (a vortex) that may or may not be in contact with the ground (http://amsglossary.allenpress.com/glossary/search?p=1&query=funnel+cloud).

Glazed – an opening that is filled with sheets of glass, an in a window (Harris, 2006).

Glazing – the glass surface of a glazed opening (Harris, 2006). See glazed

Governmental agency – an administrative unit of the government (http://dictionary.reference.com/browse/government+agency&o=100074).

Gross square footage – the total square footage of a building including elevator shafts, vertical penetrations, and equipment areas, ductwork shafts and stairwells (http://www.miami-dade-realtor.com/glossary.html).

Grout – mortar containing a considerable amount of water so that it has the consistency of viscous liquid, permitting it to be poured or pumped into joints, spaces, and cracks within masonry walls and floors, between pieces of ceramic clay, slate, and floor tile, and into joints between preformed roof deck unit (Harris, 2006).

Handicapped accessibility – a federal law, enacted in 1990, requiring that public accommodations be accessible to those having physical disabilities; the law mandates that existing physical barriers be placed or modified so there are no impediments to access by the physically disabled (Harris, 2006).

Interior partition – a non-structural interior divider that can span horizontally or vertically, such as wall or suspended ceiling (Harmon & Kennon, 2008).

Lateral strength – strength which resists a tendency to fracture arising from lateral pressure (http://www.thefreedictionary.com/Lateral+strength).

Lightweight steel frame (LSF) – used in the wall, floor and roof assemblies in buildings from one to six stories in height (http://www.cssbi.ca/Eng/products/commercial/lsf.shtml). See steel frame.

Load-bearing masonry walls – a wall capable of supporting an imposed load in addition to its own weight (Harris, 2008) and is made of a combination of clay brick, concrete masonry units, stone, and calcium silicate units (http://www.maconline.org/tech/design/thinksystems/thinksystems.html).

Long-span steel joists – any steel structural member that is composed of hot-rolled or cold-formed solid or open-web sections of steel or welded bars, strip- or sheet-steel member, or slotted, expanded, or otherwise deformed rolled sections of steel (Harris, 2006).

Masonry infill – panel constructed from masonry, usually built in between the columns and beams of the structural frame of the building (http://www.ideers.bris.ac.uk/glossary/gloss_infill.html).

Masonry piers – a solid mass of masonry between doors, windows, and other openings in a building (Brett, 1997).

Masonry units – a building unit fabricated of burnt clay, concrete, stone, or the like (Harris, 2008).

Massive – consisting of great mass; containing a great quantity of matter (http://wordnetweb.princeton.edu/perl/webwn?s=massive).

Multi-use shelter – shelters that are designed to serve other purposes in addition to providing shelter space (fema.gov).

Non-reinforced – Not strengthened or made stronger (http://www.merriam-webster.com/dictionary/non) and (http://www.merriam-webster.com/dictionary/reinforce).

Occupancy – the use or intended use of a building, floor, or other part of a building (Harmon & Kennon, 2008).

Open web – a web composed of a group of members (in a crisscross or zigzag array) instead of solid plates (Harris, 2008).

Overhang – the horizontal measurement of the distance the roof projects from a wall (Jefferis & Madsen, 2004).

Path length – the length of a tornado track measured in miles (http://www.srh.noaa.gov/oun/tornadodata/county/).

Path width – the width of the tornado in yards (http://www.srh.noaa.gov/oun/tornadodata/county/).

Poured-in-place reinforced concrete – concrete or mortar that is poured and cured in the place where it will remain permanently, such as concrete slab foundations (http://www.helpdeskprodemo1.com/re_glossary_p15.shtml). Concrete containing reinforcement designed on the assumption that the concrete and reinforcement act together in resisting forces (Harris, 2006).

Pre-engineered metal building – a metal building that consists of light gauge metal standing seam roof panels on steel purlins spanning between rigid frames with light gauge metal wall cladding (http://www.schoolclearinghouse.org/pubs/PreEngineeredBuildings.pdf).

Private agency – an non public establishment engaged in doing business for another (http://www.merriam-webster.com).

Public agency – any political subdivision of the state or any agency of the state government of the United States (www.lrc.ky.gov/recarch/97ss/HB1/bill.doc).

Puddle weld – a type of plug weld for joining two sheets of light-gauge material; a hole, burned in the upper sheet is filled with a puddle of weld metal to fuse the upper sheet to the lower (Harris, 2006).

Real time – data or observations for which the reporting or recording of events is nearly simultaneous with their occurrence (http://amsglossary.allenpress.com/glossary/search?p=1&query=real+time).

Reinforced bond beam – a horizontal reinforced concrete beam used to strengthen a masonry wall so as to avoid its cracking; the reinforcement often extends around the perimeter of the wall (Harris, 2006).

Reinforced concrete – concrete containing reinforcement designed on the assumption that the concrete and reinforcement act together in resisting forces (Harris, 2006).

Reinforced masonry – masonry units in which reinforcement, usually steel mesh or rods, is embedded in such a manner that the two materials act together in resisting forces (Harris, 2006).

Reinforcing rod – any of a variety of steel rods used in reinforced concrete (Harris, 2006).

Rigid connected steel frame – construction in which the structural supporting elements consist of combinations of steel beams, steel girders, and steel columns joined together at their intersections, where connection between two structural members which prevents one from rotating with respect to the other (Harris, 2006).

Rigid frames – a structural framework in which all columns and beams are rigidly connected; there are no hinged joints and the angular relationship between beam and column members are maintained (Harris, 2006).

Roof deck – the structural material between the roof supports used as a base for the roof covering system; may be metal, concrete, wood, gypsum, or a combination of these or similar materials (Harris, 2006).

Slab-on-grade – the concrete slab that is to serve as the foundation for the structure is formed by pouring the foundation directly onto the ground (http://www.accu-crete.com/cs/services/glossary_of_terms.html).

Space plan – allotment of spaces to create a workable floor plan. The organization and division of spaces into rooms or areas to meet specific needs (Nielson & Taylor, 2007).

Special needs – relating to people who have specific needs, as those associated with disabilities (http://www.thefreedictionary.com/special+needs).

Steel beam lintels – a horizontal structural member (such as a beam) over an opening which carries the weight of the wall above it; usually of steel, stone, or wood (Harris, 2008).

Steel frame – construction in which the structural supporting elements consist of combinations of steel beams, steel girders, and steel columns, joined together at their intersections (Harris, 2006).

Steel open-web joists – a steel truss having an open web whose component parts are either hot-rolled structural shapes or cold-formed light gauge steel shapes (Harris, 2008).

Structurally failed – a buildings loss of strength (http://www.merriam-webster.com/dictionary/structure) and (http://www.merriam-webster.com/dictionary/fail).

Stud wall – a partition using studs as the vertical structural members; usually faced with wallboard (Harris, 2006).

Suction pressure – the difference between any vacuum pressure and atmospheric pressure (http://www.sensorsone.co.uk/pressure-measurement-glossary/suction-pressure.html).

Tornado Alley –the region that stretches from western Iowa down through Nebraska and Kansas to southern Oklahoma and over Arkansas and Louisiana to southeastern Mississippi (Perkins, 2002).

Thunderstorm – a storm resulting from strong rising air currents; heavy rain or hail along with thunder and lightning (http://wordnetweb.princeton.edu/perl/webwn?s=thunderstorm).

Vertical strength –the power of vertical structural members to resist force (http://wordnetweb.princeton.edu/perl/webwn?s=vertical) and (http://www.merriam-webster.com/dictionary/strength).

Vortex – a mass of fluid, especially of a liquid, having a whirling or circular motion tending to form a cavity or vacuum in the center of the circle, and to draw in towards the center bodies subject to its action (http://www.dictionary.net/vortex). In its most general use, any flow possessing a vector measure of local rotation in a fluid flow (http://amsglossary.allenpress.com/glossary/search?id=vortex1).

Wind-generated loads – the forces to which a structure is subjected caused by a natural movement of the air of any velocity (http://www.merriam-webster.com/dictionary/wind) and (http://www.merriam-webster.com/dictionary/load).

Wind-induced forces – strength or energy brought forth by a natural movement of the air of any velocity (http://www.merriam-webster.com/dictionary/wind), (http://www.merriam-webster.com/dictionary/induced), and (http://www.merriam-webster.com/dictionary/force).

Wood frame – building construction in which exterior walls, load-bearing walls and partitions, floor and roof constructions, and their supports are all built of wood (Harris, 2006).

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Introduction

Tornadoes are a phenomenal force of nature that can strike in various locations of the United States and even, in some rare cases, throughout the globe. Throughout the last 60 years meteorologists have spent hours studying and identifying the characteristics of why tornadoes form, the magnitude of each reported tornado, and how people can be better prepared for a tornado. As a result of this research, there have been many great advances in the field of meteorology concerning tornado research and forecasting.

Architects and structural engineers have also been conducting research, but their research specifically focuses on how buildings of various construction types and occupancies react to the forces of a tornado. Many public, private, and governmental agencies have created teams to survey damage of buildings that structurally failed during a tornado, including commercial and educational settings. These teams also have conducted experiments on the ability of the construction methods used within buildings to withstand tornadoes. Published documents by these agencies give suggestions and checklists on how to improve the storm shelter selection process in construction of educational institutions. This process can include analyzing the number of interior partitions between the location of the storm shelter and the exterior walls, as well as the number of people the shelter will hold comfortably. However, very little information is published on how to select storm shelters for existing buildings, especially in an older educational setting.

The purpose of this study is to assess whether the current design and space plan of a primary storm shelter in an educational building located on a large mid-western university campus in “Tornado Alley” is safe according to suggested safety standards established by Americans with Disabilities Act (ADA) and Federal Emergency Management Agency (FEMA). The results of this study will allow the University of Central Oklahoma (UCO) and other similar universities to see what improvements need to be made in the design of the shelter to better protect and serve the occupants of these areas.

The potential occupants of these shelters could benefit from the findings because the purpose of this study is to determine if the shelters on the UCO campus are acceptable and safe as areas of refuge according to various governmental agencies. To make this determination, the shelters are assessed based on their safety features, accessibility, and comfort.

The identification of safety features in and around the shelter includes the location of the shelters inside the building and what architectural features are hazardous to the occupants. Accessibility assessed includes the means of travel to the shelter and restroom accessibility. Comfort of each shelter is assessed based on the number of people per recommended square footage versus available square footage, availability of emergency communication, and the presence of signage to direct people to the shelter.

The location of the assessed storm shelters was at UCO in Edmond, Oklahoma. This university was chosen based on the potential impact of a tornado on campus, the population that could potentially be affected by a tornado, the age of the buildings housing the storm shelters, and the number of tornadoes directly affecting Edmond, Oklahoma.

Literature Review

The purpose of this literature review is to build a foundation supporting the need and purpose of this research. This is accomplished through the exploration of several areas of tornado and building construction research. Tornado-specific information discussed in this section includes tornado formation, classification, and activity in the United States. Building construction research includes shelter design and shelter location.

Tornado Definition and Formation

A tornado is a violently rotating column of air, in contact with the ground. It is either a pendant from a cumuliform cloud or underneath a cumuliform cloud and is often (but not always) visible as a funnel cloud. Its vortex usually rotates cyclonically (counter-clockwise) with wind speeds as low as 40mph or as high as 300mph. A vortex is a rotating column of air (American Meteorology Society, 2000). In order for a vortex to be classified as a tornado, it must be in contact with both the ground and the cloud base (Perkins, 2002). Tornadoes form from the energy released in a thunderstorm, and as powerful as they are, tornadoes account for only a fraction of the energy in a thunderstorm. Their energy is concentrated in a small area, thus, making them dangerous (National Severe Storms Laboratory, n.d.).

Knowing what a tornado is, what types of storms produce tornadoes, and the three classifications of tornadoes helps people understand the danger, destructive behavior, and nature of tornadoes (see Table 1).

Table 1

Classification of Tornadoes

Category	Percentage of All Reported Tornadoes	Percentage of All Reported Tornado Deaths	Duration	Wind Speed
Weak	69%	5%	1-10+ minutes	Less than 110 mph
Strong	29%	30%	20+ minutes	110-205 mph
Violent	2%	70%	60+ minutes	Greater than 205 mph

National Weather Service Forecast Office (2007). *Tornadoes…Nature's Most Violent Storms.*

Fujita Scale

Tornadoes cannot be characterized by their apparent size because some tornadoes are never seen and wide tornadoes do not necessarily have destructive or high wind speeds. Perkins (2002) stated they are rated according to the damage they cause to human-made structures. The F-Scale, which was developed in the early 1970's, and is named for the University of Chicago meteorologist, Dr. Theodore Fujita, since he is the meteorologist who developed the scale. A tornado's F-Scale rating is based on the worst damage found anywhere along its path.

The Fujita Scale and Enhanced Fujita Scale ranking (see Table 2) given to tornadoes is important information when describing the strength and deconstructive components of a tornado. These scales, described below, are not to be confused with the three categories of tornadoes. Schultz and Metz (2001) reviewed in their article, *Shelter from the Storm,* Dr. Theodore Fujita's scale of measuring tornadoes. The six-category scale was used to classify U.S. tornadoes into six levels of damage. The stages are named F0 through F5. F0 describes the weakest tornadoes and F5 describes the most destructive tornadoes. The F-Scale has subsequently become the definitive scale for estimating wind speeds within tornadoes based upon the damage caused by the tornado (see Table 2).

How a tornado interacts with the environment affects its classification. For example a tornado that strikes a well-constructed building may be an F2. The same tornado can strike a poorly-constructed building and be rated an F4, due to the damaged it causes.

Table 2

Fujita and Enhanced Fujita Scale

Fujita Scale		Enhanced Fujita Scale		Typical Damage
F Number	Wind Estimate (MPH)	EF Number	Wind Estimate (MPH)	
FO	< 73	EF0	65 – 85	**Light damage.** Some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; sign boards damaged.
F1	74 – 112	EF1	86 – 110	**Moderate damage.** Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos blown off roads.
F2	113 – 157	EF2	111 – 135	**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	EF3	136 – 165	**Severe damage.** Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off the ground and thrown.
F4	207 – 260	EF4	166 – 200	**Devastating damage.** Well-constructed houses leveled; structures with weak foundations blown away some distance; cars thrown and large missiles generated.
F5	261 – 318	EF5	200 >	**Incredible damage.** Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 meters (109 yds); trees debarked; incredible phenomena will occur.

Fujita, T. (1971). *Fujita Tornado Damage Scale* & National Severe Storms Laboratory (n.d.). *Enhanced F-Scale for Tornado Damage.*

The Enhanced Fujita Scale was developed as a response to several weaknesses in the original scale. Many engineers, emergency managers, and meteorologists thought the wind estimates in the original F-scale may be too high as a result of the devastating tornadoes in Jarrell, Texas, on May 27, 1997 and Moore and Oklahoma City, Oklahoma, on May 3, 1999. Other weaknesses in the original F-scale were the limitations of weak structures in conveying strong tornado damage, rankings being subjective and based solely on the damage caused by the tornado, difficulty to apply if there were no damage indicators, no account of construction quality and variability, subjectivity of survey process, and no definitive correlation between damage and wind speed (Godfrey, 2008).

Beginning in 1970 and continuing to 2006, each tornado was assigned a rating from the Fujita Scale determining the strength of the tornado. After 2006 each storm has been given a ranking from the Enhanced Fujita Scale based upon the destruction of each storm. However, before the development of the F-scale in the early 1970's tornadoes were not ranked according to this scale. In reviewing documentation of tornadoes that occurred prior to 1970, these tornadoes were given an F-scale rating. Therefore, the various rankings from the two scales listed will be used as a reference when discussing specific tornadoes throughout this report.

Wind Effects on Buildings

Tornadoes cause many different kinds of stress on buildings, and therefore, produce different hazards. According to Schultz and Metz (2001) strong winds can collapse walls, remove roofs, move heavy equipment, and roll parked vehicles. Changing wind pressures exert forces to force a door into the building or pull it open. Structural materials can become missiles when propelled at high speeds. The debris caused by the destruction of the buildings can penetrate doors, windows and even non-reinforced brick walls. Flying glass can also be a problem during a tornado.

Buildings hit by tornadoes threaten the lives of occupants inside, due to a combination of effects occurring at almost the same time in the building. In order to understand the tornado damage that can occur to a building, consider the following three categories of damage. These categories are wind-induced forces, changes in atmospheric pressure, and debris impact (Federal Emergency Management Agency [FEMA], 2003).

Wind-induced forces are created by the inward- and outward-acting pressures on building surfaces, depending on the orientation of the surface (e.g., flat, vertical, low-slope). As wind moves over and around buildings, the outward-acting pressure increases as the building geometry forces the wind to change direction. With these increases, uplift is created on parts of the building, and if the building is too weak, it will be forced apart due to the uplifting pressures. In addition, when wind makes its way inside a building or creates an opening by breaking a window or penetrating the roof or walls, the pressures on the building increase even more (FEMA, 2003).

Building shapes that “catch” the wind tend to fail and become “sails” in extreme winds. These shapes include, but are not limited to, overhangs, canopies, and eaves. Flat roofs can be lifted off when the wind flows over them and increases the uplift pressure at the corners and edges of the roof (FEMA, 2003).

The atmospheric pressure outside the building during a tornado is very low compared to the pressure inside. However, in most buildings there is enough air leakage through building component connections to equalize these pressures. The explosion of buildings during a tornado due to atmospheric pressure differences is a myth. In reality, the combination of internal pressures and outward-pull on the building from suction pressure causes building failures, forcing walls outward and giving the building the appearance of having exploded. During a tornado, doors and windows should remain closed on all sides of the building in order to minimize the entry of wind into the building which can cause the failure of a building (FEMA, 2003).

Missiles are another potential hazard to occupants of a storm shelter, and they are defined as debris and other objects picked up the wind and moved along with enough force to damage and penetrate windows, doors, walls, and other parts of a building. In general the severity of damage is determined by the strength of the wind carrying the missile and the size and weight of the debris being carried. Branches, stones, and other lighter-weight debris can easily break glass doors and windows (FEMA, 2003).

Damage from debris impact is caused when extreme winds in tornadoes pick up and carry it from two different sources. The first source is debris from damaged buildings and the second source is objects located in the path of the winds that have been picked up and carried. Heavy, massive objects such as cars, buses, and other types of vehicles can be moved by extreme winds, and these objects cause collateral damage to buildings. These heavy objects can then roll causing crushing-type damage. Light objects that become flying debris can penetrate building components such as doors, windows, and roofs. Therefore, shelters and refuge areas should provide protection overhead, as well as on the side, since missiles can travel vertically and horizontally. Walls and roofs can be designed to withstand the impact of these missiles with the possibility for protection in two options. Option one is to provide protection at the exterior building walls. The second option is to provide protection through the use of interior barriers. Both options can be constructed to provide protection for a smaller protected area within the building (FEMA, 2003).

Shelter Design, Location and Components

The design, location and architectural components are integral parts of the success or failure of a storm shelter. FEMA, National Weather Service Forecast Office (NWS), architects and structural engineers discuss the importance of shelter design, location and architectural components for the success of shelter.

FEMA's (2003) publication, *431 - Tornado Protection: Selecting Refuge Areas in Buildings*, stated that tornadoes cause heavy loss of life and property damage throughout much of the continental United States. Public buildings, including schools, have shelters offering some protection from the dangers of tornadoes and debris. These shelters are known as best available refuge areas, and these shelters refer to areas in an existing building that have been deemed likely to offer the greatest safety for building occupants during a tornado.

However, because these areas were not specifically designed as tornado shelters, occupants could be injured or killed. People in the best available refuge areas are less likely to be injured or killed in these areas than people in other parts of the structure. The best available refuge areas must be determined by a qualified architect or engineer and building administrators should know the locations of these areas. However, to plan the best shelter and to minimize hazards affecting occupants, the location and layout of the shelter should be free from glass, walls of the shelter should sustain impact from missiles or flying debris, and it should have a strong, stable roof that can withstand tornadic winds.

FEMA's (2003) publication, *Tornado Protection: Selecting Refuge Areas in Buildings*, stated:

> Most buildings, unless specifically designed as shelters, will sustain catastrophic damage if they take a direct hit from a violent tornado. Because the maximum wind speeds associated with a violent tornado greatly exceed the wind speeds that the buildings were design to withstand, complete destruction will usually occur during these extremely rare events.
>
> In reality, most tornadoes do not produce the winds of a violent tornado, and some areas of many buildings can survive these lesser events without catastrophic damage or collapse. Placing building occupants in the best available refuge areas within a building greatly reduces the risk of injsury or death. However,

> unless the refuge area was designed as a shelter, its occupants are vulnerable to injury or death.

FEMA's (2002) publication, *Community Wind Shelters*, stated:

> To survive a tornado or hurricane a building needs an extremely strong structure – to resist high-wind forces – and an extremely strong resistant envelope or skin resisting the impact of windborne debris. The results of the research presented in FEMA 361 show that a shelter that can withstand 250-mph winds as well as the impact of a 15-pound two by four traveling at 100 mph will provide "near-absolute protection" for its occupants in virtually any high-wind event.
>
> Shelters that provide "near-absolute protection" will protect occupants from death and injury. This does not mean the shelter itself will be undamaged by high winds or debris. Repairs to a shelter's walls, ceilings, and doors may be necessary after an extreme-wind event.
>
> For the goal of near-absolute protection, the entire shelter – including its walls, ceilings, and doors -- must be designed and constructed to provide the required strength and impact resistance. Shelter designs typically call for larger, stronger, and greater numbers of construction materials including concrete blocks, reinforcing rods, connectors, and door hardware. Openings into the shelter area, such as windows, must be eliminated or kept to a

minimum. When present, they must be protected with shutters or other coverings of adequate strength and impact resistance.

General shelters for a structure, including schools, are pre-designated shelter areas. The center of basements or the lowest level of the structure is the first place people should relocate to during a tornado. The center of the lowest level is often a corridor. Not only must the occupant be away from corners of the building, windows, doors, and outside walls, but they must put as many walls as possible between themselves and exterior walls (FEMA, n.d.). FEMA supplements the practice of having shelters on the lowest level possible of the structure. In their article, *Tornado Protection: Selecting Refuge Areas in Buildings,* FEMA (2003) stated "the lowest floors of the building are usually the safest because upper floors receive the full strength of the winds and below ground spaces are almost always the safest locations for storm refuge areas".

Educational settings can have several choices of shelters within a building. When school administrators begin to decide upon the best location of a shelter within the structure, they should consult a structural engineer or architect to examine building strength. FEMA (2003) suggested in their publication, *431-Tornado Protection: Selecting Refuge Areas in Buildings,* when selecting a refuge space, consider the following protective elements each building may present. Interior partitions provide the greatest protection if they are somewhat massive, fit tightly to the roof or floor structure above, and are securely connected to the floor or roof. Avoid interior partitions that contain windows. Short span roofs or floor structures are more likely to remain intact because short spans limit the amount of uplift on connections caused by winds. Buildings with rigid frames constructed of heavy steel or reinforced concrete usually remain intact during a storm, and if these types of frames are connected for lateral and vertical strength, they are superior. Wood frame buildings and pre-engineered metal buildings should not be used as tornado shelters. Buildings with poured-in-place reinforced concrete, fully grouted and reinforced masonry, and rigidly connected steel frames are usually still in place after a tornado passes because these types of buildings are more resistant to uplift and removal by extreme winds.

Two addition architectural elements to consider when planning a storm shelter are doors and windows. Buckley (2001) stated that doors are the weakest point of any storm shelter. The doors must resist the same wind-generated loads as the structure. Therefore, this building element requires special features. The first special feature is to design the doors to resist both wind and missile impacts. The second special feature is to design the doors to resist wind forces only and allowing missile penetration. For the second strategy, the design of the door includes a catchment vestibule located behind the door to catch and render penetrating missiles harmless. In, *Tornado Protection: Selecting Refuge Areas in Buildings*, FEMA (2003) stated, “windows cannot withstand extreme winds or missiles of a tornado. Windows usually break into many pieces and are blown into the interior spaces”.

Typical locations for storm shelters in educational settings include corridors and rest rooms in the center of the lowest level of the structure, but both locations have design features that might limit the protective factor of each.

Building corridors are common locations sought for shelter during tornadic storms. Schultz and Metz (2001) stated school corridors typically have construction features that make them unacceptable to serve as a storm shelter. For example, walls outlining the boundaries of the corridor are not constructed to resist winds from a tornado. These are stud walls or walls where non-reinforced masonry units are used. Another source of trouble for corridors is the roof structure over the corridor. This lightweight architectural feature may be prone to collapse in a severe wind. In addition, the roof also may extend over other areas of the building. If the roof collapses over the adjacent space, it is likely to peel back over the corridor, thus, exposing the corridor and making it unsafe.

Corridors also have many doors that lead into spaces that are not capable of withstanding wind forces and missile impacts. In addition, a corridor may have exterior doors at one or both ends. These openings can induce a wind-tunnel effect in the corridor if the exterior doors are breached by wind or missiles and the entrances are unprotected. One important architectural element found in many corridors are clerestory windows. These windows increase the chance for injury from flying missiles, they weaken the walls, and are susceptible to missiles (Schultz and Metz, 2001).

Restrooms are another popular choice for storm shelters; however, restrooms may have roofs and walls not designed to withstand the force of a tornado. Doors and windows in these spaces are often unprotected, and the plumbing fixtures and toilet partitions effectively reduce the space available for people (Schultz and Metz, 2001).

For structures without a safe room, basements are generally considered safer than spaces on the ground or upper levels. According to the Oklahoma Department of Emergency Management (n.d.), underground shelters protect occupants from flying and falling debris, a tornado's most lethal weapon. The NWS in Norman, Oklahoma, supports the idea of flying debris being the most dangerous weapon of a tornado. The National Weather Service Forecast Office's (NWSFO) (2008) article, *Safety Where You Live*, stated:

> It is not the wind inside and around the tornado that kills and injures people, but instead is the flying debris that's in the wind. Items can fly through the air (broken glass, etc) or fall down (could range from small objects to objects the size and weight of cars).

However, underground spaces may not be safe enough. Whether a basement can provide adequate shelter depends on the construction of the floor above and if it will stay attached to the foundation during a storm. In addition the structure must be strong enough to prevent collapse if building debris is piled on top of it. If the floor above blows off during a storm, the occupants of the basement may be exposed to strong winds and flying debris. On the other hand, if the floor collapses into the basement then occupants might be crushed or trapped by the debris (Schultz and Metz, 2001).

Handicapped accessibility is another issue that must be taken into consideration in the design of storm shelters. FEMA's (2002) publication, *Community Wind Shelters*, stated that approved storm shelters must be readily accessible, sited to minimize hazards and provide for the comfort of occupants.

This is especially critical for occupants with disabilities affecting mobility. When designing an accessible storm shelter four requirements must be considered. First, shelters and travel routes to designated refuge areas must be clearly identified by signs. Second, travel time of the occupants to the shelter must be minimized for safety. Third, walkways, corridors, and other routes to shelter should be free of all obstructions. Lastly, all storm shelters are required to follow federal, state, and local American with Disabilities Act (ADA) requirements. This includes shelters underground. They too must also have an effective way for people with special needs to get from the ground level to the shelter (Schultz and Metz, 2001).

The location is also an important factor when planning a storm shelter. FEMA's (2002) article, *Community Wind Shelters*, also stated that shelters must be sited to minimize additional hazards. For example, shelters must be away from large objects that could become windblown debris. In addition, FEMA's (2003) publication, *Tornado Protection: Selecting Refuge Areas in Buildings*, suggested that site of the shelter should be inspected to identify trees in excess of six inches in diameter, poles, and towers. These elements, if fallen, could cause localized buildings to collapse if near the shelter and they can also be blown a considerable distance.

FEMA's (2002) article, *Community Wind Shelters*, stated occupant comfort is another vital concern when planning and designing a storm shelter. The comfort level of the shelter user depends largely on the amount of space provided per occupant, as well as adequate ventilation and lighting. Adequate supplies of water are essential for shelters and a minimum of two toilets are also recommended.

The amount of space required per occupant depends on the duration of the occupancy. Data indicates that historically tornado shelters will typically have a maximum occupancy for two hours. FEMA's (2003) publication, *431-Tornado Protection: Selecting Refuge Areas in Buildings*, stated "refuge areas must be large enough to provide space for all occupants who may be in the building when a tornado strikes". In the case of a university which is the situation in this study, the space must provide shelter for all students, faculty, maintenance and custodial workers, as well as other visitors who may be present. Shelter occupant loads should be based on the following guidelines: five square feet of space per person is recommended for an adult who is standing, but for an adult who is sitting, six square feet per person is suggested. People who are in a wheelchair require 10 square feet per person. In addition, larger buildings should have several dispersed areas of refuge to minimize travel times for occupants in the building.

FEMA's *Community Wind Shelters* (2002) also suggested lighting, including emergency lighting, must be considered when planning a storm shelter and is usually required by local building codes for multi-use shelters. Backup power sources are essential for emergency lighting systems. Batteries are recommended because they can be placed within the shelter area. The backup sources must be protected while in the shelter. Natural lighting for shelter areas is another possibility; however, all windows must be protected with covers meeting requirements for resistance to wind pressures and debris impact.

Safety Plan, Drill, and Signage

An additional way an educational institution can be prepared for tornadic storms is to develop a safety plan tailored to the school. This safety plan includes the introduction and practice of tornado drills, appropriate signage to direct occupants to the shelter, emergency supplies, and maintenance and operational plans.

The National Weather Service (n.d.) stated:

> All schools to develop plans and conduct drills to cope with tornadoes since tornado drills require different actions than fire drills. This is true especially in the southeastern and central plain regions of the United States because the tornado threat is the greatest in these areas.
>
> As part of developing the safety plan and tornado drills, schools should be inspected and proper tornado shelter areas should be designated. Basements should act as shelters if the school design provides this area. Schools without basements should employ interior corridors on the ground floor. These corridors must not be parallel with the tornado's path, which is usually from southwest to northeast. School districts should never use gymnasiums, auditoriums, or other rooms with wide free-spanning roofs. Teachers and students should know where the designated storm shelters are located.

Edwards (n.d.) suggested that the basic concept of moving people to interior spaces of lower levels is correct; however, the plan should be configured to building layout, specific architectural features, and moving people throughout the space to the designated storm shelter. These drills should be customized for each building on campus. However, tornado drills for most buildings should include the following suggestions. The first suggestion is to consider how much time it takes to move occupants of the building to shelters. Since the lower levels of buildings are usually the safest, there may not be enough time to direct and move all occupants of the upper floors to safe areas if upper floors are not safe enough to protect occupants. Seconds count in the event of a tornado warning, and if takes more than two to three minutes to move all upper-floor people to lower levels, occupants could be in danger of being injured. The second suggestion is that shelter occupants need to put as many walls as possible between themselves and the tornado, since flying debris can be one of the biggest tornado hazards and often breeches the exterior of the building. The shelter spaces should not be exposed to the outside through windows, doors, or glass. Shelters with these architectural features can turn into a potentially life threatening space.

Once the tornado drill is in place, the drill should be rehearsed several times a year to keep students and staff in good practice. This would also allow administrators to work out any problems with the drill before it is needed in a real-life situation. In addition, school administrators should consider the following characteristics when creating institution policies during a tornado warning. In case of power failure, if the school’s alarm relies on electricity, school administrators should also consider having a compressed air horn or megaphone to sound the alert of an impending tornado. Also, the school severe weather plan should include provisions for disabled students (Edwards, n.d.).

Signage is also needed in educational buildings to move occupants through the building during a tornado warning. Large and easy-to-read maps or signage with arrows indicating the direction of the shelter should be posted throughout the corridors of the building to aid in moving students to shelters (Edwards, n.d.). According to Armes (2007), “Angela Jewett, emergency response preparedness coordinator for Iowa State University, said consistent signage of the severe weather shelter areas makes it much easier for building occupants to know where to find those areas regardless of where they are on campus”.

FEMA’s (2002) *Community Wind Shelters* stated shelters should be equipped with emergency supplies, and be operated and maintained according to formal plans. Supplies should include flashlights, fire extinguishers, first-aid kits, radios (including weather radios), extra batteries, and a signaling device (including an air horn).

Tornado Activity in the United States

The number and strength of tornadoes varies from year to year and state to state. According to FEMA’s (2002) publication, *Number 320 Taking Shelter from the Storm: Building a Safe Room for Your Home or Small Business*, almost every state in the United States has been affected by extreme windstorm and tornado. National Severe Storms Laboratory (n.d.), *Frequently Asked Questions About Tornadoes, Where do they occur?*, stated that tornadoes can happen in every state although some states have many more than others. They are most common in the central plains of North America east of the Rocky Mountains and west of the Appalachian Mountains. This area is known as “Tornado Alley”, which is the nickname for the central United States where tornadoes are most common. More specifically, Perkins (2002) defined “Tornado Alley” as the region that stretches from western Iowa down through Nebraska and Kansas to southern Oklahoma and over Arkansas and Louisiana to southeastern Mississippi (see Figure 1).

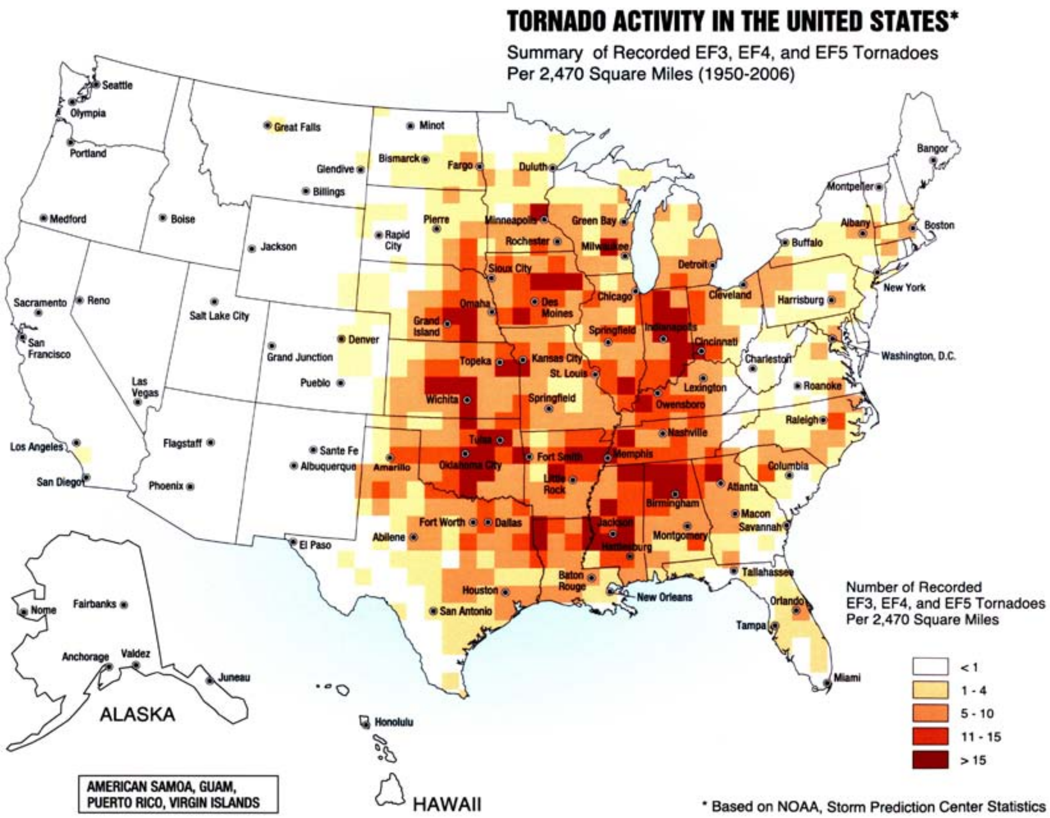

Figure 1: Map of Tornado Activity in the United States

Most tornadoes occur in this part of the United States during the spring and summer. During an average year, 800 tornadoes are reported nationwide with 80 reported deaths and over 1,500 injuries. The most violent tornadoes are capable of tremendous destruction with wind speeds of 250 mph or more, and damage paths can be in excess of one mile wide and 50 miles long (National Weather Service Forecast Office, 2007).

Oklahoma Tornado Statistics

Oklahoma City, Oklahoma, covers an area of approximately 622 square miles located in the middle of “Tornado Alley”. The intensity and frequency of tornadoes in this area is higher on average when compared to other parts of the country, and as the population of Oklahoma City continues to increase, so does the likelihood that a severe weather event, including tornadoes, will affect the property and lives of city residents (Meldrum, 2004).

The NWS in Norman, Oklahoma, has compiled lists of reported tornadoes for the state of Oklahoma, Oklahoma County, Oklahoma City, and Edmond, Oklahoma, which is a suburb of Oklahoma City. The data collected by the NWS reports 3,160 tornadoes in Oklahoma from 1950 to date (National Weather Service, n.d.). The NWS has also ranked the counties in Oklahoma by number of tornadoes from greatest to the least number of tornadoes per county. Oklahoma County ranks second out of 77 with a reported 91 tornadoes from 1950 through 2006 (National Weather Service, n.d.). The relevance of this information is important to this study because the campus of UCO is located in this county.

Branick (2008) stated, “Oklahoma City (OKC), by virtue of its large area extent and location near the heart of “Tornado Alley”, has earned a reputation over the years as one of the more tornado-prone cities in the United States”. After compiling a list of tornadoes from historic research, Branick (2008) stated “123 tornadoes have been reported in the immediate Oklahoma City area from 1890 until 2008". Although, the location of Oklahoma City limits has changed over time such that some areas that are now part of Oklahoma City were not always within the Oklahoma City limits. Branick (2008) included the present Oklahoma City limits and all surrounding cities and towns contained largely or wholly within these limits. Therefore, the tornado events contained in the list reported above have occurred wholly or partly within the Oklahoma City limits (see Figure 2).

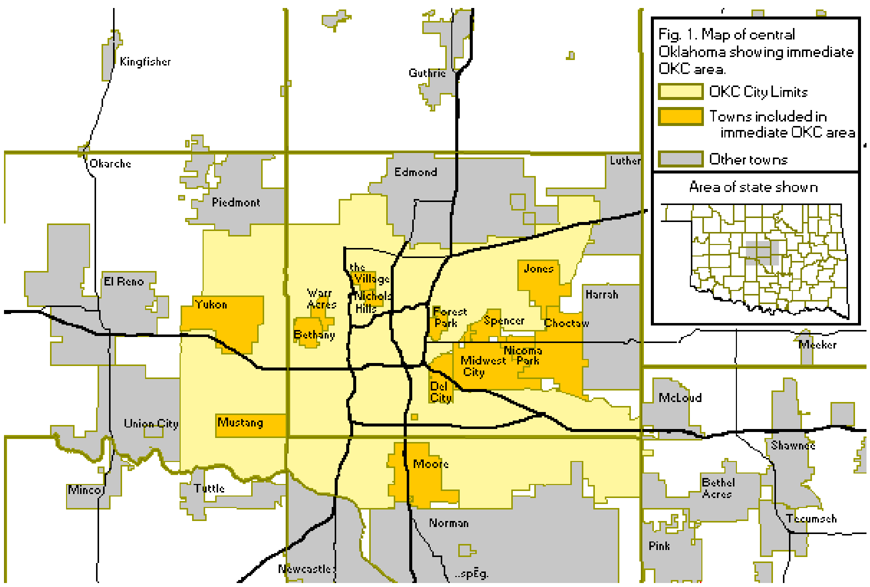

Figure 2: Map of Immediate Oklahoma City Area

The time of year and day tornadoes form is important to UCO's faculty, staff, and students because of the number of people on campus during the peak months and hours of formation. Branick (2008) stated:

> May is the peak month for all tornadoes, followed closely by April and June. Nearly two thirds of all tornadoes reported in the Oklahoma City area have struck during these three months. Strong

and violent tornadoes tend to occur slightly earlier, with April being the peak month. (Note that 15 of the 18 April tornadoes were F2 or greater and 5 of the 9 F4/F5 tornadoes on record occurred in April).

Tornadoes striking OKC have formed most frequently between mid-afternoon and early evening (2 to 7 PM Central Standard Time (CST), or 3 to 8 PM CST). The period of peak activity also appears in the distribution of strong (F2/F3) and violent (F4/F5) tornadoes, although the peak of F2 or greater tornadoes appears to occur slightly later in the day (around 6 PM CST /7 PM CST, vs. a broad peak centered around 4 PM CST/5 PM CST for all events). Other notable findings include a general lack of early morning events (only one between 5 and 7 AM CST), a prevalence of weak events during the late morning and midday hours (with one notable exception), and a rapid increase in frequency during the early afternoon (1 to 2 PM CST, or 2 to 3 PM CDT).

Nine violent tornadoes (including eight F4 and one F5) have struck the immediate Oklahoma City area. The record for tornadoes in a single day is 5, on June 8, 1974. This area has also been struck 19 times by two or more tornadoes on the same day.

Official records concerning tornadoes were not kept until 1950. The NWS has since compiled a listing which includes all tornadoes since official records began. However, in order to have basic recorded information, tornadoes before 1950 were researched based on the unofficial records from the NWS in Norman, Oklahoma. Much of the data included in the current lists compiled by the National Weather Service Office was collected through research since a great deal of the reported tornadoes prior to 1950 were not recorded in real time. Therefore, the pre-1950 tornado-related information and subsequent lists are known to be incomplete and are not meant to document all probable tornadoes in the state (or territories) before 1950 (NWS, 2008).

The threat of tornadoes is constant in Oklahoma, especially Oklahoma City and surrounding communities. Understanding the information above concerning frequency and severity of tornadoes helps Oklahomans be prepared to seek shelter and implement a disaster recovery plan if needed throughout the year, but more specifically, during the peak months of April, May, and June.

Population Census

Tornadoes affect a large number of people throughout the United States including Oklahomans. The inclusion of population census in this study gives information concerning how many people are affected in the Oklahoma City area during a tornado warning. According to the United States' Census (2008), the estimated population of the state of Oklahoma in 2007 was 3,617,316. This estimation increased 166,662, or 4.8 percent, from the 2000 population which was 3,450, 654 (Cumulative Estimates of Population Change for the United States, Regions, States, and Puerto Rico and Region and State Rankings [Table 2] April 2, 2000 to July 1, 2007). Oklahoma County reported 660,448 residences in 2000 and an estimated 701,807 residences in 2007 (Annual Estimates of the Population for Counties of Oklahoma: [Table 1] April 1, 2000 to July 1, 2007). Oklahoma City reported a population of 506,132 in 2000, but the estimated population was 547,274 in 2007 (Annual Estimates of the Population of Metropolitan Statistical Areas: [Table 1] April 1, 2000 to July 1, 2007).

Schools Damaged by Tornadoes

In “Tornado Alley”, the prime months for tornado development fall within the academic school year, and tornadoes have affected many educational institutions. They can often damage schools and injure or even kill students, faculty, and staff. The destruction of buildings, injuries sustained, and loss of life makes the inclusion of this information imperative and brings attention to the fact that tornadoes damage various types of educational settings.

Although tornadoes reported before 1950 are often based on eye witness accounts, reports of tornado-reported deaths at schools have been traced back to the late 1800’s. The Tornado Project (1999) released a table listing The Ten Worst Tornado-Related Disasters in Schools (see Table 3). The table compiled by the Tornado Project ranks the tornadoes according to the number of people who died as a direct result of the storm. The table below also includes the date, time, location, and F-scale rating of the top ten deadliest storms.

Table 3

Ten Worst Tornado Related Disasters in Schools

Rank	Deaths	Date	Time	Location	F-Scale Rating
1	33	Mar 18, 1925	?	Desoto, IL	F5
2	25	Mar 18, 1925	2:00 PM	Murphysboro, IL	F5
3	17	Feb 1, 1955	2:20 PM	Commerce Landing, MS	F3
4	16	Jan 4, 1917	11:00 AM	Vireton, OK	F3
5	14	Nov 9, 1926	2:23 PM	La Plata, MD	F3
6	13	Apr 21, 1967	3:50 PM	Belvidere, IL	F4
7	13	May 2, 1929	12:55 PM	Rye Cove, VA	F2
8	8	Mar 22, 1897	8:30 AM	Arlington, GA	F2
9	8	Jan 11, 1918	1:40 PM	Dothan, AL	F3
10	7	Jun 20, 1890	2:30 PM	Paw Paw, IL	F4

Tornado Project. (1999). *The Ten Worst Tornado Related Disasters in Schools***.**

Although the top ten deadliest tornadoes happened prior to 1970, many schools have been affected by tornadoes within the last 30 years. According to the Oologah-Talala School District's website (n.d.) (oologah.k12.ok.us.), the school district in northeastern Oklahoma suffered a devastating loss on April 26, 1991 when an F4 rated tornado ripped through town and damaged the entire school. The school district was dismissed the rest of the academic year because of damage. Most of the school buildings used by the school district were constructed during the late 1950's to the mid 1970's. The high school damaged by this particular tornado was constructed in 1971. The date of the building's construction is important to include in this study because many of the buildings assessed in this study match the age of the buildings found in the Oologah-Talala School District, which were damaged or destroyed by a tornado.

On May 3, 1999, a deadly tornado caused a great deal of destruction in numerous communities in Oklahoma. The communities most affected were Chickasha, Bride Creek, Moore, Midwest City, Del City, Choctaw, and Stroud. Other tornado activity caused significant damaged in Mulhall and Dover. One of the areas hit the hardest was Moore. The tornado completely destroyed one elementary school, Kelly Elementary School. Westmoore High School also suffered significant damage. Another community suffering devastation to the school system was Mulhall-Orlando in Logan County. The high school, located in Orlando, and the elementary school were destroyed (Copp, n.d.).

In May 2003, a tornado outbreak disrupted parts of Oklahoma, Missouri, Illinois, and Tennessee. Hurst and Richard (2003) reported the outbreak began in the same spot the May 3, 1999 struck, starting in Bridgecreek, Oklahoma. However, no school related damage was reported this time in the greater Oklahoma City area; this was not the case in other states. Hurst and Richard stated:

> Dozens of schools in several states saw serious damage, and several schools were destroyed. School buildings on the southern tip of Illinois suffered heavy damage. In Missouri, schools in the

> southeastern portion of the state were forced to close for the rest of the academic year.
>
> Meanwhile, almost every school in the 13,500-student Jackson-Madison County, Tennessee, district was damaged. Two schools had to be closed when a tornado killed 11 people and obliterated homes and buildings around the small city of Jackson in western Tennessee on May 5.
>
> School districts in southernmost Illinois were badly shaken earlier this month where at least five tornadoes ripped through the area, killing two people and injuring 50.
>
> The Pope County Schools, also in southern Illinois, postponed state testing and closed schools for at least eight days because of storm-related school damage, which included destruction of most of the district’s mobile classroom.
>
> The scene was particularly grim at the district’s grade school gymnasium, which took a direct hit.

One of the inspirations for this thesis came as a result of the 2007 Enterprise, Alabama, tornado. Robelen (2007) stated that a tornado tore through Enterprise, Alabama, during March of 2007. The tornado demolished the high school early in the afternoon and killed eight high school students when concrete from a collapsed interior wall fell on the students as they huddled together in a hallway. The death of the students and destruction of the school were other reminders of the critical need for all schools to adequately plan and prepare for emergencies. Robelen stated in the article, “the death toll at the school, which President Bush visited March 3, appears to have been the largest for a school struck by a tornado in many years”.

Case Studies

The inclusion of the three following case studies illustrates what can happen to educational buildings directly affected by a tornado. Each case study discusses the tornado’s F-scale rating and the direction of the path taken. Additional information includes geographical setting of the buildings affected by the tornado, construction of the buildings, and the sustained damage of the buildings. In addition, the case studies include information on the selection process to determine the best area of refuge for each of the buildings.

Discussion of the building’s construction is important to illustrate its reaction to the tornado. However, the researcher will not discuss the construction methods of the buildings being evaluated at the University of Central Oklahoma; past experience has been focused on interior design and not architecture.

The determination of the best available refuge area in the following three case studies was based on three sources of information. The first source of information was from people who were in the building. The second source was information provided by engineers and architects who examined the buildings. The final source of information provided was from aerial photographs taken shortly after the storm (FEMA, 2003).

The three schools chosen for the FEMA document case studies vary in several aspects. All three case studies examined school structures that were struck by different but intense storms. The structures varied in size, age, type of construction and architects and engineers who adhere to national building codes. Also, the structures had to be partially or totally destroyed at a later date because of the extent of the damage from the tornado. The identified areas of refuge for each setting were the best that were available in each of the three buildings when the storms occurred. The three case studies were presented with two goals. The first goal was to help building designers and administrators accurately locate the parts of a building that would likely be left standing after a tornado. The second goal was to help architects and engineers design buildings that offer occupants excellent tornado protection.

The devastating tornado damaging Xenia , Ohio, on April 3, 1974 was one of 148 tornadoes touching down in 13 different states. The tornado super outbreak of April 3-4, 1974 resulted in 315 deaths, more than 6,000 people injured, and 27,000 families that suffered some type of property loss. The Xenia tornado caused the most deaths during this outbreak, and destruction of the tornado was seen through this community. The tornado also destroyed many buildings and injured several people at Wilberfore University and Central State University (Ohio Historical Society, n.d.). Unfortunately, very little information exists on the construction of the buildings devastated by the tornado.

The Xenia tornado of 1974 damaged five school buildings within the school district. Some of the buildings were salvageable; however, some of the buildings had to be completely reconstructed. The article History of the Xenia Community Schools’ Buildings (n.d.) identified the buildings that were damaged during the tornado. Arrowood Elementary School, Banner Field House, and Warner Middle School were substantially damaged during the tornado. The other school buildings in the district were completely destroyed or beyond repair. These buildings included McKinley Elementary School, Simon Kenton Elementary School, and Xenia High School.

The destruction of the high school during the storm is the most important information of this case study for this report. Although the tornado did not strike during school hours, the number of injuries and the loss of life would have been greater if that had occurred, due to the destruction of the school building. FEMA' (2003) publication, *431 - Tornado Protection: Selecting Refuge Areas in Buildings,* stated the building could hold 1,450 people; however, during the tornado only 12 students and three staff members were reported in the building. These 12 people were warned about the approaching tornado and took shelter in a corridor of the first floor. The damage intensity, or F-scale rating, for this tornado was an F5 (see Table 1). As a result of the damage to the school from the tornado, the building was considered unsafe and demolished.

According to the city of Xenia's official city website (n.d.) (ci.xenia.oh.us), the original portion of the high school was constructed in 1957. The current high school, which was constructed after the 1974 tornado, was completed and open to high school students in the fall of 1977.

FEMA' (2003) publication, *431 - Tornado Protection: Selecting Refuge Areas in Buildings*, stated:

> Xenia High School was a two-story, slab-on-grade building without a basement (see Figure 3). The construction types of the building varied among the main parts of the school. The parts of the building were the main building, addition A, addition B, and addition C (see Figure 4). The original building and addition B was constructed of a light-weight steel frame, open-web steel joists, and 2-inch gypsum roof deck. Addition A was comprised of loadbearing masonry walls and hollow-core precise concrete roof planks. Addition C was constructed of precise concrete frame with double-tee floor and roof beams. The girls' gym was constructed of loadbearing masonry walls with precast concrete beams. The auditorium and boys' gym was constructed of loadbearing masonry walls with steel trusses.

