



First Responder Inspector

CHAPTER SIX

OCCUPANCY SAFETY AND EVACUATION PLANS

Part 2



Slide 1

Welcome to Part 2 of Chapter 6, Occupant Safety and Evacuation Plans

In this Part we will discuss:

- Fire and Exit doors
- Types of doors
- Horizontal exits
- Door hardware
- Door maintenance
- Stairs and Ramps
- Fire Escapes
- Smoke enclosures
- Fire separation
- Areas of Refuge
- Exit lighting and Exit signs
- Emergency Power
- Maintenance of means of egress
- we will conclude with a review of this Part

Slide 2

For purposes of fire prevention and escape from fire, doors are design to act as a barrier to the spread of smoke, hot gases, and flames and to serve as a component of the means of egress. Exit doors are usually required to swing in the direction of exit travel but not always. The building code allows a door that opens into a corridor providing access to exit to swing in as long as the occupant load of the room or suite is 60 or less.

The building code also requires that the minimum width of a door, that opens into or is located within a public corridor or other facility that provides access to exit from a suite, to provide a clear opening of not less than 800mm if there is only one door leaf. In a doorway with multiple leaves the active leaf must provide a clear opening of not less than 800mm and must be openable with not more than one releasing motion. When accessibility provisions of the building code apply, the door must be operable with one hand in a closed fist position, without requiring tight grasping, pinching with fingers, or twisting of the wrist, and with a force not more than 22 N.

Reference

BCBC 3.3.1.11. Door Swing

BCBC 3.8.3

BCBC 3.4.6.11

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An egress door from an individual dwelling unit or from a suite of residential occupancy is permitted to be provided with additional devices that require a releasing operation in addition to the main door release hardware as long as these devices are readily operable from the inside without the use of keys, special devices or specialized knowledge.

Reference

BCBC 3.3.1.13.4)

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The floor and landing on each side of the door should be level to avoid trip and fall hazards. An

exception to this is doors are permitted to open onto not more than one step, which is not more than 150mm (6") high, where there is a risk of blockage by ice or snow.

For swing type doors, the distance between a stair riser and the leading edge of a door during its swing should be not less than 300 mm. In this case, the door swings over the stairs, causing a tripping hazard. Done correctly, the door swings over the landing with 300mm or approximately 12" to spare. In this case, the corrective action was for the landing and stairs to be rebuilt to meet code, as can be seen in this photo.

Reference
BCBC 3.3.1.11. Door Swing
BCBC 3.8.3
BCBC 3.4.6.11

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There are many different types of doors used as exits, from swing type doors, to sliding doors, to revolving doors, and doors made of glass, metal, or wood and the fire inspector must be familiar with all types. Sometimes, there are more exit doors than are actually required, and occasionally, the property representative will ask if they can do away with one of the marked exits to use the space for something else. If the exit is not required, the exit could be done away with, but that would require removing any signs that indicate it as an exit. If the exit signs are left in place, the exit must remain operational.

All exit doors should swing outward in the direction of travel unless an exception is made in the building code.

Reference NBC 3.4.6.12.

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Sliding exit doors are permitted, provided they are designed and installed to swing on the vertical axis in the event of a power failure or activation of the fire alarm system. They must swing in the direction of travel to the exit when pressure is applied, and they must be identified as a swinging door by means of a label or sign affixed to the door.

Reference
BCBC 3.3.1.2

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Revolving doors are allowed by the building code, but they must be collapsible and have hinged exit doors that provide the required exit capacity located next to them. This is in case a revolving door malfunctions or becomes obstructed or to accommodate those who do not wish to use the door because of a physical disability or other reason.

Revolving doors can only be used at ground level and not at the foot a stairway. The glass must be tempered or safety glass that is approved for the use.

Revolving doors are not considered to have an exit capacity for more than 45 occupants and the allowable exiting capacity is based on the clear width of passage through the door enclosure when the doors are fully collapsed.

