

Fact Sheet 3.4.4: Building Utility Systems—Conveyances

The mitigation objective of this Fact Sheet is to improve the resilience of building conveyance systems and their components to allow a building to continue to be used or quickly repaired following a hurricane or flood, with an end goal of rapidly returning the building to full functionality.

Conveyance systems include elevators, escalators, lifts and moving walkways. Lifts are more common in small public buildings and may include outside passenger lifts consisting of a cab connected to two or more hoist beams, inside chairlifts to assist those in wheelchairs along a staircase between floors, and vertical platform lifts (VPLs) that can be installed inside or outside the building.

Vertical conveyance systems include elevators, escalators and lifts. The typical components of hydraulic and traction elevators used in small and large public buildings are shown in Figure 3.4.4.1. The typical components of escalators sometimes used in large public buildings are shown in Figure 3.4.4.2.

All components of conveyance systems can be considered primary components, which means that they must all work for the system to work. When a primary component is damaged, the entire system stops working.

Flood is the primary risk to conveyance systems. Walls and openings can be mitigated to protect conveyance systems inside buildings (see Fact Sheet 3.2, *Walls and Openings*.) However, wind and wind-related damage to conveyance systems could result from damage to rooftop-mounted equipment. Mitigation measures for rooftop-mounted conveyance system components and equipment include locating the equipment inside a penthouse built to resist wind pressures, wind-borne debris and wind-driven rain. Extra protection also can be accomplished by following best practices, which often go beyond minimum codes and standards. Additional information about measures to mitigate against wind are discussed in Fact Sheet 3.3.1, *Sloped Roof Systems*, and Fact Sheet 3.3.2, *Low-Slope Roof Systems*.