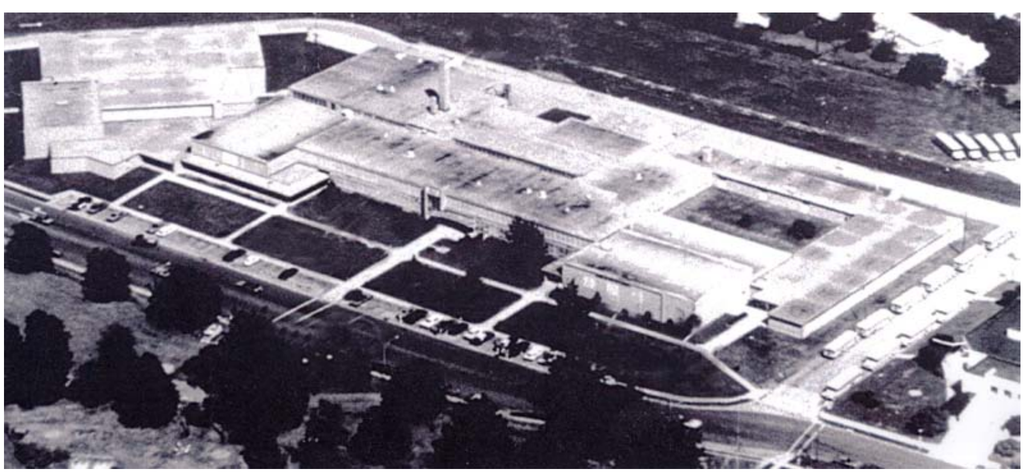

Figure 3: Xenia Senior High School, Xenia, Ohio, Prior to Tornado

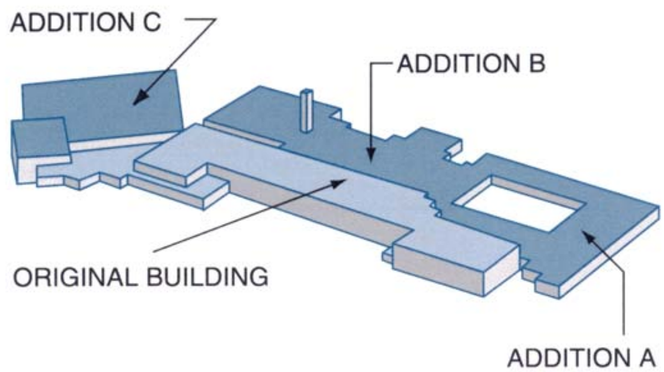

Figure 4: Diagram of Additions of Xenia Senior High School, Xenia, Ohio

Since the building was completely engulfed by the F5 rated tornado, the damage to the school was catastrophic. According to FEMA's (2003) article, *431 - Tornado Protection: Selecting Refuge Areas in Buildings*, the exterior enclosure walls on the west and south sides failed. The roofs covering the auditorium, boys' gym, and girls' gym collapsed, and the lightweight roof over the original 1957 building was blown off by the extreme winds.

In addition to the structure failures listed above, there were more specific hazardous elements. Windows are always a dangerous architectural feature in any structure during a storm. FEMA's (2003) article, *431 - Tornado Protection: Selecting Refuge Areas in Buildings*, supported this statement. The windows on the west and south facing sides of the building were blown into the interior spaces. The single-story high loadbearing masonry walls of the long-span rooms structurally failed, which allowed the roofs to fall into the structure. The unprotected west entrances allowed the corridors that were west-east oriented to become wind tunnels. Debris carried by the winds associated from the storm became missiles that impacted and entered the structure. The missiles came from nearby houses, vehicles, and Shawnee Park, which was just across the street. A non-loadbearing second-floor wall on the north side of the building collapsed on the lower level (see Figure 5).

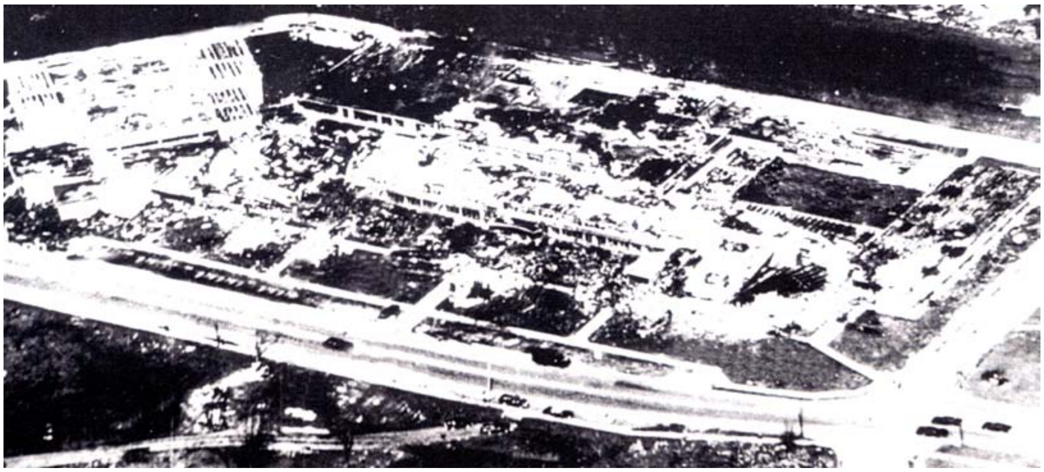

Figure 5: Destruction of Xenia Senior High School, Xenia, Ohio

Although the Xenia High School was deemed unsafe and demolished, there were some areas of the building that survived the tornado's impact. FEMA's (2003) article, *431 - Tornado Protection: Selecting Refuge Areas in Buildings*, defined several different protective elements of the building. The lowest floor, which was the first floor, was the only portion of the original building that survived. The completely interior spaces remained intact, and the smaller interior spaces fared even better. Most of the corridors perpendicular to the storm path offered considerable protection. The complete structural frame of addition C (see figure 4) remained intact. Therefore, interior portions of the second floor of that addition provided some refuge for custodians. Wherever the supports of the heavy concrete were rigid, the roof remained in place. The roof and loadbearing walls also remained intact in addition A (see Figure 4). The concrete block interior partitions blocked and stopped concrete missiles from reaching adjacent interior spaces. With consideration of all the above protected elements, extensive refuge spaces existed in scattered locations throughout the building (see figure 6).

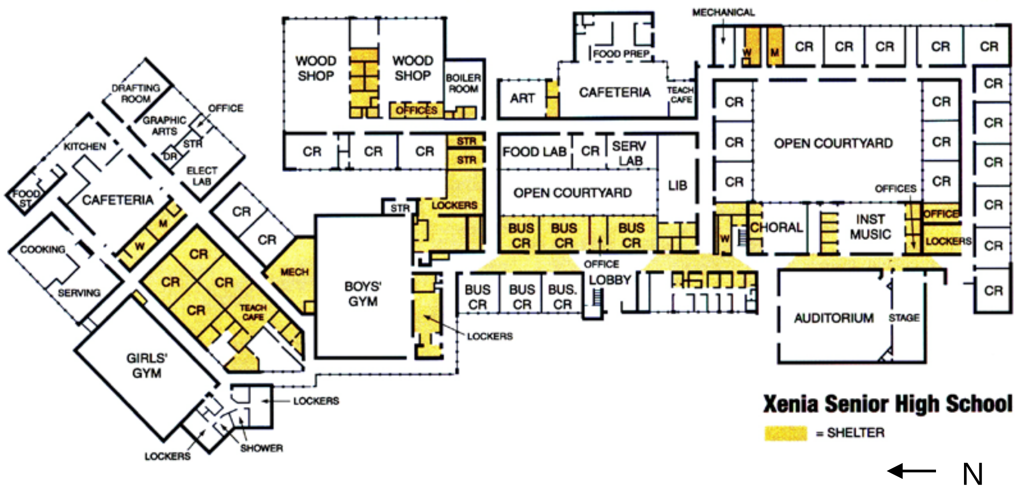

Figure 6: Diagram of Shelter Locations at Xenia Senior High School, Xenia, Ohio

On May 13, 1980, five people were killed and 79 were injured when a F3 rated tornado struck Kalamazoo, Michigan (Laurens, n.d.). FEMA's (2003) article, *431 - Tornado Protection: Selecting Refuge Areas in Buildings*, has compiled a case study concerning the destruction of the St. Augustine Elementary School and Gymnasium in Kalamazoo, Michigan. The report prepared by FEMA studied the damage of the building caused by the tornado to determine the appropriate shelters located within the building. St. Augustine Elementary School was originally constructed in 1964. The two-story building held 17 classrooms, faculty offices, and other necessary support spaces. FEMA's (2003) article, *431 - Tornado Protection: Selecting Refuge Areas in Buildings*, stated the following:

> The structural systems of the building consisted of three-foot-wide masonry piers constructed of 8-inch thick concrete masonry units

and 4-inch face bricks. Piers were spaced 8.7 feet apart. Steel beam lintels spanned the window openings between the piers. Steel open-web joists were spaced 2 feet on center supported the 1.5-inch steel roof deck, which was welded to joists. The top chords of the joists were extended to provide a 2-foot overhang.

The damage to the building included partial roof failure due to winds associated with the tornado, and the second-floor piers collapsed in one wing of the school building (see Figure 7). Most of the windows were blown in because of wind and windborne debris, which was found in several classrooms. However, wired glass windows near the exterior doors remained intact. The exterior solid-core wood doors stayed in place, and these architectural elements kept more windborne debris from coming into the structure. Even though the hinges of the interior doors were damaged, these doors to classrooms remained in place. As a result of the damage, the structure was later demolished (see Figure 8).

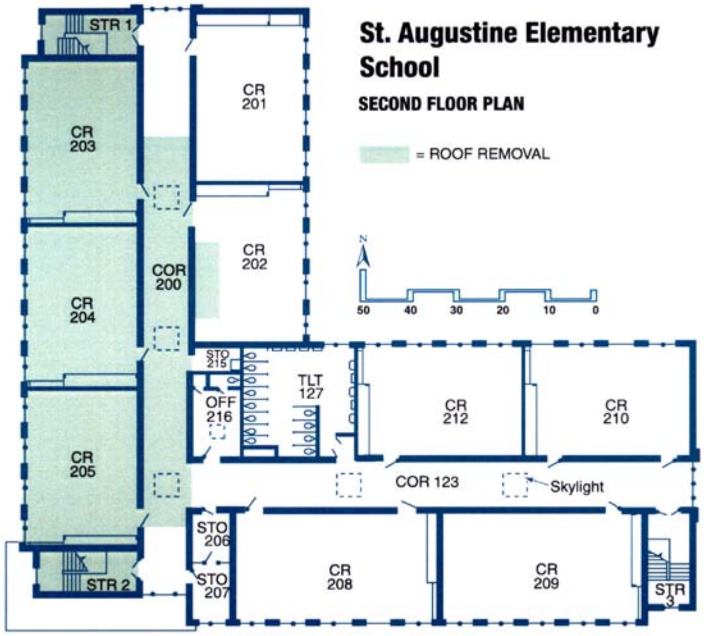

Figure 7: Floor Plan of Second Floor Showing Roof Removal by Tornado

Figure 8: St. Augustine Elementary School, Kalamazoo, Michigan

There were several hazardous elements identified by the FEMA team. The structural system of the unreinforced masonry piers collapsed, and almost one third of the lightweight second-floor was lifted, causing classrooms and corridors on this side of the building to be unprotected against the storm (see Figures 7-8). Most of the skylights in the second-floor corridors were damaged by the wind or missiles carried by the storm. Almost of all of the windows throughout the structure were broken and, as a result of the breech in windows, broken glass and windborne debris was found in several classrooms.

The FEMA team found some protective elements within the building. Unlike the second-floor, the structural system stayed intact. The exterior solid-core doors as well as interior doors and walls, stayed in place and prevented debris from entering the first-floor corridor. It was determined the corridors, offices, and toilet areas on the first floor only would shield occupants from the storm. Therefore, protection was offered in the first floor corridor and some interior support spaces (see Figures 9).

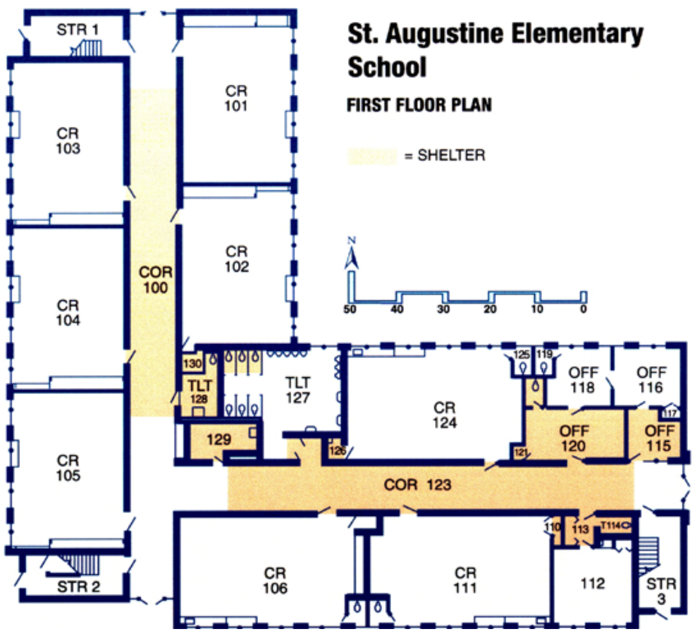

Figure 9: Designated Shelter Areas at St. Augustine Elementary, Kalamazoo, Michigan

The FEMA team also surveyed the damage the St. Augustine Elementary Gymnasium sustained during the tornado. FEMA's (2003) article, *431 - Tornado Protection: Selecting Refuge Areas in Buildings*, stated:

> The structure was an 80-foot by 100-foot structure that was 23-feet tall. This building was adjacent to the school buildings. The structural system consisted of loadbearing masonry walls constructed of 12-in concrete masonry units and 4- inch face brick. The walls were not reinforced in the vertical direction. The roof structure consisted of long-span steel joists spanning 80 feet between the walls and spaced 6 feet apart. The steel roof deck was connected to the joists with puddle welds.
>
> The building was destroyed. The loadbearing west wall collapsed inward. The east wall fell outward. As a result of the east and west wall failures, the roof collapsed. The building's hazardous elements included unreinforced masonry walls and long-span roof structure. The building did not provide any protective elements.

As a result of the damage to the school building and the catastrophic damage to the gymnasium, the FEMA team concluded this case study with an observation report. FEMA's (2003) article, *431 - Tornado Protection: Selecting Refuge Areas in Buildings*, reported:

> The unreinforced masonry walls combined with the lightweight roof structures in the building as well as the gymnasium building

> were vulnerable to collapse in windstorms. Gymnasium buildings are not considered suitable for occupants' protection because they usually include tall walls and long-span roofs. Light-weight roof structures that are not adequately anchored can be lifted in windstorms. Except in violent (F4 and F5) tornadoes, the lower floor (in two-story or higher buildings) generally provides good protection for occupants when there are two or more walls between the refuge areas and the outside.

On May 3, 1999, a deadly tornado ripped through the city of Moore, Oklahoma. Kelly Elementary School was in the path of the F4 rated tornado. FEMA's (2003) article, *431 - Tornado Protection: Selecting Refuge Areas in Buildings*, stated the school was a one-story slab-on-grade building without a basement. The damage to the building itself was both severe and extensive; and as a result, the structure was demolished and the school was rebuilt. With the knowledge of new safety features, the new building included structural elements designed to provide increased wind resistance (see Figure 10).

Figure 10: Kelly Elementary School, Moore, Oklahoma

FEMA's (2003) article, *431 - Tornado Protection: Selecting Refuge Areas in Buildings*, reported:

> Three basic wall types were used in the construction of the school: reinforced masonry, unreinforced masonry topped by reinforced bond beams, lightweight steel frame with masonry infill. The roof system consisted of open-web steel roof joists, metal decking, and a built-up roof. Wall and roof construction of this type is common to many schools in the United States.
>
> Hall corridors were the designated areas of refuge. The corridor walls were of lightweight steel frame with masonry infill. The infill extended to a height of approximately 7 feet. Above this height were clerestory windows that extended to the tops of the walls. Had the halls been occupied during the tornado, many injuries and deaths would have occurred.

A secondary report, from Brooks and Doswell (2001), concluded that corridors designated as shelters do not appear to be structurally safe due to clerestory windows. These windows were located on the top of the wall where wall and roof planes meet. Clerestory windows are vulnerable to projectile penetration. They also reduce the resistance of the corridor walls to lateral wind forces. Missiles can have a devastating impact on several structures during a tornado. Once structural failures occur, the wind field associated with a tornado becomes filled with debris acting as projectiles that fly at high speeds. When tornadoes interact with structures, common projectiles carried in the tornado are broken framing and pieces of masonry, which can breach the external envelope of other homes. Thus, this debris can initiate failures that might not otherwise have occurred.

FEMA's (2003) article, *431 - Tornado Protection: Selecting Refuge Areas in Buildings*, summarized the damage the school suffered from the tornado. Wall and roof structures failed under the combination of uplift and lateral loads caused by the tornado winds. The failures of these architectural elements were also found in the designated storm shelters. Connections between bond beams, joists, and walls were adequate for gravity loads. However, these connections did not resist the high uplift loads caused by winds associated with the tornado. The unreinforced masonry walls, described above, failed due to the roof system being lifted off or removed by the winds. The inclusion of clerestory windows in some corridor walls contributed to the failure under the imposed loads of the wind.

Inspection of the roof revealed the roof decking failed at the points where it was welded to the tops of the steel trusses. The spacing of the welds was consistent with standard practice; however, the welds were not strong enough to resist the uplift (FEMA, 2003). Wind loads due to the vortex of a violent tornado lifted the roof system until the bond beam atop the unreinforced masonry walls failed. Due to the failure of the bond beam, the roof separated from the building and some interior walls failed (FEMA, 1999).

The impact of windborne missiles damaged the structure. Steel doors appeared to have been opened by the impact of a heavy object. In addition, these doors led into an area where the roof was missing and, as a result, the open door may have allowed wind to enter the building and create internal pressure, increasing the load on the building envelope (FEMA, 2003).

From the research and findings from the surveyed site, the FEMA team found several hazardous elements in the Kelly Elementary School. The presence of clerestory windows in walls limited the capacity to resist lateral forces. Walls with these types of window were found in the designated shelter areas. Walls that were unreinforced masonry structurally failed when the reinforced bond beams located at the tops of the wall failed. Welds between the roof decking at the tops of the metal joists structurally failed because they were not strong enough to resist the uplift. Unprotected doors and windows were breached by missiles and, as a result, the openings created by the missiles allowed the wind to enter the building, causing increased pressure on the building envelope (FEMA, 2003).

FEMA’s (2003) article, *431 - Tornado Protection: Selecting Refuge Areas in Buildings*, stated:

> Because the damage to Kelly Elementary School was so great, the school was demolished and completely rebuilt. The new building, although constructed of the same footprint, incorporated several structural improvements specifically designed to improve resistance to extreme winds and create refuge areas for the school’s occupants. As in the original building, the central corridors of the three wings are the designated refuge areas.

Great consideration should be taken into account when deciding the best location for a shelter. According to various sources, the best place for a shelter is a corridor. These shelters should be located on the lowest level and they should have as many interior walls between the occupants of the shelter and the exterior walls possible.

In addition, no door leading to the exterior of the building should be located within the area of refuge. The area of refuge should also be away from glass and widows of any kind to protect the occupants from flying debris or missiles, which can penetrate doors and windows. Buildings housing areas of refuge should be located away from large objects that could be projected into the building and shelter by the winds associated with the tornado.

Shelters should also provide occupants some level of comfort. The design of the shelter should incorporate enough square feet for each occupant, especially occupants with special needs, to comfortably inhabit the space during a tornado. In additional to the level of comfort for occupants, the space should also include emergency supplies, which are essential in case an occupant is injured.

Wayfinding is also an important design feature to include into the design of buildings housing areas of refuge. Signage is a good way to aid people in the building to a shelter. Such signage would allow occupants who are unfamiliar with the building to find the shelter in a timely manner.

Numerous schools have been affected by a tornado and many educational buildings have been destroyed or badly damaged. School districts have lost faculty, staff, and students, some schools even closing their district due to the devastation of a tornado.

The destruction of some school buildings has been the focus for case studies conducted by FEMA. School buildings that were nearly completely destroyed by a tornado were analyzed to research the reaction of the construction methods of each building after being struck by the winds associated with the storm. Also, after analyzing the remaining intact areas of the structure, as well as reviewing the original floor plans, the FEMA teams determined the best available areas of refuge for each structure. Evidence to support these decisions was provided through the analysis of the building methods and reaction of the buildings to tornadic winds.

In summary, educational institutions including universities should have adequate areas of refuge for all occupants. Due to the frequency of tornadoes in “Tornado Alley”, the design, location, and structural integrity of shelters are imperative for the housing of occupants. All shelter criteria listed above should be taken into consideration when identifying the best areas of refuge.

Methodology

The literature review built a solid foundation for this study, but it also illustrated the importance of proper shelter design and location when at an educational institution specially located in “Tornado Alley”. Although evaluation tools have been developed to assess ADA compliance and shelter design, there is not one tool that assesses these two aspects together. Therefore, an assessment tool was needed to assess ADA compliance and shelter design at the same time especially for schools in “Tornado Alley”.

The methodology section of this study evaluates existing guidelines suggested by FEMA and ADA. An assessment tool was developed and implemented to specifically assess shelter spaces at large mid-western universities.

Research Question

Is the current design and space plan of a primary storm shelter in an educational building located on a large mid-western university campus in “Tornado Alley” is safe according to suggested safety standards established by Americans with Disabilities Act (ADA) and Federal Emergency Management Agency (FEMA)?

Research Process

Five storm shelters from a large mid-western university in “Tornado Alley” were evaluated and analyzed to determine if there were hazardous elements present in the design of the shelter. The number of buildings and shelter selected was based on a sample size in relation to university as a whole.

Buildings and storm shelters were assessed on accessibility from the exterior, interior accessible routes, shelter layout and design, and ADA compliance. The development of an assessment tool was needed to complete the evaluation and analysis of the storm shelters. The assessment tool employed was created from compiled data from suggested safety standards published by the government and organizations of ADA and FEMA. Both organizations have established safety standards and have respective assessment tools in place, but neither organization incorporated the standards set forth by the opposite organization. Therefore, the assessment tool was needed to complete the evaluations. See Appendix A for copies of the ADA and FEMA assessment tools.

The assessment tool takes a qualitative and quantitative approach to the evaluation of these shelters. Both types of data are gathered because some questions required information gathered through observation, while other questions required measuring of objects to have specific and concrete responses. The combination approach reinforces the results of this study.

Sampling Process

University of Central Oklahoma (UCO) in Edmond, Oklahoma was chosen as the educational institution to be evaluated for this study for four reasons. First, this university was chosen because of the potential impact of a tornado on this campus. According to the UCO's (2006) official website, http://www.uco.edu, 2006, manmade and natural disasters threaten UCO every year. Tornadoes are the most frequently occurring destructive hazard the university faces, along with ice storms, high winds, and fire and hazardous material explosion, which is due to the nearby railroad and/or interstate highway system.

Second the population of Edmond, Oklahoma and the student population of UCO supplement the above information concerning why UCO was chosen. The U.S. (2008) census reported a population of 68,315 in 2000 and an estimated population of 78,226 in 2007 for Edmond, Oklahoma (Annual Estimates of the Population for Incorporated Places in Oklahoma, Listed Alphabetically: [Table 4] April 1, 2000 to July 1, 2007).

This university employed 2,316 part-time employees and 1,123 full-time employees during the 2007 – 2008 academic year (UCO, 2008). UCO reported a fall 2007 enrollment of 15,724 students and a spring 2008 enrollment of 14,484 students. Furthermore, during the fall 2007 semester, UCO reported 10,616 students on the campus during the afternoon hours and 7,750 students on campus during the evening hours (UCO, 2008). During the spring semester of 2008, 9,598 students were identified as being on campus during the afternoon hours and 7,375 students were on campus during evening hours (UCO, 2008). UCO specifically defines afternoon hours as any class beginning after 11:30 am but before 4:30 pm and evening hours as any class that start after 4:30 pm (F. King, personal communication, September 25, 2009). As a result, there are a large number of people that could possibly be affected by a tornado at UCO. Since most tornadoes occur in the afternoon and evening hours (Branick, 2008), population statistics for morning classes were not included into this report.

Third, UCO was selected for this study because the campus is comprised of buildings constructed throughout the last 80 years. Most of the buildings that house the storm shelters were constructed between 1937 through 1966, and many of the buildings assessed in this study have similar construction dates to buildings discussed in the literature review of this report that were damaged or destroyed by a tornado. Several of these buildings serve as primary building shelters for this educational institution. Norman Nieves, who serves as Emergency Management Coordinator of Safety and Transportation Services for UCO, states that currently UCO has eight buildings serving as tornado shelters. They vary in size from the largest shelter (Chambers Library), which can hold 3,700 people during a severe weather event, to the smallest shelter (Thatcher Hall) on campus holds 186 people (N. Nieves, personal communication, April 7, 2009).

Fourth, Edmond has been affected by several tornadoes. Speheger (2006) created a list of tornadoes reported in Oklahoma County. The list includes information concerning date, time, path length, path width, F-scale rating, people killed, people injured, counties affected by the tornado, and the path location. The dates of this list range from 1893 until 2006. From this compiled list it can be determined that Edmond, Oklahoma was affected by six tornadoes during this time period.

Building Selection Process

Five buildings that house primary storm shelters for the university were selected for assessment. The buildings were chosen based on four criteria. The first criterion was the occupant load of the refuge area. According to N. Nieves (personal communication, April 22, 2009):

> The square footage is based on raw square footage of the shelter area. We take the square footage and divide it by 3 to 5 square feet per person and that gives us the occupancy. We use 3 square feet per person, for example if we had a room that was 3000 square feet, we divide that by 3 square feet and that gives us 1000 occupants.

The second criterion was the number of other buildings this refuge area served. For example, Chambers Library serves as the primary storm shelter for 16 other buildings as well as the library. Therefore, this building serves the occupants of 17 buildings; however, this shelter has the potential to serve more buildings. According to Nieves (2009), potential occupants of shelters will not be turned away.

The third criterion was the building's university assigned classification, which affects public access considerations. For example, one building excluded from this study holds approximately 1000 people in the shelter. However, it has limited access to the general population at UCO since it is a dormitory and is not accessible to other non-resident students on campus.

The fourth criterion was the construction date of the building. The year of the building's construction is important to include as a selection criterion. Many of the buildings assessed in this study match the age of the buildings discussed in the Schools Damaged by Tornadoes and Case Study sections of literature review.

Table 4

General Building Information

Building Name	Year Constructed Original/ Addition(s)	Occupant Load per shelter as per UCO	Number of Buildings Served	Building Category	Building/ Shelter Access
Chambers Library	1966/1995	3700	16	Education/ General	Open/ Locked
Liberal Arts	1967	986	3	Education/ General	Open/ Locked
Communications	1956/1966 /1981	491	2	Education/ General	Open/ Open
Art & Design	1952/1980	300	4	Education/ General	Open/ Open
Nigh University Center	1965/1997	NA	5	Education/ General	Open/ Open

(D. Stapleton, personal communication, October 26, 2009) & Nieves, N. (2009). *UCO Tornado Shelters*.

The table above lists the buildings and storm shelter chosen to include in this study. The general information provided gives a brief overview of each building. However, the occupant load for the Nigh University Center has not been given at this time. Although the primary shelter has been selected for this building, occupant load has not been calculated since additional shelters can be found in surrounding private offices that can offer shelter to countless occupants. Therefore it is difficult to determine the number of people who can occupy the additional shelter (N. Nieves, personal communication, October 2, 2009). Even though the occupancy is not stated, it was chosen because the shelter in this building serves the occupants of four other buildings, as well is its own.

As illustrated in the table above, Chambers Library and Liberal Arts have locked refuge areas. Once a tornado warning is issued the shelters are opened by the appropriate staff member. For example, the key to the library shelter is located at the front desk in the library, and the key to the shelter located in Liberal Arts is held in the dean's office of the College of Liberal Arts (N. Nieves, personal communication, October 2, 2009).

Assessment Tool

The main body of this tool was developed after analysis of similar forms produced by ADA and FEMA, as well as various FEMA publications that were used as supportive information in the literature review of this thesis. Both organizations were utilized for foundational material because of their impacts on their respective fields. Therefore, it is important to understand the purpose of ADA and FEMA and why their resources were used before discussing the assessment tool.

Review of Organizations

Due to the amount of legislature created by ADA and the impact of this governmental act on the field of interior design, this organization was consulted for imperative information when analyzing the interiors of commercial storm shelters. According to Education for Disability and Gender Equity (EDGE) (n.d.):

> The Americans with Disabilities Act, also known as Public Law 101-336, is a civil rights law. It makes it illegal to discriminate based on disability in several different areas of life. It prohibits discrimination on the basis of disability in: employment, services rendered by state and local governments, places of public accommodation, transportation, telecommunications services.

ADA is comprised of separate sections to supplement the prevention of discrimination. Only Title III, the last section, works with public accommodations and will be the basis for this study. It states that any business that serves the public must make sure it is not discriminating against disabled customers, through either prejudice or barriers. If barriers exist, the businesses must remove them if they can do so without too much difficulty or expense (EDGE, n.d.).

Because of its purpose and mission, FEMA was another important organization to look at when creating the assessment tool. According to FEMA's official website, fema.gov (2009), the organization's mission is "to support our citizens and first responders to ensure that as a nation we work together to build, sustain, and improve our capability to prepare for, protect against, respond to, recover from, and mitigate all hazards". As of 2007, FEMA has responded to more than 2,700 presidentially-declared disasters (FEMA, 2008). Seeing the importance of both governmental agencies is imperative when understanding the development of the assessment tool.

Development of Assessment Tool

The purpose of the assessment tool is to evaluate and measure the performance of refuge areas in regards to accessibility and space planning. This is done by assessing the hazardous elements and elements that pose as obstacles to accessibility requirement. The assessment tool works by completing the evaluation of the refuge area by answering the questions found in the tool. In order for the tool to work properly, the questions must be answered while in the space and conducting the evaluation. The questions are meant to identify the areas of the shelters that need improvement, while at the same time, identifying elements of the shelter that do not need improving.

In addition, the tool was written by an interior designer for use by other with knowledge of interior design, and the questions can be answered by an interior designer. However, questions dealing with construction material and back-up power questions cannot be answered by an interior designer since they are not trained in these areas.

As stated earlier, ADA and FEMA both have published documents that served as a foundation for the assessment tool. The first document serving as a source is the *ADA Checklist for Emergency Shelters* (2007). This document includes several sections of handicapped accessible questions that apply to tornado and hurricane shelters. These sections and questions were included because they specifically dealt with ADA compliance issues of interior spaces, and an interior designer can successfully assess the issues addressed in each question. These questions include:

E1-a. Is there an accessible route, or a route at least 36 inches wide, that connects the accessible entrance to all shelter areas (it may narrow to 32 inches wide for up to 2 feet in length)?

Yes No

E2-a. Are pedestrian routes leading to or serving each service or activity area of the shelter free of objects that protrude from the side more than 4 inches into the route with the bottom of the object more than 27 inches above the floor?

Yes No

However, a few areas incorporated in the ADA document were not included into the assessment tool utilized in this report. Specific sections excluded include passenger drop off, parking, sleeping areas, and shelter check-in area and, although these sections ask important questions, the results of the sections do not apply to this study. For example, sleep areas for shelter occupants are not a concern since people will not be staying overnight in these shelters on campus. A secondary example includes shelter check-in areas. This specific area is not included because it would take too long for shelter occupants to check-in as they are coming into the space. Sample questions from the excluded areas in the document, *ADA Checklist for Emergency Shelters* (2007), include:

A1. Is a relatively level (1:50 or 2% maximum slope in all directions) access aisle provided adjacent and parallel to the side of the vehicle pull-up area?
Yes No

B2. Does each accessible parking space have its own, or share an, adjacent access aisle that is at least 60 inches (5 feet) wide?
Yes No

F1. If there is a built-in reception or other type of counter, does it have a section that is at least three feet long that is no higher than 36 inches above the floor, or is there a nearby surface that is not higher than 36 inches above the floor?
Yes No

FEMA also published a document serving as a supplemental foundation for the assessment tool utilized for shelter evaluation. Questions from FEMA's (2008) publication, *361: Design and Construction Guidance for Community Safe*

Rooms, were chosen to include into the shelter assessment tool of this report since the safe rooms discussed in this resource and at UCO are both designed to hold members of a community. The questions from this document taken to serve as a foundation focus on the size of the refuge area, the location, and descriptions of the surrounding buildings. Sample questions utilized in the assessment tool include:

Refuge Area Size

Length	Width	Height	Stories

Does the location of the refuge area require occupants to go outdoors to get to it?

Yes	No

Will the structure adjacent to the refuge area or surrounding it pose a threat if subject to collapse (structural components become debris that creates impact loads on the refuge area)? Specify ____________________

The assessment tool also included a section on flooding hazards that was taken from FEMA's (2008) publication, *361: Design and Construction Guidance for Community Safe Rooms*. The inclusion of the flood hazards was important to answer and determine if any of the shelters assessed had a history of flooding, since most of the refuge areas on UCO's campus are below ground and would be occupied by people during a tornado. None of the questions could be answered by the researcher or qualified personnel of the university since this information has not been kept. Therefore, this section has been omitted from the final assessment tool. To see the questions concerning flooding hazards, please refer to Appendix B.

However, FEMA's (2008) publication, *361: Design and Construction Guidance for Community Safe Rooms*, also included sections and questions that were excluded from the assessment tool created for this report. The questions excluded asked for information concerning the construction and material selection of the building. Another reason questions were not included from the FEMA document is that the researcher of this report is not qualified or cannot assess questions concerning structural information. Some of the excluded questions include:

> The building was designed according to the following building code:
> Uniform Building Code, Year:
> International Building Code, Year:
> Standard Building Code, Year:
> International Residential Code, Year:
> National Building Code, Year:
> Other Code:
>
> Solid Load-Bearing Wall System
> Concrete Walls RM Walls
> PRM Walls URM Wall
> Framed Wall (wood or metal stud)
> Other: ________________
>
> Does a combustible gas line run through the refuge area?
> Yes No Unknown

In addition, FEMA's (2008) *361: Design and Construction Guidance for Community Safe Rooms*, included suggestions that could be implemented into a refuge area. These suggestions were adapted to serve as questions in the assessment tool. The adapted questions focus on the design and location of the shelter, wayfinding via signage, and comfort of occupants. Samples of these questions include:

> What is the usable square footage for this area? ________________
>
> How many people can the refuge area hold? ___________________

Does the square footage of the refuge area allow for each occupant to have at least 5 square feet minimum or 10 square feet minimum for people in a wheelchair?
Yes No

Is the refuge area fully or partially below ground?
Fully Partially

If the storm shelter is located in a corridor, what is the orientation of the corridor?
North/South Northeast/Southwest
East/West Northwest/Southeast

Does the building housing the refuge area have interior and/or exterior signage directing people to the refuge area?
Yes NO

The final assessment tool is divided into 12 sections. Ten sections have questions addressing general building and storm shelter information, shelter signage, ADA compliance throughout the shelter area, and finishes within the space. The other two sections include diagrams to illustrate the footprint of the building and location of the storm shelter within the building. The inclusion of these diagrams assists in understanding where the refuge area is located inside of the building. Most of the questions included are closed-ended questions; however, open-ended questions were incorporated into the assessment tool to further explain answers. To see the original copy of the assessment too, see Appendix B. An abbreviated sample of closed-ended and open-ended questions from the assessment tool includes:

Sidewalk Access
E-1. Is there a route without steps from the sidewalk to the main entrance of the building housing the storm shelter?
Yes No
If no, are there two or fewer steps? Yes____No____
Number of Steps:______

If no, is there another entrance without steps?
Yes____No____Location:______________

Accessible Entrance
F-1. Is there at least one accessible entrance connected to the exterior accessible route?
Yes No

Restrooms
G-1. Are the restrooms located in the area of refuge?
Yes No
G-1-a. If yes, please list the type and location:
____
____
____

Implementation

Once the five buildings and storm shelters were selected and the assessment tool developed, access was secured to the locked shelters and an informal walk-through of each shelter was conducted. After the initial walk-through of the buildings and shelters, the assessments of the spaces began. Each building had one assessment tool form completed during the evaluation process. See Appendix C for a copy of each completed form.

The first assessment conducted on the shelter in the Art & Design building illustrated that improvements were needed on the assessment tool. It was determined at that time some of the questions on the assessment tool needed further development and/or clarification. These changes were made before the second assessment was conducted. During the second assessment, the researcher determined that the section of the evaluation tool concerning restrooms needed reformatting to help state the results in a clear and logical manner. The changes included the addition of the “male” and “female” answer choices found in the revised copy of the assessment tool. This allowed for each type of restroom to be evaluated independently. The changes were made before the remainder of the assessments were conducted. The assessment tool did not receive any other changes from this point.

Results

The results of the assessments show that the five shelters are similar in ADA safety compliance and general location within the building itself. The information presented in the tables that follows provides an overall summary of results per shelter. More importantly this information is the primary point of the research and purpose of the study.

The questions answered with either a yes or no pass or fail according to the construction and location of the shelter. For example, the surroundings of each building housing a primary storm shelter were assessed to determine if threats against this area existed. The questions were answered with a yes; therefore, that shelter failed in that particular aspect.

The second type of question resulted in the percentage compliant result. Percentage compliant is determined by dividing the number of compliant questions by the number of overall questions that apply to the space within each section. For example, Liberal Arts complied with all of the questions pertaining to sidewalk accessibility; therefore this building was 100 percent compliant with sidewalk accessibility.

In addition, the overall success of the buildings and shelters can be seen by percentage of compliant and noncompliant. This percentage was determined by dividing the number of compliant or noncompliant buildings by the total number of building. For example, from Table 5, one out of five buildings did not include glazing into the design of the shelter. Therefore, this corresponds to a 20 percent compliance rating. This information can be found in each chart concerning general overall building information. A shelter was assigned a failing grade if its assessed safety standards failed any of the questions on the tool. See Appendix C or refer to the building summaries provided below for more specific information.

Table 5

Shelter Structural Information

Building Name	3-Point Latch Doors Y/N	Included Glazing Y/N	Threats From Surrounding Structures Y/N	Storage of Unnecessary Items Y/N
Chambers Library	No	Yes	Yes	Yes
Liberal Arts	No	No	Yes	No
Communication	No	Yes	Yes	Yes
Art & Design	No	Yes	Yes	Yes
Nigh University Center	No	Yes	Yes	Yes
Total Compliant Buildings	0	1	5	1
Percentage of Compliant Buildings	0%	20%	100%	20%
Total Noncompliant Buildings	5	4	0	4
Percentage of Noncompliant Buildings	100%	80%	0%	80%

Shelter structural information provides critical knowledge of the safe and potentially hazardous elements of the refuge area.

Table 6

Shelter Design

Building Name	Lowest Level Y/N	Fully Underground Y/N	Exterior Doors in Shelter Y/N
Chambers Library	Yes	Yes	No
Liberal Arts	Yes	Yes	No
Communication	Yes	Yes	No
Art & Design	Yes	Yes	No
Nigh University Center	Yes	No	Yes
Total Compliant Buildings	5	4	4
Percentage of Compliant Buildings	100%	80%	80%
Total Noncompliant Buildings	0	1	1
Percentage of Noncompliant Buildings	0%	20%	20%

Shelter design information pertains to the location of the refuge area in relation to the building as a whole, as well as to the exterior environment.

Table 7

Accessible Sidewalk and Building Entrance

Building Name	Exterior/Interior Signage % Compliant	Sidewalk Access % Compliant	Accessible Entrance % Compliant
Chambers Library	0	66%	85%
Liberal Art	0	100%	85%
Communications	0	66%	85%
Art & Design	0	100%	85%
Nigh University Center	0	50%	85%
Total Building Compliant	0	2	0
Percentage of Compliant Buildings	0%	40%	0%
Total Noncompliant Buildings	5	3	5
Percentage of Noncompliant Buildings	100%	60%	100%

It is important to note that currently there is no interior or exterior signage directing people to primary storm shelters in any of the buildings in this study. However, there is signage at the entrance to each shelter. Accessible sidewalk and building entrance information pertains to the ease of entering and movement within the building housing a storm shelter.

Table 8

Accessible Corridors, Doors, and Elevators

Building Name	Accessible Corridors Y/N	Doors % Compliant	Elevators % Compliant	Restrooms % Compliant
Chambers Library	No	50%	50%	23%
Liberal Arts	No	50%	75%	NA
Communications	No	25%	88%	NA
Art & Design	No	25%	NA	63%
Nigh University Center	Yes	50%	NA	Female 60% Male 65%
Total Compliant Buildings	1	0	0	0
Percentage of Compliant Buildings	20%	0%	0%	0%
Total Noncompliant Buildings	4	5	3	4
Percentage of Noncompliant Buildings	80%	100%	100%	100%

Accessible corridors, doors, and elevator information relays valuable knowledge concerning the ease of movement from the accessible entrance of the building to the storm shelter.

Table 9

Availability of Electrical Power

Building Name	Emergency Lighting Y/N	Back-Up Power Source Y/N	Duration of Generator
Chambers Library	Yes	Yes – Generator	3 – 6 hours
Liberal Arts	Yes	Yes – Generator	3 – 6 hours
Communications	Yes	No	NA
Art & Design	Yes	No	NA
Nigh University Center	Yes	Yes – Generator	3 – 6 hours
Total Compliant Buildings	5	Not required by code	Not required by code
Percentage of Compliant Buildings	100%		
Total Noncompliant Buildings	0		
Percentage of Noncompliant Buildings	0%		

Knowing the availability of electrical power is crucial (for each building) to determine which buildings will have power and which buildings will not during power failure. However, all shelters have emergency lighting in the case when the power fails, but not all shelters have generators for back-up power.

Summary of Individual Buildings

The two tables provided for each of the five buildings below give general information concerning the structure and the primary storm shelter. The accompanying paragraphs relate more pertinent information concerning the results of the assessment conducted on each building.

The process of determining gross and usable square footage, as well as the occupant load (in the following tables) was done by the researcher. The gross square footage of the spaces seen below was determined by multiplying the width by the length of the shelter space. The measurements used in the calculation process were field verified within each space. The usable square footage was determined by subtracting the summation of all structural and stored items from the gross square footage.

The occupant load given in the following tables was calculated by dividing the usable square footage by five. Five square feet is the suggested amount of square feet each person should be allotted as stated by FEMA, and this information is referenced in the literature review. For more specific information concerning the complete assessment for each building see Appendix C.

It is also important to note that the buildings assessed are locked during the week from approximately 12:00am to 7:00am. Weekend and after-hour access and procedures for a severe weather event are different than those used during the normal working weekday hours. (The after-hours and weekend procedures will not be discussed in this report.)

Table 10

Building Information

Building Name	Number of Levels including Basement	Approximate Hours Building is locked	General Description of Surroundings
Chambers Library	5	12:00am – 7:00am	Structures, trees, and light poles on all sides of building; parking lots on west side of library
Liberal Arts building	3	12:00am – 7:00am	Structure on southwest side; trees, and light poles on all sides of building; parking lots on west, north, and east sides of building
Communications building	3	12:00am – 7:00am	Structures, trees, and light poles on all sides of building
Art and Design building	3	12:00am – 7:00am	Structures on west, north, and east sides; trees and light poles on all sides of building
Nigh University Center	4	12:00am – 7:00am	Structures on southwest and west sides; trees and light poles on all sides of building; parking lots on east side

Table 11

Shelter Information

Building Name	Shelter Location	Gross Square Footage	Usable Square Footage	Occupant Load
Chambers Library	East side of basement	9397.42	5782.72	1156
Liberal Arts	Basement excluding Mechanical room	2803.54	1740.54	348
Communications	Basement excluding Mechanical room	*1115.04	*796.75	*159
Art and Design	Basement excluding Mechanical room, mechanical closet, and men's restroom	1690.71	1275.08	254
Nigh University Center	North end of central corridor on the first floor	1810.65	1764.59	352

*The calculations of this storm shelter may be skewed due to the process of measuring. The gross square footage in this space may differ from the actual gross square footage of the building. The researcher was not able to measure a room of the shelter due to the amount of furniture stored in the space. The square footage of this room was determined by calculating the area of the space from a provided floor plan and subtracting the open floor space unused by the storing of furniture to determine the usable square footage of the room.

The location and space planning of all shelters affect the functionality of the space. Each shelter has the potential to be affected by the debris from surrounding structures. More specifically, Chambers Library and Art and Design refuge areas potentially could be affected by the debris from two structures located south and west of the library. The Liberal Arts shelter potentially could be affected by the debris from other structures from the southwest and west. The shelter in the Communications building has the potential to be affected by the debris from other structures located to the south and west of the building and satellite dishes located to the southeast and southwest of the building. The shelter located in the Nigh University Center has the potential to be affected by debris from other structures from the southwest to the northwest. In addition, each storm shelter assessed in this study has light poles and trees surrounding the building that could potentially affect the primary shelters.

Another potentially hazardous element in the Art and Design and Nigh University Center shelters is the amount and location of glazing. The glazing included into the design of the Art and Design building consists of large floor-to-ceiling windows at the top of the stairs leading to the shelter. The glazing in the Nigh University Center can be found in interior windows, interior doors, and the atrium located just south of the shelter. Another hazardous element in this shelter area is the presence of exterior glass doors located at the end of a secondary corridor that meets the shelter perpendicularly.

The location of the primary shelters for Chambers Library, Liberal Arts, the Communications building, and Art and Design is fully underground. However, all of these shelters listed above exclude portions of the basement level that are not designated as refuge areas. The refuge area in Chambers Library is the east two-thirds of the building. The only portions of the basement level not designated as shelter are private offices and storage used by library staff. The Liberal Arts refuge area is the entire basement level with the exclusion of the mechanical room in the northwest corner of the basement. Similarly, the refuge area boundaries in Art and Design exclude a mechanical room, mechanical closet, and men's restroom.

On the other hand, the Nigh University Center shelter is located on the first floor and is partially underground. The north and east walls are underground, but the west and south walls are not. The shelter has magazine racks and a copier in this space. All stored equipment was subtracted from the gross square footage of the shelter space since people occupying the shelter cannot physically inhabit the space taken up by the equipment.

Additional shelter space can be found in the private offices and copy center along the north and east walls, but these shelters are not considered official by the university (N.Nieves, personal communication, October 2, 2009). As such, they were not assessed as part of this study, and the square footage for these spaces was not calculated or included in the gross square footage found in this report.

The storing of equipment and inclusion of mechanical equipment into the shelter space is another potentially hazardous situation for the occupants. One hundred percent of all shelters assessed have miscellaneous office equipment stored within the shelter. In addition, 40 percent of the shelters have mechanical, electrical, and miscellaneous equipment that is needed for the building to operate.

For example, the shelter in Liberal Arts has mechanical equipment that is hot to the touch, and other equipment has lower edges that hang below the 80 inches allowed by ADA. This specific equipment could cause head injuries to occupants of the space. In addition, N. Nieves (personal communication, October 2, 2009) states "while all equipment should not be touched, one particular piece of equipment, if touched, could actually send an electric current into the body". This particular piece of equipment currently does not have a protective barrier surrounding it. All stored and mechanical equipment were subtracted from the gross square footage of the shelter space since people occupying the shelter cannot physically inhabit the space taken up by equipment.

The overall results of accessibility of each building and refuge area are mixed. All buildings assessed meet some of the standards set by ADA concerning accessible entrances, the corridors leading to the shelter, as well as doors incorporated into routes to these spaces and in the shelter. However, the buildings do not meet all standards. For example, the doors in Chambers Library, Liberal Arts, and Nigh University Center have the proper opening width and clear floor space clearance required, but some of the doors in the library and Nigh University Center require tight grasping of hardware and more than five pounds of force to open. All of the doors in Liberal Arts require tight grasping of hardware and more than five pounds of force to open. The doors present in the Communications building have the proper opening width and most have the minimum amount of clear floor space clearance required, but as seen in Liberal Arts, all require tight grasping of hardware and more than five pounds of force to open. The Art and Design building is the only structure assessed that features the combination of doors that do not have the proper opening width and have the minimum amount of clear floor space clearance required. Some doors require tight grasping of hardware and more than five pounds of force to open.

Corridors also did not meet standards set by ADA. One hundred percent of the corridors found in the assessed buildings meet the minimum width of 36 inches established by ADA. However, Liberal Arts, Art and Design, and Nigh University Center all incorporate objects that hang lower than the 80 inch overhead clearance established by ADA. Because of the height of the lower edge, these objects could be hazardous to inhabitants with limited vision. The overhead object found in Art and Design is not a permanent object, but was present at the time of the assessment, and furthermore, the corridor does travel through gallery space the frequently features objects with lower edges that do not meet the requirements established by ADA.

Nigh University Center does not have changes in level from the accessible entrance to the refuge area. The corridor in Liberal Arts does not have a change in level from the accessible entrance to the refuge area entrance, but there is an abrupt level change from the shelter entrance to the basement. However, Chambers Library, Liberal Arts, the Communications Building, and Art and Design all have changes in level from the accessible entrances to the entrance of the shelter. Although these four buildings have elevators or a lift, stairs are the only means to descend to the shelter entrance. Nieves (personal communication, October 2, 2009) states that elevators and a lift are present but are not to be used during a severe weather event. Elevators are not to be utilized during an emergency because no secondary source of power is present to operate the elevator if the electricity fails. People with special needs are escorted to secondary shelters located in the restrooms on the first floor. In addition, for occupants to ride the elevators in Chambers Library and Liberal Arts to the shelter, occupants must have a key, which is supplied by the personnel located in the building. However, the elevator found in the Communications building does not need a key to operate the elevator.

Conclusions and Recommendations

The findings of this study present areas of noncompliance in relation to the safety standards set forth by ADA and FEMA in the primary storm shelters at UCO. In addition, the findings of the shelters can be generalized throughout UCO. Although not all buildings or storm shelters were assessed on UCO's campus, all of the buildings that house storm shelters were constructed around the same time. Therefore, it can be generalized that these buildings would produce similar results.

The occupant load of the buildings is a major consideration concerning the safety of the population of UCO. However, the actual number of people in the shelter during a severe weather event cannot be easily determined. Currently the occupant load, as given by UCO, is 5700 people. This number does not include the occupant load of the Nigh University Center since it officially is not determined at this point. The summation of the occupant load determined by the researcher of this report is 1917 for the remaining four buildings. The difference between the two occupant loads is 3783 people, which should not be potentially served by the shelters.

In addition, if too many people occupy each shelter, it can be a hazard to the occupants. As a result of a higher occupant load, the chances are higher for the occupants to be closer to the mechanical and electrical equipment in the shelter. As stated previously, some of this equipment can be harmful to the occupant's safety.

All of the shelters had hazardous elements that could potentially threaten the occupants' safety. These elements include glazing, overhead hanging objects impeding the movement of people with sight impairments, exterior doors into the shelter space, and the potential threat that surrounding buildings have on the space. Some of these hazardous elements could be eliminated. For example, tree branches hanging below 80 inches over sidewalks could simply be trimmed.

However, some of these hazardous elements cannot be easily changed. The presence of glazing cannot simply be removed, but has to be considered. If the glazing is breeched, glass could potentially injure the occupants of the shelter by cutting or embedding into the skin. Another element is the low hanging objects found in the shelter or in the corridors leading to the shelter, which cannot be easily changed, and can impede the movement of occupant. In addition, occupants could sustain head injuries if the objects are too low. The shelters can also be penetrated by flying debris from the structures and landscaping that surround each refuge area.

Another common hazard was the weight, opening clearance, and clear floor space violations of interior doors. These doors were found in the route to or in the shelter themselves. If doors do not meet the standards established and enforced by ADA, occupants of the space could injure themselves. For example, people could injure their hands if it takes more than five pounds of force to open a door while tightly grasping the door hardware, and it could possibly. In addition, if proper door clearance is not provided, people in wheelchairs are not able open the door.

One positive feature of all buildings is that the location of the shelters met the suggested requirements established by FEMA. All of the assessed shelters were either underground or partially underground. Even though the shelter in the Nigh University Center is partially underground, it was still located in the center of the lowest level of the building, which is a suggested safety measure established by FEMA, and is referenced in the literature review section. In addition, this shelter was located in a corridor and, as suggested by FEMA, this corridor lays perpendicular to a common southwest to northeast track of tornadoes. In addition, UCO has recently added emergency guide handbooks to every classroom, corridor, and public space on campus. These handbooks provide valuable information on how to react to various hazardous events, including tornadoes.

Limitations

Only five shelters on this campus were chosen for assessment. Additional assessment of other buildings might support or negate the findings of this study.

Another limitation includes the amount of ADA assessed building features. While several areas of ADA standards were included into this study, not all areas governed by this government body were assessed since some areas of ADA cannot be found in the buildings and the results from these would not have impacted this study. The age of the buildings could also be a limitation. All of the buildings assessed were constructed before current shelter guidelines used in this study were developed. Therefore, the buildings would need retrofitting to meet these specific guidelines. Newer buildings could be constructed with these guidelines in place.

Recommendations for Future Study

The results of the study brought attention to the safety and potentially hazardous nature of the storm shelters on the UCO campus. One important potential study is to analyze the perceptions of safety by those who have used a shelter at UCO. Further studies could include more in-depth assessments of individual buildings and their storm shelters on this campus. More specifically, these assessments could focus on all travel routes to the shelter entrance from various locations in the building itself. These routes were not assessed in this study due to the scope of the report. Other studies could include the assessment of older buildings versus newer buildings on campus. For example, do newer buildings on campus incorporate more safety measures established by FEMA and ADA? Furthermore, due to the geographical location of this campus, additional studies could be done comparing buildings on this campus to buildings on similar campuses throughout “Tornado Alley”.