Revolving doors generally comprise three or four leaves which are angularly spaced about a

center shaft. The leaves rotate together with the center shaft under normal operation. Most revolving doors also include a collapsing mechanism which permits the leaves to be collapsed flat against one another to allow people to pass straight through the door in the event of a fire or other emergency, thus providing a safety feature.

Reference
NBC 3.4.6.15. Revolving Doors

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Horizontal exits allow for the evacuation of people from the fire area to another protected area without them having to go outside. As identified in the chapter on Performing an Inspection, horizontal exits are common in schools, hospitals, office buildings and residential apartment buildings that are divided by fire separations walls.

References
NBC & BCBCF 3.4.1.6
A-3.4.1.1.(1)

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Although the building code requires the door on the right hand side of a horizontal exit to swing in the direction of travel through the exit, the direction of swing of the door on the left side will depend on the function of the horizontal exit. If it provides for movement from one building to the adjacent building but does not require movement in the reverse direction, both doors must swing in the direction of travel to the adjacent building as shown in this photo.

If the design is based upon both buildings providing complementary movement in either direction, then the doors must swing in opposite directions. An exit sign should be placed directly above a door that swings in the direction of travel. In this case, the exit sign is placed over the center of the two doors, indicating a singular direction of exit travel.

Reference
NBC & BCBC 3.4.6.10 see A-3.4.6.10.(5) Door Swing.

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A door equipped with a latching mechanism in an access to exit from a room or suite of assembly occupancy having an occupant load more than 100 and all F1 high-hazard industrial occupancies must be equipped with a device that will release the latch and allow the door to swing wide open when a force not more 90N is applied to the hardware. This is normally referred to as panic hardware.

In the case of a path of travel for persons with disabilities, doors must open when the force applied to the releasing mechanism is not more than 38 N in the case of an exterior swinging door, and 22N for interior doors and sliding doors.

The N stands for Newton which is a measurement of pressure required to operate the door. Newtons are named after Sir Isaac Newton and 90N is equivalent to about 20 pounds pressure, 22 Newtons is approximately 5 pounds and 38N is approximately 8.5 pounds pressure.

References
BCBC 3.3.1.13

BCBC 3.8.3.6
BCBC 3.4.6.16

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Fastening Device or turn-pieces which must be rotated through an angle of more than 90° before releasing a locking bolt are not considered to be readily openable. The release of a locking bolt should allow the door to open without having to operate other devices on the door.

If panic hardware is installed on a door with a required fire rating, the hardware must also be rated.

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When building security is an issue, electromagnetic locks are often permitted by the building code to keep doors in the closed position. They are normally permitted to be installed on doors, other than those leading from a high-hazard industrial occupancy, provided the building is equipped with a fire alarm system, the locking device releases upon actuation of the alarm signal or power loss, or upon activation of the sprinkler system.

Normally the electromagnetic device releases immediately or within a few seconds of activation of a manually operated switch readily accessible to authorized personnel.

Upon release, the locking device can only be reset manually.

A sign must be permanently mounted on the door to indicate that the locking device will release within 15 seconds of applying pressure to the door-opening hardware.

Release hardware for the operation of these doors must be installed at a height between 900mm and 1100mm above the finished floor.

There are specific requirements in the building code for the security of banks and mercantile floor areas that should be referred to.

References
NBC 3.4.6.16
NBC 3.4.6.17
A-3.4.6.16.(4)

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Electromagnetic locks are intended for use where there is a need for security additional to that provided by traditional exit hardware. They are not intended for indiscriminate use as alternative locking devices. The design of these devices requires evaluation to ensure that their operation will be fail-safe in allowing exiting in the event of foreseeable emergencies. If more than one magnetic locking device is used in a building, it is expected that one switch will release and reset all devices simultaneously.

