OPENINGS, GLAZING, AND FENESTRATION

A preparatory course assembled for the
Architectural Record Examinations

Data accumulated from Kent Ballast's "Architecture Exam Review," and various sources of the Internet

(This is only for educational purposes)

AVANT-GARDE ENGINEERING LLC
CONSULTING ARCHITECTS/ENGINEERS

INTRODUCTION

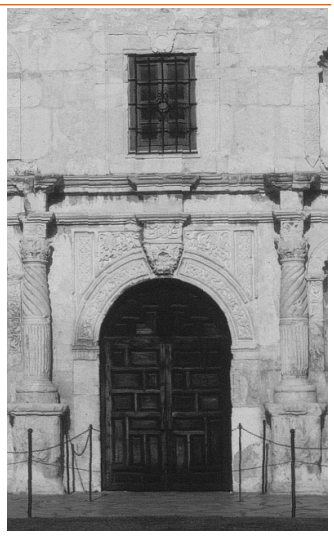
- With contemporary materials, building openings, glazing and fenestration are no longer what we used to address as doors and windows.
- A window can admit light in the structure but it will also thermally insulate the structure , minimize sound transmission, control the amount of light in hi-tech methods etc.

U.S. Embassy in Nicosia Cyprus,

Interior of the Institute du monde Arabe, Paris. –
Image Source: http://picasaweb.google.com/soledadrodriguez/AMIGOS/photo#5067864545142251634.

DOOR OPENINGS

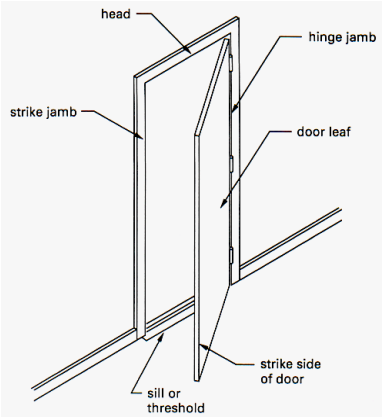
- Doors are standardized openings on buildings. They constitute a primary type of void that breaks the solid texture of the walls. They can allow or block the following:
  - Transition from one space to another
  - Visual and aural contact and thus privacy,
  - Fire resistance and safety,
  - Control of light,
  - Weather protection, etc
- Doors are solid material that can at any given time be part of the solid walls or an opening through them.
- There are three major components to a door system:
  - The door, the frame, and the hardware.
- Each of these components needs to be designed for the specified purpose the door will serve.



3 Remember the Alamo? –

DOOR OPENINGS

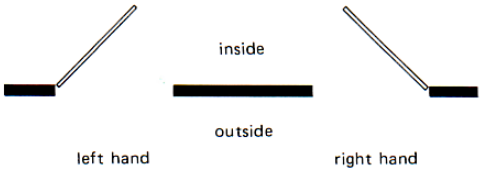
- Given the diagram, the jamb on the side where the hinges are located is called "hinge jamb" whilst the opposite side is called the "strike jamb".
- Another method of addressing the issue of door swing is by calling the opening side as "door hand" or "handing"
- Handing is addressed by specifiers, hardware suppliers and manufacturers to indicate the type of hardware that must be used.
- Some hardware may only work on one direction because of the way the strike side is beveled, or it can work on both directions in which case it is called "reversible" or "non handed".

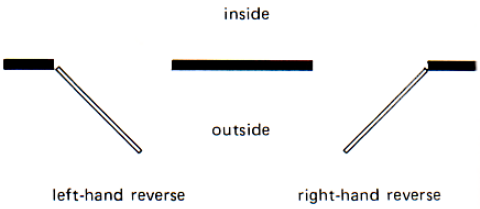


4

DOOR OPENINGS

- The hand of a door is determined from the outside. In situations where it is ambiguous where "outside" is, that is the side where the hinges are not visible.

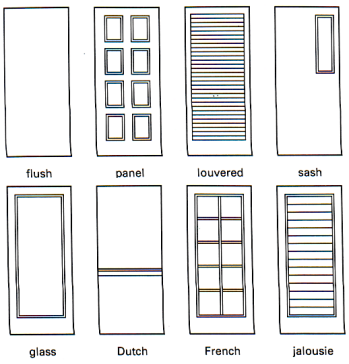


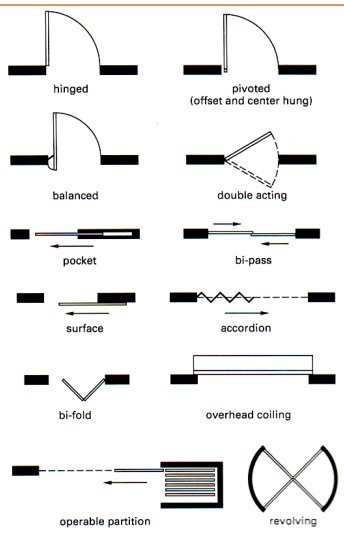


5 Typical countertop details –
Image Source: Ballast, David, K.: *Architecture Exam Review, Volume II: Nonstructural Topics,* 4th Edition, Belmont, CA, 1998, pg21-2.

DOOR OPENINGS

- Doors are classified by the function they serve, their operation, and the material they are made of.





METAL DOORS AND FRAMES

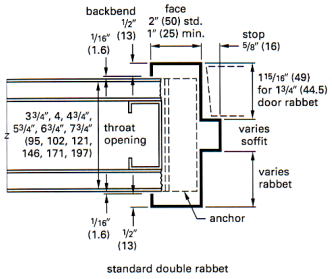
- Door types:
- The three most common types of metal doors are the flush, sash, and louvered.
- Where traditional appearance is required, yet metal is preferred as material, steel doors that resemble wood paneled designs, incorporating insulating cores are available.
- Steel, stainless steel, bronze, and aluminum are common metals used for doors although other metals may be available. Painted steel is the most common.

METAL DOORS AND FRAMES

- Construction:
- Steel doors (also called hollow metal doors) are constructed of cold rolled steel 18 and 14 gauge thicknesses are the most common used 20 and 16 gauge are also available.
- The face of the door is affixed to a core of honeycombed kraft paper, hardboard, steel ribs or other material that serves as skeleton.
- The edges are made of steel channels, and mineral wool or other sound insulators are used to dampen noise.
- Sizes:
- Of course any doors can be custom made at any size, but standard widths of 2', 2'-4", 2'-6", 2'-8", 3', 3'-4", 3'-6", 3'-8", and 4' are available.
- Standard heights are 6'-8" and 7'.
- There is one standard thickness and that is 1 3/4".