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Appendices

Appendix A

ADA Checklist for emergency Shelters

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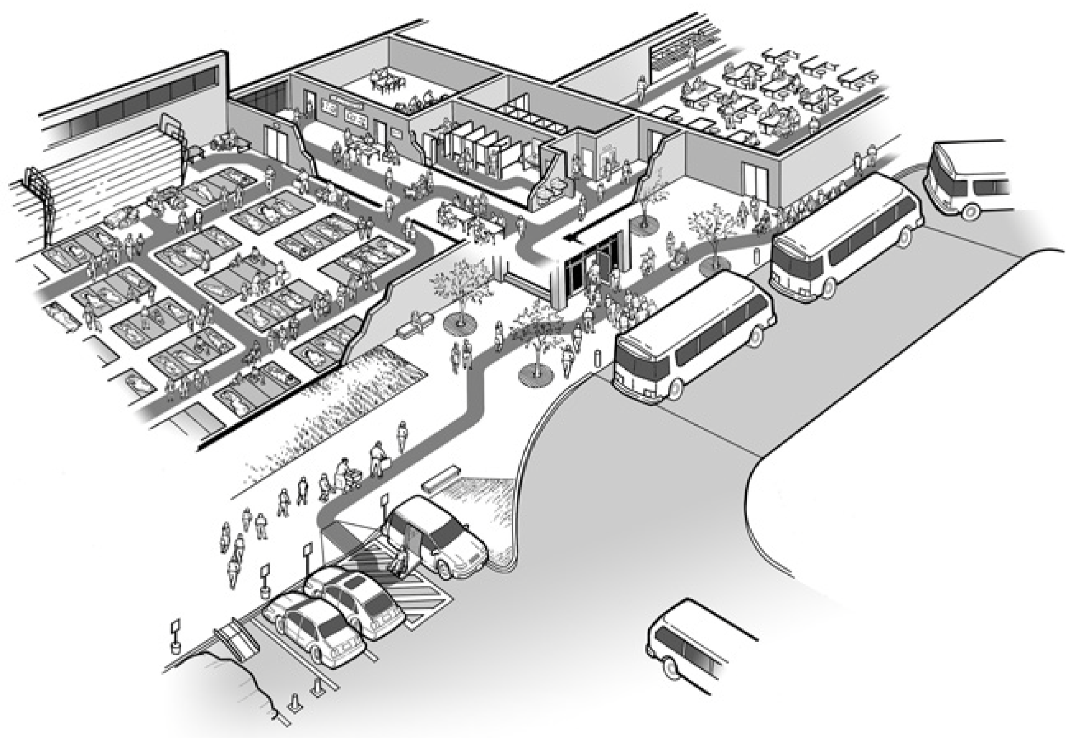
FEMA 361: Design and Construction Guidance for Community Safe Rooms

U.S. Department of Justice
Civil Rights Division
Disability Rights Section

Americans with Disabilities Act

ADA Checklist for Emergency Shelters



July 26, 2007

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Disclaimer

The ADA authorizes the Department of Justice to provide technical assistance to individuals and entities that have rights or responsibilities under the Act. This document provides informal guidance to assist you in understanding the ADA and the Department's regulation. However, this technical assistance does not constitute a legal interpretation of the statute.

ADA Checklist for Emergency Shelters

A. Evaluating the Physical Accessibility of Emergency Shelters
B. Conducting Accessibility Survey
C. Getting Started
D. Tools Needed
E. Taking Measurements
1. Sloped Surfaces
2. Using the Tape Measure
3. Measuring Door Openings
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Step One: Accessible Shelter Quick-Check Survey
Selecting Sites to Survey for Accessibility

A. Accessible Entrance
B. Accessible Routes To All Service/Activity Areas
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Step Two: Ada Checklist For Emergency Shelters

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1. Typical Issues for Individuals Who Use Wheelchairs, Scooters, or other Mobility Devices

Accessible Ramp Features

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Temporary Solutions For Emergency Sheltering - Protruding Object Hazards

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H. Restrooms and Showers

Toilet Stalls

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L. Availability of Electrical Power
M. Single-User or “Family” Toilet Room
N. Health Units/Medical Care Areas
O. Accessible Portable Toilets

Accessible Emergency Shelters

One of the most important roles of State and local government is to protect people from harm, including helping people obtain food and shelter in major emergencies. When disasters occur, people are often provided safe refuge in temporary shelters located in schools, office buildings, tents, or other facilities. Advance planning for an emergency shelter typically involves ensuring that the shelter will be well stocked with basic necessities, such as food, water, and blankets. Planning should also involve ensuring that these shelters are accessible to people with disabilities. Making emergency sheltering programs accessible is generally required by the Americans with Disabilities Act of 1990 (ADA).

A. Evaluating the Physical Accessibility of Emergency Shelters

In order to be prepared for an emergency that requires sheltering, accessible features should be part of an emergency shelter. A first step to providing an accessible shelter is to identify any physical barriers that exist that will prevent access to people with disabilities. One good way to do this is to inspect each shelter facility that your community plans to use in an emergency and identify barriers to people with disabilities, including people who use wheelchairs or scooters or who have difficulty walking, people who are deaf or hard-of-hearing, and people who are blind or who have low vision. Facilities built or extensively altered since the ADA went into effect in 1992 may have few barriers to accessibility and could be good choices for emergency shelters. Facilities built before 1992 and not altered to provide accessibility may have barriers that prevent access to people with disabilities.

When evaluating physical accessibility in older facilities, it may be a good idea to do the analysis in two parts. If you suspect that an older facility is not accessible, you can do a preliminary analysis before completing a detailed accessibility survey. This preliminary analysis, or quick-check, can eliminate facilities with extensive barriers so that the focus can be on those facilities that are most appropriate to become accessible shelters. To help identify older buildings that may be good candidates to become accessible shelters, a copy of the Accessible Shelter Quick-Check Survey is provided on page 7. After completing the Quick-Check Survey, if you have checked “Yes” for most of the questions on the forms, you should conduct a full accessibility survey using the ADA Checklist for Emergency Shelters.

If you find barriers to accessibility after completing the checklist, the next step is to either remove the barriers or identify other nearby accessible facilities that can serve as a shelter. In communities with more than one emergency shelter, until all shelters are accessible, the locations of accessible shelters should be widely publicized, particularly to people with disabilities and organizations that serve the disability community.

B. Conducting Accessibility Surveys

The following Quick-Check Survey (beginning on page 7) and the ADA Checklist for Emergency Shelters (beginning on page 11) are designed to assist State and local officials and operators of emergency shelters to determine whether a facility being considered for use as an emergency shelter is accessible and if not, whether modifications are needed to remove barriers or whether relocation to another accessible facility is necessary. Filling out the Quick-Check Survey will provide guidance on whether a facility has certain basic accessible features, and filling out the detailed ADA Checklist for Emergency Shelters will provide specific information on any barriers to accessibility.

C. Getting Started

Individuals conducting the surveys need not be experienced in evaluating facilities for accessibility. The checklist provides guidance on how to complete the survey and will prompt the user to check key elements. The checklist pages also provide space for notes and other key information. The checklist is designed to prompt the user to check key features by asking questions about sizes, sloped surfaces, and availability of accessible features; and in some areas, it suggests alternatives if a physical barrier is identified. By following the directions provided for filling out the checklist, staff can identify accessible shelters and develop information needed to implement temporary and permanent accessibility modifications.

An evaluation of shelter accessibility should focus on those areas of the facility that may be used for providing shelter in an emergency. These include areas where people are dropped off by a bus, van, or car; the parking area; the entrance to the shelter; pedestrian routes (both exterior and interior); sleeping, eating, information, and recreational areas; and toilet rooms.

Before shelter accessibility is evaluated, it is useful for staff to review the instructions for filling out the checklist and become familiar with the questions. It is also helpful to practice taking measurements, photographs, and recording information. On the day of the survey, it is helpful to first become familiar with certain areas before starting to record information. Upon arrival at the proposed shelter, first find the areas where people will disembark from vehicles, both passenger drop-off and loading zones as well as parking areas. Next find the entrances to the shelter areas that will be used during an evacuation. If possible, take an identifying “location” photograph that shows the name of the facility and the address so that other photographs can be identified correctly. When inside the building, locate the areas where people are likely to register, sleep, and eat. Locate the toilet rooms that serve the shelter area. It is also a good idea to locate any areas used for telephones, food distribution, and medical services.

D. Tools Needed

The following items are needed for the survey:

- A metal tape measure that is at least 20 feet long;
- A digital level or bubble level that is 24 inches long;
- A door pressure gauge;
- A digital (preferred) or film camera with a flash;
- One copy of the checklist for each shelter (and Quick-Check Survey if used); and
- A clipboard and pens.

If you are not familiar with taking the types of measurements needed to complete the checklist, review the following section and practice using the tools before going to conduct a survey.

E. Taking Measurements

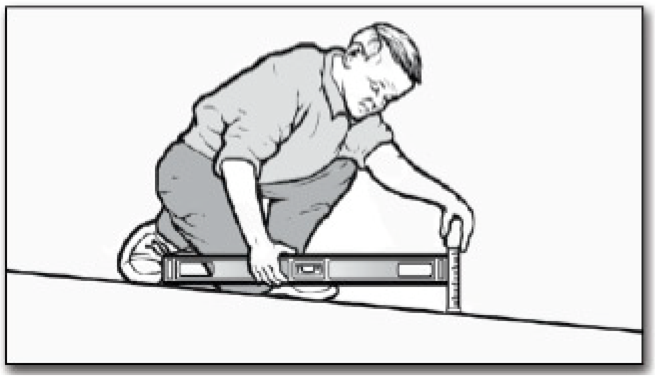
1. Sloped Surfaces

Measuring the slope of a ramp, parking space, walkway, or other ground or floor surface is important to identify whether the surface is accessible. The amount of slope or grade is described as the proportion of a vertical rise to a horizontal length. It is usually described as:

- a ratio (e.g., 1:20, which means one unit of vertical rise for each 20 units of horizontal length); or
- a percentage (e.g., 8.33% which equates to a ratio of 1:12 or 4.76 degrees).

The easiest way to measure slope is to use a digital level. The digital display gives a reading that may be shown as a percent, degrees, or as a digital bubble. Before using a digital level, make sure to understand the directions for its use. It will need to be calibrated before each use. The maximum running slope generally allowed for ramps is 1:12 (8.33% or 4.76 degrees). Cross slope is the slope or grade of a surface perpendicular to the running slope. The most cross slope allowed on an accessible route is 1:50 (2% or 1.15 degrees).

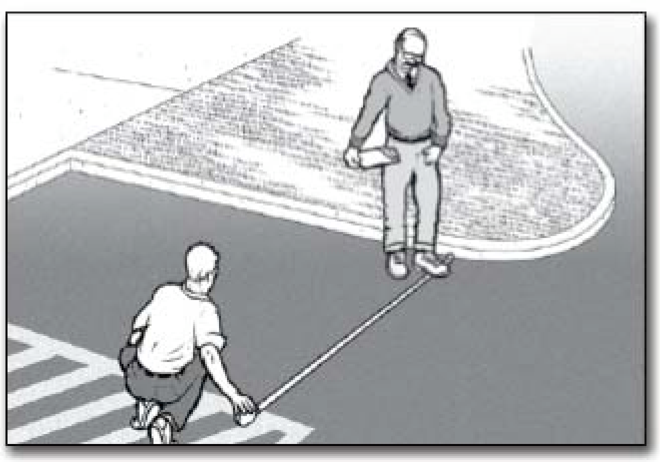
Another way to measure slope that requires more effort is to use a 24-inch level with leveling bubble and a metal tape measure. Place the level on the sloped surface in the direction you wish to measure. Rest one end of the level at the highest point of the sloped surface and lift the other end (see below) until the bubble is in the middle of the tube. This is the "level" position. While the level is in this position, measure the distance between the end of the level and the sloped surface below. If the distance is two inches or less, then the slope is 1:12 or less. When the distance is more than two inches, record the distance on the checklist so the exact slope can be calculated later. For measuring cross slope, if the distance, measured from the level position, is ½ inch or less then the slope is 1:48 or less.



Measuring slope using a 24-inch bubble level and tape measure

2. Using the Tape Measure

A metal tape measure is needed to measure the length, width, height, and depth of various elements. When measuring long distances, pull the tape tight to get an accurate measurement. The checklist will offer guidance for the specific measurement that is required.



Using a tape measure to measure the width of a parking space

3. Measuring Door Openings

Special care is needed when measuring the clear opening of a doorway. To measure the clear opening of a standard hinged door, open the door to 90 degrees. Place the end of the tape measure on the side of the door frame next to the clear opening (see below). Stretch the tape across the door opening to the face of the door. This measures the clear width of the door opening through which people pass, which is less than the width of the door itself.

Measuring the clear opening from the face of the doorstop on the frame to the face of the open door

F. Taking Photographs

A comprehensive set of photographs makes it easier to understand existing conditions after the survey is completed. It is a good idea to take many photos of the exterior and interior of the potential shelter. It is likely that many other people in your decision-making process will need to review information about the facility you are surveying, so try to record each element that you survey with several photos. It is always useful to first take a photo that will clearly Measuring the clear opening from the face of the doorstop on the frame to the face of the open door identify the location of the element so that others will easily be able to find the element. Then, take several close-up shots of that element to document the conditions you found during your survey. If you are not familiar with the camera that you plan to use, practice using it both indoors and outdoors before starting to survey the various facilities being considered for use as shelters. If you are using a digital camera, it is a good idea to review the images as you take them to ensure that you have good quality photographs.

G. Completing the Survey and Checklist

The survey and checklist forms will prompt you for what to look at and where to measure. You should write down all answers and notes for use later in the planning process. If a photo is taken of a particular element or condition, then you should note this on the checklist. It is usually more efficient for two or three people to work together doing these surveys. One person can measure while the other records the information and takes photos.

For each item, check either “Yes” or “No.” If the measurement or number falls short of that required for accessibility, write the measurement or number to the right of the question. Add notes or comments as needed. For some questions when “No” is the answer, the checklist will include a prompt to check for an alternate solution. Information on possible alternative solutions can be used later to decide how to better provide accessibility. Taking several photos is also helpful when the answer is “No” and an alternative way to provide accessibility is not readily apparent.

When completing the survey or checklist, try to answer every question in each section unless the element is not present at that facility. For example, if no parking lot is provided at the facility, (such as where only on-street parking is provided), do not measure the size of the on-street parking spaces.

Some sections of the checklist are divided into two parts, one for individuals with a mobility disability and the other for individuals who are blind or who have low vision. While evaluating a facility you will be checking to ensure that an accessible route is provided. The accessible route is a continuous unobstructed pedestrian path without steps or steep slopes that connects all accessible site and building features and spaces together. A continuous accessible route must be available at the shelter for people who use a wheelchair, scooter, or other mobility device. Other sections of the checklist ask questions related to individuals who are blind or have low vision. These questions cover all circulation paths, not just pedestrian paths that are also an accessible route.

The survey and the checklist are based on some of the requirements from the ADA Standards for Accessible Design (the Standards). Questions have been selected to reflect features that may be most important for the short-term stays common for emergency shelters. To learn more about the Standards, see the Department of Justice regulations, 28 C.F.R. Part 36, Appendix A. The regulations and the Standards are available at www.ada.gov. Copies are also available by calling the ADA Information Line at 800-514-0301 (voice) or 800-514-0383 (TTY).

H. After Completing the Survey and Checklist

Once you have completed the survey and filled out the checklist, you can determine which elements or spaces in a potential shelter facility are accessible and which may need modifications. If most answers are “yes,” the facility may need little or no modification. If some answers are “no,” modifications may be needed to remove barriers found in that space or element. Emergency shelters in older buildings with inaccessible features might be made accessible with temporary modifications, (such as portable ramps at the entrance and accessible parking spaces marked off by traffic cones) until permanent modifications can be made. However, where facilities are not capable of being made accessible, another facility will need to be selected for use as a shelter.

Step One: Accessible Shelter Quick-Check Survey

Selecting Sites to Survey for Accessibility

Providing an emergency shelter that is accessible to people with disabilities involves making sure that a number of accessible features and spaces are available. To verify accessibility before deciding on a site for an emergency shelter can involve asking many questions such as those in the ADA Checklist for Emergency Shelters. For some older buildings, especially those on hilly sites and those that have not been renovated, remodeled, or altered since 1992, before completing the detailed checklist, it may be better to do a pre-test that can rule out a facility with major accessibility problems so available resources can be focused on other locations. The following questions will help evaluate whether a facility has such major accessibility barriers. After this first step, buildings that do not have major accessibility problems should be surveyed more thoroughly, using the ADA Checklist for Emergency Shelters, to find out which, if any, barriers need to be removed to provide an accessible shelter.

A. Accessible Entrance

Having a way to get into the emergency shelter on a surface that is firm, stable, slip resistant, without steps or steep slopes, and wide enough for a person using a wheelchair or other mobility aid is essential.

A1. Is there a sidewalk connecting the parking area and any drop off area to the walkway leading to the building? [ADA Standards § 4.1.3(1)]

☐ Yes

☐ No

A2. Is there a route without steps from this sidewalk to the main entrance?

☐ Yes

☐ No

If No, are there two or fewer steps? Yes _____ No ____ Number of Steps: __________
If No, is there another entrance without steps that is connected by a sidewalk to the parking or drop off area? Yes _____ No _____Location: _________________

B. Accessible Routes To All Service/Activity Areas

Everyone must be able to get to each of the various areas where activities and services take place. This includes people who use mobility devices, such as wheelchairs and scooters, being able to get to locations where supplies are distributed, to eating areas, to sleeping areas, to toilet rooms, and to other activity areas without encountering stairs or steep slopes.

Check all of the various ways to get to each of the areas where sheltering activities are likely to take place (sleeping, eating,

B1. Sleeping Area (Location: _______________________________________)

B1-a. Is there a route without steps from the accessible entrance to this location?

☐ Yes

☐ No

If No, are there two or fewer steps? Yes ___ No ___ Number of Steps: _______
If No, is there a ramp, lift, or elevator? Yes ___ No ___ Type of device: _______

B1-b. If an elevator or lift provides the only accessible route, is there a source of backup power to operate the device for an extended period?

☐ Yes

☐ No

B2. Eating Area (Location: _______________________________________)

B2-a. Is there a route without steps from the accessible entrance to this location?

☐ Yes

☐ No

If No, are there two or less steps? Yes ___ No ____ Number of Steps: _____
If No, is there a ramp, lift, or elevator? Yes ___ No ____ Type of device: _______

B2-b. If an elevator or lift provides the only accessible route, is there a source of back up power to operate the device for an extended period?

☐ Yes

☐ No

B3. Supply Distribution Area (Location: _____________________________)

B3-a. Is there a route without steps from the accessible entrance to this location?

☐ Yes

☐ No

If No, are there two or fewer steps? Yes ___ No ___ Number of Steps: ______
If No, is there a ramp, lift, or elevator? Yes ___ No ___ Type of device: ______

B3-b. If an elevator or lift provides the only accessible route, is there a source of backup power to operate the device for an extended period?

☐ Yes

☐ No

B4. Toilet Rooms (Location: ____)

B4-a. Is there a route without steps from the accessible entrance to this location?

☐ Yes

☐ No

If No, are there two or fewer steps? Yes ___ No ____ Number of Steps: ______
If No, is there a ramp, lift, or elevator? Yes ____ No ____ Type of device: ______

B4-b. If an elevator or lift provides the only accessible route, is there a source of backup power to operate the device for an extended period?

☐ Yes

☐ No

C. Accessibility Within Toilet Rooms

C1-a. Is there an area within the toilet room where a person who uses a wheelchair or mobility device can turn around - either a minimum 60-inch diameter circle or a “T”-shaped turn area? [ADA Standards §§ 4.22.3; 4.2.3, Fig. 3]

☐ Yes

☐ No

C1-b. Is at least one stall at least 60 inches wide and 56 inches deep (wall mounted toilet) or 59 inches deep (floor mounted toilet)? [ADA Standards § 4.17.3]

☐ Yes

☐ No

Using The Information:

If most of your answers to the previous questions are Yes, then the facility has some basic accessibility features and should be surveyed using the ADA Checklist for Emergency Shelters. Whenever most of your answers are No, then these problems should be evaluated before conducting a more detailed survey, or perhaps you should consider another location to serve as an emergency shelter.

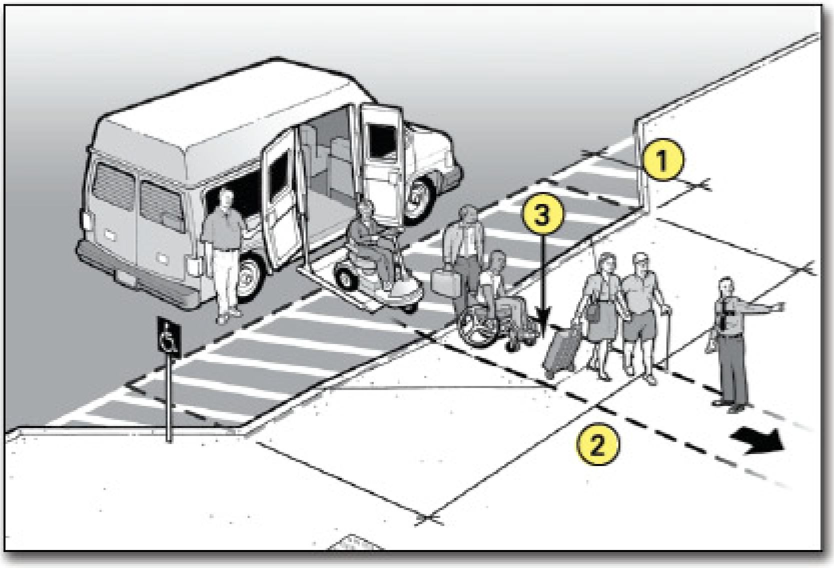
Step Two - ADA Checklist For Emergency Shelters

Getting to the Emergency Shelter

A. Passenger Drop-Off Areas

During an evacuation the most efficient method of transporting people to shelters likely will include using vans and buses. Accessible buses and vans with wheelchair lifts will be needed to transport people who use wheelchairs, scooters, or other mobility aids. When they arrive at the shelter, an accessible drop-off area (also known as a passenger loading zone) is needed for people using mobility aids to get off of the bus or van and proceed to the shelter’s accessible entrance.

An accessible drop-off area must have a level access aisle that is adjacent and parallel to the vehicle space. Where a curb separates the vehicle space from the access aisle or the access aisle from an accessible route, a curb ramp must be provided so people with mobility disabilities can get to the accessible route leading to the accessible entrance of the shelter.



Accessible drop-off area with an access aisle provided at the same level as the vehicle.

Notes

1. Access aisle depth is at least 5 feet.

2. Access aisle length is at least 20 feet. 3.

3. Curb ramp connects the access aisle for the accessible drop-off area (which is at the level of the parking lot) to the accessible route to the accessible entrance of the shelter.

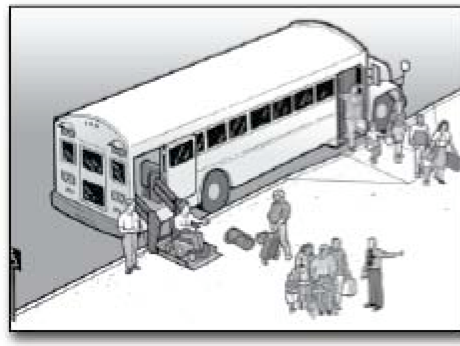
The access aisle may be at the parking-lot level or at sidewalk level. If the access aisle is at the parking-lot level, the curb ramp is provided between the access aisle and the sidewalk. If it is at the sidewalk level, an adjacent curb ramp is provided between the street and the sidewalk.

A1. Is a relatively level (1:50 or 2% maximum slope in all directions) access aisle provided adjacent and parallel to the side of the vehicle pull-up area? [ADA Standards § 4.6.6]

☐ Yes

☐ No

If No, look for another relatively level location that is on an accessible route to the accessible shelter entrance that could be used.



Accessible drop-off area with an access aisle provided as part of the sidewalk.

A2. Is the vehicle pull-up area relatively level (1:50 or 2% maximum slope in all directions)?

☐ Yes

☐ No

A3. Is the area for the access aisle at least 5-feet wide and 20-feet long? [ADA Standards § 4.6.6].

☐ Yes

☐ No

Note: Unlike at an accessible parking space, the surface for the access aisle of an accessible passenger drop-off area does not have to be marked or striped.

A4. Is there vertical clearance of at least 114 inches (9 feet 6 inches) from the site entrance to the vehicle pull-up area, the access aisle, and along the vehicle route to the exit? [ADA Standards § 4.6.5]

☐ Yes

☐ No

A5. Is a curb ramp provided between the vehicle pull up area and the access aisle (see above) or the access aisle and the accessible route to the accessible entrance? [ADA Standards § 4.6.6]

☐ Yes

☐ No

If No, is there another area with a curb ramp and on an accessible route that could serve as the drop-off area?

If there is no curb ramp near the drop-off area, can a temporary ramp be used to connect the drop-off area access aisle to the accessible route to the accessible shelter entrance?

A6. If a curb ramp is provided, is the running slope of the ramp surface (not counting the side flares) no more than 1:12 or 8.33% [ADA Standards § 4.7.2]

☐ Yes

☐ No

A7. Is the width of the curb ramp surface at least 36 inches (not counting the side flares)? [ADA Standards § 4.7.3]

☐ Yes

☐ No

A8. Does an accessible route connect the curb ramp to the shelter's accessible entrance? [ADA Standards § 4.1.2(1)]

☐ Yes

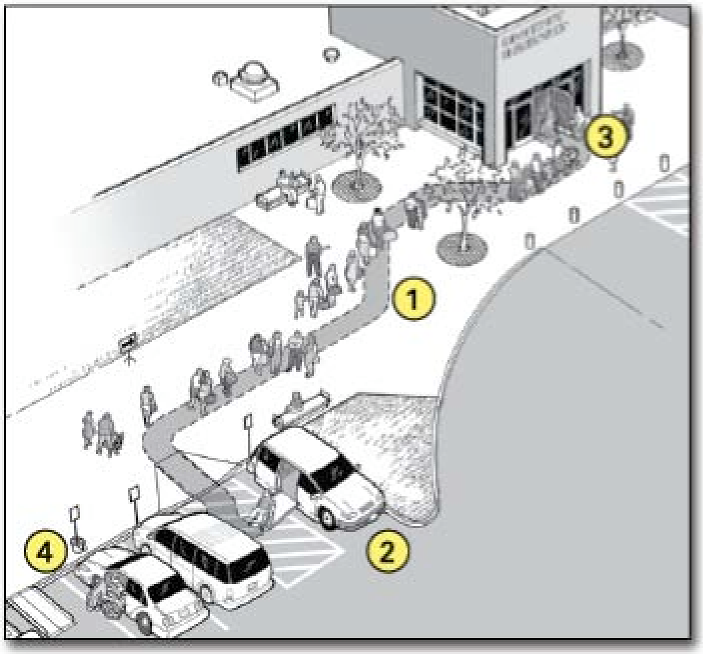
☐ No

B. Parking

1. Typical Issues

During an evacuation, some individuals with a mobility disability may arrive at the shelter in a car or van. When parking areas are provided at the shelter site, accessible parking spaces must be provided. Individuals with disabilities who arrive at the shelter in their own car or van need to be able to park in an accessible parking space close to an accessible entrance. Accessible parking spaces need an adjacent access aisle that provides space for a person with a mobility disability to exit their vehicle. The access aisle connects directly to an accessible route that leads to an accessible building entrance. In order to be usable, the access aisle must be relatively level, clear of gravel or mud, and the surface must be in good condition without wide cracks or broken pavement.

An accessible route connects the permanent access aisle of each accessible parking space with the accessible entrance to the shelter. When an accessible route crosses a curb, a curb ramp must be provided. During an emergency, as a temporary measure, if additional accessible parking spaces are needed, a portable ramp can be provided in a parking space marked off by traffic cones to provide two additional accessible parking spaces (see page 18).



An accessible entrance to an emergency shelter with accessible parking and additional temporary accessible parking spaces

Notes:

1. Accessible route.
2. Accessible parking with van accessible parking space.
3. Accessible entrance to shelter.
4. Temporary accessible parking spaces.

2. Parking Spaces Checklist

B1. When parking areas are provided at the shelter site, count the total number of parking spaces provided in each area. Is the minimum number of accessible parking spaces provided, based on the total number of available parking spaces (see table below)? [ADA Standards § 4.1.2(5)(a)]

☐ Yes

☐ No

Total Number of Parking Spaces in Each Parking Area	Required Minimum Number of Accessible Spaces

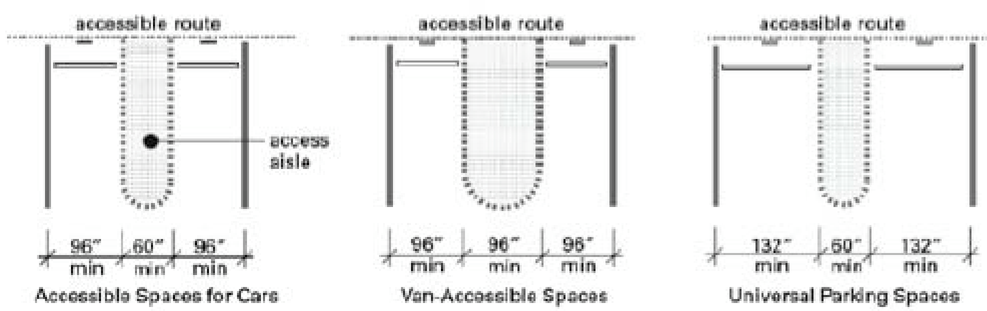
1- 25	1 van-accessible space w/min. 96-inch-wide access aisle (van space)
26 - 50	1 space w/min. 60-inch-wide access aisle + 1 van space
51 - 75	2 spaces w/min. 60-inch-wide access aisle + 1 van space
76 - 100	3 spaces w/min. 60-inch-wide access aisle + 1 van space
101 - 150	4 spaces w/min. 60-inch-wide access aisle + 1 van space

If more than 150 parking spaces are provided in a particular lot, see section 4.1.2 of the ADA Standards for the number of accessible parking spaces required.

B2. Does each accessible parking space have its own, or share, an adjacent access aisle that is least 60 inches (5 feet) wide? [ADA Standards § 4.6.3]

☐ Yes

☐ No



Accessible Parking Spaces Showing Minimum Width of Vehicle Space and Access Aisle

B3. Is there at least one van-accessible parking space provided with an access aisle that is at least 96 inches (8 feet) wide or are universal parking spaces provided that are 132 inches (11 feet) wide for vehicle space with a 60-inch (5-feet) wide access aisle? [ADA Standards § § 4.1.2(5), A4.6]

☐ Yes

☐ No

B4. For van-accessible spaces (particularly in a garage or parking structure), is there vertical clearance of at least 98 inches (8 feet - 2 inches) for the vehicle route to the parking space, the parking space, the access aisle, and along the vehicle route to the exit? [ADA Standards § 4.6.5]

☐ Yes

☐ No

If No: Can the route be cleared by removing or raising low objects, or can each van accessible parking space be relocated?

B5. Are all accessible parking spaces, including the access aisle, relatively level (1:50 or 2%) in all directions? [ADA Standards § 4.6.3]

☐ Yes

☐ No

If No: Look for a nearby area that is relatively level in all directions that could serve as an accessible parking space with an accessible route to the accessible entrance to the shelter.

B6. Does each accessible parking space have a sign with the symbol of accessibility that is visible when a vehicle is parked in the space? [ADA Standards § 4.6.4]

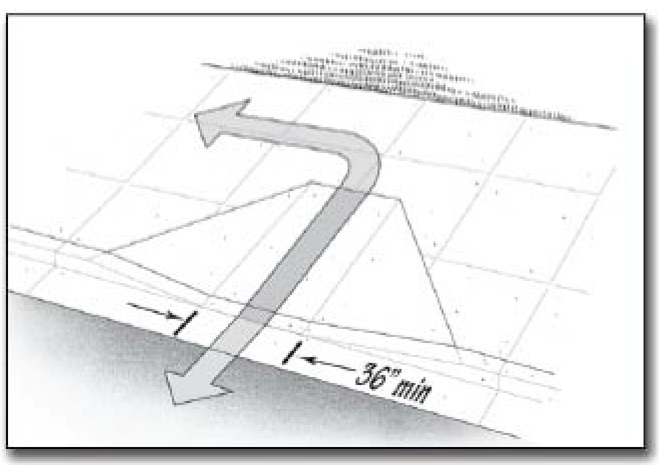
☐ Yes

☐ No

B7. If there is a curb between the access aisle and the accessible route to the building, is there a curb ramp that meets the following requirements: [ADA Standards § 4.7]

☐ Yes

☐ No



Curb ramp showing minimum 36-inch width for ramp section and 1:12 slope on ramp section.

B7-a. Is the curb ramp surface at least 36 inches wide, excluding flared sides? [ADA Standards § 4.7.3]

☐ Yes

☐ No

B7-b. Is the slope (up or down the ramp) no more than 1:12? [ADA Standards § 4.7.2]

☐ Yes

☐ No

Note: 1:12 is one inch of vertical height for each 12 inches of length.

B8. Are the accessible parking spaces serving the shelter on the shortest accessible route to the accessible entrance? [ADA Standards § 4.6.2]

☐ Yes

☐ No

B9. Does each access aisle connect to an accessible route from the parking area to the shelter's accessible entrance? [ADA Standards § 4.6.2]

☐ Yes

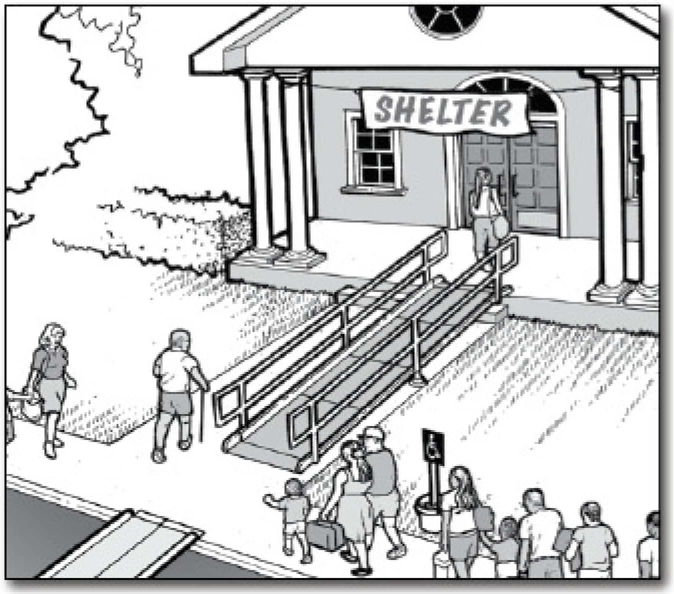
☐ No

3. Temporary Solutions for Emergency Sheltering - Parking

Problem: Parking at the shelter facility either has no accessible parking, not enough accessible parking, or accessible parking spaces are not on level ground.

Suggestion: Find a fairly level parking area near the accessible entrance and mark the area for accessible parking spaces. Three regular parking spaces will make two accessible parking spaces with a shared access aisle. Provide a sign designating each accessible parking space. Ensure there is an accessible route from each access aisle to the accessible entrance.

If temporary accessible spaces are used, mark the temporary accessible parking spaces with traffic cones or other temporary elements. Traffic cones can also be used to mark off an access aisle if designated accessible parking spaces lack an access aisle or if the access aisle is too narrow. At least one accessible parking space should be a van-accessible parking space with an access aisle that is at least 96 inches wide.

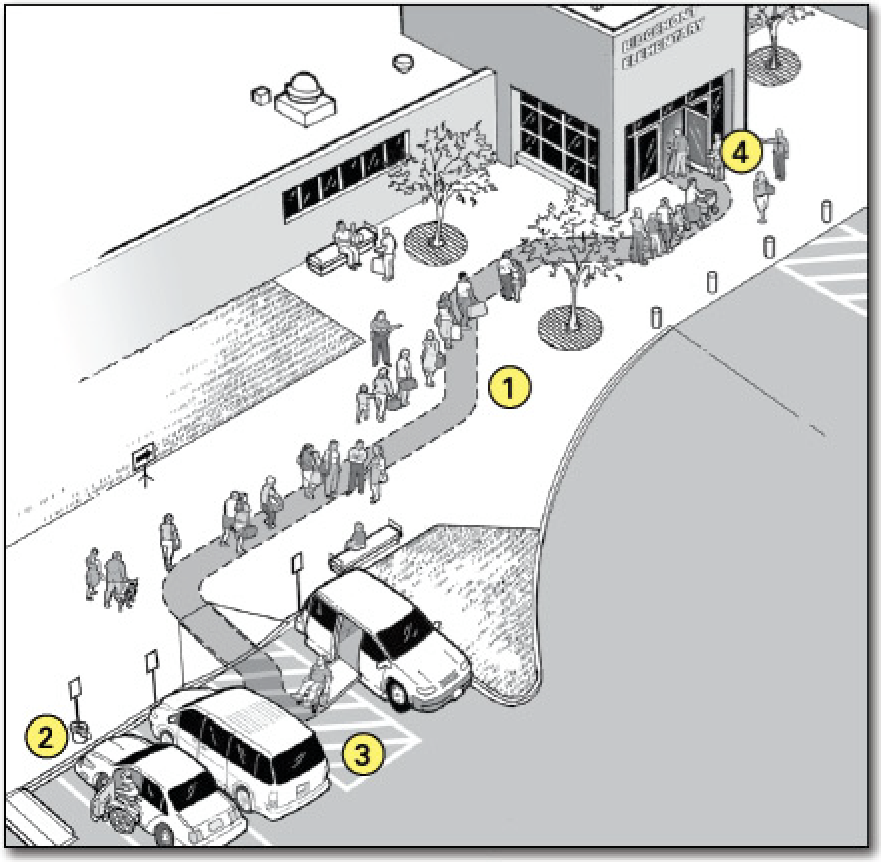


Three standard parking spaces are converted into an accessible parking space with an access aisle. Cones mark the access aisle and a temporary curb ramp with edge protection connects to an accessible route to the shelter.

C. Sidewalks and Walkways

1. Typical Issues for Individuals Who Use Wheelchairs, Scooters, or other Mobility Devices

An accessible route connects accessible passenger drop-off areas, accessible parking spaces, and other accessible elements, like a route from a bus stop, to an accessible building entrance. The accessible route is essential for people who have difficulty walking or who use wheelchairs or other mobility aids to get to the accessible entrance of the shelter. The accessible route must be at least 36 inches wide (it may narrow briefly to 32 inches wide where utility poles, signs, etc. are located along the accessible route). Abrupt level changes, steps, or steep running or cross slopes cannot be part of an accessible route. Where ramps are used, they cannot be steeper than 1:12. Ramps with a vertical rise of more than 6 inches must have handrails on both sides. Ramps must also have edge protection to stop wheelchairs from falling off the sides, and level landings at the top and bottom of each segment and where the ramp changes direction.



An accessible entrance to a shelter with accessible parking and an accessible drop-off area

Notes:

1. Accessible route

2. Accessible drop-off area

3. Accessible parking with van-accessible parking space

4. Accessible entrance to shelter

C1-a. Is an accessible route provided from accessible parking spaces to the accessible entrance of the shelter? [ADA Standards § 4.1.2(1), 4.3]

☐ Yes

☐ No

C1-b. Is an accessible route provided from public sidewalks and public transportation stops on the shelter site (if provided) to the accessible entrance for the shelter? [ADA Standards § 4.1.2(1)]

☐ Yes

☐ No

Note: The accessible route is at least 36 inches wide and may be a portion of a sidewalk.

C1-c. Is the accessible route at least 36 inches wide? [ADA Standards § 4.3.3]

☐ Yes

☐ No

If No, does the accessible route narrow to 32 inches for no more than 2 feet?

C1-d. Is the accessible route free of steps and abrupt level changes higher than 1/2 inch? [ADA Standards § 4.3.8]

☐ Yes

☐ No

Note: Level changes between 1/4 inch and 1/2 inch should be beveled (sloped) at 1:2 maximum.

C1-e. Where an accessible route crosses a curb, is a curb ramp provided? [ADA Standards § 4.3.8]

☐ Yes

☐ No

e-i. Is the curb ramp surface at least 36 inches wide, excluding flared sides? [ADA Standards § 4.7.3]

☐ Yes

☐ No

e-ii. Is the running slope (up or down the ramp) no more than 1:12? [ADA Standards § 4.7.2]

☐ Yes

☐ No

Note: 1:12 is one inch of vertical height for 12 inches of horizontal distance.

C1-f. If the slope of part of the accessible route is more than 1:20, does it meet the following requirements for an accessible ramp?

☐ Yes

☐ No

f-i. Is the running slope no greater than 1:12? [ADA Standards § 4.8.2]

☐ Yes

☐ No

Note: For existing ramps, the slope may be 1:10 for a 6-inch rise and 1:8 for a 3-inch rise in special circumstances (see ADA Standards § 4.1.6(3)).

f-ii. Are handrails installed on both sides of each ramp segment? [ADA Standards § 4.8.5]

☐ Yes

☐ No

f-iii. Is the ramp width, measured between the handrails, at least 36 inches? [ADA Standards § 4.8.3]

☐ Yes

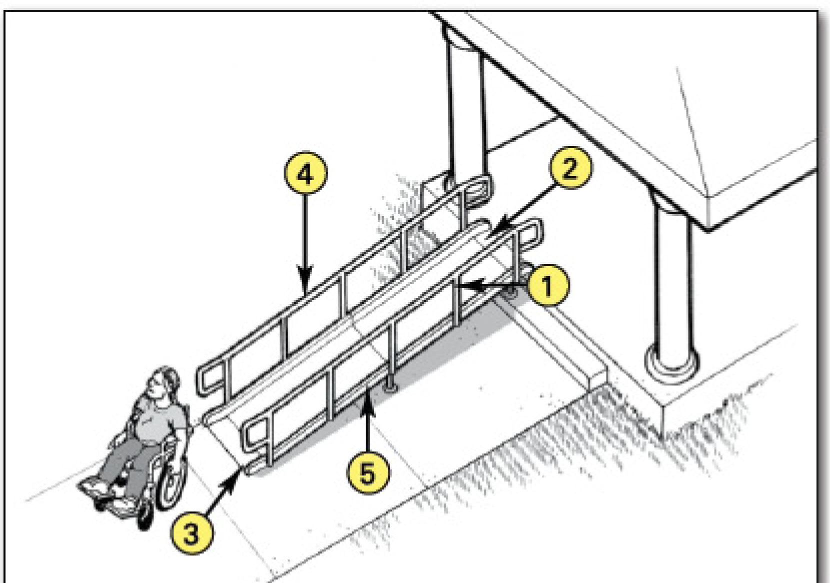
☐ No

f-iv. Does the ramp have a level landing at the top and bottom of each ramp section that is at least 60 inches long? [ADA Standards § 4.8.4]

☐ Yes

☐ No

Note: The level landing may be part of the sidewalk or walking surface.



Accessible ramp features

Notes:

1. At least 36 inches between handrails

2. Top landing part of walk

3. Bottom landing part of walk

4. Handrail height 34 to 38 inches

5. Edge protection.

f-v. If a ramp is more than 30 feet long, is a level landing at least 60 inches long provided at every 30 feet of horizontal length? [ADA Standards § 4.8.4]

☐ Yes

☐ No

Note: if the running slope is less than 1:16 but more than 1:20, each ramp segment may be up to 40 feet long followed by a level landing].

f-vi. Is there a level landing, at least 60 inches x 60 inches, when a ramp changes direction? [ADA Standards § 4.8.4]

☐ Yes

☐ No

f-vii. Are the handrails mounted 34 to 38 inches above the ramp surface? [ADA Standards § 4.8.5]

☐ Yes

☐ No

f-viii. If the ramp or landing has a vertical drop-off on either side, is edge protection provided? [ADA Standards § 4.8.7]

☐ Yes

☐ No

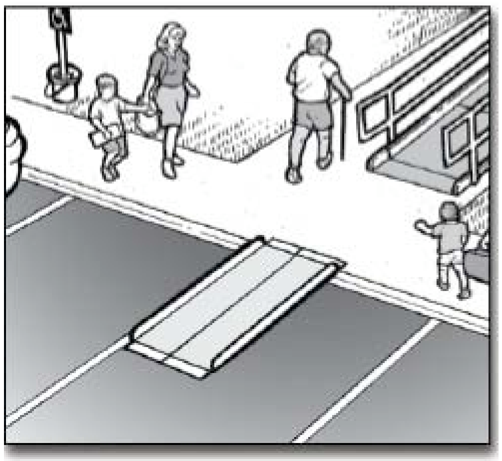
Temporary Solutions For Emergency Sheltering - Ramps

Problem: The sidewalk connecting parking to the shelter entrance is too steep to be accessible.

Suggestion: Check to see if there is another accessible route to the accessible entrance. Sometimes there is a less direct route that is accessible. During an evacuation it will be helpful to put up signs or to have volunteers stationed at the accessible parking spaces to direct people along this less direct, but nonetheless accessible, route.

Problem: The accessible route crosses a curb but no curb ramp is provided.

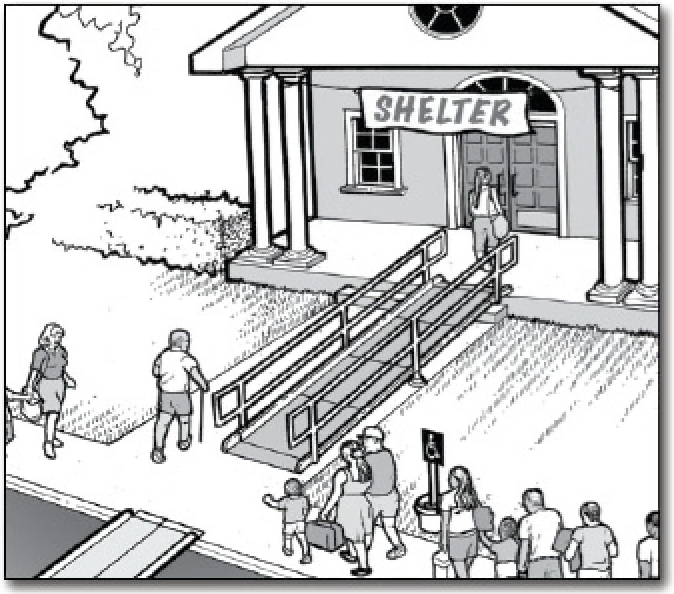
Suggestion: Install a portable ramp with a slope no steeper than 1:12 with edge protection. Store the portable ramp on site so it can be easily accessed in an emergency.



A portable ramp with edge protection is installed over a curb to provide an accessible route.

Problem: There are two steps where the sidewalk connects to the accessible entrance.

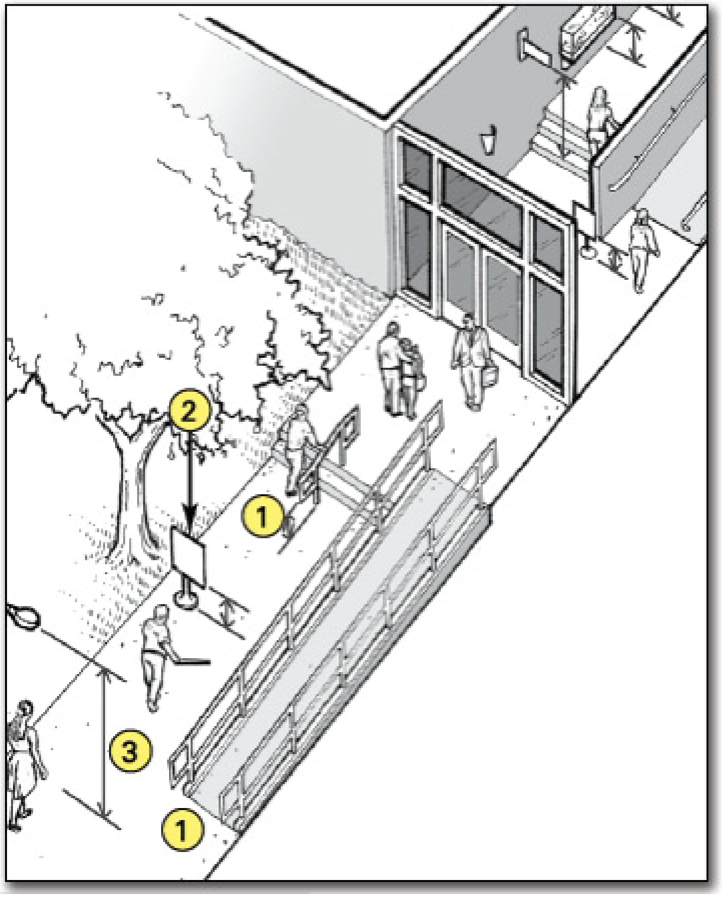
Suggestion: Install a portable ramp with a slope no steeper than 1:12 with edge protection and handrails on both sides of the ramp. Store the portable ramp and components on site so everything can be easily accessed in an emergency.



A portable ramp with edge protection and handrails is installed over two steps to provide an accessible route.

2. Typical Issues for Individuals Who Are Blind or Have Low Vision

Objects that are wall mounted, that project into a pedestrian route from the side, or that are overhead can be hazards to people who are blind or who have low vision. These objects must be positioned so people will either detect the objects before they run into them or safely pass under them. Examples may include handrail extensions on stairs and ramps, post- or wall-mounted signs, drinking fountains, and low hanging tree limbs. Pedestrian routes open to people during the time that the facility is being used as an emergency shelter, such as sidewalks, courtyards, and plazas, must be free of overhanging objects that are less than 80 inches above the route. Objects more than 27 inches and less than 80 inches above the route and that protrude from the side more than 4 inches are also a hazard. Since people can walk on any sidewalk, not just the accessible routes, all exterior pedestrian routes serving or leading to the shelter areas must be checked. The following questions apply to sidewalks and walkways leading to the emergency shelter.



Common objects along pedestrian routes to a shelter that can be hazards to people who are blind or have low vision.

Notes:

1. The bottom of the handrail extensions turn down to 27 inches or less above the route so a person who is blind or has low vision can detect the hazard before running into it.
2. Signs or other objects in the pedestrian route can be a hazard if the bottom is more than 27 inches but less than 80 inches above the route.
3. Objects that overhang the pedestrian route must be at least 80 inches above the route.

C2-1. Are all sidewalks and walkways to the shelter free of any objects (e.g., wall-mounted boxes, signs, handrail extensions) with bottom edges that are between 27 inches and 80 inches above the walkway and that extend more than 4 inches into the sidewalk or walkway? [ADA Standards §§ 4.4, 4.2.1(3), 4.1.3(2)]

☐ Yes

☐ No

If No, can the object be lowered, removed, or modified or can the route be moved so that the object can be avoided?

C2-2. Are the undersides of exterior stairs enclosed or protected with a cane-detectable barrier so that people who are blind or have low vision will not hit their heads on the underside? [ADA Standards § 4.4.2]

☐ Yes

☐ No

If No, can a barrier or enclosure be added below the stair or can the route be relocated away from the stair?

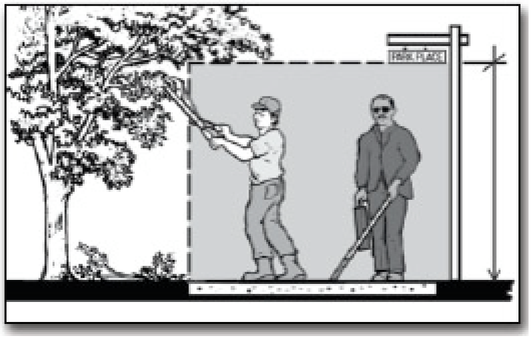
When the underside of a stair is open, it is a hazard to people who are blind or have low vision. Enclosing the area below the stair or installing a cane-detectable barrier helps this woman to stop before hitting her head.

C2-3. Are all objects that hang over the pedestrian routes at least 80 inches above the route? [ADA Standards § 4.4.2]

☐ Yes

☐ No

If No, can the objects be removed or relocated, or can a cane-detectable object be added below that is at no higher than 27 inches?



Overhead sign and tree branches are least 80 inches above the walk.