References
NBC 3.4.6.16
NBC 3.4.6.17

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The building code requires headroom clearance for doorways of not less than 2030mm or 6' 7"

and door closers or other devices can not be installed to reduce the headroom clearance of a doorway to less than 1980 mm (6' 5").

The building and fire codes prohibit the use of mirrors or drapes in or adjacent to any exit in a manner that would obstruct the visibility or impede access to the exit.

Reference
NBC 3.4.3.4 Headroom clearance
NBC 3.4.1.9. Mirrors near Exits

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The fire code requires that all doors forming part of a means of egress be tested monthly to ensure they operate as designed. The safety features of revolving doors must be tested annually which is also the case for sliding doors that are required to swing on their vertical access when pressure is applied. Doors that are equipped with electromagnetic locks also require testing at intervals not greater than 12 months.

Records of these tests are required to be retained so that at least the current and the immediately preceding records are available. Regardless of the foregoing, records must not be destroyed within two years of the last inspection.

Reference
BCFC 2.7.2.1
BCFC Division C 2.2.1.2

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Exit stairs are a critical component of the means of egress and should be designed to minimize the danger of falling which could result in obstructing other occupants trying to exit the building. The construction of stairs must meet the building code requirements which include but are not limited to:

- There should be no reduction in the width of stairs along the path of travel to the exit.
- The surface of exit stairs and ramps should be finished with slip resistant material.
- The leading edge of the stairs and landings should be coloured contrasted or have a distinctive pattern which is readily visible from both directions of travel.
- Treads and landings for exterior exits more than 10m high
- should be designed to be free of snow and ice accumulations.

Reference
NBC 3.4.6

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- Every flight of interior stairs to have not less than 3 risers.
- Treads and risers should not differ significantly in run and rise in successive flights in any stair system.
- Normally a flight of stairs should not have a vertical rise of more than 3.7 m (12' 4") between floors or landings. Landing should be provided to break up any excessively long individual flight of stairs.
- A landing should be provided at the top and bottom of each flight of stairs and where doors open onto the stairs.
- Railings should be provided on all new stairs and that start
- before the stairs begin and end after the stairs end.

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- Stairs should have a run of not less than 280mm (11") and a rise of not less than 125 mm (5") and not more than 180 mm. (7") between successive treads.
- Stair rise is the vertical distance from the top of one tread to the top of the next tread.
- The total rise is a stairway's overall change in height, from the bottom to the top landing surfaces.
- Stair run is the width of the stair tread that you stand on.
- The total run is the overall horizontal distance traveled by the stringer.
- Curved stairs must have handrails on both sides, have a minimum run of 240mm, (9.5")

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The building code no longer permits fire escapes to be constructed on new buildings, but if it is impractical to provide one or more approved exit facilities, like internal or external stairs, fire escapes can be used on existing buildings.

Access to fire escapes should not require keys or special knowledge and must be from corridors through doors at floor level, except that access from a dwelling unit is permitted to be through a window having an unobstructed opening not less than 1100mm high by 550mm wide with a sill height of not more than 900mm above the inside floor.

The clear area of a fire escape landing onto which a door opens must be at least 1m².

References

NBC 3.4.7

BCFC 2.7.1.6

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Fire escapes must be made of metal or concrete, of the stair type extending to ground level and be securely fastened to the building.

If the flight of stairs leading to the ground at the bottom of a fire escape is not fixed in position, it must be held in the raised position without a latch or locking mechanism and must be fitted with a counterbalancing device that will permit it to be easily and quickly brought into position for use. Wooden fire escapes are permitted to be used on buildings of combustible construction if all posts and brackets are not less than 89mm, three and a half inches, in their least dimension, and all other woodwork is not less than 38mm or an inch and a half in dimension.

References

NBC 3.4.7.2

NFC 2.7.1.6

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As discussed in the chapter on Performing an Inspection, be sure to visually inspect the structural stability of fire escapes, decks, railings, stairs and handrails. In many cases, fire escapes are old and may not have been inspected for years.