METAL DOORS AND FRAMES

- Frames:
- For metal fames the door does not necessarily have to be metal too. Frames made of sheet steel, bent into shape are available for all practical types of doors.
- Frames are made of 12, 14, or 16 gauge steel.
- The frame is reinforced with heavier gauge steel at the point of hinges and strikes.
- Anchoring devices are used inside the frame to secure it on masonry, gypsum board, concrete or whatever material is used for the walls.
- When fire rating is over 20 minutes, steel framing is almost exclusively used



standard double rabbet

single rabbet

For a wall assembly of required rating of 2 hours, what is the minimum rating for doors?

a. ¾ hr
b. 1 hr
c. 1½ hr
d. 2 hr

c. 1½ hr

TABLE 715.4
FIRE DOOR AND FIRE SHUTTER FIRE PROTECTION RATINGS

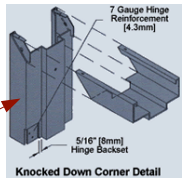
TYPE OF ASSEMBLY	REQUIRED ASSEMBLY RATING (hours)	MINIMUM FIRE DOOR AND FIRE SHUTTER ASSEMBLY RATING (hours)
Fire walls and fire barriers having a required fire-resistance rating greater than 1 hour	4 3 2 1½	3 3[a] 1½ 1½
Fire barriers having a required fire-resistance rating of 1 hour: Shaft, exit enclosure and exit passageway walls Other fire barriers	 1 1	 1 ¾
Fire partitions: Corridor walls Other fire partitions	 1 0.5 1 0.5	 ⅓ [b] ⅓ [b] ¾ ⅓
Exterior walls	3 2 1	1½ 1½ ¾
Smoke barriers	1	⅓ [b]

a. Two doors, each with a fire protection rating of 1½ hours, installed on opposite sides of the same opening in a fire wall, shall be deemed equivalent in fire protection rating to one 3-hour fire door.
b. For testing requirements, see Section 715.4.3.

IBC TABLE 715.4

METAL DOORS AND FRAMES

- Frames:
- Steel frames are manufactured in three types:
  1. One piece, welded frames; One-piece frames must be set in place before the partition is constructed
  2. Knock-down (KD), where the two jamb sections and head section are shipped to the job site as separate pieces; or
  3. And as Slip-on frames. Knock-down and slip-on frames can be set after gypsum wallboard partitions are built. Slip-on frames are not available with welded corners and should be avoided if the appearance of a joint is objectionable.

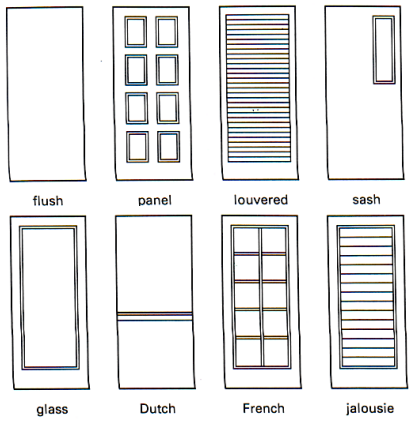


Knocked Down Corner Detail

- Aluminum frames can be used for both aluminum and wood doors. They are constructed of extruded sections. Therefore they can have thinner face dimensions and more intricate shapes than it would be possible with bent steel.
- Steel frames are painted, either in factory environment or on site. Aluminum frames are either anodized with the standard anodized colors, or they can be factory-coated with a variety of colors with baked acrylic paints and other finishes.

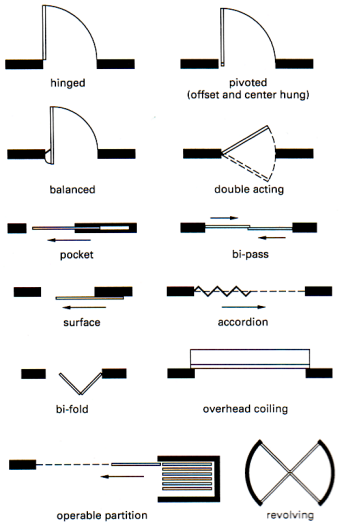
WOOD DOORS AND FRAMES

- Wood doors are the most common types for both residential and commercial construction. They are available in a variety of styles, sizes, finishes, and methods of operation.
- Door Types:
- Wood doors can be classified according to their operation. Swinging doors are the most typical type and function by being hinged or pivoted on one side. They are relatively inexpensive, easy to install, and can accommodate a large volume of traffic.



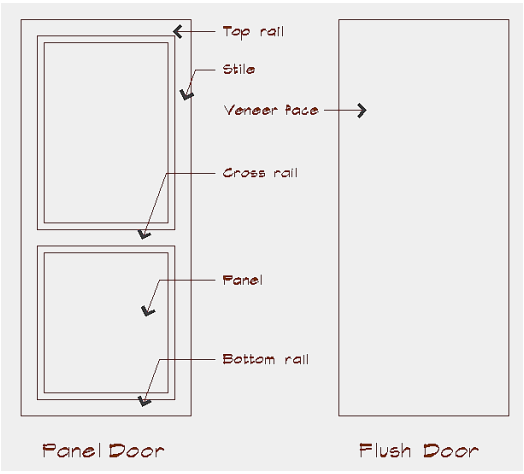
WOOD DOORS AND FRAMES

- *Double-acting doors* swing in both directions when mounted on pivot hardware or special double-acting hinges.
- Pocket sliding *doors* travel on a top track and move horizontally into a pocket built into the wall. They are good for limited space, but they are awkward to operate and latching and sealing are difficult.
- *Bi-pass sliding doors* also travel on a top or bottom rail and are often used for closet doors where space is limited. Bi-folding and multi-folding doors are also used for closets and other large openings where full access needs to be provided when the doors are open.



WOOD DOORS AND FRAMES

- Door Types cont.:
- The two primary types of wood doors are the flush door and the panel door. Flush *doors* consist of a thin, flat veneer laminated to various types of cores as described. Panel *doors* consist of solid vertical stiles and horizontal rails that serve as a frame for flat or raised panels.



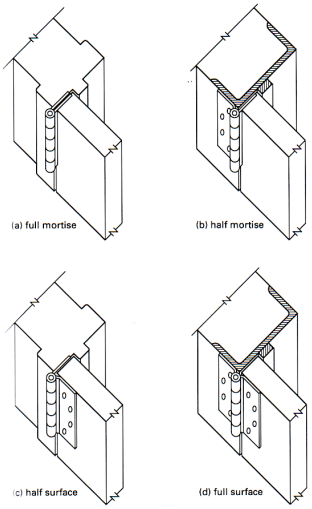
HARDWARE

- Hardware includes the various types of finish hardware normally found on interior and exterior doors, weather stripping, electrical locking devices, and window operators. Cabinet hardware and curtain and drapery hardware are classified as a different type and included with those items.
- Functions of Hardware:

  Hardware is a vital part of any door opening assembly. In general, hardware can be grouped according to the function it serves based on the following list.
  - Hanging the door: hinges, pivots, and combination pivots and closers.
  - Operating the door: handles, latchsets, push plates, and pull bars.
  - Closing the door: door closers and combination pivots and closers.
  - Locking the door: locksets, dead bolts, flush bolts, electric locks, and other special devices.
  - Sealing the door: weather stripping, sound seals, smoke seals.
  - Protecting the door: kick plates, corner protection, and similar materials.