Temporary Solutions For Emergency Sheltering - Protruding Object Hazards

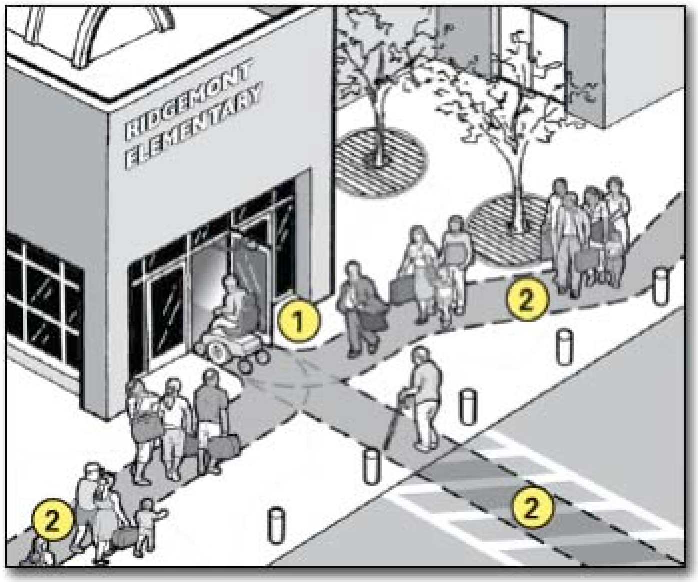
Problem: Objects protrude too far from the side into the route causing a hazard for people who are blind or who have low vision.

Suggestion: When people who are blind or who have low vision use a cane to detect hazards, objects located at 27 inches or lower are detectable. When an object is located higher than 27 inches above the ground it is a hazard if the object protrudes more than 4 inches into the circulation path. To make a protruding object cane-detectable:

- Place an object below, or on either side of, the protruding object that is not higher than 27 inches above the ground.
- If the protruding object can be moved, lower the object so that its bottom is not more than 27 inches above the ground.
- Prune or alter the protruding object so it does not protrude above the route.

D. Entering the Emergency Shelter

Building Entrance



Notes:

1. Accessible entrance to the shelter.
2. Accessible route connecting accessible parking and drop-off area (if provided) to the accessible entrance.

A shelter must have at least one accessible entrance that is on an accessible route. An accessible entrance must provide at least one accessible door with maneuvering space, accessible hardware, and enough clear width to allow people who use crutches, a cane, walker, scooter, or wheelchair to use it.

If the accessible entrance is not the main entrance to the facility that is being used as a shelter, signs must be located at inaccessible entrances to direct evacuees and volunteers to the accessible entrance. The accessible entrance must be unlocked when other shelter entrances are unlocked.

Examples of signs for inaccessible shelter entrances directing people to the accessible entrance.

D1. Is there at least one accessible entrance connected to an accessible route? [ADA Standards § 4.1.3(1)]

☐ Yes

☐ No

Notes: If this entrance is not the main entrance, it needs to be kept unlocked when other shelter entrances are unlocked.

If there are inaccessible entrances serving the shelter, signs will be needed at inaccessible entrance(s) to direct evacuees to the nearest accessible entrance.

D2. Does at least one door or one side of a double leaf-door provide at least 32 inches clear passage width when the door is open 90 degrees? [ADA Standards § 4.13.5]

☐ Yes

☐ No

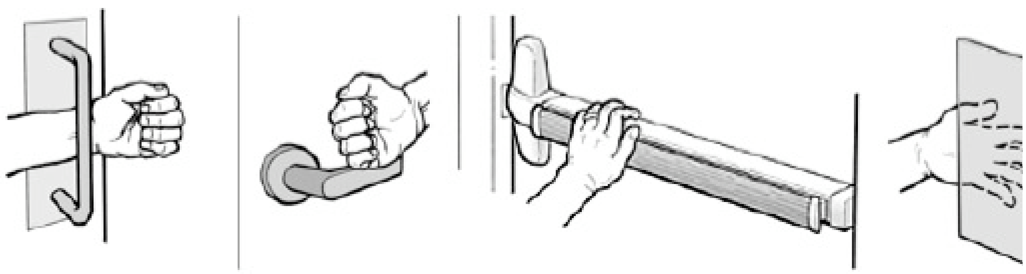
If No, does another entrance have an accessible door or can both doors be propped open during the evacuation? Other possible solutions are to enlarge the door opening, use a swing clear hinge, or, if a double-leaf door, replace with uneven width doors.

D3. Is the hardware (e.g., lever, pull, and panic bar) usable with one hand without tight grasping, pinching, or twisting of the wrist? [ADA Standards § 4.13.9]

☐ Yes

☐ No

If No, leave door propped open, add new accessible hardware, or adapt/replace hardware.



Examples of handles and door hardware that can be used without tight grasping, pinching, or twisting.

D4. On the latch, pull side of the door, is there at least 18 inches clearance provided if the door is not automatic or power-operated? [ADA Standards § 4.13.6, Fig. 25]

☐ Yes

☐ No

If No, leave the door propped open or find another accessible entrance.

D5. If there is a raised threshold, is it no higher than 3/4 inch at the door and beveled on both sides? [ADA Standards §§ 4.1.6(3)(d)(ii), 4.13.8]

☐ Yes

☐ No

If No, replace threshold with one with beveled sides or add a sloped insert.

D6. If an entry has a vestibule, is there a 30-inch by 48-inch clear floor space inside the vestibule where a wheelchair or scooter user can be outside the swing of a hinged door? [ADA Standards § 4.13.7]

☐ Yes

☐ No

If No, leave the inner door permanently open, remove inner door, or modify the vestibule.

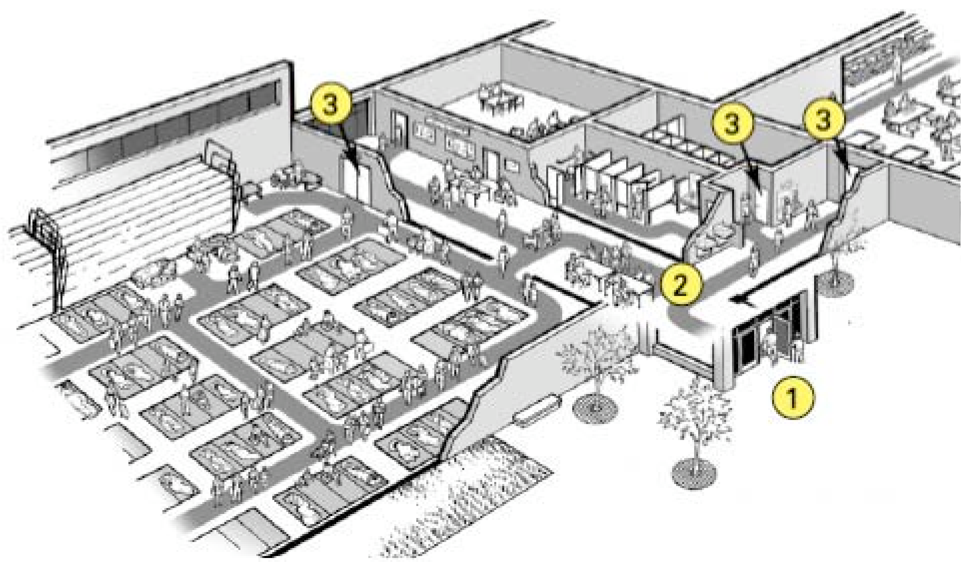
E. Hallways and Corridors

1. Typical Issues for Individuals Who Use Wheelchairs, Scooters, or Other Mobility Devices

The interior accessible route connects the accessible entrance with the various service and activity areas within the shelter. Typically made up of hallways, corridors, and interior rooms and spaces, the accessible route is essential for people who have difficulty walking or who use wheelchairs or other mobility aids to get to all of the service and activity areas of the shelter.

An accessible route is at least 36 inches wide and may narrow briefly to 32 inches wide where the route passes through doors or next to furniture and building elements. High thresholds, abrupt level changes, steps, or steep running or cross slopes cannot be part of an accessible route. Where ramps are used, they cannot be steeper than 1:12. Ramps with a vertical rise of more than 6 inches must have handrails on both sides. Ramps must also have edge protection to stop wheelchairs from falling off the sides, and level landings at the top and bottom of each segment and where a ramp changes direction.

Where an accessible route is different from the route used by most evacuees, signs will be needed at key decision points to direct individuals with disabilities to the various activity areas.



Interior of a shelter showing the accessible route from the accessible entrance to all service and activity areas.

Notes:

1. Accessible Entrance

2. Accessible Route connects the accessible entrance with shelter service and activity area
3. Accessible door to service and activity areas

E1-a. Is there an accessible route, at least 36 inches wide, that connects the accessible entrance to all shelter areas (it may narrow to 32 inches wide for up to 2 feet in length)? [ADA Standards § 4.3.2(3)]

☐ Yes

☐ No

E1-b. Is the accessible route free of steps and abrupt level changes over 1/2 inch?

☐ Yes

☐ No

Note: level changes between 1/4 inch and 1/2 inch should be beveled). [ADA Standards §§ 4.1.3(1), 4.3.8]

E1-c. Does the accessible route from the accessible entrance to all activity areas change levels using a ramp, lift or elevator? [ADA Standards §§ 4.1.3(1), 4.3.8]

☐ Yes

☐ No

If No, go to question E1-g.

c-i. If Yes, is a ramp or sloped hallway provided?

☐ Yes

☐ No

If Yes, go to question E1-d.

c-ii. Is an elevator or lift provided?

☐ Yes

☐ No

If Yes, and the elevator or lift is part of the accessible route to a shelter area, is back-up electrical power available to operate the elevator or lift for the duration of shelter operation should the normal electrical service be disrupted?

If Yes and an elevator is provided, see question E1-e.

If Yes and a lift is provided, see question E1-f.

If No, then either provide back-up electrical power to operate the lift or elevator during the power outage or locate shelter services exclusively on accessible levels that may be reached by people with a mobility disability without using an elevator or lift.

E1-d. Where the slope of the accessible route is greater than 1:20, does this area meet the following requirements for an accessible ramp?

☐ Yes

☐ No

d-i. Is the slope no greater than 1:12? [ADA Standards § 4.8.2]

☐ Yes

☐ No

Note: For existing ramps, the slope may be 1:10 for a 6-inch rise and 1:8 for a 3-inch rise in special circumstances]. [ADA Standards § 4.1.6(3)

d-ii. Are handrails installed on both sides of each ramp segment? [ADA Standards § 4.8.5]

☐ Yes

☐ No

d-iii. Is the ramp width, measured between handrails, at least 36 inches? [ADA Standards § 4.8.3]

☐ Yes

☐ No

d-iv. Are the handrails mounted 34 to 38 inches above the ramp surface? [ADA Standards § 4.8.5]

☐ Yes

☐ No

d-v. If a ramp is longer than 30 feet, is a level landing at least 60 inches long provided every 30 feet? [ADA Standards § 4.8.4]

☐ Yes

☐ No

d-vi. Does the ramp have a level landing that is at least 60 inches long at the top and bottom of each ramp section or where the ramp changes direction? [ADA Standards § 4.8.4]

☐ Yes

☐ No

d-vii. If the ramp or landing has a vertical drop-off on either side of the ramp, is edge protection provided? [ADA Standards § 4.8.7]

☐ Yes

☐ No

E1-e. Is an elevator provided to each of the levels on which each sheltering service or activity area is located?

☐ Yes

☐ No

e-i. Are the centerlines of the call buttons mounted 42 inches above the floor? [ADA Standards § 4.10.3]

☐ Yes

☐ No

e-ii. Does the floor area of the elevator car have space to enter, reach the controls, and exit? [ADA Standards § 4.10.9, Fig. 22]

☐ Yes

☐ No

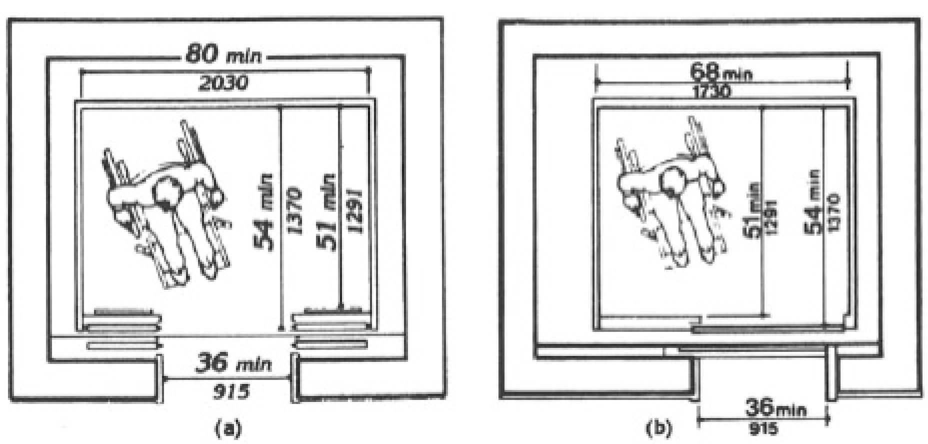


Fig. 22
Minimum Dimensions of Elevator Cars

Note: See Figure 22 for acceptable floor and opening dimensions. Floor dimensions of at least 48 inches by 48 inches may be allowed in existing facilities built before the ADA went into effect.

e-iii. Can the elevator be called and operated automatically without using a special key or having to turn on the elevator from a remote location? [ADA Standards § 4.10.2]

☐ Yes

☐ No

e-iv. Are the highest floor control buttons mounted no more than 54 inches above the floor for a side reach or 48 inches for forward reach? [ADA Standards § 4.10.12 (3)]

☐ Yes

☐ No

e-v. Are raised letters and Braille characters used to identify each floor button and each control? [ADA Standards § 4.10.12]

☐ Yes

☐ No

e-vi. Are signs mounted on both sides of the elevator hoist way door opening (for each elevator and at each floor) that designate the floor with 2-inch minimum-height raised letters and Braille characters centered at 60 inches above the floor? [ADA Standards § 4.10.5]

☐ Yes

☐ No

e-vii. Is the elevator equipped with audible tones or bells or verbal annunciators that announce each floor as it is passed? [ADA Standards § 4.10.13]

☐ Yes

☐ No

E1-f. If a wheelchair lift is provided, does it meet the following?

☐ Yes

☐ No

f-i. Is the lift operational at the time of the survey? [ADA Standards § 4.11.3]

☐ Yes

☐ No

f-ii. Is the change in level from the floor to the lift surface ramped or beveled? [ADA Standards §§ 4.11.2, 4.5.2]

☐ Yes

☐ No

f-iii. Is there at least a 30-inch by 48-inch clear floor space on the wheelchair lift? [ADA Standards §§ 4.11.2, 4.2.4]

☐ Yes

☐ No

f-iv. Does the lift allow a person using a mobility device unassisted entry, operation (is key available, if required), and exit?

☐ Yes

☐ No

f-v. Are the controls and operating mechanisms mounted no more than 54 inches above the floor for a side reach or 48 inches for a forward reach? [ADA Standards §§ 4.11.2, 4.27.3]

☐ Yes

☐ No

f-vi. Are the controls and operating mechanisms usable with one hand without tight grasping, pinching, or twisting? [ADA Standards §§ 4.11.2, 4.27.4]

☐ Yes

☐ No

E1-g. At each location on the way to each shelter activity area where the accessible route passes through a door, does at least one door meet the following requirements?

☐ Yes

☐ No

g-i. Is the clear width for the door opening at least 32 inches measured when the door is open 90 degrees? [ADA Standards §§ 4.1.3(7), 4.13.5]

☐ Yes

☐ No

g-ii. Is the door hardware (e.g., lever, pull, push, panic bar) usable with one hand, without tight grasping, pinching, or twisting of the wrist, to allow people who may not be able to easily use one or both hands to fully operate the hardware? [ADA Standards § 4.13.9]

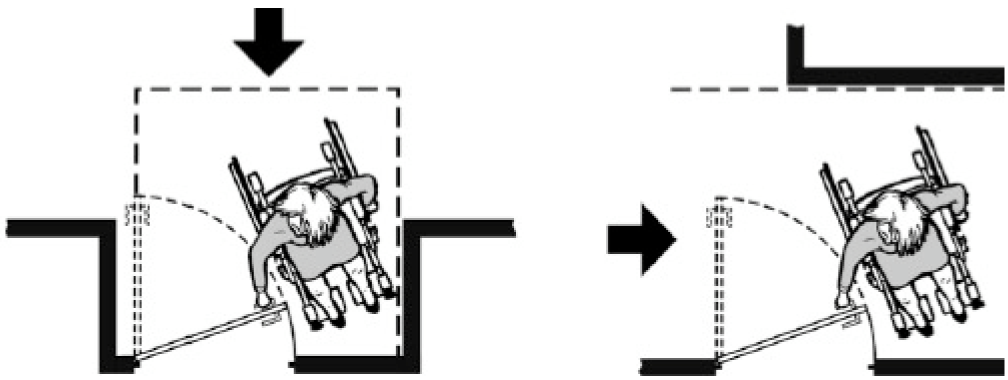
☐ Yes

☐ No

g-iii. Is there clear maneuvering floor space in front of each accessible door (see ADA Standards § Fig. 25) and, on the pull side, is there at least 18 inches clear floor space beyond the latch side of the door (see space configurations in Figure 25)? [ADA Standards § 4.13.6]

☐ Yes

☐ No



A clear floor space on the latch side of the door (pull side) allows a person using a wheelchair or scooter to pull the door open and then enter. The size of the clear floor spacevaries depending on the direction of approach (shown by the arrows) and the door swing.

g-iv. Is no more than 5 pounds force needed to push or pull open the door? [ADA Standards § 4.13.11 (2)(b)]

☐ Yes

☐ No

Note: Fire doors are still considered to be accessible if they have the minimum opening force allowable by the appropriate administrative authority.

g-v. If the answers to questions g-ii thru g-iv are No, can the door be propped open?

☐ Yes

☐ No

If an activity area is not on an accessible route and cannot be made accessible, find another area that is on an accessible route where that activity may be provided.

2. Typical Issues for People Who are Blind or Have Low Vision

Individuals who are blind or have low vision may walk along any route or through any shelter activity area, not just the accessible routes. That means any area where people using the shelter can walk, including hallways, corridors, eating areas, and sleeping areas, must be free of objects that cannot be detected by a person who is blind or has low vision. Objects that are wall mounted, that project into a pedestrian route from the side, or that are overhead must be located so that individuals who are blind or have low vision will either detect the objects before they run into them or safely pass under them. These routes must be free of overhanging objects that are less than 80 inches above the floor and side objects that protrude into the route more than 4 inches when the bottom of the object is more than 27 inches above the floor. Items to watch for include wall-mounted fire extinguishers and wall-mounted display cases when the bottom is more than 27 inches above the floor, wall sconces and light fixtures that protrude more than 4 inches off the wall, and open staircases, exit signs, overhead signs, banners, and arched doorways that are lower than 80 inches above the floor.

Overhead and wall-mounted objects that may be hazards along a pedestrian route

Notes:

1. Wall-mounted drinking fountains are a hazard when the front projects more than 4 inches beyond the wall and the bottom is more than 27 inches above the floor.
2. Wall-mounted objects cannot project more than 4 inches beyond the wall if the bottom is not in the cane-detectable area below 27 inches off the floor.
3. Overhead objects must be at least 80 inches off the floor.

The following questions apply to pedestrian routes serving or leading to the shelter activity and common use areas.

E2-a. Are pedestrian routes leading to or serving each service or activity area of the shelter free of objects that protrude from the side more than 4 inches into the route with the bottom of the object more than 27 inches above the floor? [ADA Standards § 4.4.1]

☐ Yes

☐ No

Note: These objects may be wall mounted or free standing. Items to check include wall-mounted fire extinguishers, light fixtures, coat hooks, shelves, drinking fountains, and display cases.

E2-b. Are pedestrian routes leading to or serving each of the service or activity areas free of overhead objects with the bottom edge lower than 80 inches above the floor? [ADA Standards § 4.4.2]

☐ Yes

☐ No

E2-c. Are any interior stairs along these routes configured with a cane-detectable warning or a barrier that prevents travel into the area with less than an 80-inch high head clearance so that people who are blind or who have low vision cannot hit their heads on the underside or stair frame? [ADA Standards § 4.4.2]

☐ Yes

☐ No

If No, list the objects that are a hazard and their location. Remove or relocate the object or place a detectable object on the floor below each object to remove the hazard.

When the underside of a stair is open, it is a hazard to people who are blind or have low vision. Enclosing the area below the stair or installing a cane detectable barrier helps the person to avoid the area.

F. Check-In Areas

A shelter usually has one or more check-in areas located near the entrance to the shelter. When check-in areas are provided, then at least one accessible check-in location should be provided. The accessible check-in area should be at the accessible entrance or signs should give directions to the accessible check-in area.

If a permanent reception counter is used for check in, make sure to provide a writing surface at an accessible height for people who use a wheelchair, scooter, or other mobility device. This may be a part of the reception counter that is no higher than 36 inches above the floor, a folding shelf or an adjacent table, or a clip board.

An accessible check-in location using a folding table with a height that people who use wheelchairs can easily reach.

F1. Is there an accessible route that connects the accessible entrance to areas that are likely to be used to register people as they arrive at the shelter? [ADA Standards § 4.3]

☐ Yes

☐ No

F2. If there is a built-in reception or other type of counter, does it have a section that is at least three feet long that is no higher than 36 inches above the floor or is there a nearby surface that is not higher than 36 inches above the floor? [ADA Standards § 7.2]

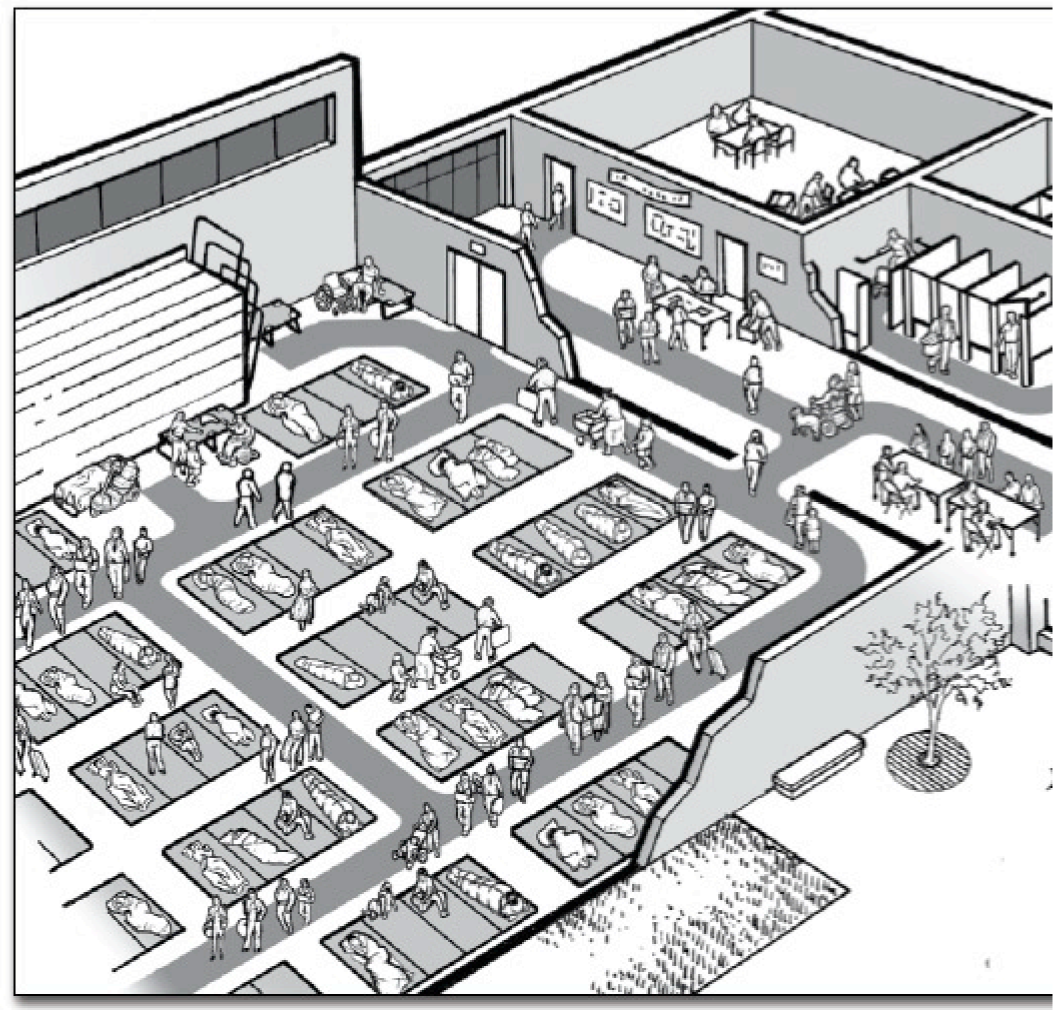
☐ Yes

☐ No

Living at the Emergency Shelter

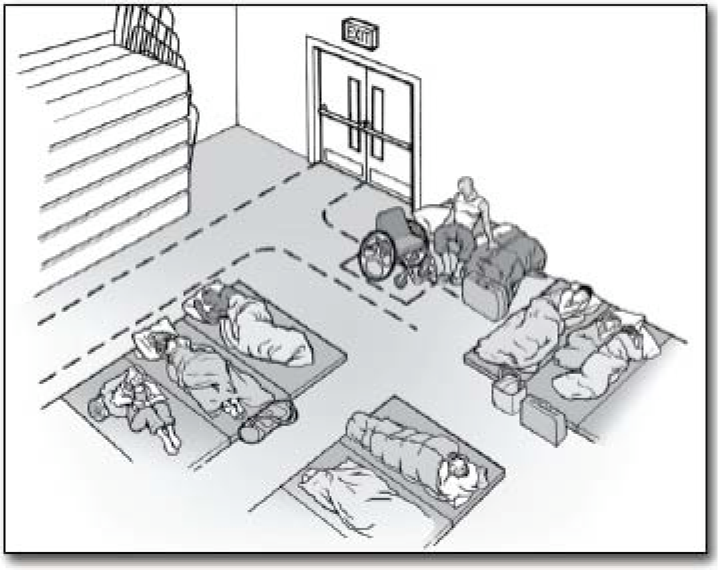
G. Sleeping Areas

Each accessible sleeping area needs to be on an accessible route connecting it to other activity areas in the shelter, including toilet rooms and bathing areas. An accessible route with adequate circulation and maneuvering space provides access in the sleeping areas for people who use wheelchairs or scooters and this route serves each accessible bed or cot.



Interior of one section of a shelter's sleeping area. The shaded pathway indicates the accessible route, which provides access to accessible beds, cots, and other activity areas in the space plus the toilet rooms and other activity areas in the shelter.

Accessible cots have a sleeping surface at approximately the same height above the floor as the seat of a wheelchair (17 to 19 inches above the floor). When placed in several sections of the sleeping area, individuals who use a wheelchair, scooter, or other mobility device will be able to sleep near their family or other companions. An accessible route is needed to provide access to each accessible cot and a clear space at least 36 inches wide is needed along the side of the cot to make it possible to transfer between the mobility device and the cot. A preferred location for accessible cots is to have one side against a wall. This helps to stabilize the cot and the wall can act as a backrest when the person sits up on the cot.



An accessible cot positioned against a wall. Dashed lines indicate the accessible route and clear floor space next to the cot.

G1. Is there an accessible route, at least 36 inches wide, that connects each sleeping area with other shelter activity areas?

☐ Yes

☐ No

Note: it may narrow to 32 inches wide for up to 2 feet in length. [ADA Standards § 4.3.2(3)]

G2. Is the accessible route free of steps and abrupt level changes over 1/2 inch?

☐ Yes

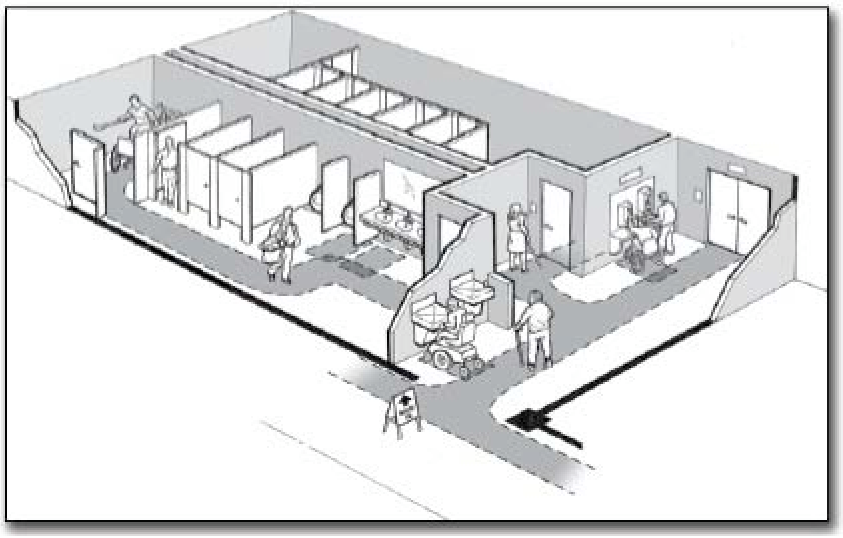
☐ No

Note: level changes between 1/4 inch and 1/2 inch should be beveled). [ADA Standards §§ 4.1.3(1), 4.3.8]

Note: Although the facility survey cannot check the accessibility of the cots because they will not be installed until the shelter is in use, planning for setting up the sleeping area and for arranging the cots and mats should include providing space for an accessible route and clear floor space at each accessible cot. Cots used by people who are blind or who have low vision should be in an easily locatable area.

H. Restrooms and Showers

At least one set of toilet rooms serving the shelter must be accessible to individuals who use a wheelchair, scooter, or other mobility device. In large shelters where more than one set of toilet rooms is needed to serve the occupants, it may be necessary to provide additional accessible toilet facilities or to establish policies to assure that individuals with disabilities have access to the accessible facilities.



Interior of an accessible toilet room showing accessible route, clear floor space at accessible fixtures, and the wide accessible toilet stall.

H1. If a sign is provided at the toilet room entrance (e.g. Men, Women, Boys, Girls, etc.), is a sign with raised characters and Braille mounted on the wall adjacent to the latch? [ADA Standards § 4.30.6]

☐ Yes

☐ No

If No, install a sign with raised characters and Braille on the wall adjacent to the latch side of the door and centered 60 inches above the floor and leave the existing sign in place on the door if removing it will damage the door.

Note: an additional sign may be mounted on the toilet room door but this cannot be considered to be the accessible sign which must be mounted on the wall adjacent to the latch side of the door.

H2. Does the door to the toilet room provide at least 32 inches clear passage width when the door is open 90 degrees? [ADA Standards § 4.13.5]

☐ Yes

☐ No

H3. Is the hardware (e.g., lever, pull, panic bar) usable with one hand without tight grasping, pinching, or twisting of the wrist? [ADA Standards § 4.13.9]

☐ Yes

☐ No

If No, can the door be propped open without compromising privacy, or can the hardware be modified by adding new accessible hardware, or adapting or replacing hardware?

H4. On the pull side of the door, is there at least 18 inches clearance provided on the latch side if the door is not automatic or power-operated? [ADA Standards § 4.13.6, Fig. 25]

☐ Yes

☐ No

H5. If there is a raised threshold, is it no higher than 3/4 inch at the door and beveled on both sides? [ADA Standards §§ 4.1.6(3)(d)(ii), 4.13.8]

☐ Yes

☐ No

☐ NA

If No, replace threshold with one with beveled sides or add a sloped insert.

H6. If the entry has a vestibule, is there a 30-inch by 48-inch clear floor space inside the vestibule where a wheelchair or scooter user can be outside the door swing? [ADA Standards § 4.13.7]

☐ Yes

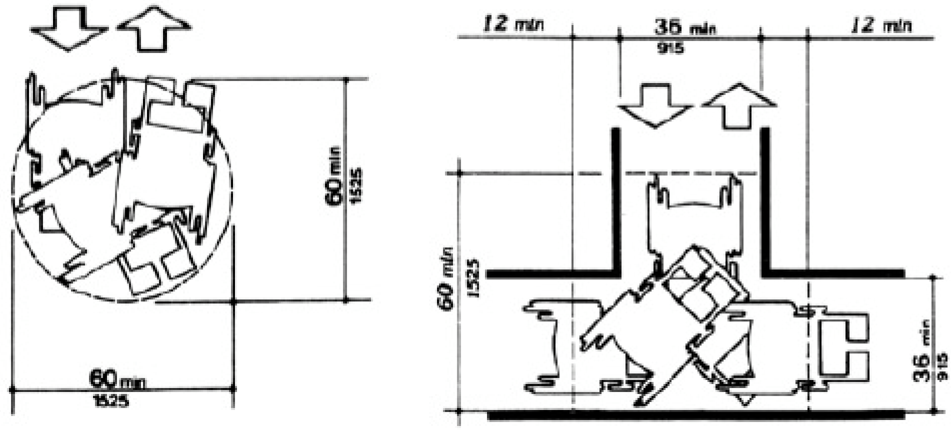
☐ No

If No, possible solutions include leaving the inner door open or removing the outer door.

H7. Inside the toilet room, is there an area where a person who uses a wheelchair or other mobility device can turn around - either at least 60-inch diameter circle or a “T”-shaped turn area as shown in the figures below? [ADA Standards §§ 4.22.3; 4.2.3]

☐ Yes

☐ No



Minimum spaces for turning

Minimum spaces for turning

H8. If lavatories are provided, does at least one have at least a 29 inch high clearance under the front apron with the top of the rim no more than 34 inches above the floor? [ADA Standards § 4.19.2]

☐ Yes

☐ No

H9. Are the drain and hot water pipes for this lavatory insulated or otherwise configured to protect against contact? [ADA Standards § 4.19.4]

☐ Yes

☐ No

H10. Does this lavatory have controls that operate easily with one hand, without tight grasping, pinching, or twisting of the wrist? [ADA Standards § 4.19.5]

☐ Yes

☐ No

H11. If mirrors are provided, is the bottom of the reflecting surface for the mirror at this lavatory no higher than 40 inches above the floor or is a full length mirror provided? [ADA Standards § 4.19.6]

☐ Yes

☐ No

H12. For at least one of each type of dispenser, receptacle, or equipment, is there clear floor space at least 30 inches wide x 48 inches long adjacent to the control or dispenser (positioned either parallel to the control or dispenser or in front of it)? [ADA Standards §§ 4.23.7; 4.27.2; 4.2.5 and Fig 5; 4.2.6 and Fig 6]

☐ Yes

☐ No

H13. Is the operating control (switch, lever, button, or pull) of at least one of each type of dispenser or built-in equipment no higher than 54 inches above the floor (if there is clear floor space for a parallel approach) or 48 inches (if there is clear floor space for a front approach)? [ADA Standards §§ 4.23.7; 4.27.3; 4.2.5 and Fig 5; 4.2.6 and Fig 6]

☐ Yes

☐ No

H14. Are all built-in dispensers, receptacles, or equipment mounted so the front does not extend more than 4 inches from the wall if the bottom edge is between 27 inches and 80 inches above the floor? [ADA Standards §§ 4.23.7; 4.27; 4.4.1; Fig. 8]

☐ Yes

☐ No

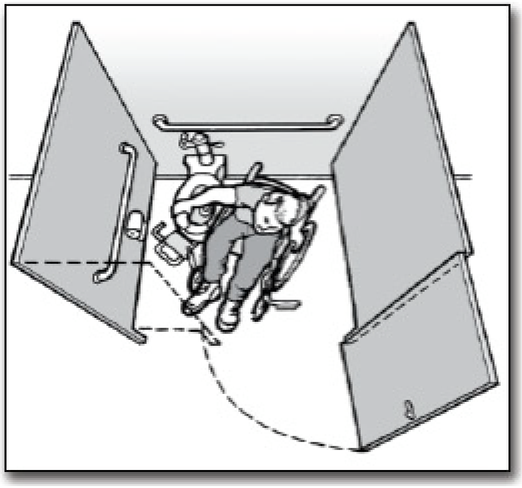
Toilet Stalls

H15. Is at least one wide toilet stall provided with an out swinging door, side and rear grab bars, and clear space next to the toilet? [ADA Standards § 4.17]

☐ Yes

☐ No

If No, check to see if another toilet room provides a wide accessible toilet stall, note its location for shelter planners, and answer all toilet room questions with respect to that toilet room.



Overhead view of an individual using a wheelchair positioned beside a toilet in a wide accessible stall.

H16. Is the toilet stall at least 60 inches wide and 56 inches deep (wall mounted toilet) or 59 inches deep (floor mounted toilet)? [ADA Standards § 4.17.3]

☐ Yes

☐ No

If No, note the width and depth of the stall. _________________

H17. Is at least 9 inches of toe clearance provided under the front wall and at least one side wall of the toilet stall? [ADA Standards § 4.17.4]

☐ Yes

☐ No

H18. Is the centerline of the toilet 18 inches from the adjacent side wall? [ADA Standards § 4.16.2; 4.17.3]

☐ Yes

☐ No

H19. Is the top of the toilet seat 17 inches to 19 inches above the floor? [ADA Standards § 4.16.3]

☐ Yes

☐ No

H20. Is the flush valve located on the wide side adjacent to the lavatory or is an automatic flush valve provided? [ADA Standards § 4.16.5]

☐ Yes

☐ No

H21. Is a horizontal grab bar at least 40 inches long securely mounted on the adjacent side wall 33 to 36 inches above the floor with one end no more than 12 inches from the back wall 33 to 36 inches above the floor? [ADA Standards § 4.16.4; 4.17.6]

☐ Yes

☐ No

H22. Is a second horizontal grab bar at least 36 inches long securely mounted on the back wall with one end no more than 6 inches from the side wall 33 to 36 inches above the floor? [ADA Standards § 4.16.4; 4.17.6]

☐ Yes

☐ No

H23. Is the door to the toilet stall located diagonally opposite, not directly in front of, the toilet or on the opposite side wall from the wall with the long grab bar? [ADA Standards § 4.17.3]

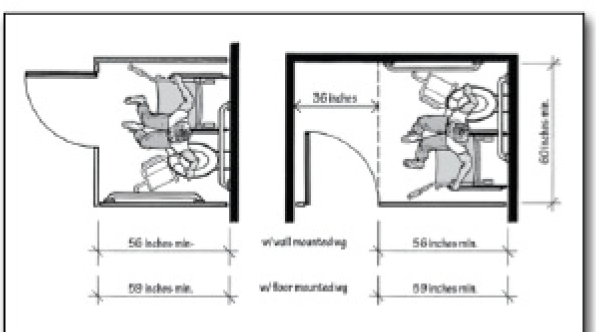
☐ Yes

☐ No

H24. Unless the wide stall is located at the end of a row of toilet stalls, does the door to this wider stall open out? [ADA Standards § 4.17.3]

☐ Yes

☐ No



Plan views showing minimum sizes of wide accessible toilet stall

H25. Is the clear width of the door at least 32 inches (measured between the face of the door and the edge of the opening) when the door is open 90 degrees? [ADA Standards § 4.13.5]

☐ Yes

☐ No

H26. If there are 6 or more stalls in the restroom, is one of those stalls (in addition to the wider stall noted above) exactly 36 inches wide with an out swinging stall door that provides at least 32 inches of clear width? [ADA Standards § 4.22.4]

☐ Yes

☐ No

H27. Does this 36-inch wide stall have horizontal grab bars on both of the side partitions that are at least 36 inches long and 33 to 36 inches above the floor? [ADA Standards § 4.22.4]

☐ Yes

☐ No

H28. Is the surface of the toilet seat in this 36-inch-wide stall 17 to 19 inches above the floor? [ADA Standards §§ 4.16.3; 4.22.4]

☐ Yes

☐ No

H29. If a coat hook is provided is it mounted no higher than 54 inches above the floor for a side approach or 48 inches above the floor for a front approach? [ADA Standards § 4.25.3]

☐ Yes

☐ No

Note: For many emergency shelters, evacuees are not expected to use shower or bathing facilities due to the short period they may stay at the shelter. If planning for the shelter operation includes offering shower or bathing facilities, then those facilities should be on an accessible route and checked for accessibility. For information on the requirements for accessible showers or bathtubs see the ADA Standards for Accessible Design which is available online at www.ada.gov.

The following are figures illustrating some accessible shower features from the ADA Standards.

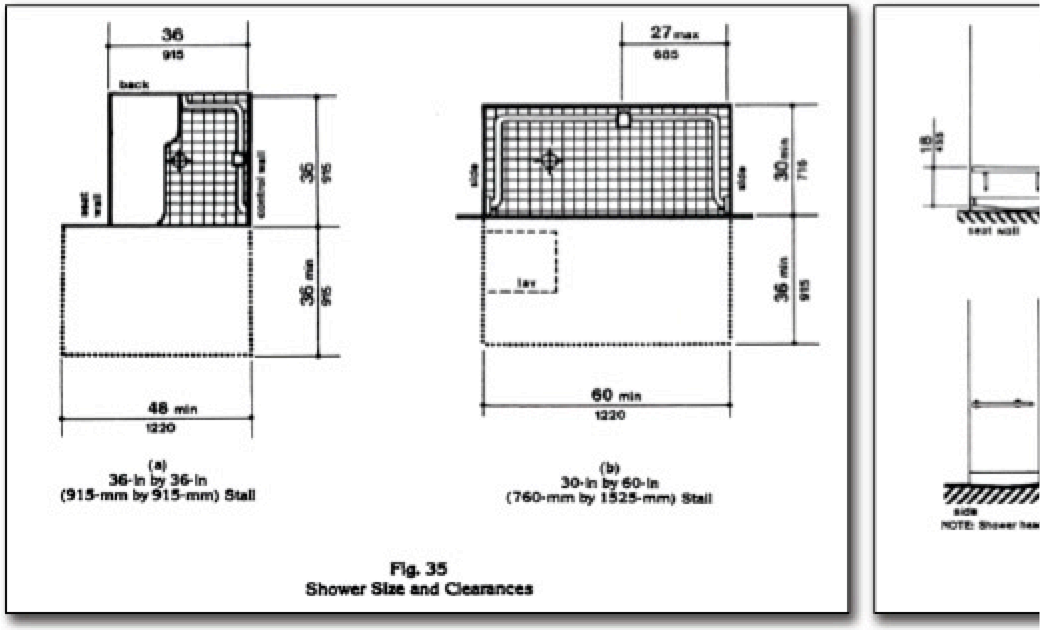


Fig. 35
Shower Size and Clearances

Accessible Shower Stall Minimum Size and Clearances

Accessible Shower Stall Grab Bars and Seat, Shower, and Control Area

I. Public Telephones

When public telephones are provided, then one or more accessible public telephones should be provided in areas serving shelter activity and service areas. Whenever accessible telephones are provided, each should be on an accessible route. In shelters it is common to provide additional telephones on tables or desks and some of these telephones should be accessible.

A text telephone (also commonly known as a TTY) is a device that allows individuals who are deaf or hard of hearing or who have a speech disability to communicate over a telephone. Having at least one TTY in any building that has at least four pay phones, provides access for people who are deaf or hard of hearing.

I1. If at least one public telephone or one bank of telephones is provided, does at least one of each type of telephone (e.g., pay telephone, intercom telephone, other telephone) have the following?

☐ Yes

☐ No

I1a. For a side approach (clear floor space at least 30 inches long x 48 inches wide), is the coin slot no higher than 54 inches above the floor? [ADA Standards § 4.31.2, Fig. 44 (a)]

☐ Yes

☐ No

I1b. For a front approach (where clear floor space at least 30 inches wide x 48 inches long), is the coin slot no higher than 48 inches above the floor? [ADA Standards § 4.31.2, Fig. 44 (b)]

☐ Yes

☐ No

I2. Does the phone have volume controls? [ADA Standards § 4.31.5]

☐ Yes

☐ No

I3. If three or more telephones are located in one bank serving the shelter, are a shelf and an electrical outlet provided at one telephone for use of a portable TTY? [ADA Standards § 4.31.9 (2)]

☐ Yes

☐ No

I4. If four or more pay telephones are provided on the site, is there a TTY (text telephone) provided at the shelter?

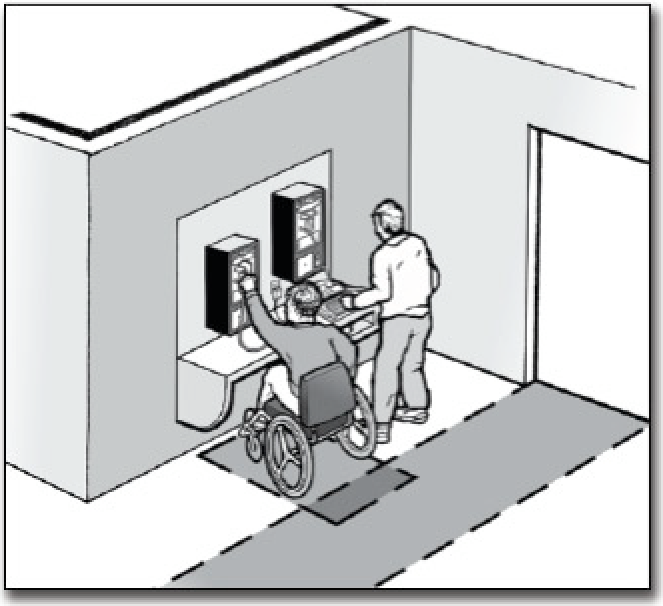
☐ Yes

☐ No
If yes, location________________

I5. Is there a sign at each pay phone or pay phone bank for the shelter directing people to the nearest TTY? [ADA Standards § 4.30.7 (3); 4.31.9(3)]

☐ Yes

☐ No

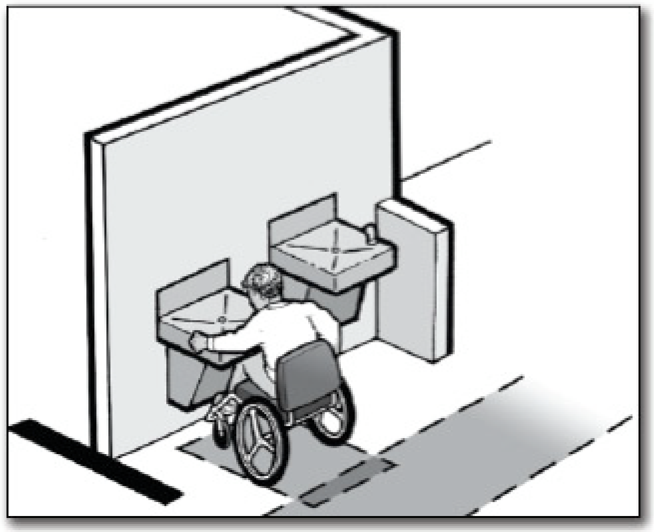


A bank of two public telephones. The accessible telephone is on the left and the telephone on the right is equipped with a TTY.

J. Drinking Fountains

Approximately 50% of the drinking fountains serving the shelter must be accessible and located on an accessible route. Accessible drinking fountains must have enough space for a person using a wheelchair, scooter, or other mobility device to use the drinking fountain. The spout and controls of the drinking fountain must be near the front edge. The controls must be usable with one hand without tight grasping, pinching, or twisting of the wrist. The other 50% of drinking fountains serving the shelter must be configured for use by people who have difficulty bending or stooping while standing.

When an object, such as a drinking fountain, protrudes more than four inches into the circulation path, the bottom edge must be at 27 inches above the floor or lower so the drinking fountain is not a hazard to people who are blind or have low vision.



A person who uses a wheelchair is drinking from an accessible drinking fountain. Beside the accessible drinking fountain is a standard height fountain that is usable by people who have difficulty bending or stooping. The short wall beside the standard height drinking fountain is cane-detectable to guide people who are blind or have low vision away from the standard height fountain which, otherwise, would be a protruding object hazard.

The following questions apply to 50% of the drinking fountains that are provided.

J1. If the drinking fountain is a wall-mounted unit, is there clear floor space at least 30 inches wide (36 inches if it is in an alcove) x 48 inches long in front of the drinking fountain and at least 27 inches high under the fountain so that a person using a wheelchair can get close to the spout and controls? [ADA Standards § 4.15.5 (1), Figs. 4 (e) and 27 (b)]

☐ Yes

☐ No

J2. If the drinking fountain is a floor-mounted unit, is there clear floor space at least 30 inches long x 48 inches wide (60 inches if it is in an alcove) for a side approach to the drinking fountain so that a person using a wheelchair can get close to the spout and controls even though the fountain has no clear space under it? [ADA Standards § 4.15.5 (2), Figs. 4 (e), 27 (c) and (d)]

☐ Yes

☐ No

J3. Is the top of the spout no higher than 36 inches above the floor and at the front of the fountain or water cooler? [ADA Standards § 4.15.2]

☐ Yes

☐ No

J4. Does the water rise at least 4 inches high when no more than 5 pounds of force is applied to the controls of the fountain? [ADA Standards §§ 4.15.3 and 4.15.4]

☐ Yes

☐ No

J5. Are the controls on or near the front of the unit and do they operate with one hand without tight grasping, pinching, or twisting of the wrist? [ADA Standards § 4.15.4]

☐ Yes

☐ No

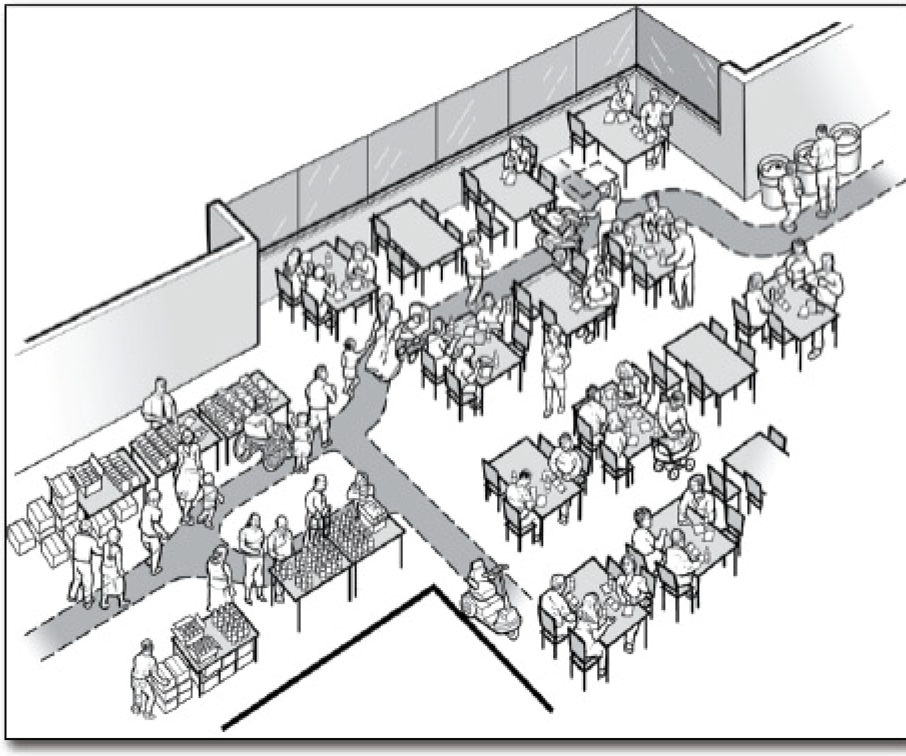
J6. Is the bottom of the apron of the fountain 27 inches above the floor so that it provides the space needed for a person who uses a wheelchair to pull up under it but is not a hazard to people who are blind or have low vision and use a cane to detect hazards? [ADA Standards §§ 4.15.5 (1) and 4.4.1]

☐ Yes

☐ No

K. Eating Areas

An accessible route, at least 36 inches wide and without steps or steep slopes, must be provided to and throughout the food service and eating areas of the shelter. The accessible route allows people who use wheelchairs, scooters, and other mobility devices to get to all of the food and drink items in the shelter and to accessible tables and seating.



A serving and eating area in a shelter are shown above. The shaded pathway illustrates the accessible route connecting the entrance, serving areas, accessible seats and tables, and the exit.

K1. Is there an accessible route, at least 36 inches wide, that connects each of the shelter activity areas with the food service and eating areas (it may narrow to 32 inches wide for up to 2 feet in length)? [ADA Standards § 4.3.2(3)]

☐ Yes

☐ No

K2. Is there an accessible route that is at least 36 inches wide that connects accessible tables with serving, condiment, and dispenser areas? [ADA Standards § 5.3; 4.3.8]

☐ Yes

☐ No

K3. In each eating area, if tables with fixed seats are provided, do at least 5% of each type of table with fixed seats have accessible locations with knee space at least 27 inches high, at least 19 inches deep, and at least 30 inches wide with a table top 28 to 34 inches above the floor? [ADA Standards § 5.1]

☐ Yes

☐ No

Note: If movable tables and chairs are used as shown, then locate at least 5% of the tables adjacent to an accessible route. Tables can be relocated as needed during operation of the shelter.