Reference: NBC 3.4.7

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Wooden fire escapes should be checked for rot, while metal fire escapes should not show visible signs of rust and should be painted. To ensure strength and rust resistance, any nuts or bolts that are worn out or missing should be replaced with stainless steel fasteners with a minimum of 9.5mm or 3/8" diameter, of the appropriate length. This ensures both the strength and resistance to rust for years to come.

Reference: NBC 3.4.7

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This news video suggests just how big the problem may be for building owners, occupants and emergency service personnel. Once again, click "play" to watch the video and after watching the video click the "next" button to carry on with this presentation.

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The three most important fire safety measures in buildings to protect the occupants are early detection of a fire, adequate exiting, and fire separation. Fire separations are structural elements made in accordance with building code requirements that prevent the spread of fire and smoke. Exits are usually fire separated from the remainder of the building to provide occupants time to escape the building with limited exposure to fire, heat and smoke.

The building code requires every exit to be fire separated from the remainder of the building by a fire separation having a fire-resistance rating not less than 45 minutes or more than 2 hours. This limits the possibility of smoke and hot gasses from entering the exit.

An exit must be designed for no purpose other than for exiting, except that an exit is allowed to serve as an access to a floor area.

NBC 3.4.4.4

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A fire separation that separates an exit from the remainder of the building should not have any openings except for standpipe and sprinkler piping, and electrical wires and cables, totally enclosed in non-combustible raceways and non-combustible piping that serve only the exit.

Fuel-fired appliance are not allowed to be installed in an exit and the exit should not be used as a plenum for a heating, ventilating or air- conditioning systems.

Service rooms, storage rooms, washrooms and other similar ancillary rooms are not allowed to open directly into an exit. This reduces the possibility of smoke and other contaminants entering the exit in the event of a fire.

NBC 3.4.4.4

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At one time safe refuge areas were provided for in the building code for many occupancy* classifications. Today, they apply to Group B care, treatment or detention occupancies and are designed to hold occupants during a fire or other emergency when evacuation may not be safe or possible. Occupants can wait in the refuge area until rescued by firefighters. This can apply to any persons who cannot access a safe escape route.

Areas of Refuge are compartments containing rooms such as operating rooms, recovery rooms, delivery rooms and intensive care units, from which it is impracticable to move patients in an emergency. The area must be separated from adjacent spaces by fire separations having a fire-resistance rating not less than 1 h, and be provided with a mechanical air supply so that during a period of 2 h after the start of a fire in another space, the compartments will not contain more than 1% by volume of contaminated air from the fire area.

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Areas of refuge should:

- Be located adjacent to an emergency exit path
- Have signs designating where to go for shelter
- Be fire separated
- Have a fresh air intake
- Be equipped with emergency lighting for power outages
- Have a two-way voice communication system
- Be large enough for wheelchair accessibility
- Be located where it doesn't block others trying to escape

Every floor area that is not sprinklered throughout and has an accessible path of travel must be served by an elevator that conforms with the building code. In buildings more than 3 storeys high the elevator must be protected against smoke movement into the hoist way.

Refuge areas are intended to provide temporary refuge for persons with disabilities. It is acknowledged, however, that the measures cannot provide absolute safety for all occupants in the fire area. It may, therefore, be necessary to develop special arrangements in the fire safety plan to evacuate persons with disabilities from these areas.

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Ropes and ladders are not recognized as approved means of egress, but in some cases, they are the only means of escape from single-family dwellings where it is not practical to add a second means of egress. In this case, a rope, chain, or folding ladder may provide a better alternative than jumping out the window. Human limitations such as age or physical ability must be considered. Where these methods are used, public education is a must.

Windows are not normally considered as a means of egress but can be used to access a fire escape if they meet certain criteria. For security purposes, windows are often protected by metal security grilles, which would prevent the escape from fire.