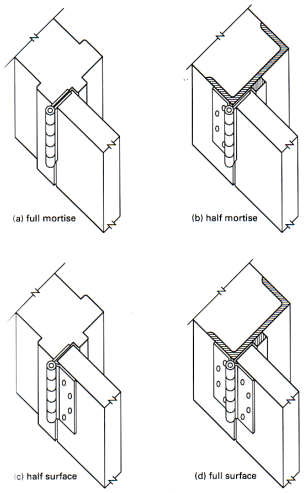
HARDWARE

- Hinging is the most common method of attaching a door to a frame. Hinges can be referred to as *butts* because they usually are attached to the butt edge of a door.
- Hinges consist of two leaves with an odd number of knuckles on one leaf and an even number of knuckles on the other. The knuckles are attached with a pin. The pin and knuckles form the barrel of the hinge, which is finished with a tip.
- There are four basic types of hinges:
  - full mortise,
  - half mortise,
  - full surface,
  - and half surface.



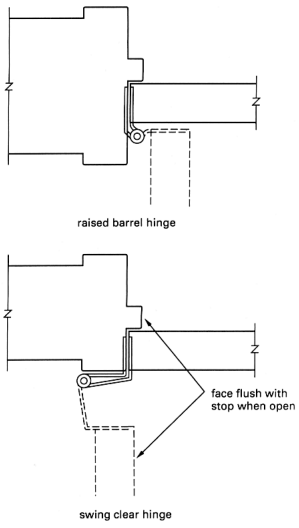
HARDWARE

- Hinges cont.:
  - *Full mortise* is the most common type and has both leaves fully mortised into the frame and edge of the door.
  - *Half- surface hinges* have one leaf mounted on the face of the door and the other leaf mortised into the frame.
  - *Half-mortise hinge leaves* are surface-applied to the frame and mortised into the edge of the door.
  - *Full-surface hinges* are applied to the face of both the door and frame.
- The various types of hinges are used when the door or the frame cannot be mortised. For example, a half-mortise hinge may be bolted or welded to a heavy steel frame.



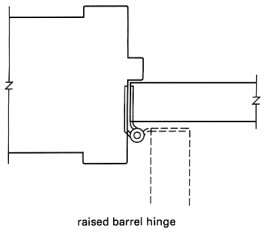
HARDWARE

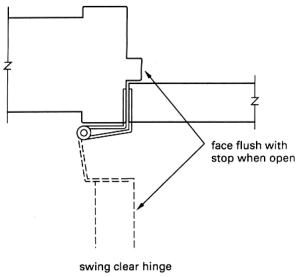
- Hinges cont.:
- There are also special types of hinges. Raised *barrel hinges* are used when there is not room for the barrel to extend past the trim. The barrel is offset to allow one leaf to be mortised into the frame. Swing *clear* hinges have a special shape that allows the door to swing 90 degrees so that the full opening of the doorway is available.
- Without a swing clear hinge, standard hardware decreases the opening width by the thickness of the door when it is open 90 degrees.



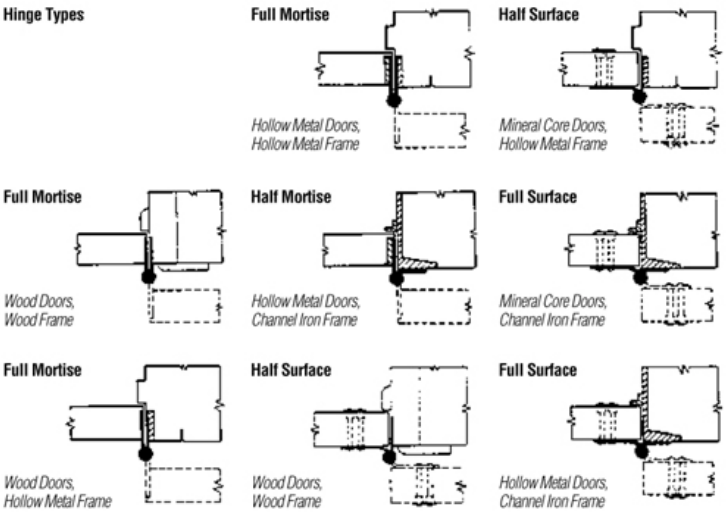
HARDWARE

- Hinges cont.:
- Hinges are available with or without ball bearings and in three weights. Which type to use depends on the door weight and frequency of use:
  - *Low-frequency doors*, like residential doors, can use standard-weight, plain-bearing hinges.
  - Most commercial applications require standard- weight, ball-bearing hinges.
  - High-frequency applications such as office building entrances, theaters, and so forth, require heavy-weight, ball-bearing hinges.
  - In addition, ball-bearing hinges are required for fire-rated assemblies and on all doors with closers.





HARDWARE



HARDWARE

- Hinges cont.:
- The size and number of hinges for a door depend on a number of factors. The size is given by two numbers like 4 x **4 1/2.** The first number is the length, which is the length of the barrel in inches, and the second number is the width, which **is** the dimension in inches when the hinge is open.
- The width of the hinge is determined by the width of the door and the clearance required around the jamb trim. A simple rule states that **the width of a hinge equals twice the door thickness, plus trim projection, minus 1/2"**. If a fraction falls between standard sizes, use the next larger size. Common hinge widths for 1-3/4" doors are 4 and **4 1/2"**
- **The length of the hinge is determined by the door thickness and the door width.**

How to Determine Hinge Heights

Door Thickness in Inches (mm)	Door Width in Inches (mm)	Height of Hinge in Inches (mm)
3/4 to 1 1/8 (19 to 29)	to 24 (610)	2 1/2 (63.5)
1 3/8 (35)	to 32 (813)	3 1/2 (89)
1 3/8 (35)	over 32 to 37 (over 813 to 940)	4 (102)
1 3/4 (44)	to 36 (to 914)	4 1/2 (114)
1 3/4 (44)	over 36 to 48 (over 914 to 1219)	5 (127)
1 3/4 (44)	over 48 (over 1219)	6 (152)
2, 2 1/4, 2 1/2 (51, 57, 64)	to 42 (to 1067)	5 (heavy weight) (127)
2, 2 1/4, 2 1/2 (51, 57, 64)	over 42 (over 1067)	6 (heavy weight) (152)

HARDWARE

- Hinges cont.:
- The number of hinges is determined by the height of the door. Numbers of hinges are commonly referred to by pairs, one pair being two hinges. Doors up to 60" high require two hinges (1 pair). Doors from 60 to 90 inches require three hinges (1-1/2 pair), and doors 90 to 120 inches require four hinges (2 pair).