K4. If built-in food, drink, condiment, and tableware dispensers are provided, are dispensers and operating controls mounted no higher than 54 inches above the floor if clear floor space is provided for a side approach? [ADA Standards § 5.5]

☐ Yes

☐ No

K5. If the operating controls are set back 10 to 24 inches from the front edge of the counter or table are they no higher than 46 inches above the floor? [ADA Standards § 5.5]

☐ Yes

☐ No

K6. If food service lines are provided, is an accessible route provided (at least 36 inches wide) and are the tray slides no higher than 34 inches above the floor? [ADA Standards § 5.5]

☐ Yes

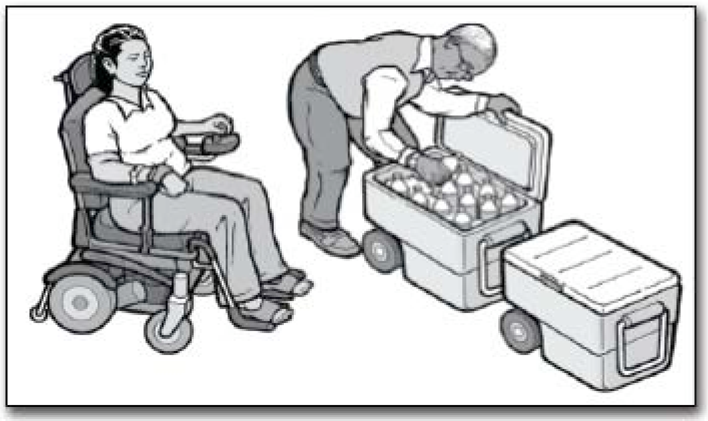
☐ No

Other Issues

L. Availability of Electrical Power

Emergency shelters should have a way to provide a back-up power supply when the electrical service is interrupted. The back-up power is needed to provide refrigeration of medicines, operation of supplemental oxygen and breathing devices, and for charging the batteries of power wheelchairs and scooters. Individuals whose medications (certain types of insulin, for example) require constant refrigeration need to know if a shelter provides supplemental power for refrigerators or ice-packed coolers. Individuals who use medical support systems, such as supplemental oxygen, or who require periodic breathing treatments using powered devices rely on a stable source of electricity. These individuals must have access to electric power from a generator or other source of electricity while at a shelter.

In general, in each community or area where a shelter is provided, a facility must have one or more back-up generators or other sources of electricity so that evacuees with a disability who rely on powered devices can have access to electrical power while at the shelter.



L1. Is there a backup source of electrical power for the facility?

☐ Yes

☐ No

L2. Is there a refrigerator or other equipment, such as coolers with a good supply of ice, at the shelter?

☐ Yes

☐ No

M. Single-User or “Family” Toilet Room

In many schools and large facilities where emergency shelters are often located, single-user toilet rooms may be provided for staff. In those facilities built or altered since the ADA went into effect, single-user toilet rooms should have accessible features that could be useful during shelter operation. These features include an accessible entrance and turning and maneuvering spaces. These rooms should also have been built to allow grab bars, accessible controls, and accessible hardware to be easily installed.

As part of the planning for operating an emergency shelter, facilities operators should consider using an available staff toilet room, if provided, as a single-user or "family" toilet room. When provided in addition to large accessible toilet rooms, this type of facility permits a person with a disability to receive assistance from a person of the opposite sex.

M1. If a sign is provided at the toilet room entrance (e.g. Men, Women, Boys, Girls, etc.), is a sign with raised characters and Braille mounted on the wall adjacent to the latch side of the door and centered 60 inches above the floor? [ADA Standards § 4.1.3(16)(a)]

☐ Yes

☐ No

If No, install a sign with raised characters and Braille on the wall adjacent to the latch side of the door and centered 60 inches above the floor and leave the existing sign in place on the door if removing it will damage the door.

Note: an additional sign may be mounted on the toilet room door but this cannot be considered to be the accessible sign which must be mounted on the wall adjacent to the latch side of the door.

M2. Does the door to the toilet room provide at least 32 inches clear passage width when the door is open 90 degrees? [ADA Standards § 4.13.5]

☐ Yes

☐ No

M3. Is the hardware (e.g., lever, pull, etc.) usable with one hand without tight grasping, pinching, or twisting of the wrist? [ADA Standards § 4.13.9]

☐ Yes

☐ No

If No, add new accessible hardware or adapt/replace hardware.

M4. On the latch, pull side of the door, is there at least 18 inches clearance provided if the door is not automatic or power operated? [ADA Standards § 4.13.6; Fig. 25]

☐ Yes

☐ No

M5. If there is a raised threshold, is it no higher than 3/4 inch at the door and beveled on both sides? [ADA Standards §§ 4.1.6(3)(d)(ii); 4.13.8]

☐ Yes

☐ No

If No, replace threshold with one with beveled sides or add a sloped insert.

M6. Inside the room is there an area for a person who uses a wheelchair to turn around - either a 60-inch diameter circle or a “T”-shaped turn area? [ADA Standards §§ 4.22.3; 4.2.3]

☐ Yes

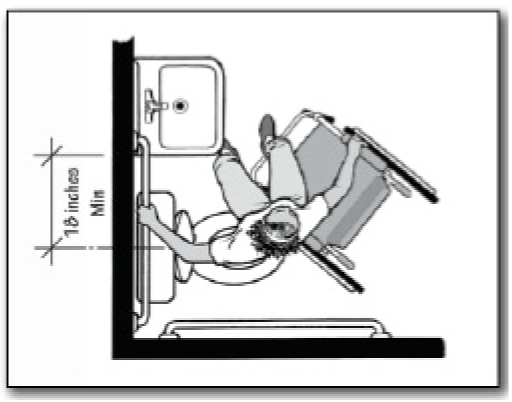
☐ No

M7. If the door swings into the room, does the door swing not overlap the required clear floor space for the toilet or lavatory? [ADA Standards §§ 4.22.2; 4.2.4.1]

☐ Yes

☐ No

Note: In the figure below the clear floor space for the toilet extends at least 66 inches from the back wall.



Plan view showing the minimum amount of space required between the toilet and the adjacent lavatory.

M8. Is there at least 18 inches between the center of the toilet and the side of the adjacent lavatory? [ADA Standards § 4.16.2; Fig. 28]

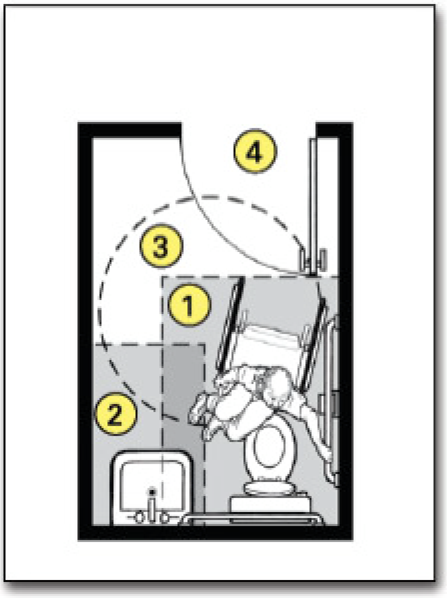
☐ Yes

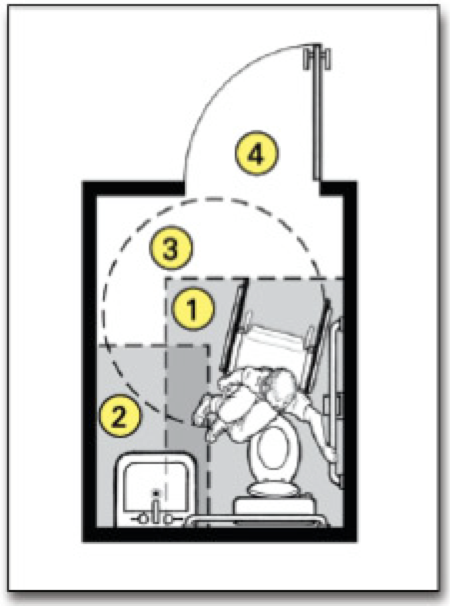
☐ No

M9. Does the lavatory have at least a 29-inch-high clearance under the front edge and the top of the rim no more than 34 inches above the floor? [ADA Standards § 4.19.2]

☐ Yes

☐ No





Plan view of a single-user toilet room showing the door swing not overlapping the dark toned area indicating the clear floor space for the toilet and lavatory. The door swing may overlap the turning space indicated by the circular area.

Notes:

1. 48-inch minimum by 66-inch minimum clear floor space for toilet
2. 48-inch minimum by 30-inch minimum clear floor space for lavatory
3. 60-inch minimum turning space
4. door swing

M10. Are the drain and hot water pipes for the lavatory insulated or otherwise configured to protect against contact? [ADA Standards § 4.19.4]

☐ Yes

☐ No

M11. Does that lavatory have controls that operate easily with one hand, without tight grasping, pinching, or twisting of the wrist? [ADA Standards § 4.19.5]

☐ Yes

☐ No

M12. If a mirror is provided, is the bottom of the reflecting surface no higher than 40 inches above the floor or is a full length mirror provided? [ADA Standards § 4.19.6]

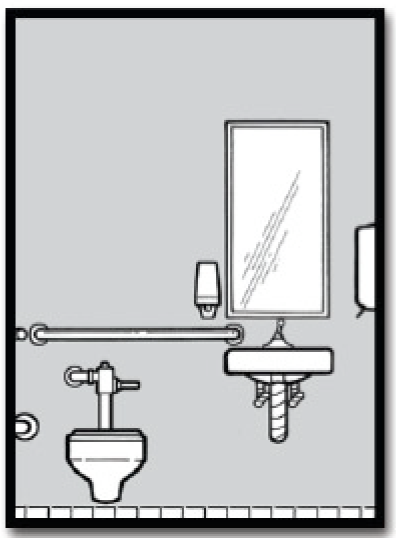
☐ Yes

☐ No

M13. For each type of dispenser, receptacle, or equipment, is there clear floor space at least 30 inches wide x 48 inches long adjacent to the control or dispenser (positioned either parallel to the control or dispenser or in front of it)? [ADA Standards §§ 4.23.7; 4.27.2; 4.2.5 and Fig. 5; 4.2.6 and Fig. 6]

☐ Yes

☐ No



ront view of toilet, lavatory, mirror and soap dispenser

M14. Is the operating control (switch, lever, button, or pull) for each type of dispenser or built-in equipment no higher than 54 inches above the floor (if there is clear floor space for a parallel approach) or 48 inches (if there is clear floor space for a front approach)? [ADA Standards §§ 4.23.7; 4.27.3; 4.2.5 and Fig. 5; 4.2.6 and Fig. 6]

☐ Yes

☐ No

M15. Are all built-in dispensers, receptacles, or equipment mounted so the front does not extend more than 4 inches from the wall if the bottom edge is between 27 inches and 80 inches above the floor? [ADA Standards §§ 4.23.7; 4.27; 4.4.1; Fig. 8]

☐ Yes

☐ No

M16. Is the centerline of the toilet 18 inches from the adjacent side wall? [ADA Standards §§ 4.16.2; 4.17.3]

☐ Yes

☐ No

M17. Is the top of the toilet seat 17 to 19 inches above the floor? [ADA Standards § 4.16.3]

☐ Yes

☐ No

M18. Is the flush valve located on the side adjacent to the lavatory? [ADA Standards § 4.16.5]

☐ Yes

☐ No

M19. Is a horizontal grab bar at least 40 inches long securely mounted on the adjacent side wall 33 to 36 inches above the floor with one end no more than 12 inches from the back wall? [ADA Standards §§ 4.16.4; 4.17.6]

☐ Yes

☐ No

M20. Is there a horizontal grab bar at least 36 inches long securely mounted behind the toilet 33 to 36 inches above the floor with one end no more than 6 inches from the side wall? [ADA Standards §§ 4.16.4; 4.17.6]

☐ Yes

☐ No

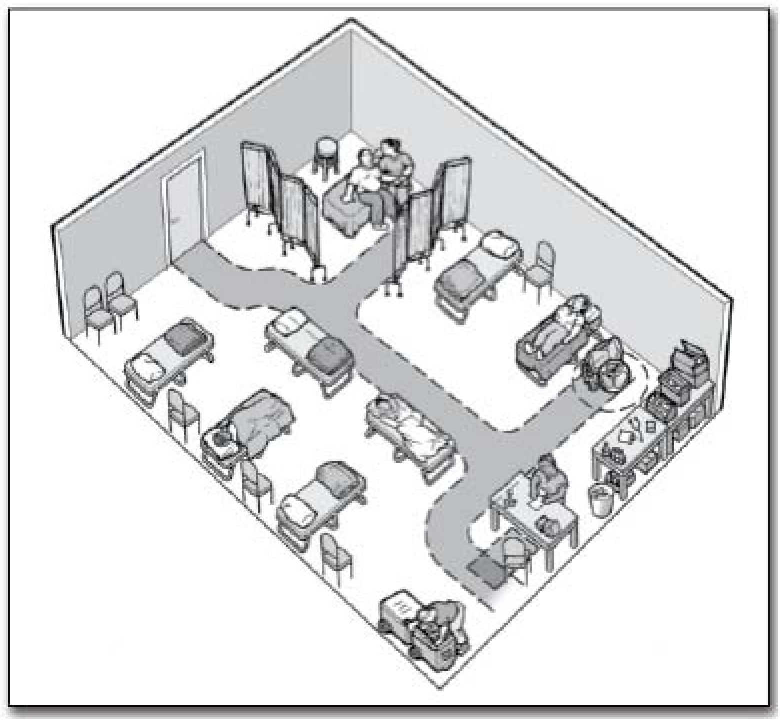
M21. If a coat hook is provided, is it mounted no higher than 54 inches above the floor for a side approach or 48 inches above the floor for a front approach? [ADA Standards § 4.25.3]

☐ Yes

☐ No

N. Health Units/Medical Care Areas

In many schools, where emergency shelters are often located, nurses' rooms or other types of health care facilities may be provided. These health care facilities should be on an accessible route and have accessible features, including an accessible entrance, an accessible route to the different types of services offered within the medical care unit, turning and maneuvering spaces, and cots or beds that are at a height to which people who use mobility devices can easily transfer.



An overhead view of a medical care area with a shaded pathway showing the accessible route shown and clear floor spaces.

N1. Is there an accessible route, at least 36 inches wide, that connects each of the shelter activity areas with the health units and medical care areas (it may narrow to 32 inches wide for up to 2 feet in length)? [ADA Standards § 4.3.2(3)]

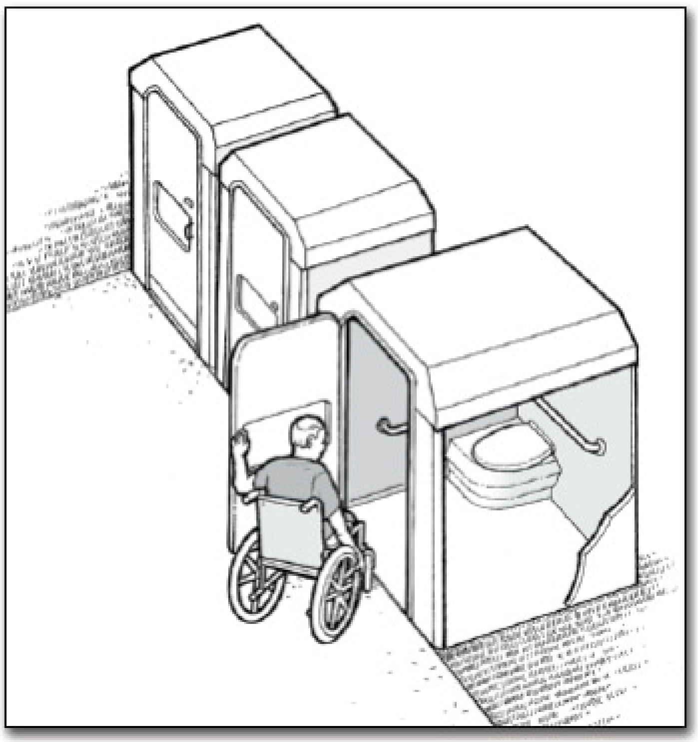
☐ Yes

☐ No

O. Accessible Portable Toilets

Portable toilets are often used at emergency shelters to supplement permanent toilet facilities. When portable toilets are provided, at least one must be a unit with accessible features that is located on an accessible route connecting it with the shelter. For the entrance to an accessible portable toilet to be usable, there must either be no step or a ramp must be installed that extends extends from the hinge side of the door to at least 18 inches beyond the latch side of the door.

Accessible portable toilets should similar features to a standard accessible toilet stall including an accessible door, side and rear grab bar, clear space next to the toilet, and maneuvering space.



A person using a wheelchair enters an accessible portable toilet. The unit is positioned to provide a level entry from the accessible route.

ADA Tool Kit for State and Local Governments

ADA Home Page

August 10, 2007

GENERAL BUILDING INFORMATION

CONTACT INFORMATION

Site Name:__________

Street Address:__________

City, State, Zip:__________

Contact Person:__________

Contact Phone #:__________

Potential Refuge Population:__________

Typical hours the building is occupied:__________

Is the building locked at any time?__________

BUILDING DATA

Size/Square Footage: __________ Number of Stories:__________

Describe the building configuration:__________

General description of surrounding area:__________

Are there any portable/temporary units: __________ How many:__________

Describe the condition of the building (are there cracks in the walls, signs of deterioration, rusting, peeling paint, or other repair needs):__________

What are the power or fuel sources for the following utilities (natural gas, oil, electric, LP, etc.)?

❑ Heating:__________ ❑ Cooling:__________ ❑ Cooking:__________

Is there a refuge area or safe room already identified within the building?__________

From which hazard(s) is the refuge area supposed to protect?

❑ Tornado ❑ Hurricane ❑ Combined (Tornado and Hurricane)

If an existing safe room was designed for extreme winds, indicate the design professional and all relevant design parameters, specifically design wind speed:__________

Evaluator's Name:__________ Date of Evaluation__________

Site Name: __________

Provide a General Sketch of the Building:

Additional Comments:

Evaluator's Name:______________________________ Date of Evaluation____________________

Site Name: ____

WIND HAZARD CHECKLIST

Address the following evaluation statements, giving the most appropriate answer for each question. After selecting the appropriate answer, take the score for that answer (# in the parentheses) and enter it into the score block for that question. Evaluation judgment is subject to limitations of visual examination. Questions have been grouped into sections based on structural issues, cladding and glazing, envelope protection, and non-structural issues. These questions apply only to the refuge area. **After all questions have been appropriately scored, sum the score column and determine the final wind hazard score for the refuge area.**

Question	Score
Structural Issues	
Refuge Area Size Length: Width: Height: Stories:	No Score
Usable square footage for this area (see FEMA 361, Section 3.3.1 or 3.4.1):	No Score
When was building constructed? Check box below. ❑ Post-2003 (0) ❑ 2003 – 1999 (0) ❑ 1998 – 1995 (0) ❑ 1994 – 1988 (2) ❑ 1987 – 1980 (4) ❑ 1979 – 1970 (6) ❑ 1969 – 1951 (8) ❑ Pre-1950 (10) Date on plans:	
The building was designed according to the following building code: ❑ Uniform Building Code, Year: ❑ International Building Code, Year: ❑ Standard Building Code, Year: ❑ International Residential Code, Year: ❑ National Building Code, Year: ❑ Other Code:	No Score
Were any of the following guidance documents or standards used in the construction of the refuge area or building? ❑ FEMA 361, year: ❑ ICC-600, year: ❑ SSTD 10, year: ❑ FEMA 320, year: ❑ ICC-500, year: ❑ ASCE 7, year:	No Score
What is the structural construction material of the refuge area? ❑ Concrete (10) ❑ Pre-Cast Concrete (10) ❑ RM (10) ❑ Engineered/Heavy Steel Frame (12) ❑ Partially Reinforced Masonry (PRM) (15) ❑ Unreinforced Masonry (URM) (20) ❑ Wood or Metal Studs (20) ❑ Light Steel Building/Pre-engineered (20) ❑ Unknown (20)	

Evaluator's Name:________________ Date of Evaluation____________

Site Name: ________________________

What building plans are available for the inspection? ❏ As-built Plans (including full architectural and structural plans) (0) ❏ Design/Construction Plans (including full architectural and structural plans) (2) ❏ Structural Plans only (3) ❏ Architectural Plans only (5) ❏ Partial set of plans (8) ❏ No plans are available (12)	
Vertical and Lateral Load Resisting Systems (select the system that applies) ❏ Moment Resisting Frame or Braced Frame (identify infill wall below) (0) ❏ Concrete Beams/Columns ❏ Precast Concrete Beams/Columns ❏ Steel Beams/Columns (heavy) ❏ Wood Beams/Columns ❏ Steel Beams/Columns (light) ❏ Steel Bar Joist and Concrete or RM Columns	
Shear Wall of Braced Frame; bracing or support is provided by: ❏ Concrete Shear Wall (0) ❏ RM Shear Wall (0) ❏ PRM Shear Wall (2) ❏ URM Shear Wall (5) ❏ Plywood Shear Wall (5) ❏ Other: ____________ (5)	
❏ Solid Load-Bearing Wall System ❏ Concrete Walls (0) ❏ RM Walls (0) ❏ PRM Walls (4) ❏ URM Walls (10) ❏ Framed Walls (wood or metal stud) (6) ❏ Other: ____________ (6)	

Evaluator's Name:________________________________ Date of Evaluation____________________

Site Name: ____

Elevated Floor or Roof Deck Systems (check all that apply) ❑ Concrete Beams and Slab ❑ Concrete Flat Slab ❑ Precast Concrete Deck ❑ Steel Deck with Concrete ❑ Steel Deck with Insulation Only ❑ Diagonal Sheathing ❑ Plywood Sheathing ❑ Wood Joists/Beams ❑ Wood Trusses ❑ Wood Plank ❑ Concrete Plank ❑ Concrete Waffle Slab ❑ Open Web Steel Joist ❑ Steel Beam	No Score
Do the connections in the structural systems provide a continuous load path for all loads (gravity, uplift, lateral)? ❑ Yes (0) ❑ No (10) ❑ Do not know (10) If YES, identify the following connections:	
Actual connectors of the roof structure and the spacing ____________________	No Score
Actual connectors between the roof and wall and the spacing ____________________	No Score

Connection Details for Refuge Area (check at least one item in each column)

	Roof to Roof Structure	Roof Structure to Wall Structure	Within Wall	Walls to Foundation
Reinforcing Steel	❑ (0)	❑ (0)	❑ (0)	❑ (0)
Welded (not tack)	❑ (0)	❑ (0)	❑ (0)	❑ (0)
Bolted	❑ (0)	❑ (0)	❑ (0)	❑ (0)
Metal Clips/Fasteners	❑ (1)	❑ (1)	❑ (1)	❑ (1)
Metal Hangers	❑ (1)	❑ (1)	❑ (1)	❑ (1)
Self Tapping Screws	❑ (1)	❑ (1)	❑ (1)	❑ (1)
Wire Fastener	❑ (2)	❑ (2)	❑ (2)	❑ (2)
Nailed	❑ (4)	❑ (4)	❑ (2)	❑ (4)
Other:__________ (possible tack weld)	❑ (5)	❑ (5)	❑ (5)	❑ (5)
Gravity Connection	❑ (6)	❑ (6)	❑ (6)	❑ (6)
Unknown	❑ (6)	❑ (6)	❑ (6)	❑ (6)

If walls are masonry units, are they grouted? Which cells are grouted (every cell, every 4th cell, etc.)? ____________________	No Score

Evaluator's Name:______________________________ Date of Evaluation__________________

Site Name: ____

For all URM, both load-bearing and non-load-bearing, fill in the blanks and answer the following two questions. Maximum height: __________ Longest span: __________ Thickness: __________	No Score
Is the maximum wall height/wall thickness (h/t) ratios for URM in excess of those noted in AFM 32-1095, page G-63 (see chart below). ❑ Yes (5) ❑ No (0) ❑ Not applicable (0)	
Is the maximum wall length/wall thickness (l/t) ratios for URM in excess of those noted in AFM 32-1095, page G-63 (see chart below). (Measure longest span between column or pilaster supports or from end wall to wall opening). ❑ Yes (5) ❑ No (0) ❑ Not applicable (0)	

Allowable Value of Height-to-Thickness Ratio of URM Walls in High Wind Regions

Wall Types	Maximum l/t to h/t	
	Solid or Solid Grouted	All Other
Bearing Walls		
Walls of one-story buildings	16	13
First-story wall of multistory building	18	15
Walls in top story of multistory building	13	9
All other walls	16	13
Nonbearing Walls (Exterior and Interior[1])	15	13
Cantilever Walls	3	2
Parapets	2	1 1/2

[1] Interior wall ratio should be the same as the exterior wall ratio due to the risk of internal pressure through breached openings.

Chart from Air Force Manual (AFM) 32-1095: *Structural Evaluation of Existing Buildings for Seismic and Wind Loads*, page G-63.

Does the location of the refuge area require occupants to go outdoors to get to it? ❑ No (0) ❑ Yes (2)	
If the refuge area is a section of a building, are the wall systems separated from the remainder of the building structure with expansion joints? ❑ Yes (0) ❑ No (3)	
Does the refuge area have its own roof system (i.e., the roof does not extend over other sections of the building outside the refuge area or is separated by joints)? ❑ Yes (0) ❑ No (5)	

Evaluator's Name:______________________ Date of Evaluation______________

Site Name: ______________________________________

Is the height of the refuge area roof less than 30 feet above ground level? ❑ Yes (0) ❑ No (2)	
Is there a roof span in the refuge area longer than 40 feet from support to support? ❑ Yes (10) ❑ No (0)	
Is the pitch of the roof less than 30° (less than 6/12 pitch)? ❑ Yes (4) ❑ No (0)	
If the building has parapet walls, are they taller than 3 feet (as compared to the adjacent roof level)? Check any of the following that apply. ❑ Structurally attached to the refuge area (2) ❑ Adjacent to egress routes (2) (if parapet walls collapse, egress routes to the refuge area may be blocked)	
Is there a roof overhang that is more than 2 feet wide? ❑ Yes (2) ❑ No (0)	
Structural Issues Subtotal =	

Evaluator's Name:____________________ Date of Evaluation____________

Site Name: ____________________________________

Cladding and Glazing Issues	
What is the percentage of the exterior wall surface covered by windows and doors on the outer perimeter of the refuge area? ❑ No windows/protected doors (0) ❑ No windows/unprotected doors (1) ❑ 0% – 1% (1) ❑ 2% (2) ❑ 3% – 4% (4) ❑ 5% – 6% (6) ❑ 7% or more (10)	
Are the ALL windows, doors, and openings protected from impacts from windborne debris? If no, enter a score of 10 in the column to the right. If so, identify the level of protection offered by the system. The windows, doors, or openings of this space are protected from debris impact by systems that have been tested to resist the appropriate missile at the site as defined by: ❑ The FEMA 361 or ICC-500 Tornado Missile Criteria (15-lb 2x4 board @ at 100-80 mph) (0) ❑ The FEMA 361 Hurricane Missile Criteria (9-lb 2x4 board @ at 128-80 mph) (2) ❑ The ICC-500 Hurricane Missile Criteria (9-lb 2x4 board @ at 102-64 mph) (4) ❑ ASTM E 1996 for Critical Facilities Criteria (9-lb 2x4 board @ at 55 mph) (6) ❑ ASTM E 1996 for Critical Facilities Criteria (9-lb 2x4 board @ at 34 mph) (7) ❑ No criteria or a level of protection that does not meet any of the above criteria (10)	
Are doors to the refuge area secured at top and bottom with connections to resist suction effects that may pull the doors open (3-point latches)? ❑ Yes (0) ❑ No (10)	
Are there skylights or overhead atrium glass or plastic? ❑ Yes (5) ❑ No (0)	
What is the roof covering on the refuge area? NOTE: If more than one material type is used on the roof, choose the one with the highest penalty. ❑ Storm-resistant shingles (0) (greater than 100 mph rating) ❑ Wood shingles and shakes (2) ❑ Clay tile (2) ❑ Built-up roof, with stone ballast (2) ❑ Single-ply membrane with ballast (2) ❑ Built-up roof, without ballast (1) ❑ Single-ply membrane without ballast (1) ❑ Traditional metal roofing (1) ❑ Asphalt/metal shingles (1) ❑ Material other than those listed above (2) ❑ No roof covering (0)	
Cladding and Glazing Issues Subtotal =	

Evaluator's Name:____________ Date of Evaluation____________

Site Name: ____________

Envelope Protection	
What are the debris hazards (choose all that apply): ❑ Large light towers (such as for an athletic field) and/or antennas within 300 feet of the structure? (2) ❑ Portable classrooms/trailers, small light frame buildings, HVAC units within 300 feet of the structure? (4) ❑ Unanchored fuel tanks within 300 feet of the structure? (5)	
❑ Are there buildings with roof gravel within 300 feet of the structure? (including the building site itself) (2) ❑ Are there debris generating sources (e.g., lumber yards, nurseries, and junk yards) within 300 feet of the structure? (4) ❑ Is the refuge area vulnerable to trees, telephone poles, light poles, and other potential missiles? (4)	
What is the material on the exterior walls of the refuge area (excluding window and door systems)? ❑ Concrete (0) ❑ RM (0) ❑ PRM (4) ❑ Brick and block composite wall with reinforcing steel @4 feet on center (o.c.) (6) ❑ 3-wythes of solid masonry brick (6) ❑ URM (8) ❑ Metal/vinyl siding (10) ❑ Metal panels (pre-engineered metal building) (10) ❑ Combination (other than EIFS) (12) ❑ EIFS (on substrate other than concrete or RM) (15)	
What is the material of the roof deck/elevated floor at the refuge area? ❑ Reinforced concrete at least 6 inches thick (0) ❑ Metal deck at least 14 gauge (0) ❑ Reinforced concrete at least 3-inches thick (2) ❑ Metal deck at least 20 gauge (4) ❑ Wood panels at least 1-inch thick (4) ❑ Cement fiber board/deck (tectum) (6) ❑ Metal deck 22 gauge or higher (8) ❑ Wood panels at least ½-inch thick (8) ❑ Other ______________________ (10)	

Evaluator's Name:________________________________ Date of Evaluation____________________

Site Name: ____

Will the structure adjacent to the refuge area or surrounding it pose a threat if subject to collapse (structural components become debris that creates impact loads on the refuge area)? Specify: ____________ ❑ Yes (5) ❑ No (0)	
Are there large, roll-down or garage type doors (metal, wood, plastic) on the exterior of the refuge area? ❑ Yes (5) ❑ No (0)	
For tornado and combined hazard safe rooms, identify what wind zone region the building is located in based on the Wind Zones Map provided in Figure 1. ❑ Zone I [130 mph] (4) ❑ Zone II [160 mph] (6) ❑ Zone III [200 mph] (8) ❑ Zone IV [250 mph] (10) Or For hurricane hazard safe rooms, identify the wind speed contour for the site (if the site is between contour lines, select the highest wind speed contour) provided in Figure 2. ❑ 160-170 (6) ❑ 180-190 (7) ❑ 200-225 (8) ❑ 225 + (10)	
Envelope Protection Subtotal =	

Evaluator's Name:____________ Date of Evaluation____________

Site Name: ____________

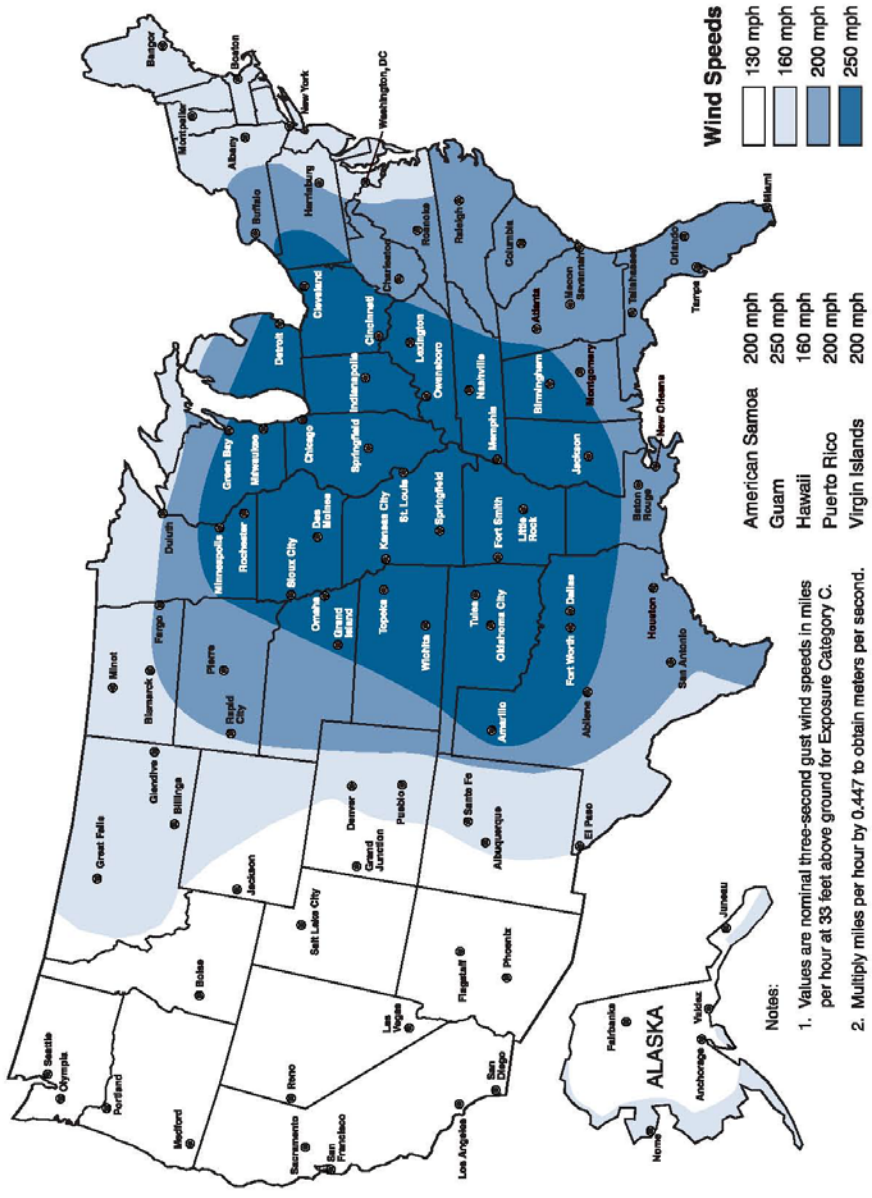


Figure 1: Wind Zones in the United States (Federal Emergency Management Agency) previously printed in FEMA 320, *Taking Shelter From the Storm.*

Evaluator's Name:____________________ Date of Evaluation____________________

Site Name: ____

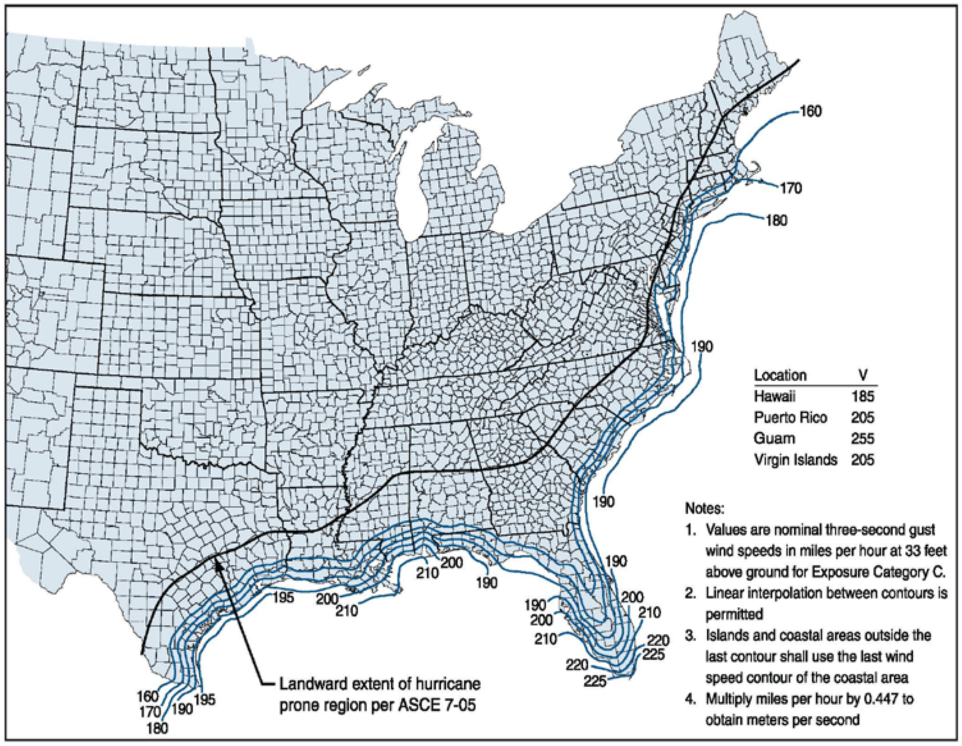


Figure 2: Hurricane Safe Room Design Wind Speed Map from the ICC-500

SOURCE: *ICC/NSSA STANDARD FOR THE DESIGN AND CONSTRUCTION OF STORM SHELTERS* (ICC-500). COPYRIGHT 2008, WASHINGTON, DC: INTERNATIONAL CODE COUNCIL. REPRODUCED WITH PERMISSION. ALL RIGHTS RESERVED. WWW.ICCSAFE.ORG < HTTP://WWW.ICCSAFE.ORG >.

Non-structural Issues	
Does a combustible gas line run through the refuge area? ❑ Yes (10) ❑ No (0) ❑ Unknown (10)	
Is there a stand-by power source/generator? ❑ Yes (0) ❑ No (8)	
If yes, what is the power source: ❑ Battery powered (0) ❑ Other power (indicate fuel type) ____________________(2)	
Is there an automatic transfer switch? ❑ Yes (0) ❑ No (2)	
What is the duration of lighting under the back-up power source? ❑ 0-2 hours (2) ❑ 3-6 hours (1) ❑ 7 or more hours (0)	
If the stand-by power supply is not within the refuge area, is it in a place where it will be protected during an extreme-wind event (in an interior room, or below grade)? ❑ Yes (0) ❑ No (5) ❑ Not Applicable (0)	
Is there a back-up communications system (if yes, list type)? ❑ Yes (0) ❑ No (2)	
Are bathrooms accessible within the refuge area? ❑ Yes (0) ❑ No (2)	
Is the refuge area ADA accessible? ❑ Yes (0) ❑ No (2)	

Evaluator's Name:________________________ Date of Evaluation________________

Site Name: ____

Is an operations plan in place for evacuation to a refuge area during an extreme-wind event? ❑ Yes (0) ❑ No (8)	
If yes, answer the following questions: Does the evacuation plan include practice drills? ❑ Yes (0) ❑ No (2)	
What type of warning signal is used to indicate a tornado drill?:_______________ Does it differ from a fire drill alarm? ❑ Yes (0) ❑ No (1)	
Can all occupants reach the candidate refuge area within 5 minutes? ❑ Yes (0) ❑ No (2) ❑ Unknown (2) List time: _______________	
Non-structural Subtotal =	
Total Wind Hazard Score =	

Evaluator's Name:_________________________ Date of Evaluation_______________

Site Name: ____

FLOOD HAZARD CHECKLIST

Address the following evaluation statements, giving the most appropriate answer for each question. After selecting the appropriate answer, take the score for that answer (# in the parentheses) and enter it into the score block for that question. Evaluation judgment is subject to limitations of visual examination. Elevations are only required if a flood hazard has been identified at the building site. <u>If no flood hazard exists at the site, answer flood related questions with "not applicable."</u> **After all questions have been appropriately scored, sum the score column and determine the final flood hazard score for the building/structure.**

Question	Score
Flood Hazard Issues	
Community Panel No.: ____________ Date Revised: ________ Flood Hazard Zone: ____________ What is the base flood elevation (BFE) at the building site?* ________ What is the 500-year flood elevation at the building site?** ________ ❑ Not applicable (Explain): ________	No Score
Is the site located in a mapped storm surge inundation zone? ❑ Yes ❑ No (0) If yes, what is the source used to verify this? ________ If the site is located in a storm surge inundation zone, which category is it in? ❑ Category 1-2 (6) ❑ Category 3 (8) ❑ Category 4-5 (10)	
Is the site located in any of the following areas? ❑ The Coastal High Hazard Area (VE zones) or other areas known to be subject to high-velocity wave action (10) ❑ Areas seaward of the Limit of Moderate Wave Action (LiMWA) where mapped, also referred to as the Coastal A Zone in ASCE 24-05 (10) ❑ Floodways (10) (Note: if the selected refuge area(s) is located in any of the areas listed above, serious consideration as to the use of the selected area(s) should be made. The areas listed above are locations that should not be used to provide protection to occupants.)	
Is there a history of floods at the building site? ❑ Yes (5) ❑ No (0) ❑ Unknown (5) ❑ Not applicable (0)	
Is there a history of drains (storm or sanitary) backing up due to flooding? ❑ Yes (2) ❑ No (0) ❑ Unknown (2) ❑ Not applicable (0)	

Evaluator's Name: ____________ Date of Evaluation ____________

Site Name: ____________

Does the surrounding topography contribute to flooding in low-lying areas? Are there poor drainage patterns, basement stairwells, etc.? ❑ Yes (5) ❑ No (0)	
Are access roads to the building site sufficiently elevated and expected to be accessible during periods of high water (based on local flooding history and/or FIRM panel information)? ❑ Yes (0) ❑ No (2)	
If the building is within a 500-year floodplain or storm surge inundation zone, complete the following. If not, STOP HERE and skip to page 21 for THE STRUCTURAL SEISMIC HAZARD CHECKLIST.	

* BFEs are shown on the Flood Insurance Rate Map (FIRM) for the community.

** 500-year flood elevations are not shown on the FIRM; they are provided in the Flood Insurance Study (FIS) report for the community

Structural Issues***	
What is the building/structure type? ❑ Concrete (0) ❑ RM (2) ❑ Steel (2) ❑ PRM (5) ❑ URM (8) ❑ Wood (10) ❑ Unknown (10)	
What is the elevation of the lowest floor/level of the building being used for refuge? ____	
Is this elevation: ❑ Above the 100-year flood elevation + 2 feet (0) ❑ Less than 2 feet above the BFE (4) ❑ Below the BFE or unknown (8) ❑ Not applicable (0)	
Is this elevation: ❑ Above the 500-year stillwater flood elevation (0) ❑ Less than the 500-year stillwater flood elevation (10) ❑ Not applicable (0)	
Is this elevation: ❑ Above the lowest floor elevation required by the community's floodplain ordinance (0) ❑ Below the lowest floor elevation required by the community's floodplain ordinance (10) ❑ Not applicable (0)	
If the site is in a mapped Zone D (or has not been evaluated as part of a NFIP flood study), is this elevation: ❑ Above the highest recorded flood elevation in the area + 2 feet (0) ❑ Below the highest recorded flood elevation in the area + 2 feet (10) ❑ Not applicable (0)	

Evaluator's Name:____________________ Date of Evaluation______________

Site Name: ____________________________________

If the site is in a mapped coastal storm surge inundation zone, is this elevation: ❑ Above the maximum stillwater elevation associated with a Category 5 hurricane and/or above the wave crest elevation having a 0.2 percent annual chance of being equaled or exceeded (0) ❑ Below the the maximum stillwater elevation associated with a Category 5 hurricane and/or below the wave crest elevation having a 0.2 percent annual chance of being equaled or exceeded (10) ❑ Not applicable (0)	
Is the elevation above the highest of the applicable requirements listed in the last 5 questions? ❑ Yes (0) ❑ No (10) ❑ Not applicable (0)	
If the lowest floor of the building is susceptible to flooding, are there openings in the walls to allow water to pass through the wall, thus avoiding pressure buildup on the foundation and first floor walls? ❑ Yes (0) ❑ No (5) ❑ Not applicable (0)	
Is any space below the applicable flood criteria used for classroom or office space? (If this area is used for storage, access, and parking only answer "No"). ❑ Yes (2) ❑ No (0) ❑ Not applicable (0)	
Is the building material located at the susceptible parts of the base of the structure constructed of entirely flood-resistant material? ❑ Yes (0) ❑ No (2) ❑ Not applicable (0)	
Facility and Utility Issues	
Are the heating, electrical, and other utilities located in a basement or on a slab area that is below the BFE? ❑ Yes (4) ❑ No (0) ❑ Not applicable (0)	
Is there a method of removing floodwaters from the building (e.g., sump pump)? What is the size and capacity of the pump? ______________________________ ❑ Yes (0) ❑ No (4) ❑ Not applicable (0)	
Total Flood Hazard Score =	

*** Ensure that all elevations that are compared to base flood elevations (BFEs) are defined on the vertical datum that is stated on the FIRM panel. (Do not compare local benchmarks to mean sea level (MSL), National Geodetic Vertical Datum of 1929 (NGVD '29), etc.)

Evaluator's Name:______________________________ Date of Evaluation____________________

Site Name: ____

STRUCTURAL SEISMIC HAZARD CHECKLIST

Address the following evaluation statements, giving the most appropriate answer for each question. After selecting the appropriate answer, take the score for that answer (# in the parentheses) and enter it into the score block for that question. Evaluation judgment is subject to limitations of visual examination and availability of plans. (NOTE: This checklist is based upon the guidelines set forth in the FEMA 154 publication, *Rapid Visual Screening of Buildings for Potential Seismic Hazards: A Handbook* (2nd Edition, March 2002). One significant difference is the scoring procedure used herein. Do not compare a building scored on this checklist system with a building scored from FEMA 154. The comparison will not be valid.) After all questions have been appropriately scored, sum the structural seismic hazard score column and determine the final score for the building/structure.

For additional guidance on the design and construction of buildings subject to seismic hazards see FEMA 454, *Designing for Earthquakes: A Manual for Architects* (December 2006), and FEMA 232, *Homebuilder's Guide to Earthquake-Resistant Design and Construction* (June 2006).

Question	Score
See the Seismic Zone Map of the United States (Figure 3 on page B-23) to determine the region of seismicity (low, medium, or high) of the building locale.	
Is the building located in a low region of seismicity and was it designed by a design professional? ❑ Yes (0) If yes, further inspection within the seismic checklist is not necessary. STOP HERE. Is the building located in a medium or high region of seismicity? ❑ Yes (0) If yes, complete all remaining questions on this checklist.	
What is the building/structure type? ❑ Wood (10) ❑ RM and PRM (12) ❑ Steel (12) ❑ Concrete (14) ❑ Pre-cast " Tilt-up" Concrete (15) ❑ URM (17) ❑ Unknown (20)	

Evaluator's Name:______________________ Date of Evaluation______________

Site Name: ______________________________________

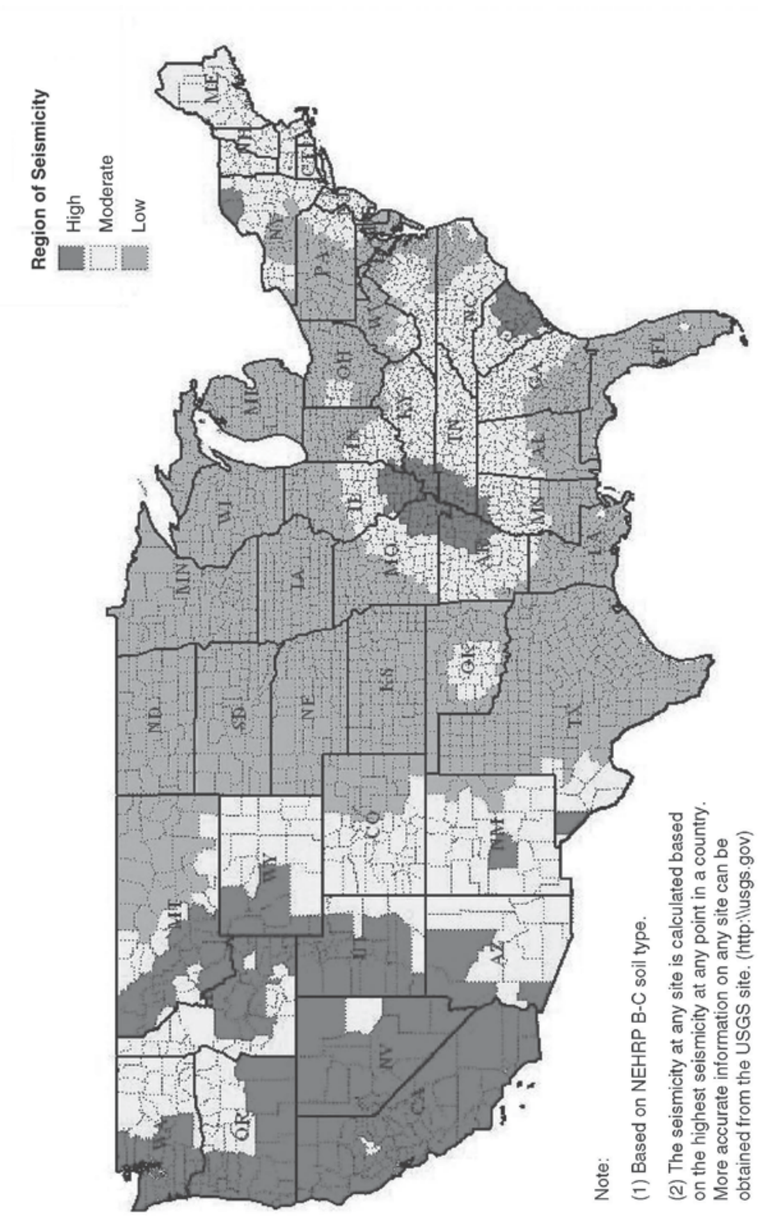
Add penalty points for deficiencies as noted during the inspection. Select one column based on the building type determined in the previous question. Under each column, circle the penalty points if they apply for the criteria listed. (Use descriptions provided on the following page when filling out the matrix below.) When complete, sum the penalties that have been circled and place that total in the score box at right.

Building Characteristic	RM and PRM	URM	Steel	Wood	Concrete	Pre-cast	Unknown
High Rise	1.0	0.5	1.0	N/A	1.0	0.5	1.0
Poor Condition	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Vertical Irregularity	0.5	0.5	0.5	0.5	1.0	1.0	1.0
Soft Story	2.0	2.0	2.0	1.0	2.0	2.0	2.0
Plan Irregularity	2.0	2.0	1.5	2.0	1.5	2.0	2.0
Pounding	N/A	N/A	0.5	N/A	0.5	0.5	0.5
Large (and Heavy) Cladding	N/A	N/A	N/A	N/A	1.0	1.0	1.0
Post Benchmark	2.0	N/A	2.0	2.0	2.0	2.0	2.0

Total Structural Seismic Hazard Score =

Evaluator's Name:____________________ Date of Evaluation________________

Site Name: ________________________________



Note:

(1) Based on NEHRP B-C soil type.

(2) The seismicity at any site is calculated based on the highest seismicity at any point in a country. More accurate information on any site can be obtained from the USGS site. (http:\\usgs.gov)

Figure 3: Seismic Zone Map of the United States (FEMA 154, March 2002)

Appendix B

Original Assessment Tool

Assessment Tool Questionnaire

Building Information

Contact Information

A-1. Building Name:
____

A-2. Street Address:
____

A-3. City, State, Zip:
____

A-4. Designated storm shelters as per UCO:
____

A-5. Typical hours the building is occupied:
____

A-6. What hours might the building locked at any time?
____

A-7. Number of stories:
____

A-8. General description of surrounding area:
____

____

____

____

A-9. Is there a storm shelter or safe room already indentified within the building?
____

A-9-a. If so, where is the location of the storm shelter?
____

____

____

____

A-10. What is the exterior building/structure type?

Concrete	RM	Steel	PRM	URM
Wood	Unknown			

A-11. When was the building constructed?
____

Storm Shelter Information
A-12. Area of storm shelter: Length:______ Width:______ Area: ______

A-13. What is the usable square footage for this area?
____

A-14. How many people can the storm shelter hold?
____

A-15. Does the square footage of the storm shelter allow for each occupant to have at least 5 square feet minimum or 10 square feet minimum for people in a wheelchair?
Yes No

Building Layout

Provide a General Sketch of the Building:

Area of Refuge Information

Provide a sketch of Area of Refuge
Please include access routes to area of refuge

Structural Information

Cladding and Glazing Information

B-1. Are the doors to the storm shelter secured at top and bottom with connections to resist suction effects that may pull the door open (3-point latches)?