Some jurisdictions will allow windows to be used as a second means of egress from residential daycares, provided there are a limited number of children, and they are age-appropriate with the physical ability to use the exit. Usually, this requires stairs and a landing to provide access and the window discharges at ground level.

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Buildings over two storeys high, buildings with an occupant load over 150, or buildings that have a fire escape are required to have exit signs. New buildings require the international running man green and white signs. However, because the building code is seldom retroactive, the red exit signs in existing buildings do not have to be changed out. In most jurisdictions, if one or two signs require replacement, they can continue to install the red exit signs to maintain continuity. If, however, there is a need to replace a bunch of exit signs, this may provide the opportunity to replace all the signs with the running man signs.

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The building code requires every room or space used by the public to be provided with lighting outlets with fixtures controlled by a wall switch or panel. The building code also requires every exit, public corridor, or corridor providing access to exit for the public to provide illumination to an average level not less than 50 lx at floor or tread level. The minimum value of the illumination must be not less than 10 lx.

Lux or (lx) is the International System of Units that describes the measurement of illuminance. Lux or lx means lumens per square meter and refers to brightness.

References

NBC 3.2.7

NBC 9.34.2.7

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The building code also requires emergency lighting to be provided to an average level of illumination of not less than 10 lx at floor or tread level in:

- exits,
- principal routes providing access to exit in open floor areas and in service rooms,
- corridors used by the public,
- corridors serving sleeping rooms in a treatment occupancy, and care facilities
- corridors serving classrooms,
- underground walkways,
- public corridors,
- floor areas where the public may congregate
- Group A Division 2 assembly occupancies with an occupant load of 60 or more
- Daycare facilities
- Food preparation areas
- Public washrooms

As a rule of thumb, 10 lx is about enough light to see to tie your shoelaces.

References

BCBC 3.2.7.3

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The building code also requires an emergency power supply to be provided to maintain the emergency lighting from a power source such as batteries or generators that will continue to supply power in the event that the regular power supply to the building is interrupted.

When emergency generators are used to provide emergency power, they must be installed in conformance with CSA C282, “Emergency Electrical Power Supply for Buildings” or with CSA Z32, “Electrical Safety and Essential Electrical Systems in Health Care Facilities.”

Emergency power systems must be inspected, tested and maintained in conformance with CSA C282, “Emergency Electrical Power Supply for Buildings.” The Canadian Standards Association (CSA) has developed safety guidelines for emergency generators. This standard applies to the design, installation, operation, maintenance, and testing of emergency generators and associated equipment.

To make it easier CSA has created a series of inspection, testing and maintenance checklists that are available online. Simply google with CSA C282, “Emergency Electrical Power Supply for Buildings” for copies of the checklists.

When emergency generators are used, there can be a delay of up to 10 seconds before the transfer is made to the emergency power supply.

References
BCBC 3.2.7
BCFC 6.5.1

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Emergency lighting must be designed and installed so that if the regular power fails, emergency power will assume the electrical load automatically for a period of 2 hours for high buildings, and 1 hour for Group B major occupancies, and 30 min for any other building.

In some areas power outages are frequent and may be of long duration. These local conditions should be taken into account in determining the type of system for supplying emergency power for lighting. This should be studied at the planning stage of a building project in conjunction with the local fire safety and building officials.

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The fire code provides the requirement for inspection, testing and maintenance of exit signs and emergency lighting. Exit signs must be inspected at intervals not greater than 12 months to ensure that the exit signs will be visible upon failure of the primary power supply. Exit signs provided with a battery back-up must be inspected monthly to ensure the exit signs will be visible upon failure of the primary power supply and the lights are working. Every 12 months, exit signs must be tested by a qualified person acceptable to the authority having jurisdiction to ensure they will be visible for a duration equal to the design criterion upon failure of the primary power supply.