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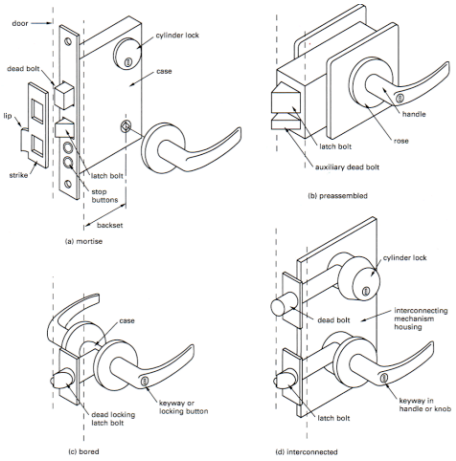
2, 2 1/4, 2 1/2 (51, 57, 64)	over 42 (over 1067)	6 (heavy weight) (152)

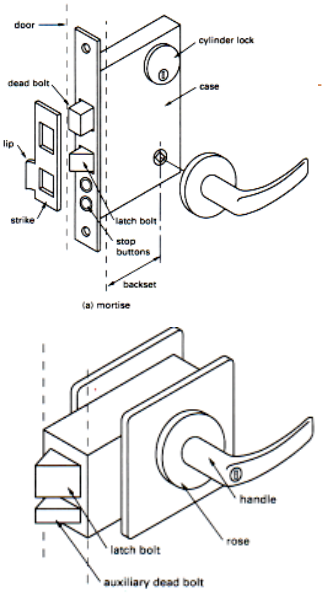
HARDWARE

- **Latchsets and Locksets:**
- These are devices to hold a door in the closed position and lock it. A *latchset* only holds the door in place with no provision for locking. It has a beveled latch extending from the face of the door edge and automatically engages the strike mounted in the frame when the door is closed. A lockset has a special mechanism that allows the door to be locked with a key or thumb-turn.
  There are four types of latches and locks: **mortise, preassembled, bored**, and **interconnected**.



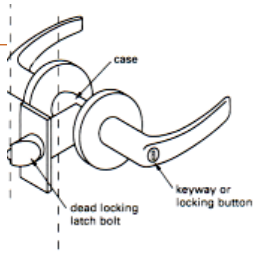
HARDWARE

- **Latchsets and Locksets cont.:**
- Another type, the integral lock, is no longer produced in the United States, but is still found in older buildings.
- A *mortise lock or latch* is installed in a rectangular area cut out of the door. It is generally more secure than a bored lock and offers a much wider variety of locking options. Mortise locks allow the use of a dead bolt and a latch bolt, both of which can be retracted with a single operation. A variety of knob and level handle designs can be used with the basic mechanism.
- *Preassembled locks and latches* (also called *unit locks*) come from the factory as a complete unit. They are slid into a notch made in the edge of the door and require very little adjustment. Preassembled locks are seldom used anymore, but they are often found in older buildings.

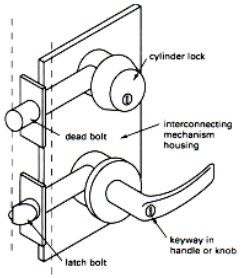


HARDWARE

- **Latchsets and Locksets cont.:**
- *Bored locks and latches* (**also called *cylindrical locks or latches***) are installed by boring holes through the face of the door and from the edge of the door to the other bored opening. They are relatively easy to install and are less expensive than mortise locks, but they offer fewer operating functions than do mortise locks. They are used in residential and small commercial projects.
- *Interconnected locks* have a cylindrical lock and a dead bolt. The two locks are interconnected for single action of turning a knob or lever handle from the inside.
- With all types of latches and locks, either a doorknob or lever handle may be used to operate the latching device. In most cases, a lever handle is required to meet requirements for accessibility.
- The distance from the edge of the door knob to the center of the knob or pivot of a lever handle is called the *backset*, and the standard lengths are 2 3/4" and 5" although other lengths can be special ordered.



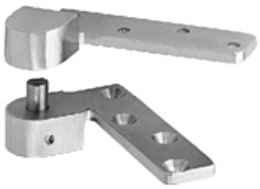
(c) bored

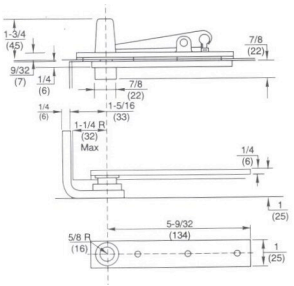


(d) interconnected

HARDWARE

- **Other Types of Hardware:**
- *Pivots* provide an alternative way to hang doors where the visual appearance of hinges is objectionable or where a frameless door design may make **it** impossible to use hinges. Pivots may be center hung or offset and are mounted in the floor and head of the door.
- For large or heavy doors, an intermediate pivot is often required for offset-hung doors only. Center- hung pivots allow the door to swing in either direction and can be completely concealed, but they allow only a 90-degree swing. Offset pivots allow the door to swing 180 degrees.

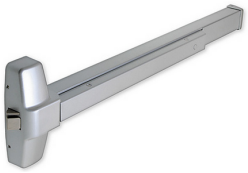


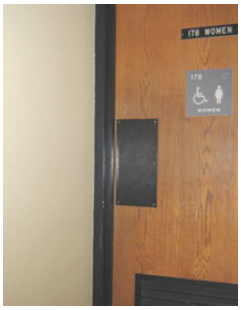


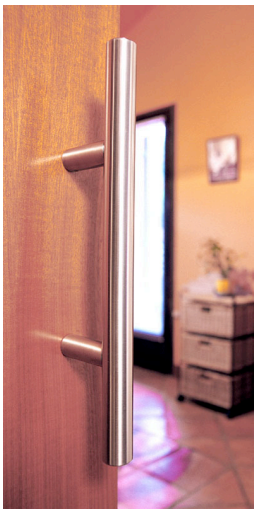
Offset Pivot, Image source: http:///jacksoncorp.thomasnet.com/ April, 2008
Center hung Pivot, Image Source: http://www.hardwaresoource.com/, April 2008

HARDWARE

- Other Types of Hardware:
- Panic hardware. This type of operating hardware is used where required by the building code for safe egress during a panic situation. Push bars extending across the width of the door operate vertical rods that disengage latches at the top and bottom. The vertical rods can be surface mounted or concealed.
- *Push plates and pull bars.* These are used to operate a door that does not require automatic latching. They are also used on doors to toilet rooms and commercial kitchens.





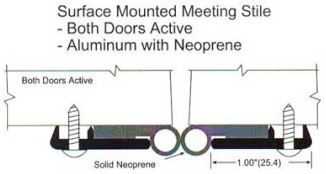


HARDWARE

- Other Hardware cont.:
- *Closers* are devices that automatically return a door to its closed position after it is opened. They also control the distance a door can be opened and thereby protect the door and surrounding construction from damage.
- Closers can be surface mounted on the door or head frame or concealed in the frame or door Selection of a closer depends on the type, size, and weight of the door, the frequency of operation the visual appearance desired, and the door height clearance required. Closers can also be integral with pivots mounted in the floor or ceiling, either center hung or offset. Closers available may have fire and smoke detectors built in so that a door may be held open during normal operation but will close when smoke is sensed.

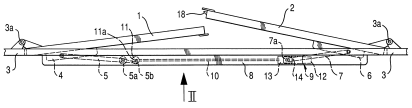
HARDWARE

- **Other Hardware cont.:**
- *Door stops and bumpers*: A method of keeping a door from damaging adjacent construction should be provided. Closers will do this to some extent, but floor stops or wall bumpers provide more positive protection. These devices are small metal fabrications with rubber bumpers attached.
- *Astragals* are vertical members used between double doors to seal the opening, act as a door stop, or provide extra security when the doors are closed. Astragals may be fixed or removable to allow for a wide opening when moving furniture.