Yes No

B-2. Is the storm shelter free from glass of any kind?

Yes No

If no, please specify placement and type.

____

____

____

Envelope Protection

B-3. Will the structure adjacent to the storm shelter or surrounding it pose a threat if subject to collapse? (Structural components become debris that creates impact loads on the refuge area.)

Yes No

B-3-a. If yes, please specify:

____

____

____

B-4. Is the potential storm shelter susceptible to damage from collapsing heavy structures nearby or other objects (e.g., concrete towers, telephone or power poles, antenna towers, chimneys, trees, etc)?

Yes No

B-5. Are there large, roll-down or garage type doors (metal, wood, plastic) on the exterior of the storm shelter?

Yes No

B-6. Does the storm shelter have unnecessary furniture and other items stored in it?

Yes No

B-6-a. If yes, can these items be easily moved to create additional usable space?

Yes No

Shelter Design

C-1. Does the location of the storm shelter require occupants to go outdoors to get to it?

Yes No

C-1-a. If yes, please specify building housing the primary storm shelter:

____

____

____

____

C-1-b. If no, is the storm shelter located in an area of the building that the occupants can reach quickly, easily, and without having to go outside during the storm?

Yes No

C-2. Is the storm shelter on the lowest level of the building?

Yes No

C-2-a. If no, please specify the level of the storm shelter within is located?

____

____

____

C-3. Is the storm shelter in the center of the level on which it is located?

Yes No

C-3-a. If no, please specify the location of the storm shelter within the level?

____

____

____

C-4. Is the storm shelter partially or fully underground?

_____ Partially _____ Fully

C-5. Is the storm shelter partially or fully above ground?

_____ Partially _____ Fully

C-6. Is the storm shelter located away from the following:

C-6-a. Corners of the building housing the storm shelter?

Yes No

C-6-b. Exterior walls of the building housing the storm shelter?
Yes No

C-7. Does the storm shelter have doors the open to the exterior of the building?
Yes No

C-8. If the storm shelter is located in a corridor, how many doors lining the storm shelter walls open into other spaces?____

C-9. If the storm shelter is located in a corridor, what is the orientation of the corridor?
____ North/South ____ Northeast/Southwest
____ East/West ____ Northwest/Southeast

C-10. Does the storm shelter have emergency lighting?
Yes No
C-10-a. If yes, does the emergency lighting have back-up power?
Yes No

Signage

D-1. Does the building that houses the storm shelter have interior and/or exterior signage directing people to the shelter?
Yes No
D-1-a. If yes, which type of signage is included?
Exterior____ Interior____

D-1-b. If yes, does the signage include raised and/Braille letters?
Yes No

Sidewalk Access

E-1. Is there a route without steps from the sidewalk to the main entrance of the building housing the storm shelter?
Yes No
If no, are there two or fewer steps? Yes____No____Number of Steps:______
If no, is there another entrance without steps?
Yes____No____Location:_____________

Individuals Who Are Blind or Have Low Vision

E-2. Are all sidewalks and walkways to the shelter free of any objects (e.g., wall-mounted boxes, signs, handrail extensions) with bottom edges that are between 27 inches and 80 inches above the walkway and that extend more than 4 inches into the sidewalk or walkway?

Yes No

E-3. Are the undersides of exterior stairs enclosed or protected with a cane-detectable barrier so that people who are blind or have low vision will not hit their heads on the underside?

Yes No

E-3-a. If no, can a barrier or enclosure be added below the stair or can the route be relocated away from the stair?

Yes No

E-4. Are all objects that hang over the pedestrian routes at least 80 inches above the route?

Yes No

E-4-a. If no, can the objects be removed or relocated, or can a cane-detectable object be added below that is at no higher than 27 inches?

Accessible Entrance

F-1. Is there at least one accessible entrance connected to an accessible route?

Yes No

F-2. Is the accessible entrance kept unlocked?

Yes No

F-3. Does at least one door or one side of a double leaf-door offer at least 32 inches clear passage width when the door is open 90 degrees? (This distance is measured between the face of the door and the edge of the opening.)

Yes No

If no, does another entrance have an accessible door or can both doors be propped open during the evacuation?

F-4. Does the accessible entrance doors swing in the direction of egress, or do they swing into the space?

Yes No

F-5. Is the door hardware (e.g., lever, pull, push, and panic bar) usable with one hand without tight grasping, pinching, or twisting of the wrist?

Yes No

F-6. On the pull side of the door, is there at least 18 inches of clearance provided next to the latch side of the door if the door is not automatic or power-operated?

Yes No

F-7. If there is a raised threshold, is it no higher than ¾ at the door and beveled on both sides?

Yes No

F-8. If an entry has a vestibule, is there a 30 inch by 48 inch clear floor space inside the vestibule where a wheelchair or scooter user can be outside the swing of a hinged door?

Yes No

Corridors

F-9. Is there an accessible route, at least 36 inches, wide that connects the accessible entrance to all shelter areas (it may narrow to 32 inches wide for up to 2 feet in length)?

Yes No

F-10. Is the accessible route free of steps and abrupt level changes over ½ inch all shelter areas?

Yes No

F-11. Does the accessible route from the accessible entrance to lead to the entrance of the storm shelter change levels using a ramp, lift, or elevator?

Yes No

If no, go to question F-15.

F-11-a. If yes, is a ramp or sloped hallway provided?

Yes No

If yes, go to question F-12.

F-11-b. Is an elevator or lift provided?

Yes No

If yes, and the elevator or lift is part of the accessible route to a entrance of the storm shelter, is back-up electrical power available to operate the elevator or lift for the duration of shelter operation should be the normal electrical service disrupted?

If yes and an elevator is provided, see question F-13

If yes and an lift is provided, see question F-14.

F-12. Where the slope of the accessible route is greater than 1:20, does this area meet the following requirements for an accessible ramp?

F-12-a. Is the slope no greater than 1:12?

F-12-b. Are handrails installed on both sides of each ramp segment?
Yes No

F-12-c. Is the ramp width, measured between handrails, at least 36 inches?
Yes No

F-12-d. Are the handrails mounted 34 to 38 inches above the ramp surface?
Yes No

F-12-e. If a ramp is longer than 30 feet, is a level landing at least 60 inches square provided every 30 feet?
Yes No

F-12-f. Does the ramp have a level landing that is at least 60 inches long at the top and bottom of each ramp section or where the ramp changes direction?
Yes No

F-12-g. If the ramp or landing has a vertical drop-off on either side of the ramp, is edge protection provided?
Yes No

F-13. Is an elevator provided to the level of which the entrance of the storm shelter is located?
Yes No

F-13-a. Are the centerlines of the call buttons mounted 42 inches above the floor?
Yes No

F-13-b. Does the floor area of the elevator car have space to enter for a wheel chair user, reach the controls, and exit? See Figure AT1.
Yes No

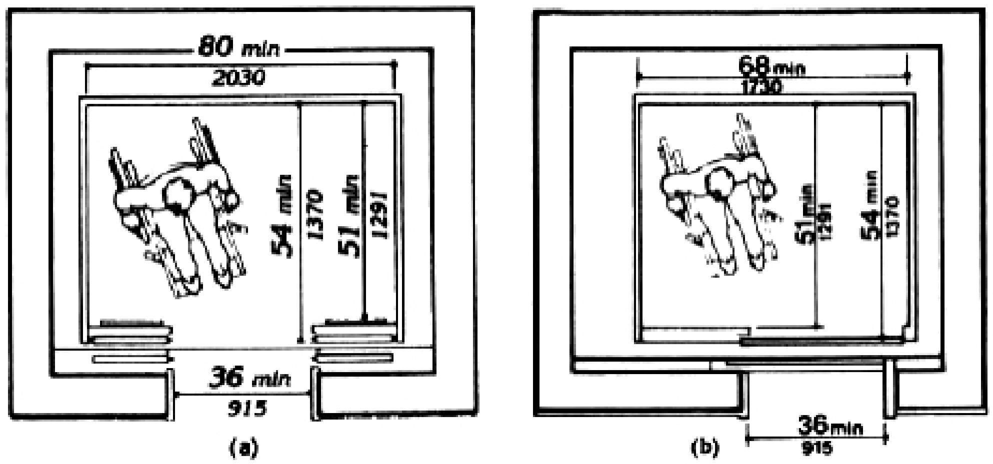


Figure AT1: Minimum dimensions of elevator cars.

F-13-c. Can the elevator be called and operated automatically without using a special key or having to turn on the elevator from a remote location?
Yes No

F-13-d. Are the highest floor control buttons mounted no more than 54 inches above the floor for a side reach or 48 inches for a forward reach?
Yes No

F-13-e. Are raised letters and Braille characters used to identify each floor button and each control?
Yes No

F-11-f. Are signs mounted on both sides of the elevator hoist way door opening (for each elevator and at each floor) that designates the floor with 2 inch minimum-height raised letters and Braille characters centered at 60 inches above the floor?
Yes No

F-13-g. Is the elevator equipped with audible tones, bells or verbal annunciators that announce each floor as it is passed?
Yes No

F-14. Is a wheel chair lift provided?

Yes No

If no, please go to question F-15

F-14-a. Is the lift operational at the time of the survey?

Yes No

F-14-b. Is the change in level for the floor to the lift surface ramped or beveled?

Yes No

F-14-c. Is there at least a 30 inch by 48 inch clear floor space on the wheelchair lift?

Yes No

F-14-d. Does the lift allow a person using a mobility device unassisted entry, operation and exit?

Yes No

F-14-e. Is key available, if required?

Yes No

F-14-f. Are the controls and operating mechanisms mounted no more than 54 inches above the floor for a side reach or 48 inches above the floor for a forward reach?

Yes No

F-14-g. Are the controls and operating mechanisms usable with one hand without tight grasping, pinching, or twisting?

Yes No

F-15. At each location on the way to each shelter area where the accessible route passes through a door, does at least one door meet the following requirements?

Yes No

If no, see question(s):____

F-15-a. Is the clear width for the door opening at least 32 inches measured when the door is open 90 degrees? (This distance is measured between the face of the door and the edge of the opening.)

Yes No

F-15-b. Is the door hardware (e.g., lever, pull, push, panic bar) usable with one hand, without tight grasping, pinching, or twisting of the wrist to fully operate the hardware?
Yes No

F-15-c. Is there clear maneuvering floor space in front of each accessible door and, on the pull side, is there at least 18 inches clear floor space next to the latch side of the door?
Yes No

F-15-d. Is no more than 5 pounds force needed to push or pull open the door?
Yes No

Note: fire doors are still considered to be accessible if they have the minimum opening force allowable by the appropriate administrative authority?

F-15-e. If the answers to questions F-15-b – F-15-d are No, can the door be propped open?
Yes No

Typical Issues for People Who are Blind or Have Low Vision

F-16. Are pedestrian routes leading to the entrance of the storm shelter free of objects that protrude from the side more then 4 inches into the route with the bottom of the object more than 27 inches above the floor?
Yes No

Note: These objects may be wall mounted or free standing. Items to check include wall-mounted fire extinguishers, light fixtures, coat hooks, shelves, drinking fountains, and display cases.

F-17. Are pedestrian routes leading to the entrance of the storm shelter free of overhead objects with the bottom edge lower than 80 inches above the floor?
Yes No

F-18. Are any interior stairs along these routes configured with a cane-detectable warning or a barrier that prevents travel into the area with less than 80 inch high head clearance so that people who are blind or who have low vision cannot hit their heads on the underside of stair frame?
Yes No

Restrooms

G-1. Are the restrooms located in the storm shelter?

Yes No

G-1-a. If yes, please list the type and location:

____

____

____

If no, please go to question H-1.

G-2. Are bathrooms accessible within the storm shelter?

Yes No

If no, see question(s):____

G-3. Is there a route without steps from the accessible entrance to this location?

Yes No

If no, are there two or fewer steps? Yes____No____Number of Steps:______

If no, is there a ramp, lift, or elevator? Yes____No____Type of device:______________

G-4. If an elevator or lift provides the only accessible route, is there a source of backup power to operate the device for an extended period of time?

Yes No

G-5. If a sign is provided at the toilet room entrance (e.g. Men, Women, Boys, Girls, etc.), is a sign with raised characters and Braille mounted on the wall adjacent to the door latch?

Yes No

Note: an additional sign may be mounted on the toilet room door, but this cannot be considered to be the accessible sign which must be mounted on the wall adjacent to the latch side of the door.

G-6. Does the door to the toilet room provide at least 32 inches clear passage width when the door is open 90 degrees? (This distance is measured between the face of the door and the edge of the opening.)

Yes No

G-7. Is the hardware (e.g., lever, pull, push, panic bar) usable with one hand without tight grasping, pinching, or twisting of the wrist?

Yes No

If no, can the door be propped open without compromising privacy, or can the hardware be modified by adding new accessible hardware or adapting or replacing hardware?

G-8. On the pull side of the door, is there at least 18 inches clearance provided located on the floor next to the latch side of the door if it is not automatic or power-operated?
Yes No

G-9. If there is a raised threshold, is it no higher than ¾ inch at the door and beveled on both sides?
Yes No NA

G-10. If the entry has a vestibule, is there a 30 inch by 48 inch clear floor space inside the vestibule where a wheelchair or scooter user can be outside the door swing?
Yes No

G-11. Inside the toilet room, is there an area where a person who uses a wheelchair or other mobility device can turn around? It should be either at least 60 inch diameter circle or a "T"-shaped turn are as shown in the figures below. See figure AT2.
Yes No

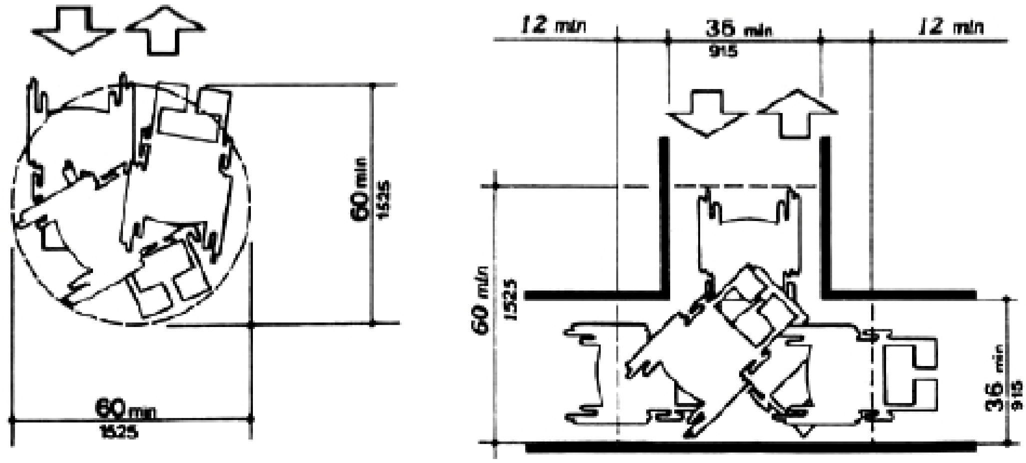


Figure AT2: Minimum spaces for turning.

G-12. If lavatories are provided, does at least one have at least a 29 inch high clearance under the front apron of the lavatory with the top of the rim lavatory no more than 34 inches above the floor?
Yes No

G-13. Are the drain and hot water pipes for the lavatory insulated or otherwise configured to protect against contact?

Yes No

G-14. Does this lavatory have controls that operate easily with one hand, without tight grasping, pinching, or twisting of the wrist?

Yes No

G-15. If mirrors are provided, is the bottom of the reflecting surface for the mirror at this lavatory no higher than 40 inches above the floor or is a full length mirror provided?

Yes No

Specify type of mirror:____

G-16. For at least one of each type of dispenser, receptacle, or item of equipment, is there clear floor space at least 30 inches wide by 48 inches long adjacent to the control or dispenser (positioned either parallel to the control or dispenser or in front of it)?

Yes No

G-17. Is the operating control (switch, lever, button, or pull) of at least one of each type of dispenser or built-in equipment no higher than 54 inches above the floor for a side reach or 48 inches above the floor for a forward reach?

Yes No

G-18. Are all built-in dispensers, receptacles, or equipment mounted so the front does not extend more than 4 inches from the wall if the bottom edge is between 27 inches and 80 inches above the floor?

Yes No

Toilet Stalls

G-19. Is at least one accessible toilet stall provided with an outward swinging door, side and rear grab bars, and clear space next to the toilet?

Yes No

If no, check to see if another toilet room provides an accessible toilet stall, note its location for shelter planners, and answer all toilet room questions with respect to that toilet room.

G-20. Is the toilet stall at least 60 inches wide and 56 inches deep (wall mounted toilet) or 59 inches deep (floor mounted toilet).

Yes No

G-21. Is at least 9 inches of toe clearance provided under the front wall, opposite from the wall with toilet, and at least one side wall of the toilet stall?
Yes No

G-22. Is the centerline of the toilet 18 inches from the adjacent side wall?
Yes No

G-23. Is the top of the toilet seat 17-inches to 19 inches above the floor?
Yes No

G-24. Is the flush valve located on the wide side adjacent to the lavatory or is an automatic flush valve provided?
Yes No

G-25. Is a horizontal grab bar at least 40 inches long securely mounted on the adjacent side wall to the toilet 33 to 36 inches above the floor with one end no more than 12 inches from the back wall and 33 to 36 inches above the floor?
Yes No

G-26. Is a second horizontal grab bar at least 36 inches long securely mounted on the back wall with one end no more than 6 inches from the side wall and 33 to 36 inches above the floor?
Yes No

G-27. Is the door to the toilet stall located diagonally opposite, not directly in front of, the toilet or on the opposite side wall from the wall with the long grab bar?
Yes No

G-28. Unless the accessible stall is located at the end of a row of toilet stalls, does the door to the wider stall open out?
Yes No

G-29. Is the clear width of the door at least 32 inches when the door is open 90 degrees? (This distance is measured between the face of the door and the edge of the opening.)
Yes No

G-30. If there are more than 6 stalls in the restroom, is one of those stalls Is one of those stalls (in addition to the accessible stall noted above) exactly 36 inches wide with an outward swinging stall door that provides at least 32 inches of clear width?
Yes No

G-31. Does this 36 inch wide stall have horizontal grab bars on both of the side partitions that are at least 36 inches long and 33 to 36 inches above the floor?

Yes No

G-32. Is the surface of the toilet seat in this 36 inch wide stall 17 to 19 inches above the floor?

Yes No

G-33. If a coat hook is provided is it mounted no higher than 54 inches above the floor for a side approach or 48 inches above the floor for a front approach?

Female: Yes No
Male: Yes No

Drinking Fountains

H-1. Are there drinking fountains located within the storm shelter?

Yes No

If no, please go to question I-1.

H-2. Are the drinking fountains in the refuge area ADA accessible?

Yes No

If no, please see question(s):
____

H-3. If the drinking fountain is a wall-mounted unit, is there clear floor space at least 30 inches wide (36 inches if it is in an alcove) by 48 inches long in front of the drinking fountain and at least 27 inches high under the fountain so that a person using a wheelchair can get close to the spout and controls?

Yes No

H-4. If the drinking fountain is a floor-mounted unit, is there clear floor space at least 30 inches long by 48 inches wide (60 inches if it is in an alcove) for a side approach to the drinking fountain so that a person using a wheelchair can get close to the spout and controls even though the fountain has not clear space under it?

Yes No

H-5. Is the top of the spout no higher than 36 inches above the floor and at the front of the fountain or water cooler?

Yes No

H-6. Does the water rise at least 4 inches high when no more than 5 pounds of force is applied to the controls of the fountain?

Yes No

H-7. Are the controls on or near the front of the unit and do they operate with one hand without tight grasping, pinching, or twisting of the wrist?

Yes No

H-8. Is the bottom of the apron of the fountain 27 inches above the floor so that it provides the space needed for a person who uses a wheelchair to pull up under it but is not a hazard to people who are blind or have low vision and use a caned to detect the hazard?

Yes No

Availability of Electrical Power

I-1. Is there a backup source of electrical power for the facility?

Yes No

I-1-a. If yes, what is the power source?

____ Battery powered

____ Other power (indicate fuel type)

____

I-2. Is there an automatic transfer switch?

Yes No

I-2-a. What is the duration of lighting under the back-up power source?

____ 0-2 hours

____ 3-6 hours

____ 7 or more hours

I-3. If back-up power supply is not within the storm shelter, Is the back-up power supply located within the storm shelter, is it in a place where it will be protected during an extreme-wind event (for example, in an interior room, or below grade)??

Yes No NA

Flood Hazard Checklist

J-1. What is the Community Panel No. _______ Date Revised: _______

J-2. Flood Hazard Zone:

____

J-3. What is the base floor elevation (BFE) at the building site?

____

J-4. Is there a history of floods at the building site?
Yes No Unknown Not Applicable

J-5. Is there a history of drains (storm or sanitary) backing up due to flooding at the site?
Yes No Unknown Not Applicable

J-6. Does the surrounding topography contribute to flooding in low-lying areas?
Yes No

J-7. Are there poor drainage patterns?
Yes No
If yes, please specify location:
____
____
____

J-8. Are access sidewalks to the building site sufficiently elevated and expected to be accessible during periods of high water (based on local flooding history and/or Flood Insurance Rate Map panel information)?
Yes No

Structural Issues

J-9. What is the elevation of the lowest floor/level of the building being used for the storm shelter?
____

J-10. Is this elevation:
- ____ Above the 100-year flood elevation + 2 feet
- ____ Less than 2 feet above the BFE
- ____ Below the BFE or unknown
- ____ Not applicable

J-11. Is this elevation:
- ____ Above the lowest floor elevation required by the community’s floodplain ordinance
- ____ Below the lowest floor elevation required by the community’s floodplain ordinance
- ____ Not applicable

J-12. Is any space below the applicable floor criteria used for classroom or office space? (If this area is used for storage, access, and parking only, answer “No”).

Yes No Not Applicable

Appendix C

Assessment Tool Results

Assessment Tool Questionnaire

Building Information

Contact Information

A-1. Building Name: Chambers Library

A-2. Street Address: NA

A-3. City, State, Zip: Edmond, OK 73034

A-4. Designated refuge area as per UCO: Basement

A-5. Typical hours the building is occupied: 7:30am – 12:00am

A-6. What hours might the building locked at any time? 12:00am – 7:30am

A-7. Number of stories: 5 including basement

A-8. General description of surrounding area:
One building to the south, west, north, east, and southeast; parking lots on the southwest side clockwise to the north sides; and light poles and trees surround building.

A-9. Is there a refuge area or safe room already indentified within the building? Yes

A-9-a. If so, where is the location of the storm shelter?
The eastern two-thirds of the basement.

A-10. What is the exterior building/structure type?

<u>Concrete</u> RM Steel PRM URM
Wood Unknown

A-11. When was the building constructed? 1966 with addition in 1195

Storm Shelter Information

A-12. Area of refuge area: Length:______ Width:______ Area: 9397.42

A-13. What is the usable square footage for this area? 5782.72

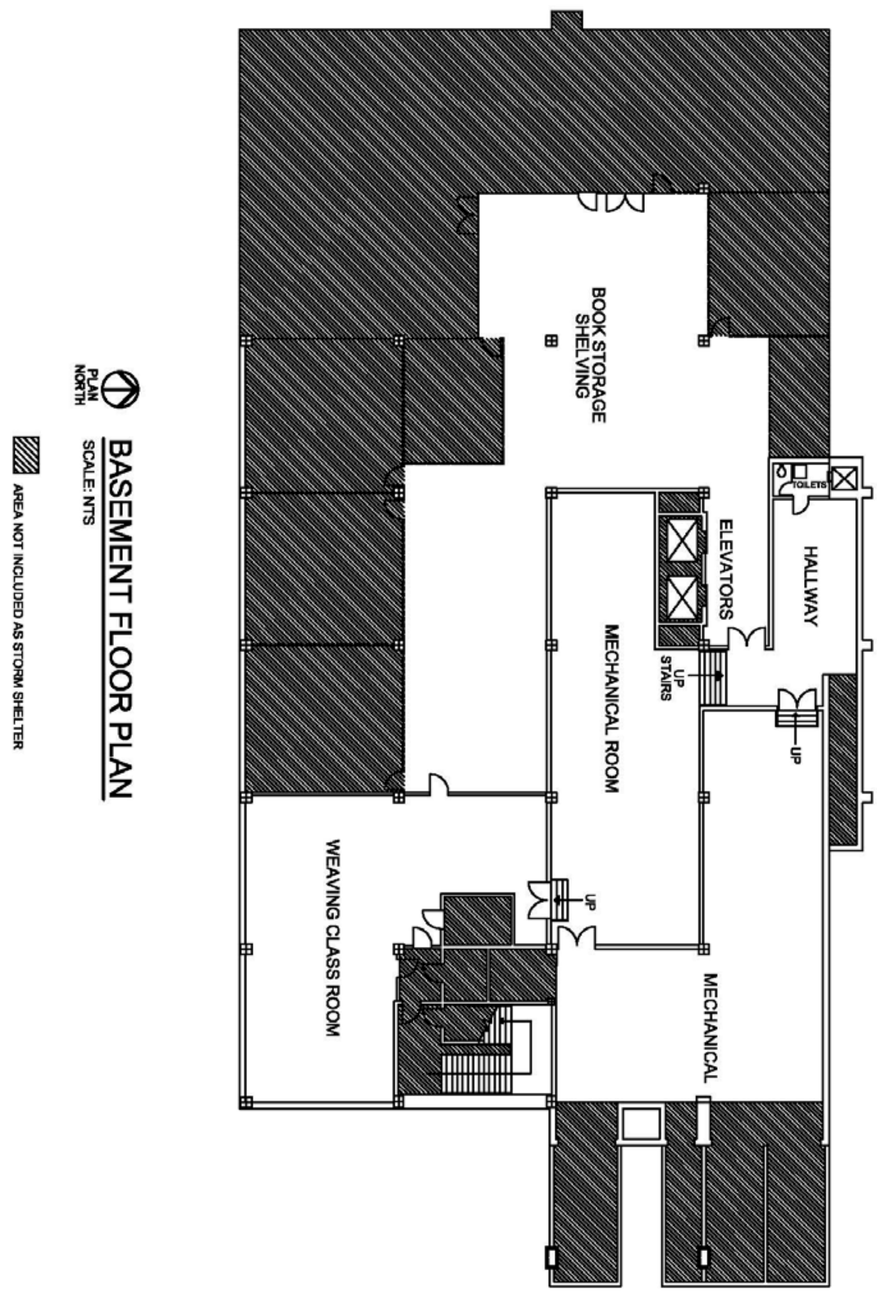
A-14. How many people can the refuge area hold as stated by UCO? 3700

A-15. Does the square footage of the refuge area allow for each occupant to have at least 5 square feet minimum or 10 square feet minimum for people in a wheelchair?

Yes **<u>No</u>**

Area of Refuge Information

Provide a sketch of Area of Refuge
Please include access routes to area of refuge



Structural Information

Cladding and Glazing Information

B-1. Are the doors to the refuge area secured at top and bottom with connections to resist suction effects that may pull the door open (3-point latches)?

Yes **No**

B-2. Is the storm shelter free from glass of any kind?

Yes **No**

If no, please specify placement and type.

Mirror in restroom

Envelope Protection

B-3. Will the structure adjacent to the refuge area or surrounding it pose a threat if subject to collapse? (Structural components become debris that creates impact loads on the refuge area.)

Yes No

B-3-a. If yes, please specify:

Structures on the south and west sides could pose a threat

B-4. Is the potential refuge area susceptible to damage from collapsing heavy structures nearby or other objects (e.g., concrete towers, telephone or power poles, antenna towers, chimneys, trees, etc)?

Yes No

B-5. Are there large, roll-down or garage type doors (metal, wood, plastic) on the exterior of the refuge area?

Yes **No**

B-6. Does the refuge area have unnecessary furniture and other items stored in it?

Yes No

B-6-a. If yes, can these items be easily moved to create additional usable space?

Yes **No**

Shelter Design

C-1. Does the location of the refuge area require occupants to go outdoors to get to it?

Yes **No – If inside the building**

C-1-a. If yes, please specify building housing the primary refuge area:

____

____

____

C-1-b. If no, is the refuge area located in an area of the building that the occupants can reach quickly, easily, and without having to go outside during the storm?
Yes No

C-2. Is the refuge area on the lowest level of the building?
Yes No
C-2-a. If no, please specify the level of the refuge area within is located?
____
____
____

C-3. Is the refuge area in the center of the level on which it is located?
Yes **No**
C-3-a. If no, please specify the location of the refuge area within the level?
The shelter occupies the central and northeastern sections of the basement

C-4. Is the refuge area partially or fully underground?
Partially **Fully**

C-5. Is the refuge area partially or fully above ground?
Partially Fully

C-6. If the refuge area is fully or partially above ground, is it located away from the following:
C-6-a. Corners of the building housing the refuge area?
Yes No

C-6-b. Exterior walls of the building housing the refuge area?
Yes No

C-7. Does the refuge area have doors the open to the exterior of the building?
Yes **No**

C-8. If the refuge area is located in a corridor, how many doors lining the storm shelter walls open into other spaces?____

C-9. If the refuge area is located in a corridor, what is the orientation of the corridor?
____ North/South ____ Northeast/Southwest
____ East/West ____ Northwest/Southeast

C-10. Does the refuge area have emergency lighting?
Yes No

C-10-a. If yes, does the emergency lighting have back-up power?
Yes No

Signage

D-1. Does the building that houses the refuge area have interior and/or exterior signage directing people to the shelter?
Yes **No -- signage at the entrance of the shelter**
D-1-a. If yes, which type of signage is included?
Exterior____ Interior____

D-1-b. If yes, does the signage include raised and/Braille letters?
Yes No

Sidewalk Access

E-1. Is there a route without steps from the sidewalk to the main entrance of the building housing the refuge area?
Yes No
If no, are there two or fewer steps? Yes____No____Number of Steps:______
If no, is there another entrance without steps?
Yes____No____Location:_____________

Individuals Who Are Blind or Have Low Vision

E-2. Are all sidewalks and walkways to the shelter free of any objects (e.g., wall-mounted boxes, signs, handrail extensions) with bottom edges that are between 27 inches and 80 inches above the walkway and that extend more than 4 inches into the sidewalk or walkway?
Yes No

E-3. Are the undersides of exterior stairs enclosed or protected with a cane-detectable barrier so that people who are blind or have low vision will not hit their heads on the underside?
Yes No

E-3-a. If no, can a barrier or enclosure be added below the stair or can the route be relocated away from the stair?
Yes No

E-4. Are all objects that hang over the pedestrian routes at least 80 inches above the route?
Yes **No**

E-4-a. If no, can the objects be removed or relocated, or can a cane-detectable object be added below that is at no higher than 27 inches?
Yes No

Accessible Entrance

F-1. Is there at least one accessible entrance connected to the exterior accessible route?

Yes No

F-2. Is the accessible entrance kept unlocked?

Yes **No – see question A-6**

F-3. Does at least one door or one side of a double leaf-door offer at least 32 inches clear passage width when the door is open 90 degrees? (This distance is measured between the face of the door and the edge of the opening.)

Yes No

If no, does another entrance have an accessible door or can both doors be propped open during the evacuation?

F-4. Does the accessible entrance doors swing in the direction of egress, or do they swing into the space?

Direction of Egress Swing into the space

F-5. Is the door hardware (e.g., lever, pull, push, and panic bar) usable with one hand without tight grasping, pinching, or twisting of the wrist?

Yes **No**
Push side Pull side

F-6. On the pull side of the door, is there at least 18 inches of clearance provided next to the latch side of the door if the door is not automatic or power-operated?

Yes No

F-7. If there is a raised threshold, is it no higher than ¾ at the door and beveled on both sides?

Yes No

F-8. If an entry has a vestibule, is there a 30 inch by 48 inch clear floor space inside the vestibule where a wheelchair or scooter user can be outside the swing of a hinged door?

Yes No

Corridors

F-9. Is there an accessible route, at least 36 inches wide that connects the accessible entrance to the entrance of the shelter (it may narrow to 32 inches wide for up to 2 feet in length)?

Yes No

F-10. Is the accessible route from the accessible entrance free of steps and abrupt level changes over ½ inch to the entrance of the shelter?

Yes **No**

F-11. Does the accessible route from the accessible entrance to lead to the entrance of the refuge area change levels using a ramp, lift, or elevator?

Yes No

If no, go to question F-15.

F-11-a. If yes, is a ramp or sloped hallway provided?

Yes **No**

If yes, go to question F-12.

F-11-b. Is an elevator or lift provided?

Yes No

If yes, and the elevator or lift is part of the accessible route to a entrance of the refuge area, is back-up electrical power available to operate the elevator or lift for the duration of shelter operation should be the normal electrical service disrupted?

If yes and an elevator is provided, see question F-13

If yes and an lift is provided, see question F-14.

F-12. When a ramp is present in the accessible route, does this it meet the following requirements for an accessible ramp?

F-12-a. Is the slope no greater than 1:12?

F-12-b. Are handrails installed on both sides of each ramp segment?

Yes No

F-12-c. Is the ramp width, measured between handrails, at least 36 inches?

Yes No

F-12-d. Are the handrails mounted 34 to 38 inches above the ramp surface?

Yes No

F-12-e. If a ramp is longer than 30 feet, is a level landing at least 60 inches square provided every 30 feet?

Yes No

F-12-f. Does the ramp have a level landing that is at least 60 inches long at the top and bottom of each ramp section or where the ramp changes direction?
Yes No

F-12-g. If the ramp or landing has a vertical drop-off on either side of the ramp, is edge protection provided?
Yes No

F-13. Is an elevator provided to the level of which the entrance of the refuge area is located?
Yes No
If no, go to question F-14.

F-13-a. Are the centerlines of the call buttons mounted 42 inches above the floor?
Yes **No**

F-13-b. Does the floor area of the elevator car have space to enter for a wheel chair user, reach the controls, and exit? See Figure AT1.
Yes No

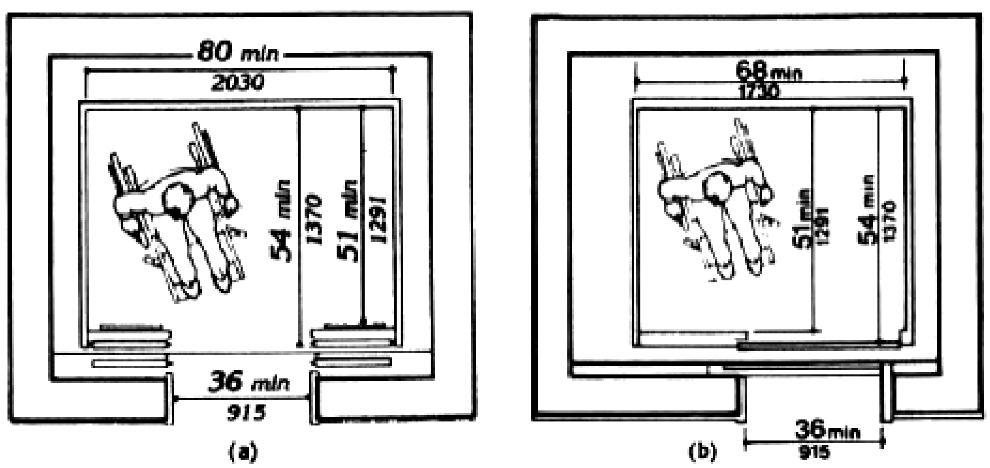


Figure AT1: Minimum dimensions of elevator cars.

F-13-c. Can the elevator be called and operated automatically without using a special key or having to turn on the elevator from a remote location?
Yes **No**
The elevator cannot be lowered to the basement level without the use of a key; however, it can be called from the basement level without a key.

F-13-d. Are the highest floor control buttons mounted no more than 54 inches above the floor for a side reach or 48 inches for a forward reach?
Yes No

F-13-e. Are raised letters and Braille characters used to identify each floor button and each control?
Yes **No**

F-11-f. Are signs mounted on both sides of the elevator hoist way door opening (for each elevator and at each floor) that designates the floor with 2 inch minimum-height raised letters and Braille characters centered at 60 inches above the floor?
Yes **No**

F-13-g. Is the elevator equipped with audible tones, bells or verbal annunciators that announce each floor as it is passed?
Yes No

F-14. Is a wheel chair lift provided?
Yes **No**
If no, please go to question F-15

F-14-a. Is the lift operational at the time of the survey?
Yes No

F-14-b. Is the change in level for the floor to the lift surface ramped or beveled?
Yes No

F-14-c. Is there at least a 30 inch by 48 inch clear floor space on the wheelchair lift?
Yes No

F-14-d. Does the lift allow a person using a mobility device unassisted entry, operation and exit?
Yes No

F-14-e. Is key available, if required?
Yes No

F-14-f. Are the controls and operating mechanisms mounted no more than 54 inches above the floor for a side reach or 48 inches above the floor for a forward reach?
Yes No

F-14-g. Are the controls and operating mechanisms usable with one hand without tight grasping, pinching, or twisting?
Yes No

F-15. At each location on the way to each shelter area where the accessible route passes through a door, does at least one door meet the following requirements?
Yes **<u>No</u>**
If no, see question(s): F-15-b and F-15-d

F-15-a. Is the clear width for the door opening at least 32 inches measured when the door is open 90 degrees? (This distance is measured between the face of the door and the edge of the opening.)
<u>Yes</u> No

F-15-b. Is the door hardware (e.g., lever, pull, push, panic bar) usable with one hand, without tight grasping, pinching, or twisting of the wrist to fully operate the hardware?
Yes **<u>No</u>**

F-15-c. Is there clear maneuvering floor space in front of each accessible door and, on the pull side, is there at least 18 inches clear floor space next to the latch side of the door?
<u>Yes</u> No

F-15-d. Is no more than 5 pounds force needed to push or pull open the door?
Yes **<u>No</u>**

Note: fire doors are still considered to be accessible if they have the minimum opening force allowable by the appropriate administrative authority?

F-15-e. If the answers to questions F-15-b – F-15-d are No, can the door be propped open?
Yes **<u>No</u>**

Typical Issues for People Who are Blind or Have Low Vision
F-16. Are pedestrian routes leading to the entrance of the refuge area free of objects that protrude from the side more then 4 inches into the route with the bottom of the object more than 27 inches above the floor?
<u>Yes</u> No

Note: These objects may be wall mounted or free standing. Items to check include wall-mounted fire extinguishers, light fixtures, coat hooks, shelves, drinking fountains, and display cases.

F-17. Are pedestrian routes leading to the entrance of the refuge area free of overhead objects with the bottom edge lower than 80 inches above the floor?

Yes No

F-18. Are any interior stairs along these routes configured with a cane-detectable warning or a barrier that prevents travel into the area with less than 80 inch high head clearance so that people who are blind or who have low vision cannot hit their heads on the underside of stair frame?

Yes No

Restrooms

G-1. Are the restrooms located in the refuge area?

Yes No

G-1-a. If yes, please list the type and location:
Unisex at the northwest corner. Since the restroom is unisex, both male and female answer blanks will be checked.
If no, please go to question H-1.

G-2. Are bathrooms accessible within the refuge area?

Female: Yes **No**
Male: Yes **No**

If no, see question(s): G-4 – G-7, G -11, G-13, G-15, G-17 – G20, G-22 – G-30, & G-34

G-3. Is there a route without steps from the refuge area entrance to this location?

Yes No

If no, are there two or fewer steps? Yes____No____Number of Steps:______

If no, is there a ramp, lift, or elevator? Yes____No____Type of device:_____________

G-4. If an elevator or lift provides the only accessible route, is there a source of backup power to operate the device for an extended period of time?

Yes No

G-5. If a sign is provided at the toilet room entrance (e.g. Men, Women, Boys, Girls, etc.), is a sign with raised characters and Braille mounted on the wall adjacent to the door latch?

Female: Yes **No**
Male: Yes **No**

Note: an additional sign may be mounted on the toilet room door, but this cannot be considered to be the accessible sign which must be mounted on the wall adjacent to the latch side of the door.

G-6. Does the door to the toilet room provide at least 32 inches clear passage width when the door is open 90 degrees? (This distance is measured between the face of the door and the edge of the opening.)

Female: Yes **No**
Male: Yes **No**

G-7. Is the hardware (e.g., lever, pull, push, panic bar) usable with one hand without tight grasping, pinching, or twisting of the wrist?

Female: Yes **No**
Male: Yes **No**

If no, can the door be propped open without compromising privacy, or can the hardware be modified by adding new accessible hardware or adapting or replacing hardware?

G-8. On the pull side of the door, is there at least 18 inches clearance provided located on the floor next to the latch side of the door if it is not automatic or power-operated?

Female: **Yes** No
Male: **Yes** No

G-9. If there is a raised threshold, is it no higher than ¾ inch at the door and beveled on both sides?

Female: **Yes** No
Male: **Yes** No

G-10. If the entry has a vestibule, is there a 30 inch by 48 inch clear floor space inside the vestibule where a wheelchair or scooter user can be outside the door swing?

Female: Yes No
Male: Yes No

G-11. Inside the toilet room, is there an area where a person who uses a wheelchair or other mobility device can turn around? It should be either at least 60 inch diameter circle or a "T"-shaped turn are as shown in the figures below. See figure AT2.

Female: Yes **<u>No</u>**
Male: Yes **<u>No</u>**

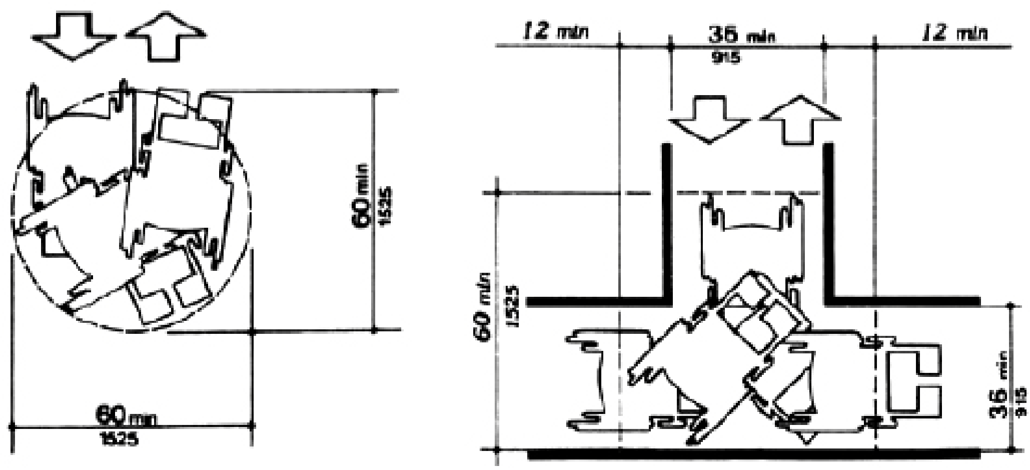


Figure AT2: Minimum spaces for turning.

G-12. If lavatories are provided, does at least one have at least a 29 inch high clearance under the front apron of the lavatory with the top of the rim lavatory no more than 34 inches above the floor?

Female: **<u>Yes</u>** No
Male: **<u>Yes</u>** No

G-13. Are the drain and hot water pipes for the lavatory insulated or otherwise configured to protect against contact?

Female: Yes **<u>No</u>**
Male: Yes **<u>No</u>**

G-14. Does this lavatory have controls that operate easily with one hand, without tight grasping, pinching, or twisting of the wrist?

Female: **<u>Yes</u>** No
Male: **<u>Yes</u>** No

G-15. If mirrors are provided, is the bottom of the reflecting surface for the mirror at this lavatory no higher than 40 inches above the floor or is a full length mirror provided?

Female: Yes **<u>No</u>**
Male: Yes **<u>No</u>**

Specify type of mirror: Wall mount

G-16. For at least one of each type of dispenser, receptacle, or item of equipment, is there clear floor space at least 30 inches wide by 48 inches long adjacent to the control or dispenser (positioned either parallel to the control or dispenser or in front of it)?

Female: **Yes** No
Male: **Yes** No

G-17. Is the operating control (switch, lever, button, or pull) of at least one of each type of dispenser or built-in equipment no higher than 54 inches above the floor for a side reach or 48 inches above the floor for a forward reach?

Female: Yes **No**
Male: Yes **No**

G-18. Are all built-in dispensers, receptacles, or equipment mounted so the front does not extend more than 4 inches from the wall if the bottom edge is between 27 inches and 80 inches above the floor?

Female: Yes **No**
Male: Yes **No** o

Toilet Stalls

G-19. Is at least one accessible toilet stall provided with an outward swinging door, side and rear grab bars, and clear space next to the toilet?

Female: Yes **No**
Male: Yes **No**
If no, check to see if another toilet room provides an accessible toilet stall, note its location for shelter planners, and answer all toilet room questions with respect to that toilet room.

G-20. Is the toilet stall at least 60 inches wide and 56 inches deep (wall mounted toilet) or 59 inches deep (floor mounted toilet).

Female: Yes **No**
Male: Yes **No**

G-21. Is at least 9 inches of toe clearance provided under the front wall, opposite from the wall with toilet, and at least one side wall of the toilet stall?

Female: **Yes** No
Male: **Yes** No

G-22. Is the centerline of the toilet 18 inches from the adjacent side wall?

Female: Yes **No**
Male: Yes **No**

G-23. Is the top of the toilet seat 17-inches to 19 inches above the floor?

Female: Yes **No**
Male: Yes **No**

G-24. Is the flush valve located on the wide side adjacent to the lavatory or is an automatic flush valve provided?

Female: Yes **No**

Male: Yes **No** o

G-25. Is a horizontal grab bar at least 40 inches long securely mounted on the adjacent side wall to the toilet 33 to 36 inches above the floor with one end no more than 12 inches from the back wall?

Female: Yes **No**

Male: Yes **No**

G-26. Is a second horizontal grab bar at least 36 inches long securely mounted on the back wall with one end no more than 6 inches from the side wall and 33 to 36 inches above the floor?

Female: Yes **No**

Male: Yes **No**

G-27. Is the door to the toilet stall located diagonally opposite, not directly in front of, the toilet or on the opposite side wall from the wall with the long grab bar?

Female: Yes **No**

Male: Yes **No**

G-28. Unless the accessible stall is located at the end of a row of toilet stalls, does the door to the wider stall open out?

Female: Yes **No**

Male: Yes **No**

G-29. Is the clear width of the door at least 32 inches when the door is open 90 degrees? (This distance is measured between the face of the door and the edge of the opening.)

Female: Yes **No**

Male: Yes **No**

G-30. Are there 6 or more stalls in the restroom?

Female: Yes **No**

Male: Yes **No**

If no, go to question G-34.

G-31. Is one of those stalls (in addition to the accessible stall noted above) exactly 36 inches wide with an outward swinging stall door that provides at least 32 inches of clear width?

Female: Yes No

Male: Yes No

G-32. Does this 36 inch wide stall have horizontal grab bars on both of the side partitions that are at least 36 inches long and 33 to 36 inches above the floor?

Female: Yes No
Male: Yes No

G-33. Is the surface of the toilet seat in this 36 inch wide stall 17 to 19 inches above the floor?

Female: Yes No
Male: Yes No

G-34. If a coat hook is provided is it mounted no higher than 54 inches above the floor for a side approach or 48 inches above the floor for a front approach?

Female: Yes **No**
Male: Yes **No**

Drinking Fountains

H-1. Are there drinking fountains located within the refuge area?

Yes **No**

If no, please go to question I-1.

H-2. Are the drinking fountains in the refuge area ADA accessible?

Yes No

If no, please see question(s): ______________________________

H-3. If the drinking fountain is a wall-mounted unit, is there clear floor space at least 30 inches wide (36 inches if it is in an alcove) by 48 inches long in front of the drinking fountain and at least 27 inches high under the fountain so that a person using a wheelchair can get close to the spout and controls?

Yes No

H-4. If the drinking fountain is a floor-mounted unit, is there clear floor space at least 30 inches long by 48 inches wide (60 inches if it is in an alcove) for a side approach to the drinking fountain so that a person using a wheelchair can get close to the spout and controls even though the fountain has not clear space under it?

Yes No

H-5. Is the top of the spout no higher than 36 inches above the floor and at the front of the fountain or water cooler?

Yes No

H-6. Does the water rise at least 4 inches high when no more than 5 pounds of force is applied to the controls of the fountain?

Yes No

H-7. Are the controls on or near the front of the unit and do they operate with one hand without tight grasping, pinching, or twisting of the wrist?

Yes No

H-8. Is the bottom of the apron of the fountain 27 inches above the floor so that it provides the space needed for a person who uses a wheelchair to pull up under it but is not a hazard to people who are blind or have low vision and use a caned to detect the hazard?

Yes No

Availability of Electrical Power

I-1. Is there a backup source of electrical power for the facility?

Yes No

I-1-a. If yes, what is the power source?

Battery powered ____

Other power (indicate fuel type) Diesel

I-1-b. If yes, is there an automatic transfer switch?

Yes No

1-2. What is the duration of lighting under the back-up power source?

0-2 hours

3-6 hours

7 or more hours

I-3. Is the back-up power supply located within the refuge area?

Yes No

If no, is it in a place where it will be protected during an extreme-wind event (for example, in an interior room, or below grade)?

Yes No Not Applicable

Assessment Tool Questionnaire

Building Information

Contact Information

A-1. Building Name: Liberal Arts

A-2. Street Address: NA

A-3. City, State, Zip: Edmond, OK 73034

A-4. Designated refuge area as per UCO: Basement

A-5. Typical hours the building is occupied: 8:00am – 9:00pm

A-6. What hours might the building locked at any time? 12:00am – 7:00am

A-7. Number of stories: 3 including basement

A-8. General description of surrounding area:
From the east clock wise to the south are parking lots with light poles; buildings to the southwest and east; at time of assessment construction of new building to the southwest; and trees surrounding the building

A-9. Is there a refuge area or safe room already indentified within the building? Yes

A-9-a. If so, where is the location of the storm shelter?
Basement of building excluding mechanical room

A-10. What is the exterior building/structure type?

<u>Concrete</u>	RM	Steel	PRM	URM
Wood	Unknown			

A-11. When was the building constructed? 1967

Storm Shelter Information

A-12. Area of refuge area: Length:______ Width:______ Area: 2803.546

A-13. What is the usable square footage for this area? 1740.549

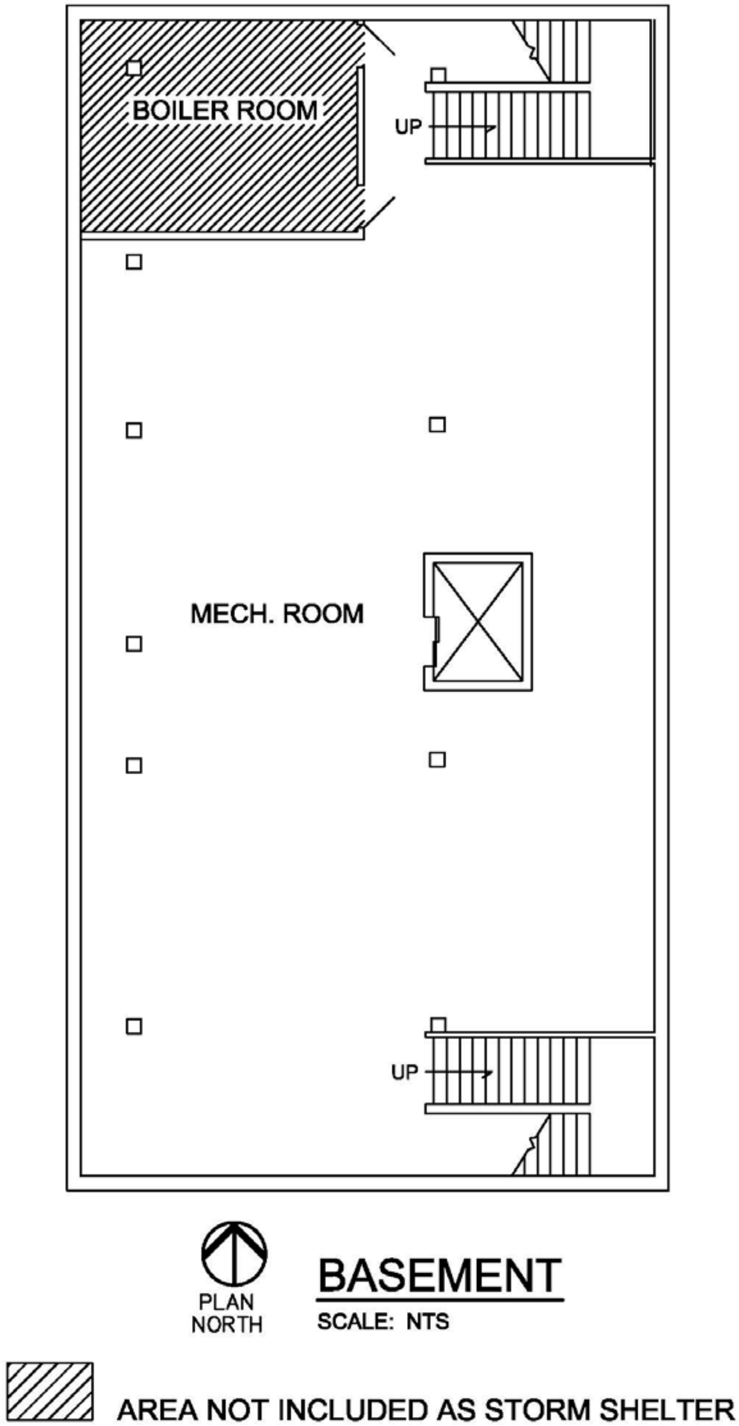
A-14. How many people can the refuge area hold as stated by UCO? 986

A-15. Does the square footage of the refuge area allow for each occupant to have at least 5 square feet minimum or 10 square feet minimum for people in a wheelchair?