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The fire code requires self-contained emergency lighting equipment to be inspected at intervals not greater than one month to ensure that:

- terminal connections are clean, free of corrosion and lubricated when necessary,
- terminal clamps are clean and tight as per manufacturer's
- specifications, and
- the battery surface is kept clean and dry.

Self-contained emergency lighting units must be tested at least monthly to ensure that the emergency lights will function upon failure of the primary power supply and at intervals not greater than 12 months to ensure that the unit will provide emergency lighting for a duration equal to the design criterion under simulated power failure conditions.

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After completion of the annual test, the charging conditions for voltage and current and the recovery period must be tested to ensure that the charging system is functioning in accordance with the manufacturer's specifications.

The monthly test can be performed by trained building occupants but the annual inspection and testing must be performed by a qualified person acceptable to the authority having jurisdiction.

Building owners must ensure that fire protection and life safety systems like emergency power and emergency lighting, including their interconnections with other building systems, are functioning according to the intent of their design.

BCFC 6.5.1.7. Inspection of Emergency
BCFC A-6.8.1.1.(1)

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Time and time again, fire inspectors walk into buildings and find exits and exit routes blocked. This poses a significant risk to all of the occupants.

How can anyone safely exit in an emergency if the exit door is locked, or there are chairs or tables filling the corridor?

Many building owners try to maximize the useable space in their building without considering the need for egress. In the case of this pub, for example, they wanted to maximize the space for seating, so they blocked off two exit doors. The door on the right is blocked by tables and chairs and the door on the left is blocked by band equipment. In addition, both exit doors were equipped with deadbolts and magnetic locks, making the exits inoperable. Fire inspectors should take immediate action to correct these deficiencies.

Unfortunately, most people don't recognize the problem until they experience an emergency situation where they have to rush out of the building because of a fire, explosion, or other emergency.

That is why the fire code requires that every means of egress to be maintained in good repair and free of obstructions.

References:
BCFC 2.7.1.6

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The fire code also requires exterior passageways and stairs to be maintained free of snow and ice accumulations.

In this case, the stairs are covered in snow, and the bottom of the stairs is completely blocked. A clear passageway to an unobstructed area must be provided. This may require manually removing the snow.

Where equipment is provided to melt snow or ice on exterior passageways or exterior exit stairs, such equipment must be maintained in working order or alternative measures must be taken to comply.

Where an exit door leading directly to the outside is subject to being obstructed by parked vehicles or storage because of its location, a visible sign or a physical barrier prohibiting such obstructions must be installed on the exterior side of the door.

References:
BCFC 2.7.1.6

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In Part 2 we discussed:

- Fire and Exit doors are designed to act as a barrier to the spread of smoke, fire and hot gases
- Most doors should open onto a level landing to avoid trip and fall hazards.
- Types of doors, including swing, revolving, and sliding doors, that may be part of a means of egress.
- Automatic sliding doors that form part of an exit must also swing on their vertical access and have emergency activation signs posted.
- Revolving doors are allowed by the building code, but they must be collapsible and can only be used at ground level.
- Horizontal exits allow for the evacuation of people from the fire area to another protected area.
- Panic hardware is required in assembly occupancy having an occupant load more than 100 and in all F1 occupancies.
- When building security is an issue, electromagnetic locks may be permitted.
- The fire code requires that all doors forming part of a means of egress

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We also discussed:

- Fire escapes - Wooden fire escapes should be checked for rot, while metal fire escapes should not show visible signs of rust and should be painted.
- Fire separation of exits and that service rooms, storage rooms, washrooms etc. should not open directly into an exit.
- That safe refuge areas are used in Group B care and treatment facilities where occupants may not be able to leave the area.
- Exit signs are required in buildings over two storeys and when the occupant load exceeds 150 people.
- We discussed when emergency power and emergency lighting is required and maintenance requirements.
- And
- We finished this Part taking about the need for every means of egress to be maintained in good repair and free of obstructions.