HARDWARE

- **Other Hardware cont.:**
- A door *coordinator* is a device used with double doors that are rabbeted or that have an astragal on the active leaf. The coordinator is mounted in or on the head of the frame, coordinating the closing sequence of the two doors so that they close completely, rather than having the leaf with the astragal close first, preventing the other leaf from closing.
- *Flush* bolts are used on the inactive leaf of a pair of doors to lock the doors. They may be surface mounted or mortised into the edge of the door. The active leaf then closes to the locked inactive leaf, but both can be opened when needed. Flush bolts are not allowed on exit doors.

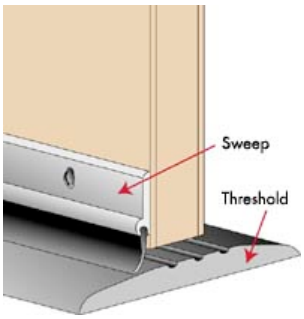


HARDWARE

- Other Hardware cont.:
- *Automatic door bottoms* are devices that are mortised or surface applied to the bottom of the door to provide a sound or light seal. When the door is open the seal is up; as the door is closed a plunger strikes the jamb and forces the seal down.
- *Weather stripping* is used along the edge and bottom of doors to provide a tight seal against water and air infiltration. Various types of door seals are also used to provide light and sound protection on interior doors as well as sealing against the passage of smoke around the fire doors. Different types of neoprene, felt, metal, vinyl, and other materials are used.

HARDWARE

- Other Hardware cont.:
- *Thresholds* are used where floor materials change at a door line, where weather stripping is required, where a hard surface is required for an automatic door bottom, or where minor changes in floor level occur.



HARDWARE

- Electronic Hardware:
- *Electronic hardware* includes devices that control or monitor door openings using electric or electromechanical means local building codes must be consulted because some electronic hardware does not qualify as an allowable exit device. If an exit door is electronically locked and controlled from the outside, most codes require that exiting be possible from the inside with purely mechanical action on the locking device that does not depend on any power supply or deactivation of the lock on the inside by the person exiting. Following are some of the most common types of electronic hardware.

HARDWARE

- Electronic Hardware:
- *Electric locks* maintain a mortise or bored lockset in the locked position until a signal is activated by some type of regulating device. Regulating devices can include wall switches, push buttons, card readers, key switches, computerized controls, automatic time devices, security consoles, and other sophisticated control devices. Electric locks can also be specified so that they automatically open if there is a power failure. In either case, the inside knob or handle mechanically unlatches the door for exiting at any time.

HARDWARE

- Electronic Hardware:
- A variation of the electric lock is the electric latch. This device is normally in a position to hold the latch bolt of the lock so that the door cannot be opened. On activation, the electric latch pivots slightly, allowing the door to be opened. From the inside, the mechanical operation of the knob or handle retracts the latch, allowing exit regardless of the position of the electric latch.
- Electric latches have the advantage of not requiring any power to be run to the door; all wiring is done in the door jamb. Electric locks require the use of electric hinges or other power transfer devices to make the low-voltage wiring connections from the door frame to the mechanism in the door.

HARDWARE

- Electronic Hardware cont.:
- *Electric bolts* are devices separate from the operating hardware of a door. They can be mounted in the strike jamb or head of a door. In the normal, locked position, a bolt extends from the unit into a strike in the door. A push button, card reader, or other regulating device activates a solenoid that retracts the bolt. Fail-safe units are available that open when there is a power failure.
- Electric bolts are generally not allowed on exit doors because there is no sure way to mechanically open the door if the bolt does not retract.

HARDWARE

- Electronic Hardware cont.:
- *Card readers.* Card readers are one type of regulating device that read a magnetic code on a small plastic card when the card is inserted into the reader. If the reader detects a valid code, the switch is activated and the door is unlocked. Card readers can also be used to send a signal to a central monitoring computer that keeps track of whose card was used to open which door and when the entry was made. The computer can also control the times of day when a door can be opened by particular cards. Card readers are usually mounted on the partition near the door they control, but they can also be part of the lockset, as is typically the case in hotels.
- *Keypad devices.* An alternative to the card reader is the keypad, in which a coded number must be entered to gain access. These can be separate units mounted near the door or they can be part of the door knob or lever.

HARDWARE

- Electronic Hardware cont.:
- *Magnetic hold-open* devices: Although exit doors must have closers, most codes allow them to be held in an open position if they can be closed automatically upon activation of a smoke detect to or other approved fire signal.
- One method of doing this is to use a closer with an integral smoke detector. Another way is to use a magnetic hold-open device that is an electromagnet mounted on a wall or on the floor that contacts a metal plate attached to the door. Upon activation by a central alarm or smoke detector, or upon a power failure, the electromagnet releases and the door closes.

HARDWARE

- Finishes:
- Hardware is available in a variety of finishes, the choice of which is dependent primarily on the appearance desired, but also on its ability to withstand use and weathering. The finish is applied over a base metal from which the hardware is made. For most hardware items this is not critical, but for hinges and other operating hardware it can be significant.
- There are five basic metals: steel, stainless steel, bronze, brass, and aluminum. Fire-rated doors must have steel or stainless steel hinges, and hardware in corrosive environments may require stainless steel or bronze base metals with compatible surface finishes.
- Hardware finishes have been standardized according to numbers developed by the federal government (U.S. designations) and the Builders Hardware Manufacturer's Association (BHMA).

BUILDING CODE

- Doors and hardware are highly regulated by the building codes. The requirements generally fall into three major categories:
  - exiting requirements,
  - fire-rated assemblies,
  - and access requirements.
- The building codes regulate under what circumstances a door must provide fire protection. If a partition must have a fire rating, the openings in that partition must also be fire rated. Typical places where fire-rated doors are required include openings in stairways, in fire-rated corridors, in occupancy separation walls, and in certain hazardous locations.
- The codes consider not just the door but the entire collection of door, frame, and hardware to be the fire door assembly Every part of the assembly must be rated to make an approved opening. Doors, frames, and hardware are tested by Underwriters Laboratories (UL) and Factory Mutual (FM) according to standard ASTM tests.

BUILDING CODE

- If the door meets the requirements of the standard fire test, a small metal label is attached to the door indicating its class and hourly rating. Thus, a fire-rated door is also called a labeled door.
- Doors are rated according to the time they can withstand the standard fire test and according to the class of opening in which they can be installed. Time ratings range from 20 minutes to 3 hours.
- The class of door also implies requirements for the maximum amount of wire glass permitted.
  - For example, no glass is permitted in 3-hour, A-label doors, whereas up to 1296 square inches is permitted in 3/4-hour, C-label doors. A B-label door may have up to 100 square inches of glass.

BUILDING CODE

- Additional requirements, based on the code, are listed below:
  - A fire-rated door assembly must have a label attached to the door and frame.
  - A fire door must be self-latching.
  - All hardware used must be UL listed.
  - A fire door must be self-closing. In some cases the code permits the door to be held open if the hold-open or closer is connected to an approved smoke or fire detector.
  - A fire door must use steel hinges of the ball bearing type.
  - In some cases fire doors must have panic hardware.
  - If a pair of doors is used, astragals or other required hardware must also be used.
  - Glass (if permitted) must conform in maximum area and construction to requirements of the local code. Glass must be wire or fiberglass and set in a steel frame with the glass stop made of steel.
  - Louvers must conform to UL requirements for maximum size and construction.