Yes **<u>No</u>**

Area of Refuge Information

Provide a sketch of Area of Refuge



Structural Information

Cladding and Glazing Information

B-1. Are the doors to the refuge area secured at top and bottom with connections to resist suction effects that may pull the door open (3-point latches)?

Yes **No**

B-2. Is the storm shelter free from glass of any kind?

Yes No

If no, please specify placement and type.

____

____

____

Envelope Protection

B-3. Will the structure adjacent to the refuge area or surrounding it pose a threat if subject to collapse? (Structural components become debris that creates impact loads on the refuge area.)

Yes No

B-3-a. If yes, please specify:

Buildings the east and southwest could become potential missiles.

B-4. Is the potential refuge area susceptible to damage from collapsing heavy structures nearby or other objects (e.g., concrete towers, telephone or power poles, antenna towers, chimneys, trees, etc)?

Yes No

B-5. Are there large, roll-down or garage type doors (metal, wood, plastic) on the exterior of the refuge area?

Yes **No**

B-6. Does the refuge area have unnecessary furniture and other items stored in it?

Yes **No**

B-6-a. If yes, can these items be easily moved to create additional usable space?

Yes No

Shelter Design

C-1. Does the location of the refuge area require occupants to go outdoors to get to it?

Yes **No – If inside the building**

C-1-a. If yes, please specify building housing the primary refuge area:

____

____

____

C-1-b. If no, is the refuge area located in an area of the building that the occupants can reach quickly, easily, and without having to go outside during the storm?

Yes No

C-2. Is the refuge area on the lowest level of the building?

Yes No

C-2-a. If no, please specify the level of the refuge area within is located?

____

____

____

C-3. Is the refuge area in the center of the level on which it is located?

Yes No

C-3-a. If no, please specify the location of the refuge area within the level? Although the shelter is centrally located, it does not take up the entire basement with the exclusion of the mechanical room in the northwest corner.

C-4. Is the refuge area partially or fully underground?

Partially **Fully**

C-5. Is the refuge area partially or fully above ground?

Partially Fully

C-6. If the refuge area is fully or partially above ground, is it located away from the following:

C-6-a. Corners of the building housing the refuge area?

Yes No

C-6-b. Exterior walls of the building housing the refuge area?

Yes No

C-7. Does the refuge area have doors the open to the exterior of the building?

Yes **No**

C-8. If the refuge area is located in a corridor, how many doors lining the storm shelter walls open into other spaces?____

C-9. If the refuge area is located in a corridor, what is the orientation of the corridor?

____ North/South ____ Northeast/Southwest
____ East/West ____ Northwest/Southeast

C-10. Does the refuge area have emergency lighting?

<u>Yes</u> No

C-10-a. If yes, does the emergency lighting have back-up power?

<u>Yes</u> No

Battery powered – required by code

Signage

D-1. Does the building that houses the refuge area have interior and/or exterior signage directing people to the shelter?

Yes **<u>No</u> – signage at the entrance of the shelter**

D-1-a. If yes, which type of signage is included?

Exterior____ Interior____

D-1-b. If yes, does the signage include raised and/Braille letters?

Yes No

Sidewalk Access

E-1. Is there a route without steps from the sidewalk to the main entrance of the building housing the refuge area?

<u>Yes</u> No

If no, are there two or fewer steps? Yes____No____Number of Steps:______

If no, is there another entrance without steps? Yes____No____Location:______________

Individuals Who Are Blind or Have Low Vision

E-2. Are all sidewalks and walkways to the shelter free of any objects (e.g., wall-mounted boxes, signs, handrail extensions) with bottom edges that are between 27 inches and 80 inches above the walkway and that extend more than 4 inches into the sidewalk or walkway?

<u>Yes</u> No

E-3. Are the undersides of exterior stairs enclosed or protected with a cane-detectable barrier so that people who are blind or have low vision will not hit their heads on the underside?

Yes No

E-3-a. If no, can a barrier or enclosure be added below the stair or can the route be relocated away from the stair?
Yes No

E-4. Are all objects that hang over the pedestrian routes at least 80 inches above the route?
Yes No

E-4-a. If no, can the objects be removed or relocated, or can a cane-detectable object be added below that is at no higher than 27 inches?
Yes No

Accessible Entrance

F-1. Is there at least one accessible entrance connected to the exterior accessible route?
Yes No

F-2. Is the accessible entrance kept unlocked?
Yes **No – see question A-6**

F-3. Does at least one door or one side of a double leaf-door offer at least 32 inches clear passage width when the door is open 90 degrees? (This distance is measured between the face of the door and the edge of the opening.)
Yes No

If no, does another entrance have an accessible door or can both doors be propped open during the evacuation?

F-4. Does the accessible entrance doors swing in the direction of egress, or do they swing into the space?
Direction of Egress Swing into the space

F-5. Is the door hardware (e.g., lever, pull, push, and panic bar) usable with one hand without tight grasping, pinching, or twisting of the wrist?
Yes **No**
Push side Pull side

F-6. On the pull side of the door, is there at least 18 inches of clearance provided next to the latch side of the door if the door is not automatic or power-operated?
Yes No

F-7. If there is a raised threshold, is it no higher than ¾ at the door and beveled on both sides?
Yes No

F-8. If an entry has a vestibule, is there a 30 inch by 48 inch clear floor space inside the vestibule where a wheelchair or scooter user can be outside the swing of a hinged door?

Yes No

Corridors

F-9. Is there an accessible route, at least 36 inches wide that connects the accessible entrance to the entrance of the shelter (it may narrow to 32 inches wide for up to 2 feet in length)?

Yes No

F-10. Is the accessible route from the accessible entrance free of steps and abrupt level changes over ½ inch to the entrance of the shelter?

Yes **No**

F-11. Does the accessible route from the accessible entrance to lead to the entrance of the refuge area change levels using a ramp, lift, or elevator?

Yes No

If no, go to question F-15.

F-11-a. If yes, is a ramp or sloped hallway provided?

Yes **No**

If yes, go to question F-12.

F-11-b. Is an elevator or lift provided?

Yes No

If yes, and the elevator or lift is part of the accessible route to a entrance of the refuge area, is back-up electrical power available to operate the elevator or lift for the duration of shelter operation should be the normal electrical service disrupted?

If yes and an elevator is provided, see question F-13

If yes and an lift is provided, see question F-14.

F-12. When a ramp is present in the accessible route, does this it meet the following requirements for an accessible ramp?

F-12-a. Is the slope no greater than 1:12?

F-12-b. Are handrails installed on both sides of each ramp segment?

Yes No

F-12-c. Is the ramp width, measured between handrails, at least 36 inches?

Yes No

F-12-d. Are the handrails mounted 34 to 38 inches above the ramp surface?
Yes No

F-12-e. If a ramp is longer than 30 feet, is a level landing at least 60 inches square provided every 30 feet?
Yes No

F-12-f. Does the ramp have a level landing that is at least 60 inches long at the top and bottom of each ramp section or where the ramp changes direction?
Yes No

F-12-g. If the ramp or landing has a vertical drop-off on either side of the ramp, is edge protection provided?
Yes No

F-13. Is an elevator provided to the level of which the entrance of the refuge area is located?
Yes No
If no, go to question F-14.

F-13-a. Are the centerlines of the call buttons mounted 42 inches above the floor?
Yes No

F-13-b. Does the floor area of the elevator car have space to enter for a wheel chair user, reach the controls, and exit? See Figure AT1.
Yes No

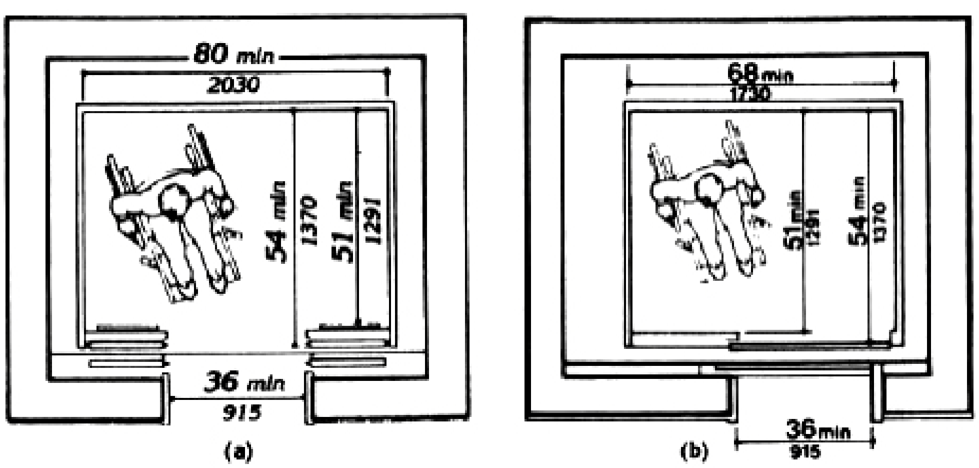


Figure AT1: Minimum dimensions of elevator cars.

F-13-c. Can the elevator be called and operated automatically without using a special key or having to turn on the elevator from a remote location?
Yes **No**
The elevator cannot be lowered to the basement level without the use of a key; however, it can be called from the basement level without a key.

F-13-d. Are the highest floor control buttons mounted no more than 54 inches above the floor for a side reach or 48 inches for a forward reach?
Yes No

F-13-e. Are raised letters and Braille characters used to identify each floor button and each control?
Yes **No**

F-11-f. Are signs mounted on both sides of the elevator hoist way door opening (for each elevator and at each floor) that designates the floor with 2 inch minimum-height raised letters and Braille characters centered at 60 inches above the floor?
Yes No

F-13-g. Is the elevator equipped with audible tones, bells or verbal annunciators that announce each floor as it is passed?
Yes No

F-14. Is a wheel chair lift provided?
Yes **No**
If no, please go to question F-15

F-14-a. Is the lift operational at the time of the survey?
Yes No

F-14-b. Is the change in level for the floor to the lift surface ramped or beveled?
Yes No

F-14-c. Is there at least a 30 inch by 48 inch clear floor space on the wheelchair lift?
Yes No

F-14-d. Does the lift allow a person using a mobility device unassisted entry, operation and exit?
Yes No

F-14-e. Is key available, if required?
Yes No

F-14-f. Are the controls and operating mechanisms mounted no more than 54 inches above the floor for a side reach or 48 inches above the floor for a forward reach?
Yes No

F-14-g. Are the controls and operating mechanisms usable with one hand without tight grasping, pinching, or twisting?
Yes No

F-15. At each location on the way to each shelter area where the accessible route passes through a door, does at least one door meet the following requirements?
Yes **No**
If no, see question(s): F-15-b and F-15-d

F-15-a. Is the clear width for the door opening at least 32 inches measured when the door is open 90 degrees? (This distance is measured between the face of the door and the edge of the opening.)
Yes No

F-15-b. Is the door hardware (e.g., lever, pull, push, panic bar) usable with one hand, without tight grasping, pinching, or twisting of the wrist to fully operate the hardware?
Yes **No**

F-15-c. Is there clear maneuvering floor space in front of each accessible door and, on the pull side, is there at least 18 inches clear floor space next to the latch side of the door?
Yes No

F-15-d. Is no more than 5 pounds force needed to push or pull open the door?
Yes **No**

Note: fire doors are still considered to be accessible if they have the minimum opening force allowable by the appropriate administrative authority?

F-15-e. If the answers to questions F-15-b – F-15-d are No, can the door be propped open?
Yes **No**
Door cannot be propped open because they are the doors to the shelter. They help protect the occupants from the storm.

Typical Issues for People Who are Blind or Have Low Vision

F-16. Are pedestrian routes leading to the entrance of the refuge area free of objects that protrude from the side more then 4 inches into the route with the bottom of the object more than 27 inches above the floor?

Yes No

Note: These objects may be wall mounted or free standing. Items to check include wall-mounted fire extinguishers, light fixtures, coat hooks, shelves, drinking fountains, and display cases.

F-17. Are pedestrian routes leading to the entrance of the refuge area free of overhead objects with the bottom edge lower than 80 inches above the floor?

Yes **No – TV near south shelter entrance**

F-18. Are any interior stairs along these routes configured with a cane-detectable warning or a barrier that prevents travel into the area with less than 80 inch high head clearance so that people who are blind or who have low vision cannot hit their heads on the underside of stair frame?

Yes No

Restrooms

G-1. Are the restrooms located in the refuge area?

Yes **No**

G-1-a. If yes, please list the type and location:

____

____

____

If no, please go to question H-1.

G-2. Are bathrooms accessible within the refuge area?

Female: Yes No

Male: Yes No

If no, see question(s):____

G-3. Is there a route without steps from the refuge area entrance to this location?

Yes No

If no, are there two or fewer steps? Yes____No____Number of Steps:______

If no, is there a ramp, lift, or elevator? Yes____No____Type of device:______________

G-4. If an elevator or lift provides the only accessible route, is there a source of backup power to operate the device for an extended period of time?

Yes No

G-5. If a sign is provided at the toilet room entrance (e.g. Men, Women, Boys, Girls, etc.), is a sign with raised characters and Braille mounted on the wall adjacent to the door latch?

Female: Yes No
Male: Yes No

Note: an additional sign may be mounted on the toilet room door, but this cannot be considered to be the accessible sign which must be mounted on the wall adjacent to the latch side of the door.

G-6. Does the door to the toilet room provide at least 32 inches clear passage width when the door is open 90 degrees? (This distance is measured between the face of the door and the edge of the opening.)

Female: Yes No
Male: Yes No

G-7. Is the hardware (e.g., lever, pull, push, panic bar) usable with one hand without tight grasping, pinching, or twisting of the wrist?

Female: Yes No
Male: Yes No

If no, can the door be propped open without compromising privacy, or can the hardware be modified by adding new accessible hardware or adapting or replacing hardware?

G-8. On the pull side of the door, is there at least 18 inches clearance provided located on the floor next to the latch side of the door if it is not automatic or power-operated?

Female: Yes No
Male: Yes No

G-9. If there is a raised threshold, is it no higher than ¾ inch at the door and beveled on both sides?

Female: Yes No
Male: Yes No

G-10. If the entry has a vestibule, is there a 30 inch by 48 inch clear floor space inside the vestibule where a wheelchair or scooter user can be outside the door swing?

Female: Yes No
Male: Yes No

G-11. Inside the toilet room, is there an area where a person who uses a wheelchair or other mobility device can turn around? It should be either at least 60 inch diameter circle or a "T"-shaped turn are as shown in the figures below. See figure AT2.

Female: Yes No
Male: Yes No

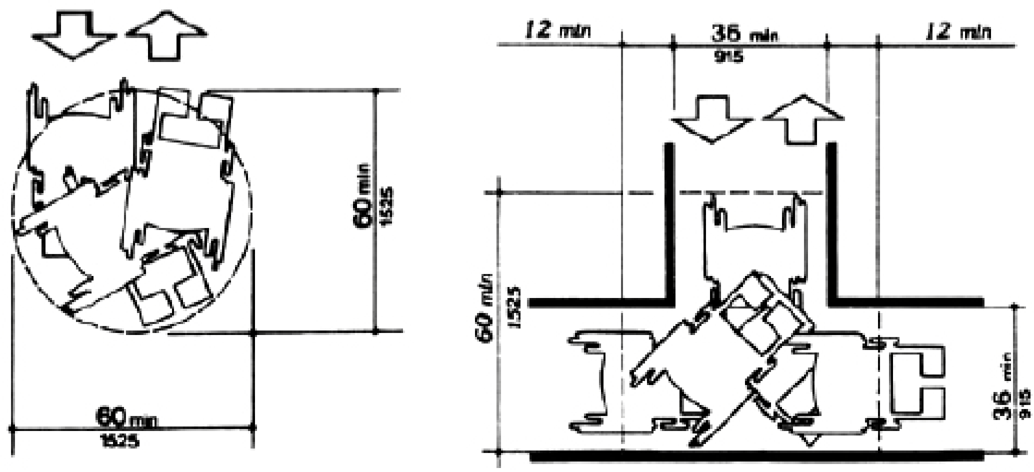


Figure AT2: Minimum spaces for turning.

G-12. If lavatories are provided, does at least one have at least a 29 inch high clearance under the front apron of the lavatory with the top of the rim lavatory no more than 34 inches above the floor?

Female: Yes No
Male: Yes No

G-13. Are the drain and hot water pipes for the lavatory insulated or otherwise configured to protect against contact?

Female: Yes No
Male: Yes No

G-14. Does this lavatory have controls that operate easily with one hand, without tight grasping, pinching, or twisting of the wrist?

Female: Yes No
Male: Yes No

G-15. If mirrors are provided, is the bottom of the reflecting surface for the mirror at this lavatory no higher than 40 inches above the floor or is a full length mirror provided?

Female: Yes No
Male: Yes No

Specify type of mirror:____

G-16. For at least one of each type of dispenser, receptacle, or item of equipment, is there clear floor space at least 30 inches wide by 48 inches long adjacent to the control or dispenser (positioned either parallel to the control or dispenser or in front of it)?

Female: Yes No
Male: Yes No

G-17. Is the operating control (switch, lever, button, or pull) of at least one of each type of dispenser or built-in equipment no higher than 54 inches above the floor for a side reach or 48 inches above the floor for a forward reach?

Female: Yes No
Male: Yes No

G-18. Are all built-in dispensers, receptacles, or equipment mounted so the front does not extend more than 4 inches from the wall if the bottom edge is between 27 inches and 80 inches above the floor?

Female: Yes No
Male: Yes No

Toilet Stalls

G-19. Is at least one accessible toilet stall provided with an outward swinging door, side and rear grab bars, and clear space next to the toilet?

Female: Yes No
Male: Yes No

If no, check to see if another toilet room provides an accessible toilet stall, note its location for shelter planners, and answer all toilet room questions with respect to that toilet room.

G-20. Is the toilet stall at least 60 inches wide and 56 inches deep (wall mounted toilet) or 59 inches deep (floor mounted toilet).

Female: Yes No
Male: Yes No

G-21. Is at least 9 inches of toe clearance provided under the front wall, opposite from the wall with toilet, and at least one side wall of the toilet stall?

Female: Yes No
Male: Yes No

G-22. Is the centerline of the toilet 18 inches from the adjacent side wall?

Female: Yes No
Male: Yes No

G-23. Is the top of the toilet seat 17-inches to 19 inches above the floor?

Female: Yes No
Male: Yes No

G-24. Is the flush valve located on the wide side adjacent to the lavatory or is an automatic flush valve provided?

Female: Yes No
Male: Yes No

G-25. Is a horizontal grab bar at least 40 inches long securely mounted on the adjacent side wall to the toilet 33 to 36 inches above the floor with one end no more than 12 inches from the back wall?

Female: Yes No
Male: Yes No

G-26. Is a second horizontal grab bar at least 36 inches long securely mounted on the back wall with one end no more than 6 inches from the side wall and 33 to 36 inches above the floor?

Female: Yes No
Male: Yes No

G-27. Is the door to the toilet stall located diagonally opposite, not directly in front of, the toilet or on the opposite side wall from the wall with the long grab bar?

Female: Yes No
Male: Yes No

G-28. Unless the accessible stall is located at the end of a row of toilet stalls, does the door to the wider stall open out?

Female: Yes No
Male: Yes No

G-29. Is the clear width of the door at least 32 inches when the door is open 90 degrees? (This distance is measured between the face of the door and the edge of the opening.)

Female: Yes No
Male: Yes No

G-30. Are there 6 or more stalls in the restroom?

Female: Yes No
Male: Yes No
If no, go to question G-34.

G-31. Is one of those stalls (in addition to the accessible stall noted above) exactly 36 inches wide with an outward swinging stall door that provides at least 32 inches of clear width?

Female: Yes No
Male: Yes No

G-32. Does this 36 inch wide stall have horizontal grab bars on both of the side partitions that are at least 36 inches long and 33 to 36 inches above the floor?

Female: Yes No
Male: Yes No

G-33. Is the surface of the toilet seat in this 36 inch wide stall 17 to 19 inches above the floor?

Female: Yes No
Male: Yes No

G-34. If a coat hook is provided is it mounted no higher than 54 inches above the floor for a side approach or 48 inches above the floor for a front approach?

Female: Yes No
Male: Yes No

Drinking Fountains

H-1. Are there drinking fountains located within the refuge area?

Yes **No**
If no, please go to question I-1.

H-2. Are the drinking fountains in the refuge area ADA accessible?

Yes No
If no, please see question(s):
____

H-3. If the drinking fountain is a wall-mounted unit, is there clear floor space at least 30 inches wide (36 inches if it is in an alcove) by 48 inches long in front of the drinking fountain and at least 27 inches high under the fountain so that a person using a wheelchair can get close to the spout and controls?

Yes No

H-4. If the drinking fountain is a floor-mounted unit, is there clear floor space at least 30 inches long by 48 inches wide (60 inches if it is in an alcove) for a side approach to the drinking fountain so that a person using a wheelchair can get close to the spout and controls even though the fountain has not clear space under it?

Yes No

H-5. Is the top of the spout no higher than 36 inches above the floor and at the front of the fountain or water cooler?

Yes No

H-6. Does the water rise at least 4 inches high when no more than 5 pounds of force is applied to the controls of the fountain?

Yes No

H-7. Are the controls on or near the front of the unit and do they operate with one hand without tight grasping, pinching, or twisting of the wrist?

Yes No

H-8. Is the bottom of the apron of the fountain 27 inches above the floor so that it provides the space needed for a person who uses a wheelchair to pull up under it but is not a hazard to people who are blind or have low vision and use a caned to detect the hazard?

Yes No

Availability of Electrical Power

I-1. Is there a backup source of electrical power for the facility?

Yes No

I-1-a. If yes, what is the power source?

Battery powered ____

Other power (indicate fuel type) Diesel

I-1-b. If yes, is there an automatic transfer switch?

Yes No

1-2. What is the duration of lighting under the back-up power source?

0-2 hours

3-6 hours

7 or more hours

I-3. Is the back-up power supply located within the refuge area?

Yes No

If no, is it in a place where it will be protected during an extreme-wind event (for example, in an interior room, or below grade)?

Yes No Not Applicable

Assessment Tool Questionnaire
Building Information
Contact Information
A-1. Building Name: Communication

A-2. Street Address: NA

A-3. City, State, Zip: Edmond, OK 73034

A-4. Designated refuge area as per UCO: Basement

A-5. Typical hours the building is occupied: 7:30am – 9:00pm

A-6. What hours might the building locked at any time? 12:00am – 7:00am

A-7. Number of stories: 3 including basement

A-8. General description of surrounding area:
From the west clockwise to the southeast sides have buildings; on the south side of the building is a pond and the Nigh University Center; satellite dishes are on the southwest and southeast sides; and trees and light poles surround the building

A-9. Is there a refuge area or safe room already indentified within the building? Yes

A-9-a. If so, where is the location of the storm shelter?
The basement level excluding the mechanical room and adjoining corridor

A-10. What is the exterior building/structure type?

Concrete	RM	**Steel**	PRM	URM
Wood	Unknown			

A-11. When was the building constructed? 1956 with additions in 1981 and 1996

Storm Shelter Information
A-12. Area of refuge area: Length:______ Width:______ Area:1115.04*

A-13. What is the usable square footage for this area? 796.75*

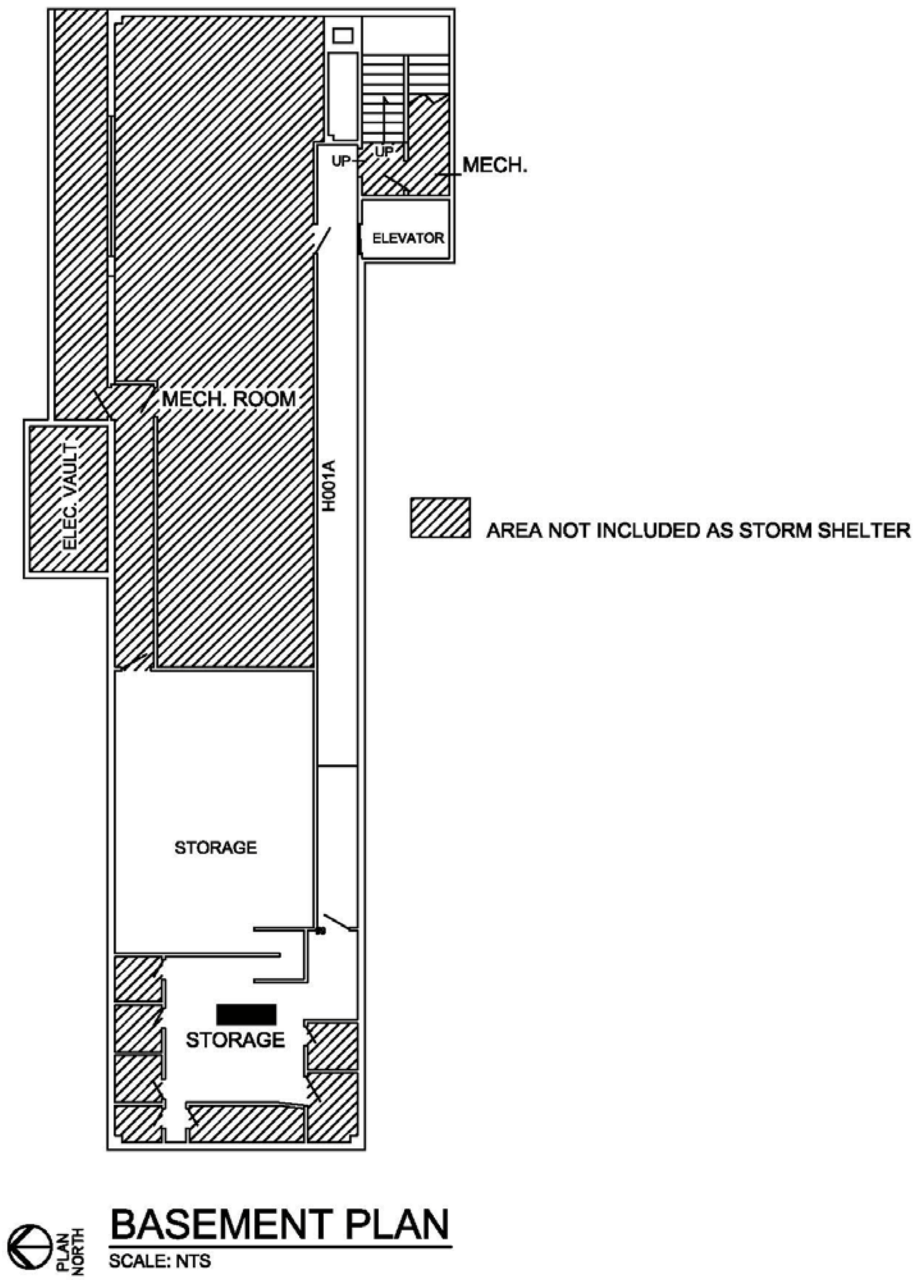
A-14. How many people can the refuge area hold as stated by UCO? 491

A-15. Does the square footage of the refuge area allow for each occupant to have at least 5 square feet minimum or 10 square feet minimum for people in a wheelchair?

Yes **No**

*The calculations of this storm shelter may be skewed due to the process of measuring. The gross square footage in this space may differ from the actual gross square footage of the building. The researcher was not able to measure a room of the shelter due to the amount of furniture stored in the space. The square footage of this room was determined by calculating the area of the space from a provided floor plan and subtracting the open floor space unused by the storing of furniture to determine the usable square footage of the room.

Area of Refuge Information
Provide a sketch of Area of Refuge



Structural Information

Cladding and Glazing Information

B-1. Are the doors to the refuge area secured at top and bottom with connections to resist suction effects that may pull the door open (3-point latches)?

Yes **No**

B-2. Is the storm shelter free from glass of any kind?

Yes **No**

If no, please specify placement and type.

System furniture panels stored on south wall of east room

Envelope Protection

B-3. Will the structure adjacent to the refuge area or surrounding it pose a threat if subject to collapse? (Structural components become debris that creates impact loads on the refuge area.)

Yes No

B-3-a. If yes, please specify:

Structures from the southwest clockwise to the north could pose a threat

B-4. Is the potential refuge area susceptible to damage from collapsing heavy structures nearby or other objects (e.g., concrete towers, telephone or power poles, antenna towers, chimneys, trees, etc)?

Yes No

B-5. Are there large, roll-down or garage type doors (metal, wood, plastic) on the exterior of the refuge area?

Yes **No**

B-6. Does the refuge area have unnecessary furniture and other items stored in it?

Yes No

B-6-a. If yes, can these items be easily moved to create additional usable space?

Yes **No**

Shelter Design

C-1. Does the location of the refuge area require occupants to go outdoors to get to it?

Yes **No – If inside the building**

C-1-a. If yes, please specify building housing the primary refuge area:

____

____

____

C-1-b. If no, is the refuge area located in an area of the building that the occupants can reach quickly, easily, and without having to go outside during the storm?
Yes No

C-2. Is the refuge area on the lowest level of the building?
Yes No
C-2-a. If no, please specify the level of the refuge area within is located?
____
____
____

C-3. Is the refuge area in the center of the level on which it is located?
Yes No
C-3-a. If no, please specify the location of the refuge area within the level? Although the shelter is centrally located, it does not take up the entire basement with the exclusion of the mechanical room on the west end.

C-4. Is the refuge area partially or fully underground?
Partially **Fully**

C-5. Is the refuge area partially or fully above ground?
Partially Fully

C-6. If the refuge area is fully or partially above ground, is it located away from the following:
C-6-a. Corners of the building housing the refuge area?
Yes No

C-6-b. Exterior walls of the building housing the refuge area?
Yes No

C-7. Does the refuge area have doors the open to the exterior of the building?
Yes No

C-8. If the refuge area is located in a corridor, how many doors lining the storm shelter walls open into other spaces? Main section of shelter is not in the corridor; however, the portion that is in the corridor has four doors lining the walls.

C-9. If the refuge area is located in a corridor, what is the orientation of the corridor?
North/South Northeast/Southwest
East/West Northwest/Southeast

C-10. Does the refuge area have emergency lighting?

Yes No

C-10-a. If yes, does the emergency lighting have back-up power?

Yes No

Signage

D-1. Does the building that houses the refuge area have interior and/or exterior signage directing people to the shelter?

Yes **No - signage at the entrance of the shelter**

D-1-a. If yes, which type of signage is included?

Exterior____ Interior____

D-1-b. If yes, does the signage include raised and/Braille letters?

Yes No

Sidewalk Access

E-1. Is there a route without steps from the sidewalk to the main entrance of the building housing the refuge area?

Yes No

If no, are there two or fewer steps? Yes____No____Number of Steps:______

If no, is there another entrance without steps?
Yes____No____Location:_____________

Individuals Who Are Blind or Have Low Vision

E-2. Are all sidewalks and walkways to the shelter free of any objects (e.g., wall-mounted boxes, signs, handrail extensions) with bottom edges that are between 27 inches and 80 inches above the walkway and that extend more than 4 inches into the sidewalk or walkway?

Yes No

E-3. Are the undersides of exterior stairs enclosed or protected with a cane-detectable barrier so that people who are blind or have low vision will not hit their heads on the underside?

Yes No

E-3-a. If no, can a barrier or enclosure be added below the stair or can the route be relocated away from the stair?

Yes No

E-4. Are all objects that hang over the pedestrian routes at least 80 inches above the route?

Yes **No**

E-4-a. If no, can the objects be removed or relocated, or can a cane-detectable object be added below that is at no higher than 27 inches?

Yes No

Accessible Entrance

F-1. Is there at least one accessible entrance connected to the exterior accessible route?

Yes No

F-2. Is the accessible entrance kept unlocked?

Yes **No – see question A-6**

F-3. Does at least one door or one side of a double leaf-door offer at least 32 inches clear passage width when the door is open 90 degrees? (This distance is measured between the face of the door and the edge of the opening.)

Yes No

If no, does another entrance have an accessible door or can both doors be propped open during the evacuation?

F-4. Does the accessible entrance doors swing in the direction of egress, or do they swing into the space?

Direction of Egress Swing into the space

F-5. Is the door hardware (e.g., lever, pull, push, and panic bar) usable with one hand without tight grasping, pinching, or twisting of the wrist?

Yes **No**
Push side Pull side

F-6. On the pull side of the door, is there at least 18 inches of clearance provided next to the latch side of the door if the door is not automatic or power-operated?

Yes No

F-7. If there is a raised threshold, is it no higher than ¾ at the door and beveled on both sides?

Yes No

F-8. If an entry has a vestibule, is there a 30 inch by 48 inch clear floor space inside the vestibule where a wheelchair or scooter user can be outside the swing of a hinged door?

Yes No

Corridors

F-9. Is there an accessible route, at least 36 inches wide that connects the accessible entrance to the entrance of the shelter (it may narrow to 32 inches wide for up to 2 feet in length)?

Yes No

F-10. Is the accessible route from the accessible entrance free of steps and abrupt level changes over ½ inch to the entrance of the shelter?

Yes **No**

F-11. Does the accessible route from the accessible entrance to lead to the entrance of the refuge area change levels using a ramp, lift, or elevator?

Yes No

If no, go to question F-15.

F-11-a. If yes, is a ramp or sloped hallway provided?

Yes **No**

If yes, go to question F-12.

F-11-b. Is an elevator or lift provided?

Yes No

If yes, and the elevator or lift is part of the accessible route to a entrance of the refuge area, is back-up electrical power available to operate the elevator or lift for the duration of shelter operation should be the normal electrical service disrupted?

If yes and an elevator is provided, see question F-13

If yes and an lift is provided, see question F-14.

F-12. When a ramp is present in the accessible route, does this it meet the following requirements for an accessible ramp?

F-12-a. Is the slope no greater than 1:12?

F-12-b. Are handrails installed on both sides of each ramp segment?

Yes No

F-12-c. Is the ramp width, measured between handrails, at least 36 inches?

Yes No

F-12-d. Are the handrails mounted 34 to 38 inches above the ramp surface?

Yes No

F-12-e. If a ramp is longer than 30 feet, is a level landing at least 60 inches square provided every 30 feet?
Yes No

F-12-f. Does the ramp have a level landing that is at least 60 inches long at the top and bottom of each ramp section or where the ramp changes direction?
Yes No

F-12-g. If the ramp or landing has a vertical drop-off on either side of the ramp, is edge protection provided?
Yes No

F-13. Is an elevator provided to the level of which the entrance of the refuge area is located?
Yes No
If no, go to question F-14.

F-13-a. Are the centerlines of the call buttons mounted 42 inches above the floor?
Yes No

F-13-b. Does the floor area of the elevator car have space to enter for a wheel chair user, reach the controls, and exit? See Figure AT1.
Yes **No – Cart width is not the minimum 68 inches required**

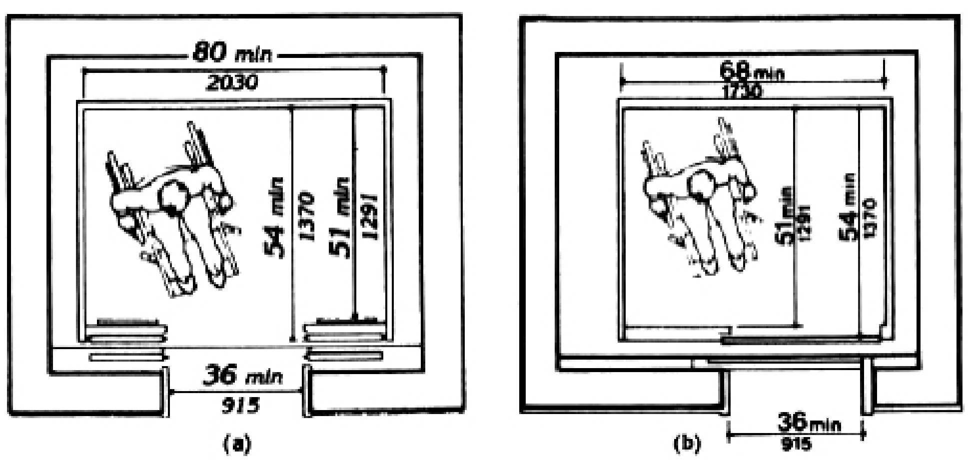


Figure AT1: Minimum dimensions of elevator cars.

F-13-c. Can the elevator be called and operated automatically without using a special key or having to turn on the elevator from a remote location?
Yes No

F-13-d. Are the highest floor control buttons mounted no more than 54 inches above the floor for a side reach or 48 inches for a forward reach?
Yes No

F-13-e. Are raised letters and Braille characters used to identify each floor button and each control?
Yes No

F-11-f. Are signs mounted on both sides of the elevator hoist way door opening (for each elevator and at each floor) that designates the floor with 2 inch minimum-height raised letters and Braille characters centered at 60 inches above the floor?
Yes No

F-13-g. Is the elevator equipped with audible tones, bells or verbal annunciators that announce each floor as it is passed?
Yes No

F-14. Is a wheel chair lift provided?
Yes **No**
If no, please go to question F-15

F-14-a. Is the lift operational at the time of the survey?
Yes No

F-14-b. Is the change in level for the floor to the lift surface ramped or beveled?
Yes No

F-14-c. Is there at least a 30 inch by 48 inch clear floor space on the wheelchair lift?
Yes No

F-14-d. Does the lift allow a person using a mobility device unassisted entry, operation and exit?
Yes No

F-14-e. Is key available, if required?
Yes No

F-14-f. Are the controls and operating mechanisms mounted no more than 54 inches above the floor for a side reach or 48 inches above the floor for a forward reach?
Yes No

F-14-g. Are the controls and operating mechanisms usable with one hand without tight grasping, pinching, or twisting?
Yes No

F-15. At each location on the way to each shelter area where the accessible route passes through a door, does at least one door meet the following requirements?
Yes **No**
If no, see question(s): F-15-a, F-15-b, F-15-c, F-15-d

F-15-a. Is the clear width for the door opening at least 32 inches measured when the door is open 90 degrees? (This distance is measured between the face of the door and the edge of the opening.)
Yes **No**

F-15-b. Is the door hardware (e.g., lever, pull, push, panic bar) usable with one hand, without tight grasping, pinching, or twisting of the wrist to fully operate the hardware?
Yes **No**

F-15-c. Is there clear maneuvering floor space in front of each accessible door and, on the pull side, is there at least 18 inches clear floor space next to the latch side of the door?
Yes **No**

F-15-d. Is no more than 5 pounds force needed to push or pull open the door?
Yes **No**

Note: fire doors are still considered to be accessible if they have the minimum opening force allowable by the appropriate administrative authority?

F-15-e. If the answers to questions F-15-b – F-15-d are No, can the door be propped open?
Yes No

Typical Issues for People Who are Blind or Have Low Vision

F-16. Are pedestrian routes leading to the entrance of the refuge area free of objects that protrude from the side more then 4 inches into the route with the bottom of the object more than 27 inches above the floor?
Yes No

Note: These objects may be wall mounted or free standing. Items to check include wall-mounted fire extinguishers, light fixtures, coat hooks, shelves, drinking fountains, and display cases.

F-17. Are pedestrian routes leading to the entrance of the refuge area free of overhead objects with the bottom edge lower than 80 inches above the floor?

Yes **No**

F-18. Are any interior stairs along these routes configured with a cane-detectable warning or a barrier that prevents travel into the area with less than 80 inch high head clearance so that people who are blind or who have low vision cannot hit their heads on the underside of stair frame?

Yes **No**

Restrooms

G-1. Are the restrooms located in the refuge area?

Yes **No**

G-1-a. If yes, please list the type and location:

____

____

____

If no, please go to question H-1.

G-2. Are bathrooms accessible within the refuge area?

Female: Yes No

Male: Yes No

If no, see question(s):____

G-3. Is there a route without steps from the refuge area entrance to this location?

Yes No

If no, are there two or fewer steps? Yes____No____Number of Steps:______

If no, is there a ramp, lift, or elevator? Yes____No____Type of device:______________

G-4. If an elevator or lift provides the only accessible route, is there a source of backup power to operate the device for an extended period of time?

Yes No

G-5. If a sign is provided at the toilet room entrance (e.g. Men, Women, Boys, Girls, etc.), is a sign with raised characters and Braille mounted on the wall adjacent to the door latch?

Female: Yes No
Male: Yes No

Note: an additional sign may be mounted on the toilet room door, but this cannot be considered to be the accessible sign which must be mounted on the wall adjacent to the latch side of the door.

G-6. Does the door to the toilet room provide at least 32 inches clear passage width when the door is open 90 degrees? (This distance is measured between the face of the door and the edge of the opening.)

Female: Yes No
Male: Yes No

G-7. Is the hardware (e.g., lever, pull, push, panic bar) usable with one hand without tight grasping, pinching, or twisting of the wrist?

Female: Yes No
Male: Yes No

If no, can the door be propped open without compromising privacy, or can the hardware be modified by adding new accessible hardware or adapting or replacing hardware?

G-8. On the pull side of the door, is there at least 18 inches clearance provided located on the floor next to the latch side of the door if it is not automatic or power-operated?

Female: Yes No
Male: Yes No

G-9. If there is a raised threshold, is it no higher than ¾ inch at the door and beveled on both sides?

Female: Yes No
Male: Yes No

G-10. If the entry has a vestibule, is there a 30 inch by 48 inch clear floor space inside the vestibule where a wheelchair or scooter user can be outside the door swing?

Female: Yes No
Male: Yes No

G-11. Inside the toilet room, is there an area where a person who uses a wheelchair or other mobility device can turn around? It should be either at least 60 inch diameter circle or a "T"-shaped turn are as shown in the figures below. See figure AT2.

Female: Yes No
Male: Yes No

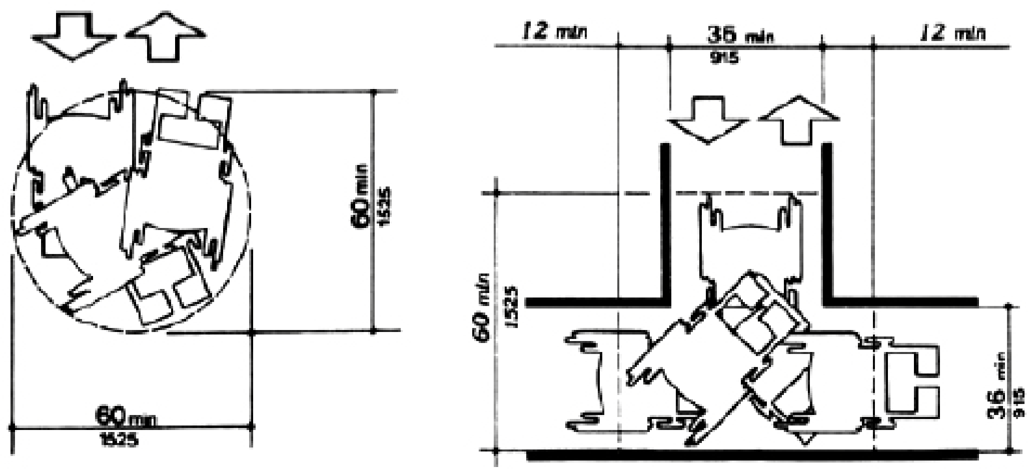


Figure AT2: Minimum spaces for turning.

G-12. If lavatories are provided, does at least one have at least a 29 inch high clearance under the front apron of the lavatory with the top of the rim lavatory no more than 34 inches above the floor?

Female: Yes No
Male: Yes No

G-13. Are the drain and hot water pipes for the lavatory insulated or otherwise configured to protect against contact?

Female: Yes No
Male: Yes No

G-14. Does this lavatory have controls that operate easily with one hand, without tight grasping, pinching, or twisting of the wrist?

Female: Yes No
Male: Yes No

G-15. If mirrors are provided, is the bottom of the reflecting surface for the mirror at this lavatory no higher than 40 inches above the floor or is a full length mirror provided?

Female: Yes No
Male: Yes No

Specify type of mirror:____

G-16. For at least one of each type of dispenser, receptacle, or item of equipment, is there clear floor space at least 30 inches wide by 48 inches long adjacent to the control or dispenser (positioned either parallel to the control or dispenser or in front of it)?

Female: Yes No
Male: Yes No

G-17. Is the operating control (switch, lever, button, or pull) of at least one of each type of dispenser or built-in equipment no higher than 54 inches above the floor for a side reach or 48 inches above the floor for a forward reach?

Female: Yes No
Male: Yes No

G-18. Are all built-in dispensers, receptacles, or equipment mounted so the front does not extend more than 4 inches from the wall if the bottom edge is between 27 inches and 80 inches above the floor?

Female: Yes No
Male: Yes No

Toilet Stalls

G-19. Is at least one accessible toilet stall provided with an outward swinging door, side and rear grab bars, and clear space next to the toilet?

Female: Yes No
Male: Yes No

If no, check to see if another toilet room provides an accessible toilet stall, note its location for shelter planners, and answer all toilet room questions with respect to that toilet room.

G-20. Is the toilet stall at least 60 inches wide and 56 inches deep (wall mounted toilet) or 59 inches deep (floor mounted toilet).

Female: Yes No
Male: Yes No

G-21. Is at least 9 inches of toe clearance provided under the front wall, opposite from the wall with toilet, and at least one side wall of the toilet stall?

Female: Yes No
Male: Yes No

G-22. Is the centerline of the toilet 18 inches from the adjacent side wall?

Female: Yes No
Male: Yes No

G-23. Is the top of the toilet seat 17-inches to 19 inches above the floor?

Female: Yes No
Male: Yes No

G-24. Is the flush valve located on the wide side adjacent to the lavatory or is an automatic flush valve provided?

Female: Yes No
Male: Yes No

G-25. Is a horizontal grab bar at least 40 inches long securely mounted on the adjacent side wall to the toilet 33 to 36 inches above the floor with one end no more than 12 inches from the back wall?

Female: Yes No
Male: Yes No

G-26. Is a second horizontal grab bar at least 36 inches long securely mounted on the back wall with one end no more than 6 inches from the side wall and 33 to 36 inches above the floor?

Female: Yes No
Male: Yes No

G-27. Is the door to the toilet stall located diagonally opposite, not directly in front of, the toilet or on the opposite side wall from the wall with the long grab bar?

Female: Yes No
Male: Yes No

G-28. Unless the accessible stall is located at the end of a row of toilet stalls, does the door to the wider stall open out?

Female: Yes No
Male: Yes No

G-29. Is the clear width of the door at least 32 inches when the door is open 90 degrees? (This distance is measured between the face of the door and the edge of the opening.)

Female: Yes No
Male: Yes No

G-30. Are there 6 or more stalls in the restroom?

Female: Yes No
Male: Yes No
If no, go to question G-34.

G-31. Is one of those stalls (in addition to the accessible stall noted above) exactly 36 inches wide with an outward swinging stall door that provides at least 32 inches of clear width?

Female: Yes No
Male: Yes No

G-32. Does this 36 inch wide stall have horizontal grab bars on both of the side partitions that are at least 36 inches long and 33 to 36 inches above the floor?

Female: Yes No
Male: Yes No

G-33. Is the surface of the toilet seat in this 36 inch wide stall 17 to 19 inches above the floor?

Female: Yes No
Male: Yes No

G-34. If a coat hook is provided is it mounted no higher than 54 inches above the floor for a side approach or 48 inches above the floor for a front approach?

Female: Yes No
Male: Yes No

Drinking Fountains

H-1. Are there drinking fountains located within the refuge area?

Yes **No**
If no, please go to question I-1.

H-2. Are the drinking fountains in the refuge area ADA accessible?

Yes No
If no, please see question(s):
____

H-3. If the drinking fountain is a wall-mounted unit, is there clear floor space at least 30 inches wide (36 inches if it is in an alcove) by 48 inches long in front of the drinking fountain and at least 27 inches high under the fountain so that a person using a wheelchair can get close to the spout and controls?

Yes No

H-4. If the drinking fountain is a floor-mounted unit, is there clear floor space at least 30 inches long by 48 inches wide (60 inches if it is in an alcove) for a side approach to the drinking fountain so that a person using a wheelchair can get close to the spout and controls even though the fountain has not clear space under it?

Yes No

H-5. Is the top of the spout no higher than 36 inches above the floor and at the front of the fountain or water cooler?

Yes No

H-6. Does the water rise at least 4 inches high when no more than 5 pounds of force is applied to the controls of the fountain?

Yes No

H-7. Are the controls on or near the front of the unit and do they operate with one hand without tight grasping, pinching, or twisting of the wrist?

Yes No

H-8. Is the bottom of the apron of the fountain 27 inches above the floor so that it provides the space needed for a person who uses a wheelchair to pull up under it but is not a hazard to people who are blind or have low vision and use a caned to detect the hazard?

Yes No

Availability of Electrical Power

I-1. Is there a backup source of electrical power for the facility?

Yes **No**

I-1-a. If yes, what is the power source?

____ Battery powered

____ Other power (indicate fuel type)

____

I-1-b. If yes, is there an automatic transfer switch?

Yes No

1-2. What is the duration of lighting under the back-up power source?

____ 0-2 hours

____ 3-6 hours

____ 7 or more hours

I-3. Is the back-up power supply located within the refuge area?

Yes No

If no, is it in a place where it will be protected during an extreme-wind event (for example, in an interior room, or below grade)?

Yes No Not Applicable

Assessment Tool Questionnaire

Building Information

Contact Information

A-1. Building Name: Art & Design

A-2. Street Address:

A-3. City, State, Zip: Edmond, OK 73034

A-4. Designated refuge area as per UCO: Basement

A-5. Typical hours the building is occupied: 8:00am-12:00am

A-6. What hours might the building locked at any time? 12:00am – 7:00am

A-7. Number of stories: 3 including basement

A-8. General description of surrounding area:
From the southwest the clock-wise to the southeast are buildings; open field to the south; and trees and lighting poles surround the building

A-9. Is there a refuge area or safe room already indentified within the building? Yes

A-9-a. If so, where is the location of the storm shelter?
Northwest side of the basement

A-10. What is the exterior building/structure type?