BUILDING CODE

- Accessibility requirements for doors and hardware include the following:
  - Minimum width, clear of hardware, of an opened door must be 32 inches.
  - There must be adequate maneuvering clearance in front of and on the latch side of the door to operate it.
  - There must be a minimum of 48 inches between two doors in a series when they are open 90 degrees.
  - The maximum opening force required is specified by the code for various types of doors.
  - Handles and latches must have a shape that is easy to grasp and use. This usually means lever handles or push-pull-type mechanisms.
  - Thresholds cannot exceed 3/4 inch in height for exterior doors or 1/2 inch for interior doors, and they must be beveled.

WOOD DOORS AND FRAMES

- Construction:
- Wood doors are either hollow core or solid core. *Hollow-core doors* are made of one or three plies of veneer on each side of a cellular cardboard interior. The stile-and-rails frame is made of solid wood with larger blocks of solid wood where the locksets or latchsets are installed. Hollow-core doors are used in interior applications where only light use is expected and where cost is a consideration. They have no fire-resistance capabilities.

WOOD DOORS AND FRAMES

- Construction cont.:
- *Solid-core doors* are made with a variety of core types depending on the functional requirements of the door. Cores may be particleboard, stave core (solid blocks of wood), or mineral core for fire-rated doors.
- Solid-core doors are used for their fire-resistance properties, as acoustical barriers, for security, and for their superior durability.
- Solid-core doors may have a fire rating from 20 minutes to 1 1/2 hours. Mineral-core doors are used when fire ratings of 3/4, 1, and 1 1/2 hours are required.

WOOD DOORS AND FRAMES

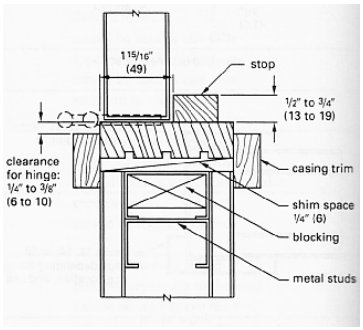
- Construction cont.:
- The face veneers of wood doors can be made from any available hardwood species using rotary-cut, plain-sliced, quarter-sliced, or rift-cut methods, just like wood panels. The veneers can be bookmatched, slip matched, or random matched, although bookmatching is the most common. Veneers of hardboard suitable for painting and plastic laminate are also available.

WOOD DOORS AND FRAMES

- Sizes:
- Like metal doors, wood doors can be custom made to any size, but the standard widths are 2' 0", 2' 4", 2' 6", 2' 8", 3' 0" and 3' 4".Standard heights are 6' 8" and 7' 0", although higher doors, used in commercial construction, are available.
- **Hollow core doors are 1 3/8" thick and solid-core doors are 1 3/4" thick**; doors 2 1/4" thick are available for large, exterior use and acoustical purposes.

WOOD DOORS AND FRAMES

- Frames:
- Frames for wood doors can be made from wood, or steel, or aluminum. Although the stop and casing shown in the figure are rectangular pieces, several different trim types are available and frequently used.
- The decision concerning the type of frame to use for a wood door depends on the appearance desired, the type of portion in which the opening is being installed, the requirements, the security needed, and the durability desired. For example, wood frames may be used in 20, 30, and 45-minute fire door assemblies, but a 1-hour rated door must be installed in a rated metal frame.

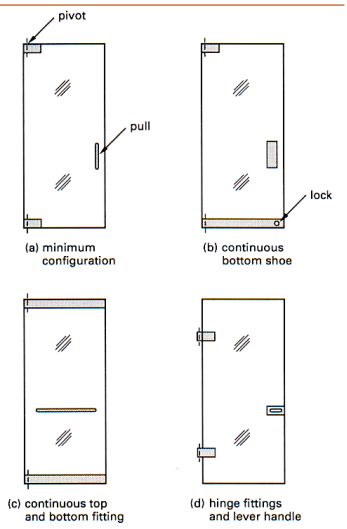


GLASS DOORS

- Glass doors are those constructed primarily of glass with fittings to hold the pivots and other hardware. Sometimes they are called all-glass doors. Their strength depends on the glass rather than the framing. They are different from sash doors in that sash doors have a frame around all four sides of the door.

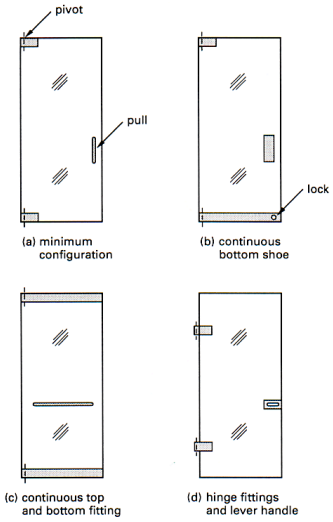
GLASS DOORS

- Components:
- Glass doors are generally constructed of 1/2" or 1/4" tempered glass with fittings and operating hardware as required by the installation. Common door sizes are 36" wide and 7' 0" high, although many architects prefer to specify glass doors at the same height as that of the ceiling.
- The minimum configuration requires some type of door pull and a corner fitting at the top and bottom to hold the pivots. In lieu of corner fittings, some manufacturers provide hinge fittings that clamp on the glass and support the door in much the same way as a standard hinged door.



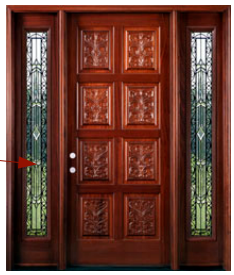
GLASS DOORS

- Components cont.:
- If a lock is required, the bottom fitting may be continuous across the door to allow for a dead bolt to be installed. Some architects prefer continuous fittings (sometimes called the shoes) on both the top and bottom.
- Because a full glass door is a potential hazard and extra strength is required, the glass must be tempered. Any holes, notches, or other modification to the glass must be made before it is tempered.



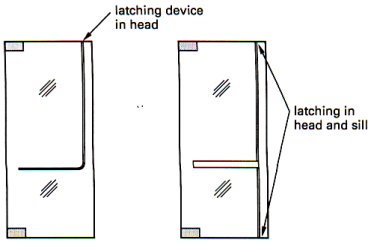
GLASS DOORS

- Standard Assemblies:
- Glass doors can be used alone and set within a wall opening with or without a frame, or they can be installed between glass sidelights. If glass sidelights are used, the same type of fitting used on the door is generally used to support the sidelights. Although jamb frames of aluminum, wood, or ornamental metal can be used, they are not necessary; and the glass sidelights can be butted directly to the partition or held away a fraction of an inch.



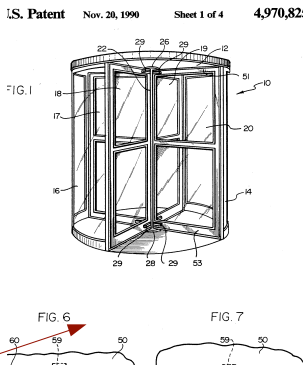
GLASS DOORS

- Building Code requirements for All-Glass doors:
- Because all-glass doors cannot be fire rated, they cannot be used where a protected opening is required in a fire-rated partition. When they are allowed and serve as exit doors, the type of hardware used must conform to the requirements of the local building code. Some codes and local amendments are more restrictive than others and usually prohibit the use of a simple dead bolt in the bottom rail fitting Instead, special panic-type hardware is available for glass doors that allows the door to be locked from the outside (and operated with card keys or keypads, if necessary), but still allows the door to be unlatched and opened from the inside in a single operation without any special knowledge or effort.



SPECIAL DOORS

- Special doors have a wide variety of applications where special closing assembly is required. Some of the more common types of special doors include the following.
  - *Revolving doors* are assemblies of three or four leaves connected at a central point that rotate within an enclosure. They are used to control air infiltration and to allow large numbers of people to pass in and out. They are made of glass framed with aluminum, bronze, or other metals. In most cases, revolving doors do not count in determining the total exit width from a building or as a required exit.
  - Some revolving doors are available with collapsing leaves that fold open if subjected to the force of a crowd of people pushing against them.



SPECIAL DOORS

- *Overhead coiling doors* are made from thin slats of metal that roll up into an enclosure above the head of the opening. They are used to close large openings such as industrial and garage doors, or as fire separations for large openings. They can be connected to fusible links so that they automatically close in the event of fire.
- *Sectional overhead doors* also close large openings and are typically used for industrial buildings and garages. The door is made from individual sections of wood or metal that hinge as the door opens.
- Other special doors include blast-resistant doors, sound- retardant doors, hangar doors, folding doors used to divide rooms, security doors, and cold-storage doors.

Multiple means of egress shall be sized so that the loss of any one means of egress shall not reduce the available capacity to less than _____ of the required capacity.

a. 10 percent
b. 25 percent
c. 33.3 percent
d. 50 percent

d. 50%

IBC Sec 1005.1

When fully open, a door is permitted to project into the required width of the path of egress travel a maximum of:

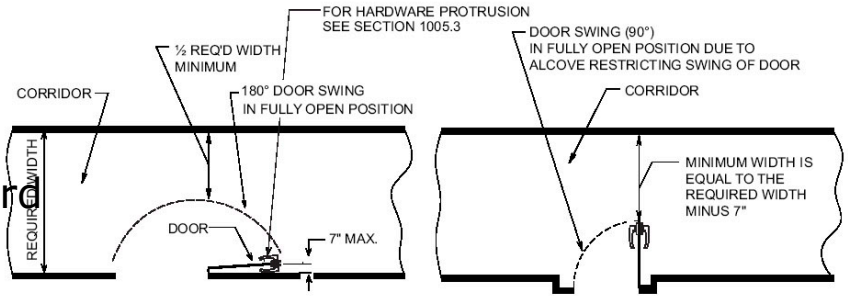
a. 1 inch
b. 2 inches
c. 3.5 inches
d. 7 inches

d. 7 inches

IBC Sec 1005.2

How much minimum width is allowed for any non residential type means of egress once a door opens

a. 36”
b. 48”
c. half
d. a third



c. half

IBC 1005.2 is somewhat confusing but here is how it goes: Doors when fully opened, and handrails shall not reduce the required means of egress width by more than 7”. Doors in any position shall not reduce the required width by more than one half.

Fully open is where it meets the wall. If there is no closer it will swing within 7”

What would be the minimum distance necessary (including landings) for a ramp that reaches 13' high?

a. 150 ft
b. 157 ft
c. 175 ft
d. 181 ft

d. 181ft

Min slope is 1/12. Ramps within the accessible route of travel have landings at he top and bottom, points of turning, entrance, exits, and doors and at least one **intermediate landing for each 30 inches (2.5') of rise with a minimum dimension of 60 inches in the direction of the ramp run**.

Which of the following elements is considered most potentially hazardous for children in a renovation project?

a. Asbestos
b. Germs
c. PCB
d. Lead

d. Lead

Which of the following contains respiratorable particulates?

a. Asbestos
b. Formaldehyde
c. Carbon monoxide
d. Lead

a. Asbestos

A court or yard that provides access to a public way for one or more exits is considered a(n)...

a. exit accessway
b. egress court
c. public way
d. horizontal exit

b. egress court

IBC 1002.1

Which of the following elements is not a distinct and separate part of the means of egress?

a. exit discharge
b. exit access
c. exit
d. exit convergence

d. exit convergence

IBC 1002.1

The codes treat means of egress as a comprehensive "system" of components. A means of egress consists of three separate and distinct parts: the exit access, the exit, and the exit discharge.

The portion of the exit access that occupants must traverse before two separate and distinct paths of egress travel to two exits are available is defined as a.

a. means of egress
b. single egress path
c. common path of egress travel
d. limited egress travel distance

c. common path of egress travel

IBC 1002.1

Panic hardware that is listed for use on fire door assemblies is considered to be _____ hardware.

a. fire egress
b. fire exit
c. panic
d. panic and fire

b. fire exit

IBC 1002.1

An alternating tread device has a series of steps that are positioned a minimum of _____ degrees and maximum of___ degrees from horizontal.

a. 30, 45
b. 45, 60
c. 50, 70
d. 60, 75

c. 50, 70

IBC 1002.1

Doors in 2-hour stairway must be rated as __ hours, and those in 1-hour stairways must be rated as __ hours:

a. 1½ - 1
b. 1-1½
c. 1½-1½
d. 1-1

a. 1½ - 1

Ballast 29-24
IBC 1019.1

Panic hardware that is listed for use on fire door assemblies is considered to be _____ hardware.

a. fire egress
b. fire exit
c. panic
d. panic and fire

b. fire exit

IBC 1002.1

The means of egress shall have a ceiling height of not less than:

90” (7'-6”)

Exceptions can be sloped ceilings, ceilings of dwelling units and sleeping units within residential occupancies, allowable projections, stair headroom, door and ramp headroom, clear height of floor levels in vehicular and pedestrian traffic areas in parking garages, and areas above and below mezzanine floors, all according to specific sections of the IBC.

Up to 50 percent of the ceiling area of a means of egress may have a minimum ceiling height of _____where reduced by protruding objects.

a. 78 inches
b. 80 inches
c. 84 inches
d. 90 inches

b. 80” (6'-10”)

IBC Sec 1003.3.1

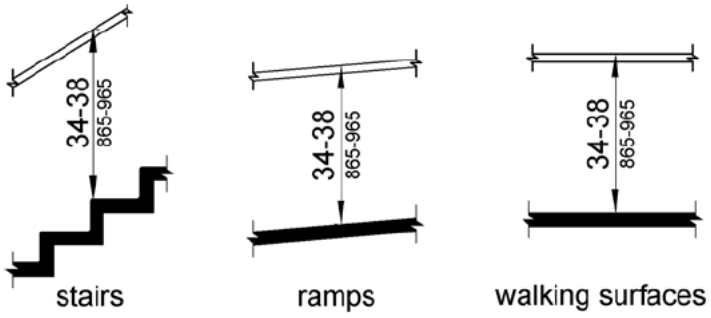
A door equipped with double-pivoted hardware so designed as to cause a semicounter balanced swing action when opening is defined as...