Concrete RM **Steel** PRM URM
Wood Unknown

A-11. When was the building constructed? 1952 with addition in 1980

Storm Shelter Information

A-12. Area of refuge area: Length:______ Width:______ Area: 1690.71

A-13. What is the usable square footage for this area? 1275.083

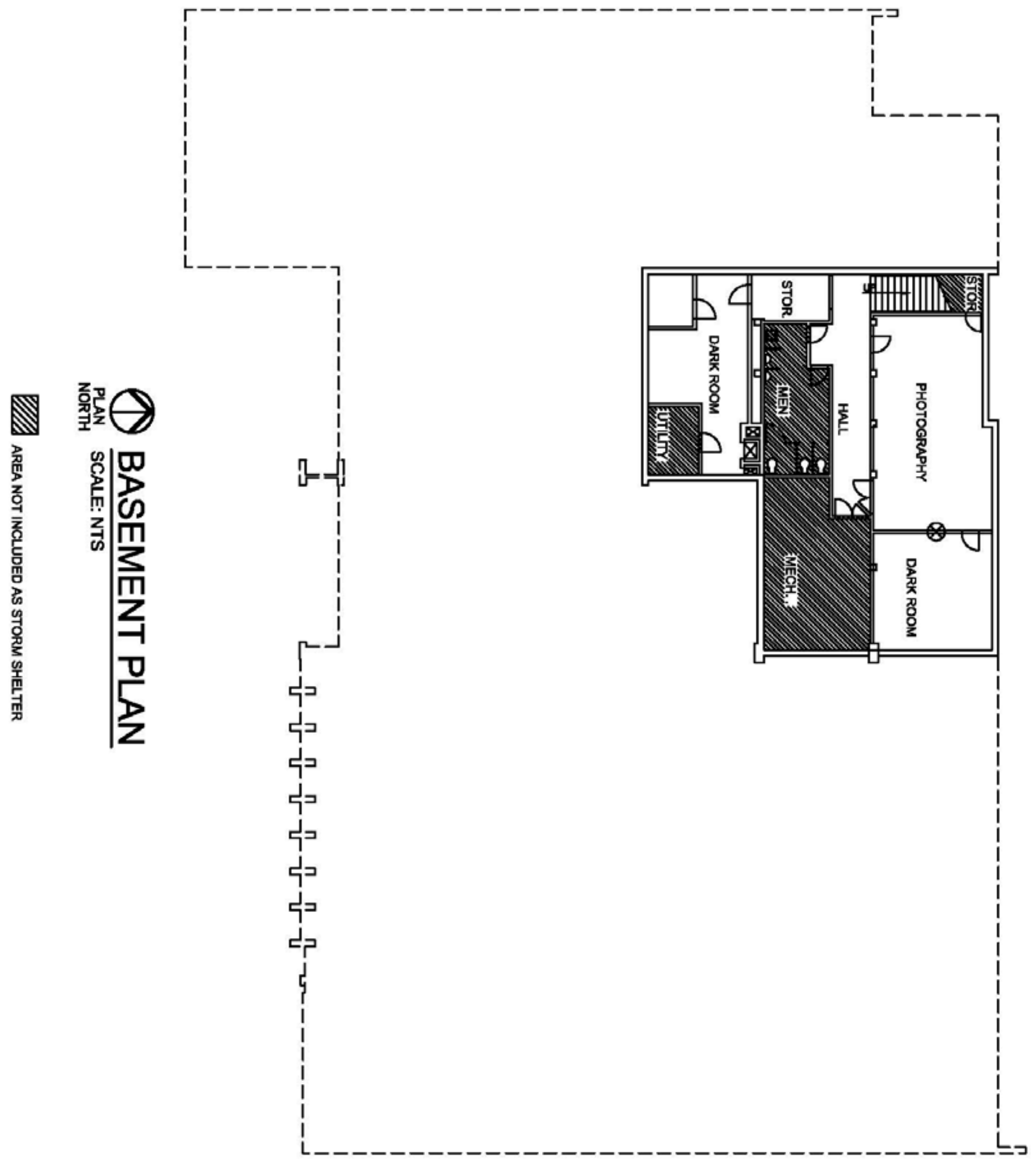
A-14. How many people can the refuge area hold as stated by UCO? 300

A-15. Does the square footage of the refuge area allow for each occupant to have at least 5 square feet minimum or 10 square feet minimum for people in a wheelchair?

Yes **No**

Area of Refuge Information

Provide a sketch of Area of Refuge



Structural Information

Cladding and Glazing Information

B-1. Are the doors to the refuge area secured at top and bottom with connections to resist suction effects that may pull the door open (3-point latches)?

Yes **No**

B-2. Is the storm shelter free from glass of any kind?

Yes **No**

If no, please specify placement and type.

At the top of the stairs leading to the shelter, there is floor to ceiling windows

Envelope Protection

B-3. Will the structure adjacent to the refuge area or surrounding it pose a threat if subject to collapse? (Structural components become debris that creates impact loads on the refuge area.)

Yes No

B-3-a. If yes, please specify:

The buildings to the southwest and west

B-4. Is the potential refuge area susceptible to damage from collapsing heavy structures nearby or other objects (e.g., concrete towers, telephone or power poles, antenna towers, chimneys, trees, etc)?

Yes No

B-5. Are there large, roll-down or garage type doors (metal, wood, plastic) on the exterior of the refuge area?

Yes **No**

B-6. Does the refuge area have unnecessary furniture and other items stored in it?

Yes No

B-6-a. If yes, can these items be easily moved to create additional usable space?

Yes **No**

Shelter Design

C-1. Does the location of the refuge area require occupants to go outdoors to get to it?

Yes **No – If inside the building**

C-1-a. If yes, please specify building housing the primary refuge area:

____

____

____

C-1-b. If no, is the refuge area located in an area of the building that the occupants can reach quickly, easily, and without having to go outside during the storm?
Yes No

C-2. Is the refuge area on the lowest level of the building?
Yes No
C-2-a. If no, please specify the level of the refuge area within is located?
____
____
____
____

C-3. Is the refuge area in the center of the level on which it is located?
Yes **No**
C-3-a. If no, please specify the location of the refuge area within the level?
The shelter is located in the northwest quarter

C-4. Is the refuge area partially or fully underground?
Partially **Fully**

C-5. Is the refuge area partially or fully above ground?
Partially Fully

C-6. If the refuge area is fully or partially above ground, is it located away from the following:
C-6-a. Corners of the building housing the refuge area?
Yes No

C-6-b. Exterior walls of the building housing the refuge area?
Yes No

C-7. Does the refuge area have doors the open to the exterior of the building?
Yes **No**

C-8. If the refuge area is located in a corridor, how many doors lining the storm shelter walls open into other spaces?____

C-9. If the refuge area is located in a corridor, what is the orientation of the corridor?
____ North/South ____ Northeast/Southwest
____ East/West ____ Northwest/Southeast

C-10. Does the refuge area have emergency lighting?

Yes No

C-10-a. If yes, does the emergency lighting have back-up power?

Yes No

Signage

D-1. Does the building that houses the refuge area have interior and/or exterior signage directing people to the shelter?

Yes **No – signage at the entrance of the shelter**

D-1-a. If yes, which type of signage is included?

Exterior____ Interior____

D-1-b. If yes, does the signage include raised and/Braille letters?

Yes No

Sidewalk Access

E-1. Is there a route without steps from the sidewalk to the main entrance of the building housing the refuge area?

Yes No

If no, are there two or fewer steps? Yes____No____Number of Steps:______

If no, is there another entrance without steps? Yes____No____Location:_____________

Individuals Who Are Blind or Have Low Vision

E-2. Are all sidewalks and walkways to the shelter free of any objects (e.g., wall-mounted boxes, signs, handrail extensions) with bottom edges that are between 27 inches and 80 inches above the walkway and that extend more than 4 inches into the sidewalk or walkway?

Yes No

E-3. Are the undersides of exterior stairs enclosed or protected with a cane-detectable barrier so that people who are blind or have low vision will not hit their heads on the underside?

Yes No

E-3-a. If no, can a barrier or enclosure be added below the stair or can the route be relocated away from the stair?

Yes No

E-4. Are all objects that hang over the pedestrian routes at least 80 inches above the route?

Yes No

E-4-a. If no, can the objects be removed or relocated, or can a cane-detectable object be added below that is at no higher than 27 inches?

Yes No

Accessible Entrance

F-1. Is there at least one accessible entrance connected to the exterior accessible route?

Yes No

F-2. Is the accessible entrance kept unlocked?

Yes **No – see question A-6**

F-3. Does at least one door or one side of a double leaf-door offer at least 32 inches clear passage width when the door is open 90 degrees? (This distance is measured between the face of the door and the edge of the opening.)

Yes No

If no, does another entrance have an accessible door or can both doors be propped open during the evacuation?

F-4. Does the accessible entrance doors swing in the direction of egress, or do they swing into the space?

Direction of Egress Swing into the space

F-5. Is the door hardware (e.g., lever, pull, push, and panic bar) usable with one hand without tight grasping, pinching, or twisting of the wrist?

Yes **No**
Push side Pull side

F-6. On the pull side of the door, is there at least 18 inches of clearance provided next to the latch side of the door if the door is not automatic or power-operated?

Yes No

F-7. If there is a raised threshold, is it no higher than ¾ at the door and beveled on both sides?

Yes No

F-8. If an entry has a vestibule, is there a 30 inch by 48 inch clear floor space inside the vestibule where a wheelchair or scooter user can be outside the swing of a hinged door?

Yes No

Corridors
F-9. Is there an accessible route, at least 36 inches wide that connects the accessible entrance to the entrance of the shelter (it may narrow to 32 inches wide for up to 2 feet in length)?
Yes No

F-10. Is the accessible route from the accessible entrance free of steps and abrupt level changes over ½ inch to the entrance of the shelter?
Yes **No**

F-11. Does the accessible route from the accessible entrance to lead to the entrance of the refuge area change levels using a ramp, lift, or elevator?
Yes No
If no, go to question F-15.

F-11-a. If yes, is a ramp or sloped hallway provided?
Yes No
If yes, go to question F-12.

F-11-b. Is an elevator or lift provided?
Yes No
If yes, and the elevator or lift is part of the accessible route to a entrance of the refuge area, is back-up electrical power available to operate the elevator or lift for the duration of shelter operation should be the normal electrical service disrupted?

If yes and an elevator is provided, see question F-13

If yes and an lift is provided, see question F-14.

F-12. When a ramp is present in the accessible route, does this it meet the following requirements for an accessible ramp?

F-12-a. Is the slope no greater than 1:12?
Yes No

F-12-b. Are handrails installed on both sides of each ramp segment?
Yes **No – 1 set on northwest side**

F-12-c. Is the ramp width, measured between handrails, at least 36 inches?
Yes No

F-12-d. Are the handrails mounted 34 to 38 inches above the ramp surface?
Yes No

F-12-e. If a ramp is longer than 30 feet, is a level landing at least 60 inches square provided every 30 feet?
<u>Yes</u> No

F-12-f. Does the ramp have a level landing that is at least 60 inches long at the top and bottom of each ramp section or where the ramp changes direction?
<u>Yes</u> No

F-12-g. If the ramp or landing has a vertical drop-off on either side of the ramp, is edge protection provided?
Yes No

F-13. Is an elevator provided to the level of which the entrance of the refuge area is located?
Yes **<u>No</u>**
If no, go to question F-14.

F-13-a. Are the centerlines of the call buttons mounted 42 inches above the floor?
Yes No

F-13-b. Does the floor area of the elevator car have space to enter for a wheel chair user, reach the controls, and exit? See Figure AT1.
Yes No

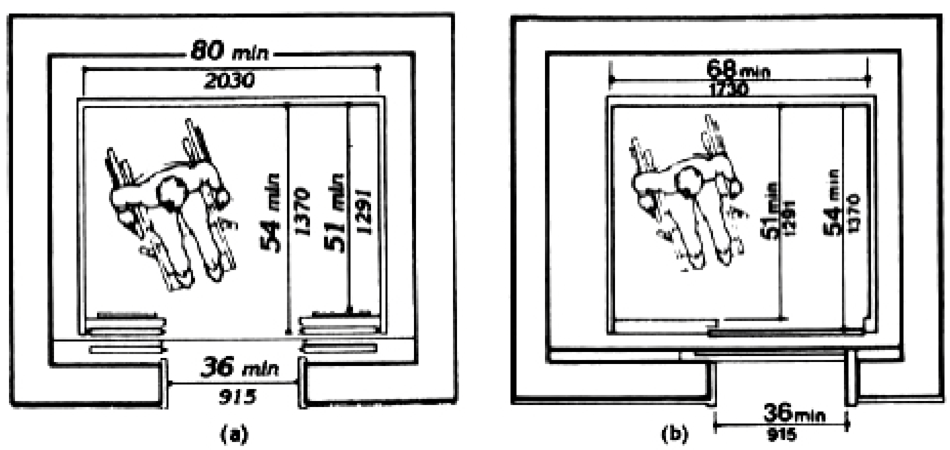


Figure AT1: Minimum dimensions of elevator cars.

F-13-c. Can the elevator be called and operated automatically without using a special key or having to turn on the elevator from a remote location?

Yes No

F-13-d. Are the highest floor control buttons mounted no more than 54 inches above the floor for a side reach or 48 inches for a forward reach?
Yes No

F-13-e. Are raised letters and Braille characters used to identify each floor button and each control?
Yes No

F-11-f. Are signs mounted on both sides of the elevator hoist way door opening (for each elevator and at each floor) that designates the floor with 2 inch minimum-height raised letters and Braille characters centered at 60 inches above the floor?
Yes No

F-13-g. Is the elevator equipped with audible tones, bells or verbal annunciators that announce each floor as it is passed?
Yes No

F-14. Is a wheel chair lift provided?
Yes No
If no, please go to question F-15

F-14-a. Is the lift operational at the time of the survey?
Yes No

F-14-b. Is the change in level for the floor to the lift surface ramped or beveled?
Yes No

F-14-c. Is there at least a 30 inch by 48 inch clear floor space on the wheelchair lift?
Yes No

F-14-d. Does the lift allow a person using a mobility device unassisted entry, operation and exit?
Yes No

F-14-e. Is key available, if required?
Yes No

F-14-f. Are the controls and operating mechanisms mounted no more than 54 inches above the floor for a side reach or 48 inches above the floor for a forward reach?
Yes No

F-14-g. Are the controls and operating mechanisms usable with one hand without tight grasping, pinching, or twisting?
Yes No

F-15. At each location on the way to each shelter area where the accessible route passes through a door, does at least one door meet the following requirements?
Yes **No**
If no, see question(s): F-15-b – F-15-d

F-15-a. Is the clear width for the door opening at least 32 inches measured when the door is open 90 degrees? (This distance is measured between the face of the door and the edge of the opening.)
Yes No

F-15-b. Is the door hardware (e.g., lever, pull, push, panic bar) usable with one hand, without tight grasping, pinching, or twisting of the wrist to fully operate the hardware?
Yes **No**

F-15-c. Is there clear maneuvering floor space in front of each accessible door and, on the pull side, is there at least 18 inches clear floor space next to the latch side of the door?
Yes **No**

F-15-d. Is no more than 5 pounds force needed to push or pull open the door?
Yes **No**

Note: fire doors are still considered to be accessible if they have the minimum opening force allowable by the appropriate administrative authority?

F-15-e. If the answers to questions F-15-b – F-15-d are No, can the door be propped open?
Yes No

Typical Issues for People Who are Blind or Have Low Vision
F-16. Are pedestrian routes leading to the entrance of the refuge area free of objects that protrude from the side more then 4 inches into the route with the bottom of the object more than 27 inches above the floor?
Yes **No – Moveable art display at the time of the assessment**

Note: These objects may be wall mounted or free standing. Items to check include wall-mounted fire extinguishers, light fixtures, coat hooks, shelves, drinking fountains, and display cases.

F-17. Are pedestrian routes leading to the entrance of the refuge area free of overhead objects with the bottom edge lower than 80 inches above the floor?

Yes **No**

F-18. Are any interior stairs along these routes configured with a cane-detectable warning or a barrier that prevents travel into the area with less than 80 inch high head clearance so that people who are blind or who have low vision cannot hit their heads on the underside of stair frame?

Yes **No**

Restrooms

G-1. Are the restrooms located in the refuge area?

Yes No

G-1-a. If yes, please list the type and location:
Men's rest room in the center of the storm shelter

If no, please go to question H-1.

G-2. Are bathrooms accessible within the refuge area?

Female: Yes No
Male: Yes **No**
If no, see question(s): G-3, G-5 – G-6, G-12, G-15, G-18, G-22, & G-34

G-3. Is there a route without steps from the entrance of the storm shelter to this location?

Yes No

If no, are there two or fewer steps? Yes____No____Number of Steps:______

If no, is there a ramp, lift, or elevator? Yes____No____Type of device:______________

G-4. If an elevator or lift provides the only accessible route, is there a source of backup power to operate the device for an extended period of time?

Yes No

G-5. If a sign is provided at the toilet room entrance (e.g. Men, Women, Boys, Girls, etc.), is a sign with raised characters and Braille mounted on the wall adjacent to the door latch?

Female: Yes No
Male: Yes **No**

Note: an additional sign may be mounted on the toilet room door, but this cannot be considered to be the accessible sign which must be mounted on the wall adjacent to the latch side of the door.

G-6. Does the door to the toilet room provide at least 32 inches clear passage width when the door is open 90 degrees? (This distance is measured between the face of the door and the edge of the opening.)

Female: Yes No
Male: Yes **No**

G-7. Is the hardware (e.g., lever, pull, push, panic bar) usable with one hand without tight grasping, pinching, or twisting of the wrist?

Female: Yes No
Male: **Yes** No

If no, can the door be propped open without compromising privacy, or can the hardware be modified by adding new accessible hardware or adapting or replacing hardware?

G-8. On the pull side of the door, is there at least 18 inches clearance provided located on the floor next to the latch side of the door if it is not automatic or power-operated?

Female: Yes No
Male: **Yes** No

G-9. If there is a raised threshold, is it no higher than ¾ inch at the door and beveled on both sides?

Female: Yes No
Male: Yes No

G-10. If the entry has a vestibule, is there a 30 inch by 48 inch clear floor space inside the vestibule where a wheelchair or scooter user can be outside the door swing?

Female: Yes No
Male: Yes No

G-11. Inside the toilet room, is there an area where a person who uses a wheelchair or other mobility device can turn around? It should be either at least 60 inch diameter circle or a “T”-shaped turn are as shown in the figures below. See figure AT2.

Female: Yes No
Male: **<u>Yes</u>** No

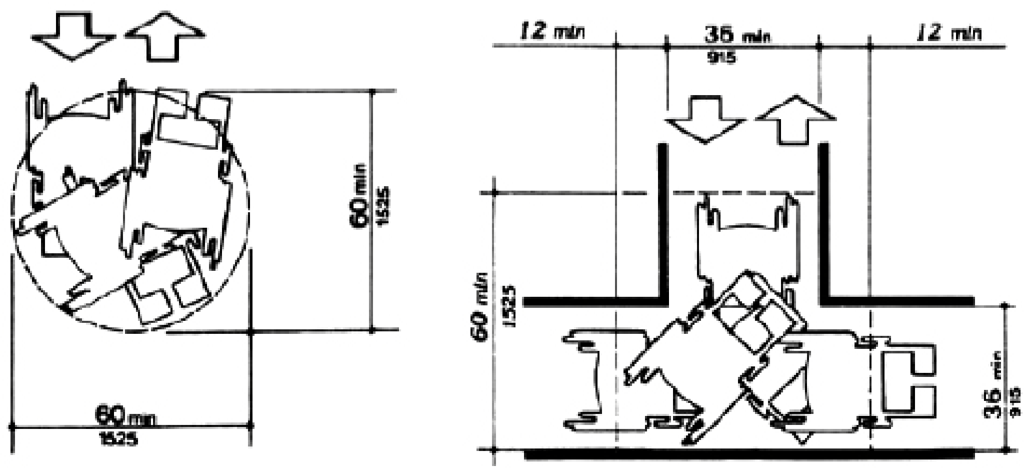


Figure AT2: Minimum spaces for turning.

G-12. If lavatories are provided, does at least one have at least a 29 inch high clearance under the front apron of the lavatory with the top of the rim lavatory no more than 34 inches above the floor?

Female: Yes No
Male: Yes **<u>No</u>**

G-13. Are the drain and hot water pipes for the lavatory insulated or otherwise configured to protect against contact?

Female: Yes No
Male: **<u>Yes</u>** No

G-14. Does this lavatory have controls that operate easily with one hand, without tight grasping, pinching, or twisting of the wrist?

Female: Yes No
Male: **<u>Yes</u>** No

G-15. If mirrors are provided, is the bottom of the reflecting surface for the mirror at this lavatory no higher than 40 inches above the floor or is a full length mirror provided?

Female: Yes No
Male: Yes **<u>No</u>**

Specify type of mirror: Wall-mount

G-16. For at least one of each type of dispenser, receptacle, or item of equipment, is there clear floor space at least 30 inches wide by 48 inches long adjacent to the control or dispenser (positioned either parallel to the control or dispenser or in front of it)?

Female: Yes No
Male: Yes **No**

G-17. Is the operating control (switch, lever, button, or pull) of at least one of each type of dispenser or built-in equipment no higher than 54 inches above the floor for a side reach or 48 inches above the floor for a forward reach?

Female: Yes No
Male: Yes **No**

G-18. Are all built-in dispensers, receptacles, or equipment mounted so the front does not extend more than 4 inches from the wall if the bottom edge is between 27 inches and 80 inches above the floor?

Female: Yes No
Male: Yes **No**

Toilet Stalls

G-19. Is at least one accessible toilet stall provided with an outward swinging door, side and rear grab bars, and clear space next to the toilet?

Female: Yes No
Male: **Yes** No

If no, check to see if another toilet room provides an accessible toilet stall, note its location for shelter planners, and answer all toilet room questions with respect to that toilet room.

G-20. Is the toilet stall at least 60 inches wide and 56 inches deep (wall mounted toilet) or 59 inches deep (floor mounted toilet).

Female: Yes No
Male: **Yes** No

G-21. Is at least 9 inches of toe clearance provided under the front wall, opposite from the wall with toilet, and at least one side wall of the toilet stall?

Female: Yes No
Male: **Yes** No

G-22. Is the centerline of the toilet 18 inches from the adjacent side wall?

Female: Yes No
Male: Yes **No**

G-23. Is the top of the toilet seat 17-inches to 19 inches above the floor?

Female: Yes No
Male: **Yes** No

G-24. Is the flush valve located on the wide side adjacent to the lavatory or is an automatic flush valve provided?

Female: Yes No
Male: **Yes** No

G-25. Is a horizontal grab bar at least 40 inches long securely mounted on the adjacent side wall to the toilet 33 to 36 inches above the floor with one end no more than 12 inches from the back wall?

Female: Yes No
Male: **Yes** No

G-26. Is a second horizontal grab bar at least 36 inches long securely mounted on the back wall with one end no more than 6 inches from the side wall and 33 to 36 inches above the floor?

Female: Yes No
Male: **Yes** No

G-27. Is the door to the toilet stall located diagonally opposite, not directly in front of, the toilet or on the opposite side wall from the wall with the long grab bar?

Female: Yes No
Male: **Yes** No

G-28. Unless the accessible stall is located at the end of a row of toilet stalls, does the door to the wider stall open out?

Female: Yes No
Male: **Yes** No

G-29. Is the clear width of the door at least 32 inches when the door is open 90 degrees? (This distance is measured between the face of the door and the edge of the opening.)

Female: Yes No
Male: **Yes** No

G-30. Are there 6 or more stalls in the restroom?

Female: Yes No
Male: Yes **No**
If no, go to question G-34.

G-31. Is one of those stalls (in addition to the accessible stall noted above) exactly 36 inches wide with an outward swinging stall door that provides at least 32 inches of clear width?

Female: Yes No
Male: Yes No

G-32. Does this 36 inch wide stall have horizontal grab bars on both of the side partitions that are at least 36 inches long and 33 to 36 inches above the floor?

Female: Yes No
Male: Yes No

G-33. Is the surface of the toilet seat in this 36 inch wide stall 17 to 19 inches above the floor?

Female: Yes No
Male: Yes No

G-34. If a coat hook is provided is it mounted no higher than 54 inches above the floor for a side approach or 48 inches above the floor for a front approach?

Female: Yes No
Male: Yes **Yes**

Drinking Fountains

H-1. Are there drinking fountains located within the refuge area?

Yes **No**
If no, please go to question I-1.

H-2. Are the drinking fountains in the refuge area ADA accessible?

Yes No
If no, please see question(s):
____

H-3. If the drinking fountain is a wall-mounted unit, is there clear floor space at least 30 inches wide (36 inches if it is in an alcove) by 48 inches long in front of the drinking fountain and at least 27 inches high under the fountain so that a person using a wheelchair can get close to the spout and controls?

Yes No

H-4. If the drinking fountain is a floor-mounted unit, is there clear floor space at least 30 inches long by 48 inches wide (60 inches if it is in an alcove) for a side approach to the drinking fountain so that a person using a wheelchair can get close to the spout and controls even though the fountain has not clear space under it?

Yes No

H-5. Is the top of the spout no higher than 36 inches above the floor and at the front of the fountain or water cooler?

Yes No

H-6. Does the water rise at least 4 inches high when no more than 5 pounds of force is applied to the controls of the fountain?

Yes No

H-7. Are the controls on or near the front of the unit and do they operate with one hand without tight grasping, pinching, or twisting of the wrist?

Yes No

H-8. Is the bottom of the apron of the fountain 27 inches above the floor so that it provides the space needed for a person who uses a wheelchair to pull up under it but is not a hazard to people who are blind or have low vision and use a caned to detect the hazard?

Yes No

Availability of Electrical Power

I-1. Is there a backup source of electrical power for the facility?

Yes **No**

I-1-a. If yes, what is the power source?

____ Battery powered

____ Other power (indicate fuel type)

____

I-1-b. If yes, is there an automatic transfer switch?

Yes No

1-2. What is the duration of lighting under the back-up power source?

____ 0-2 hours

____ 3-6 hours

____ 7 or more hours

I-3. Is the back-up power supply located within the refuge area?

Yes No

If no, is it in a place where it will be protected during an extreme-wind event (for example, in an interior room, or below grade)?

Yes No Not Applicable

Assessment Tool Questionnaire
Building Information
Contact Information
A-1. Building Name: Nigh University Center

A-2. Street Address: NA

A-3. City, State, Zip: Edmond, OK 73034

A-4. Designated refuge area as per UCO: North end of central corridor on the first floor

A-5. Typical hours the building is occupied: 8:00am – 12:00am

A-6. What hours might the building locked at any time? 12:00am – 7:00am

A-7. Number of stories: 4

A-8. General description of surrounding area:
From the southwest to the northwest are buildings; on the north side is a pond; from the northeast to the southeast are parking lots; and trees and light poles surround the building

A-9. Is there a refuge area or safe room already indentified within the building? Yes

A-9-a. If so, where is the location of the storm shelter?
North end of central corridor on the first floor

A-10. What is the exterior building/structure type?

<u>Concrete</u> RM Steel PRM URM
Wood Unknown

A-11. When was the building constructed? 1965 with addition 1997

Storm Shelter Information
A-12. Area of refuge area: Length:______ Width:______ Area: 1810.65

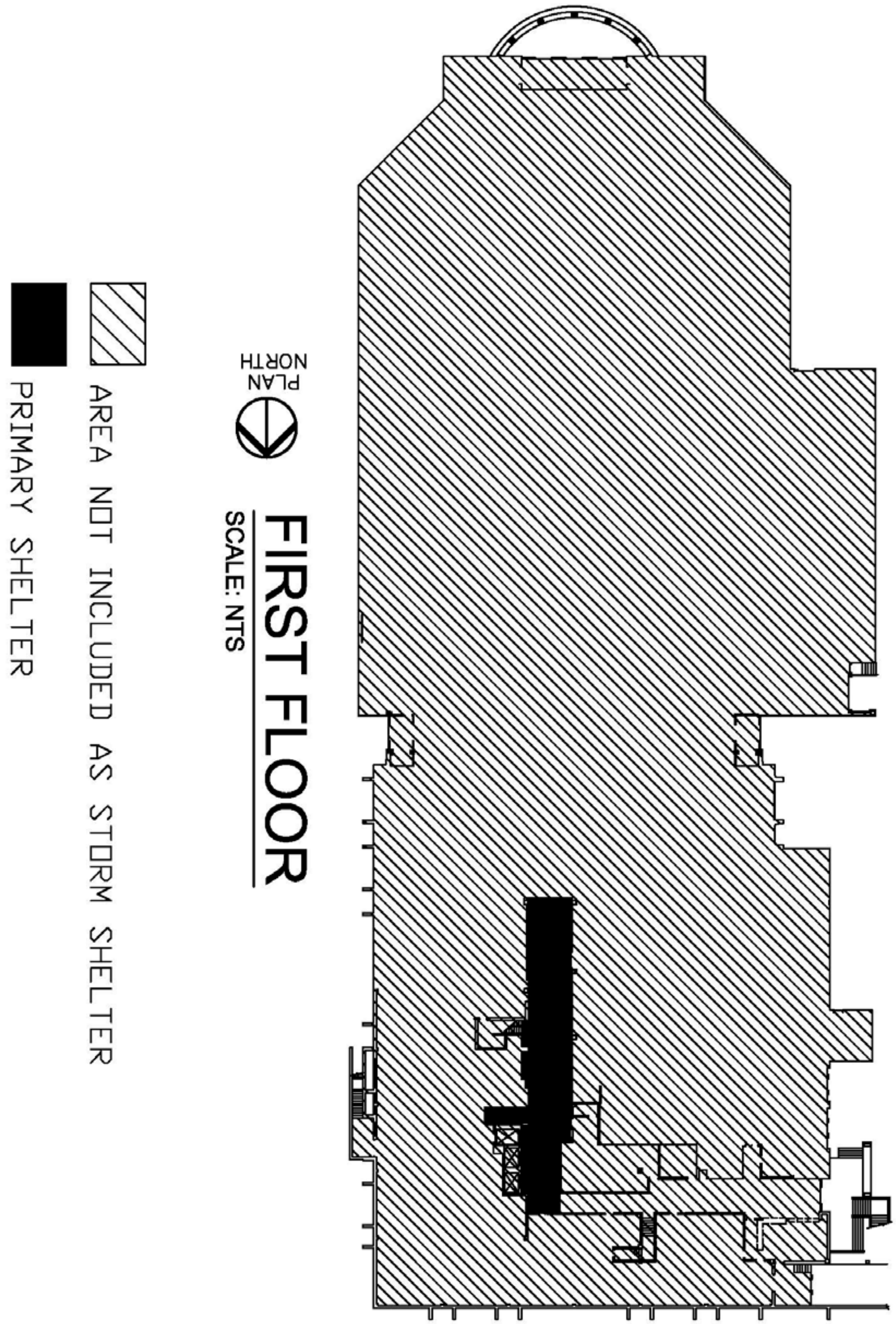
A-13. What is the usable square footage for this area? 1764.59

A-14. How many people can the refuge area hold as stated by UCO? NA

A-15. Does the square footage of the refuge area allow for each occupant to have at least 5 square feet minimum or 10 square feet minimum for people in a wheelchair?

Yes **<u>No</u>**

Area of Refuge Information
Provide a sketch of Area of Refuge



Structural Information

Cladding and Glazing Information

B-1. Are the doors to the refuge area secured at top and bottom with connections to resist suction effects that may pull the door open (3-point latches)?

Yes **No**

B-2. Is the storm shelter free from glass of any kind?

Yes **No**

If no, please specify placement and type.

Glazing can be found in interior doors and windows

Envelope Protection

B-3. Will the structure adjacent to the refuge area or surrounding it pose a threat if subject to collapse? (Structural components become debris that creates impact loads on the refuge area.)

Yes No

B-3-a. If yes, please specify:

The buildings on the southwest and west sides

B-4. Is the potential refuge area susceptible to damage from collapsing heavy structures nearby or other objects (e.g., concrete towers, telephone or power poles, antenna towers, chimneys, trees, etc)?

Yes No

B-5. Are there large, roll-down or garage type doors (metal, wood, plastic) on the exterior of the refuge area?

Yes **No**

B-6. Does the refuge area have unnecessary furniture and other items stored in it?

Yes No

B-6-a. If yes, can these items be easily moved to create additional usable space?

Yes No

Shelter Design

C-1. Does the location of the refuge area require occupants to go outdoors to get to it?

Yes **No – signage at the entrance of the shelter**

C-1-a. If yes, please specify building housing the primary refuge area:

____

____

____

C-1-b. If no, is the refuge area located in an area of the building that the occupants can reach quickly, easily, and without having to go outside during the storm?
<u>Yes</u> No

C-2. Is the refuge area on the lowest level of the building?
<u>Yes</u> No
C-2-a. If no, please specify the level of the refuge area within is located?
____
____
____
____

C-3. Is the refuge area in the center of the level on which it is located?
<u>Yes</u> No
C-3-a. If no, please specify the location of the refuge area within the level?
____
____
____
____

C-4. Is the refuge area partially or fully underground?
Partially Fully

C-5. Is the refuge area partially or fully above ground?
<u>Partially</u> Fully

C-6. If the refuge area is fully or partially above ground, is it located away from the following:
C-6-a. Corners of the building housing the refuge area?
<u>Yes</u> No

C-6-b. Exterior walls of the building housing the refuge area?
Yes **<u>No</u>**
Secondary corridor off the north end of the shelter leads the exterior

C-7. Does the refuge area have doors the open to the exterior of the building?
Yes **<u>No</u> – see note above**

C-8. If the refuge area is located in a corridor, how many doors lining the storm shelter walls open into other spaces? 6 plus 3 elevator doors

C-9. If the refuge area is located in a corridor, what is the orientation of the corridor?

North/South Northeast/Southwest
East/West Northwest/Southeast

C-10. Does the refuge area have emergency lighting?

Yes No

C-10-a. If yes, does the emergency lighting have back-up power?

Yes No

Signage

D-1. Does the building that houses the refuge area have interior and/or exterior signage directing people to the shelter?

Yes **No – The only signage is for the severe weather phone**

D-1-a. If yes, which type of signage is included?

Exterior____ Interior____

D-1-b. If yes, does the signage include raised and/Braille letters?

Yes No

Sidewalk Access

E-1. Is there a route without steps from the sidewalk to the main entrance of the building housing the refuge area?

Yes No

If no, are there two or fewer steps? Yes____No____Number of Steps:______

If no, is there another entrance without steps?
Yes____No____Location:_____________

Individuals Who Are Blind or Have Low Vision

E-2. Are all sidewalks and walkways to the shelter free of any objects (e.g., wall-mounted boxes, signs, handrail extensions) with bottom edges that are between 27 inches and 80 inches above the walkway and that extend more than 4 inches into the sidewalk or walkway?

Yes No

E-3. Are the undersides of exterior stairs enclosed or protected with a cane-detectable barrier so that people who are blind or have low vision will not hit their heads on the underside?

Yes **No**

E-3-a. If no, can a barrier or enclosure be added below the stair or can the route be relocated away from the stair?

Yes **No**

E-4. Are all objects that hang over the pedestrian routes at least 80 inches above the route?

Yes **No**

E-4-a. If no, can the objects be removed or relocated, or can a cane-detectable object be added below that is at no higher than 27 inches?

Yes No

Accessible Entrance

F-1. Is there at least one accessible entrance connected to the exterior accessible route?

Yes No

F-2. Is the accessible entrance kept unlocked?

Yes **No – see question A-6**

F-3. Does at least one door or one side of a double leaf-door offer at least 32 inches clear passage width when the door is open 90 degrees? (This distance is measured between the face of the door and the edge of the opening.)

Yes No

If no, does another entrance have an accessible door or can both doors be propped open during the evacuation?

F-4. Does the accessible entrance doors swing in the direction of egress, or do they swing into the space?

Direction of Egress Swing into the space

F-5. Is the door hardware (e.g., lever, pull, push, and panic bar) usable with one hand without tight grasping, pinching, or twisting of the wrist?

Yes **No**
Push side Pull side

F-6. On the pull side of the door, is there at least 18 inches of clearance provided next to the latch side of the door if the door is not automatic or power-operated?

Yes No

F-7. If there is a raised threshold, is it no higher than ¾ at the door and beveled on both sides?

Yes No

F-8. If an entry has a vestibule, is there a 30 inch by 48 inch clear floor space inside the vestibule where a wheelchair or scooter user can be outside the swing of a hinged door?

Yes No

Corridors

F-9. Is there an accessible route, at least 36 inches wide that connects the accessible entrance to the entrance of the shelter (it may narrow to 32 inches wide for up to 2 feet in length)?

Yes No

F-10. Is the accessible route from the accessible entrance free of steps and abrupt level changes over ½ inch to the entrance of the shelter?

Yes No

F-11. Does the accessible route from the accessible entrance to lead to the entrance of the refuge area change levels using a ramp, lift, or elevator?

Yes **No**

If no, go to question F-15.

F-11-a. If yes, is a ramp or sloped hallway provided?

Yes No

If yes, go to question F-12.

F-11-b. Is an elevator or lift provided?

Yes No

If yes, and the elevator or lift is part of the accessible route to a entrance of the refuge area, is back-up electrical power available to operate the elevator or lift for the duration of shelter operation should be the normal electrical service disrupted?

If yes and an elevator is provided, see question F-13

If yes and an lift is provided, see question F-14.

F-12. When a ramp is present in the accessible route, does this it meet the following requirements for an accessible ramp?

F-12-a. Is the slope no greater than 1:12?

F-12-b. Are handrails installed on both sides of each ramp segment?

Yes No

F-12-c. Is the ramp width, measured between handrails, at least 36 inches?

Yes No

F-12-d. Are the handrails mounted 34 to 38 inches above the ramp surface?

Yes No

F-12-e. If a ramp is longer than 30 feet, is a level landing at least 60 inches square provided every 30 feet?
Yes No

F-12-f. Does the ramp have a level landing that is at least 60 inches long at the top and bottom of each ramp section or where the ramp changes direction?
Yes No

F-12-g. If the ramp or landing has a vertical drop-off on either side of the ramp, is edge protection provided?
Yes No

F-13. Is an elevator provided to the level of which the entrance of the refuge area is located?
Yes No
If no, go to question F-14.

F-13-a. Are the centerlines of the call buttons mounted 42 inches above the floor?
Yes No

F-13-b. Does the floor area of the elevator car have space to enter for a wheel chair user, reach the controls, and exit? See Figure AT1.
Yes No

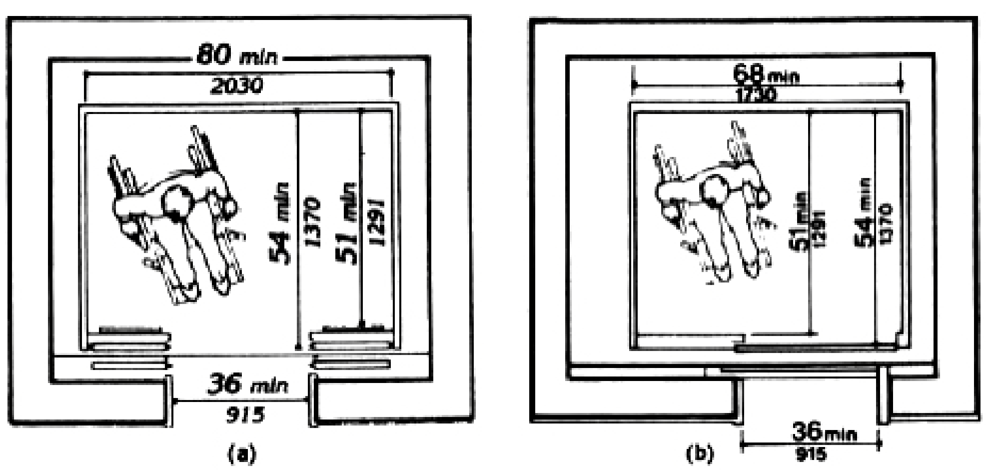


Figure AT1: Minimum dimensions of elevator cars.

F-13-c. Can the elevator be called and operated automatically without using a special key or having to turn on the elevator from a remote location?

Yes No

F-13-d. Are the highest floor control buttons mounted no more than 54 inches above the floor for a side reach or 48 inches for a forward reach?
Yes No

F-13-e. Are raised letters and Braille characters used to identify each floor button and each control?
Yes No

F-11-f. Are signs mounted on both sides of the elevator hoist way door opening (for each elevator and at each floor) that designates the floor with 2 inch minimum-height raised letters and Braille characters centered at 60 inches above the floor?
Yes No

F-13-g. Is the elevator equipped with audible tones, bells or verbal annunciators that announce each floor as it is passed?
Yes No

F-14. Is a wheel chair lift provided?
Yes No
If no, please go to question F-15

F-14-a. Is the lift operational at the time of the survey?
Yes No

F-14-b. Is the change in level for the floor to the lift surface ramped or beveled?
Yes No

F-14-c. Is there at least a 30 inch by 48 inch clear floor space on the wheelchair lift?
Yes No

F-14-d. Does the lift allow a person using a mobility device unassisted entry, operation and exit?
Yes No

F-14-e. Is key available, if required?
Yes No

F-14-f. Are the controls and operating mechanisms mounted no more than 54 inches above the floor for a side reach or 48 inches above the floor for a forward reach?
Yes No

F-14-g. Are the controls and operating mechanisms usable with one hand without tight grasping, pinching, or twisting?
Yes No

F-15. At each location on the way to each shelter area where the accessible route passes through a door, does at least one door meet the following requirements?
Yes **No**
If no, see question(s): F-15-b and F-15-d

F-15-a. Is the clear width for the door opening at least 32 inches measured when the door is open 90 degrees? (This distance is measured between the face of the door and the edge of the opening.)
Yes No

F-15-b. Is the door hardware (e.g., lever, pull, push, panic bar) usable with one hand, without tight grasping, pinching, or twisting of the wrist to fully operate the hardware?
Yes **No**
Push side Pull side

F-15-c. Is there clear maneuvering floor space in front of each accessible door and, on the pull side, is there at least 18 inches clear floor space next to the latch side of the door?
Yes No

F-15-d. Is no more than 5 pounds force needed to push or pull open the door?
Yes **No**

Note: fire doors are still considered to be accessible if they have the minimum opening force allowable by the appropriate administrative authority?

F-15-e. If the answers to questions F-15-b – F-15-d are No, can the door be propped open?
Yes **No**
These are exterior doors that if left open could let tornadic wind into the shelter

Typical Issues for People Who are Blind or Have Low Vision

F-16. Are pedestrian routes leading to the entrance of the refuge area free of objects that protrude from the side more then 4 inches into the route with the bottom of the object more than 27 inches above the floor?

Yes **No**

Note: These objects may be wall mounted or free standing. Items to check include wall-mounted fire extinguishers, light fixtures, coat hooks, shelves, drinking fountains, and display cases.

F-17. Are pedestrian routes leading to the entrance of the refuge area free of overhead objects with the bottom edge lower than 80 inches above the floor?

Yes **No**

F-18. Are any interior stairs along these routes configured with a cane-detectable warning or a barrier that prevents travel into the area with less than 80 inch high head clearance so that people who are blind or who have low vision cannot hit their heads on the underside of stair frame?

Yes No

Restrooms

G-1. Are the restrooms located in the refuge area?

Yes No

G-1-a. If yes, please list the type and location:
Both female and male restrooms on the east wall of the shelter

If no, please go to question H-1.

G-2. Are bathrooms accessible within the refuge area?

Female: Yes **No**
Male: Yes **No**
If no, see question(s): G-6, G-16, G-22, G-22, & G-34

G-3. Is there a route without steps from the refuge area entrance to this location?

Yes No

If no, are there two or fewer steps? Yes____No____Number of Steps:______

If no, is there a ramp, lift, or elevator? Yes____No____Type of device:_____________

G-4. If an elevator or lift provides the only accessible route, is there a source of backup power to operate the device for an extended period of time?

Yes No

G-5. If a sign is provided at the toilet room entrance (e.g. Men, Women, Boys, Girls, etc.), is a sign with raised characters and Braille mounted on the wall adjacent to the door latch?

Female: **<u>Yes</u>** No
Male: **<u>Yes</u>** No

Note: an additional sign may be mounted on the toilet room door, but this cannot be considered to be the accessible sign which must be mounted on the wall adjacent to the latch side of the door.

G-6. Does the door to the toilet room provide at least 32 inches clear passage width when the door is open 90 degrees? (This distance is measured between the face of the door and the edge of the opening.)

Female: **<u>Yes</u>** No
Male: **<u>Yes</u>** No

G-7. Is the hardware (e.g., lever, pull, push, panic bar) usable with one hand without tight grasping, pinching, or twisting of the wrist?

Female: Yes **<u>No</u> – Pull Side**
Male: Yes **<u>No</u> – Pull side**

If no, can the door be propped open without compromising privacy, or can the hardware be modified by adding new accessible hardware or adapting or replacing hardware?

G-8. On the pull side of the door, is there at least 18 inches clearance provided located on the floor next to the latch side of the door if it is not automatic or power-operated?

Female: **<u>Yes</u>** No
Male: **<u>Yes</u>** No

G-9. If there is a raised threshold, is it no higher than ¾ inch at the door and beveled on both sides?

Female: Yes No
Male: Yes No

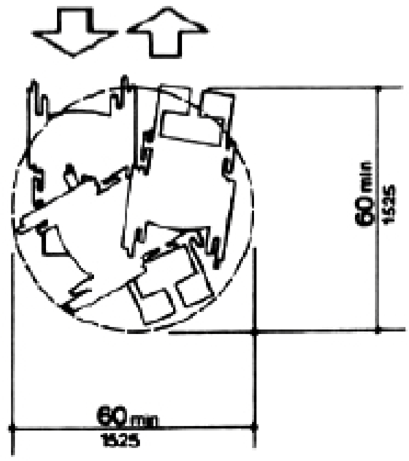
G-10. If the entry has a vestibule, is there a 30 inch by 48 inch clear floor space inside the vestibule where a wheelchair or scooter user can be outside the door swing?

Female: Yes No
Male: **<u>Yes</u>** No

G-11. Inside the toilet room, is there an area where a person who uses a wheelchair or other mobility device can turn around? It should be either at least

60 inch diameter circle or a “T”-shaped turn are as shown in the figures below. See figure AT2.

Female: **Yes** No
Male: **Yes** No



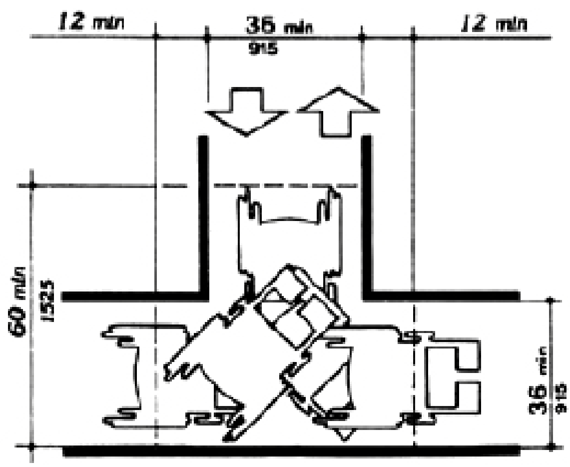


Figure AT2: Minimum spaces for turning.

G-12. If lavatories are provided, does at least one have at least a 29 inch high clearance under the front apron of the lavatory with the top of the rim lavatory no more than 34 inches above the floor?

Female: Yes **No**
Male: **Yes** No

G-13. Are the drain and hot water pipes for the lavatory insulated or otherwise configured to protect against contact?

Female: **Yes** No
Male: **Yes** No

G-14. Does this lavatory have controls that operate easily with one hand, without tight grasping, pinching, or twisting of the wrist?

Female: **Yes** No
Male: **Yes** No

G-15. If mirrors are provided, is the bottom of the reflecting surface for the mirror at this lavatory no higher than 40 inches above the floor or is a full length mirror provided?

Female: Yes **No**
Male: Yes **No**

Specify type of mirror: Wall mount

G-16. For at least one of each type of dispenser, receptacle, or item of equipment, is there clear floor space at least 30 inches wide by 48 inches long adjacent to the control or dispenser (positioned either parallel to the control or dispenser or in front of it)?

Female: Yes **No**
Male: Yes **No**

G-17. Is the operating control (switch, lever, button, or pull) of at least one of each type of dispenser or built-in equipment no higher than 54 inches above the floor for a side reach or 48 inches above the floor for a forward reach?

Female: **Yes** No
Male: **Yes** No

G-18. Are all built-in dispensers, receptacles, or equipment mounted so the front does not extend more than 4 inches from the wall if the bottom edge is between 27 inches and 80 inches above the floor?

Female: Yes **No**
Male: **Yes** No

Toilet Stalls

G-19. Is at least one accessible toilet stall provided with an outward swinging door, side and rear grab bars, and clear space next to the toilet?

Female: Yes **No – See question G-28**
Male: **Yes** No

If no, check to see if another toilet room provides an accessible toilet stall, note its location for shelter planners, and answer all toilet room questions with respect to that toilet room.

G-20. Is the toilet stall at least 60 inches wide and 56 inches deep (wall mounted toilet) or 59 inches deep (floor mounted toilet).

Female: **Yes** No
Male: Yes **No**

G-21. Is at least 9 inches of toe clearance provided under the front wall, opposite from the wall with toilet, and at least one side wall of the toilet stall?

Female: **Yes** No
Male: **Yes** No

G-22. Is the centerline of the toilet 18 inches from the adjacent side wall?

Female: **Yes** No
Male: Yes **No**

G-23. Is the top of the toilet seat 17-inches to 19 inches above the floor?

Female: **Yes** No
Male: **Yes** No

G-24. Is the flush valve located on the wide side adjacent to the lavatory or is an automatic flush valve provided?

Female: Yes **No**

Male: Yes **No**

G-25. Is a horizontal grab bar at least 40 inches long securely mounted on the adjacent side wall to the toilet 33 to 36 inches above the floor with one end no more than 12 inches from the back wall?

Female: **Yes** No

Male: **Yes** No

G-26. Is a second horizontal grab bar at least 36 inches long securely mounted on the back wall with one end no more than 6 inches from the side wall and 33 to 36 inches above the floor?

Female: **Yes** No

Male: **Yes** No

G-27. Is the door to the toilet stall located diagonally opposite, not directly in front of, the toilet or on the opposite side wall from the wall with the long grab bar?

Female: **Yes** No

Male: **Yes** No

G-28. Unless the accessible stall is located at the end of a row of toilet stalls, does the door to the wider stall open out?

Female: Yes No

Male: **Yes** No

G-29. Is the clear width of the door at least 32 inches when the door is open 90 degrees? (This distance is measured between the face of the door and the edge of the opening.)

Female: **Yes** No

Male: **Yes** No

G-30. Are there 6 or more stalls in the restroom?

Female: Yes **No**

Male: Yes **No**

If no, go to question G-34.

G-31. Is one of those stalls (in addition to the accessible stall noted above) exactly 36 inches wide with an outward swinging stall door that provides at least 32 inches of clear width?

Female: Yes No

Male: Yes No

G-32. Does this 36 inch wide stall have horizontal grab bars on both of the side partitions that are at least 36 inches long and 33 to 36 inches above the floor?

Female: Yes No
Male: Yes No

G-33. Is the surface of the toilet seat in this 36 inch wide stall 17 to 19 inches above the floor?

Female: Yes No
Male: Yes No

G-34. If a coat hook is provided is it mounted no higher than 54 inches above the floor for a side approach or 48 inches above the floor for a front approach?

Female: Yes **No**
Male: Yes **No**

Drinking Fountains

H-1. Are there drinking fountains located within the refuge area?

Yes No

If no, please go to question I-1.

H-2. Are the drinking fountains in the refuge area ADA accessible?

Yes **No**

If no, please see question(s): H-3 & H-5

H-3. If the drinking fountain is a wall-mounted unit, is there clear floor space at least 30 inches wide (36 inches if it is in an alcove) by 48 inches long in front of the drinking fountain and at least 27 inches high under the fountain so that a person using a wheelchair can get close to the spout and controls?

Yes **No**

H-4. If the drinking fountain is a floor-mounted unit, is there clear floor space at least 30 inches long by 48 inches wide (60 inches if it is in an alcove) for a side approach to the drinking fountain so that a person using a wheelchair can get close to the spout and controls even though the fountain has not clear space under it?

Yes No

H-5. Is the top of the spout no higher than 36 inches above the floor and at the front of the fountain or water cooler?

Yes **No**

H-6. Does the water rise at least 4 inches high when no more than 5 pounds of force is applied to the controls of the fountain?

Yes No

H-7. Are the controls on or near the front of the unit and do they operate with one hand without tight grasping, pinching, or twisting of the wrist?

Yes No

H-8. Is the bottom of the apron of the fountain 27 inches above the floor so that it provides the space needed for a person who uses a wheelchair to pull up under it but is not a hazard to people who are blind or have low vision and use a caned to detect the hazard?

Yes **No**

Availability of Electrical Power

I-1. Is there a backup source of electrical power for the facility?

Yes No

I-1-a. If yes, what is the power source?

____ Battery powered

Other power (indicate fuel type) Diesel

I-1-b. If yes, is there an automatic transfer switch?

Yes No

1-2. What is the duration of lighting under the back-up power source?

0-2 hours

3-6 hours

7 or more hours

I-3. Is the back-up power supply located within the refuge area?

Yes **No**

If no, is it in a place where it will be protected during an extreme-wind event (for example, in an interior room, or below grade)?

Yes **No** Not Applicable