BALANCED DOOR

What should be the height of handrails according to ADA?

A) 32in
B) 32in – 34in
C) 32in – 36in
D) 34in – 38in

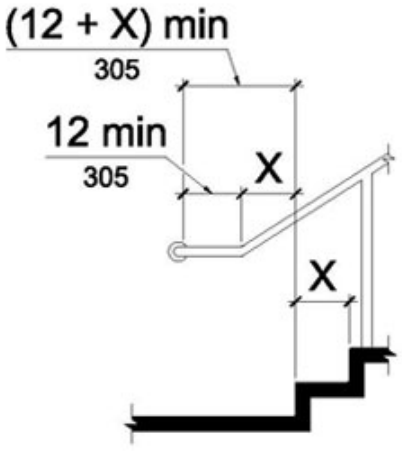
D



What should be the minimum extension of handrails on the lower end of a staircase according to ADA?

A) 12″
B) 24″
C) 14″ + riser
D) 12″ + run

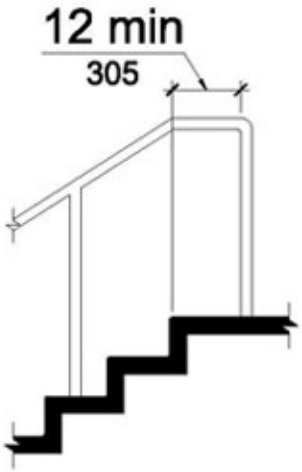
D



What should be the minimum extension of handrails on the upper end of a staircase according to ADA?

A) 12in
B) 24in
C) 14″ + riser
D) 12″ + run

A



Minimum number of exits per story per occupant loads of:
1 – 500
501 – 1000
> 1000

- 2
- 3
- & 4

An operable window, door or other similar device that provides a means of escape and access for rescue in the event of an emergency, is considered:

EMERGENCY ESCAPE AND RESCUE OPENING

A court or yard which provides access to a public way for one or more exits.

EGRESS COURT

Exits can not pass through...

Kitchens ! !
Storerooms
Closets (or spaces used for similar purposes)
Through rooms that can be locked to prevent egress

Other Considerations for egress:

- One Fire Tower is required in buildings over 75'-0" (one exit, minimum)
- Non combustible construction that is connected with mechanically vented vestibules on backup power or balconies
- Doors must swing in the direction of travel
- The number of exits is based on the number of occupants
- Typically spaces with more than 50 occupants must have 2 exits
- Required width of exits is determined by occupants on the floor plus an allowance for occupants from floors above
- Elevators are not a means of egress
- Escalators provide a conduit for smoke and are not an approved exit
- Ramps may constitute a portion of the required legal exits
- Revolving doors must collapse to be part of required legal exit

How many doors out of a series in a large building entry need to meet ADA standards? (Ratio and Min number)

At least one

That portion of a means of egress system that leads from any occupied portion of a building or structure to an exit.

EXIT ACCESS

A door or access point along the path of egress travel from an occupied room, area or space where the path of egress enters an intervening room, corridor, unenclosed exit access stair or unenclosed exit access ramp.

EXIT ACCESS DOORWAY

That portion of a means of egress system between the termination of an exit and a public way.

EXIT DISCHARGE

The story at the point at which an exit terminates and an exit discharge begins.

EXIT DISCHARGE, LEVEL OF

An exit component that is separated from other interior spaces of a building or structure by tire-resistance-rated construction and opening protectives, and provides for a protected path of egress travel in a vertical or horizontal direction to the exit discharge or the public way is called:

EXIT ENCLOSURE

A path of egress travel from one building to an area in another building on approximately the same level, or a path of egress travel through or around a wall or partition to an area on approximately the same level in the same building, which affords safety from fire and smoke from the area of incidence and areas communicating therewith.

EXIT, HORIZONTAL

An exit component that is separated from other interior spaces of a building or structure by tire-resistance-rated construction and opening protectives, and provides for a protected path of egress travel in a horizontal direction to the exit discharge or the public way.

EXIT PASSAGEWAY

Panic hardware that is listed for use on fire door assemblies.

FIRE EXIT HARDWARE

A continuous and unobstructed way of egress travel from any accessible point in a building or facility to a public way.

ACCESSIBLE MEANS OF EGRESS

An unenclosed exit access component that defines and provides a path of egress travel.

AISLE

That portion of an exit access that leads to an aisle.

AISLE ACCESSWAY

An area where persons unable to use stairways can remain temporarily to await instructions or assistance during emergency evacuation.

AREA OF REFUGE

Which of the following elements is not a distinct and separate part of the means of egress?

a. exit discharge
b. exit access
c. exit
d. exit convergence

d. exit convergence

IBC 1002.1

The codes treat means of egress as a comprehensive "system" of components. A means of egress consists of three separate and distinct parts: the exit access, the exit, and the exit discharge.

That portion of the exit access that occupants must traverse before two separate and distinct paths of egress travel to two exits are available is defined as a.

a. means of egress
b. single egress path
c. common path of egress travel
d. limited egress travel distance

c. common path of egress travel

IBC 1002.1

An non fully sprinkled office has an occupant load of 170. What is the minimum width of the exit corridor?

a. 60”
b. 48”
c. 44”
d. 34”

c. 44”

IBC par 1005.1 - (.2” per occupant would give 34”, but any occupancy above 50 the minimum given is 44” which governs)

A stairway that is considered as part of accessible means of egress should have a minimum width of:

a. 36”
b. 40”
c. 44”
d. 48”

d. 48”

IBC 1007.3

The maximum vertical distance between landings in a stairway is:

a. 6'
b. 8'
c. 12'
d. 16'

c. 12'

Ballast 29-24

Doors in 2-hour stairway must be rated as __ hours, and those in 1-hour stairways must be rated as __ hours:

a. 1½ - 1
b. 1-1½
c. 1½-1½
d. 1-1

a. 1½ - 1

Ballast 29-24
IBC 1019.1

Group I and H occupancies, serving 10 or less occupants, not more than 1 story above the level of exit discharge

Stairways serving and contained within a single residential dwelling of Group R-2 and R-3, and guestrooms in R-1 occupancies

Up to 50% of the number of stairways in other occupancies

Do not have to be enclosed (True / False)

True

Ballast 29-24

IBC 1019.1

The staircase in a 4+ floor height should be enclosed in a __ hour rated wall. In a building of 3 or less floors, in a __ hour wall:

a. 2 - 1
b. 2 - 2
c. 1 - 1
d. 1 - 1

a. 2 - 1

Ballast 29-23

The range of acceptable heights of risers on a staircase is:

a. 6” - 7”
b. 4” - 7”
c. 6” - 8”
d. 4” - 8”

b. 4” - 7”

Ballast 29-24