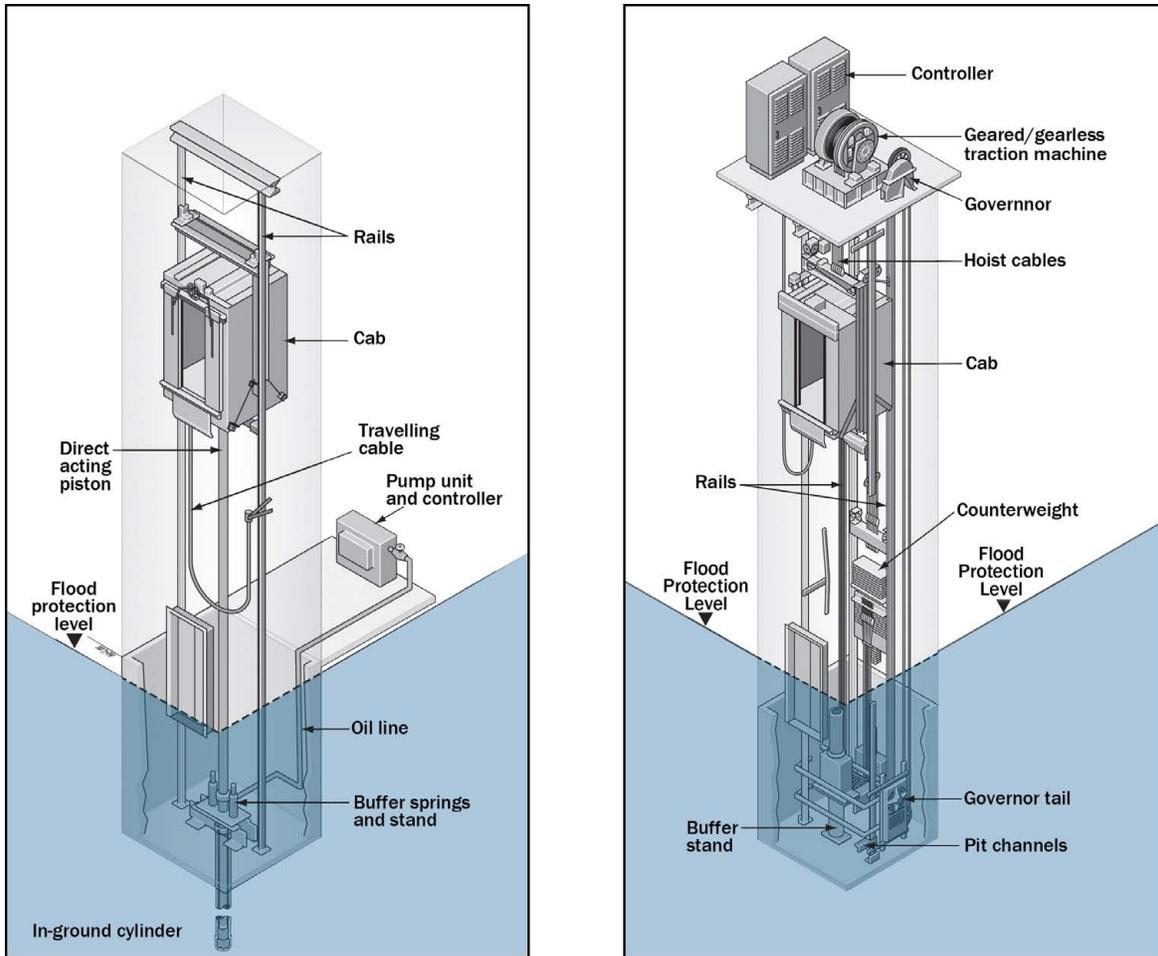


Figure 3.4.4.1. Typical elements of hydraulic elevators common in low-rise construction (left) and traction elevators common in high-rise construction (right). (Source: Otis Elevator Company)

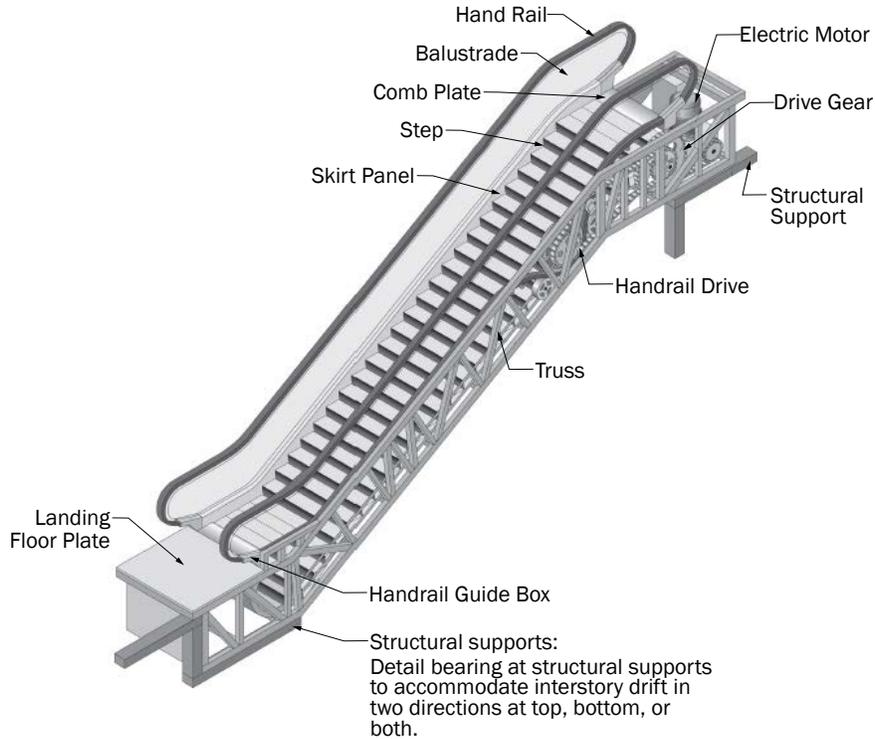


Figure 3.4.4.2. Typical elements of escalators used in some large public buildings. (Source: Otis Elevator Company)

Table 3.4.4.1 summarizes some common mitigation solutions that can improve the performance of building conveyance system components. These strategies then are discussed in the sections that follow.

Table 3.4.4.1. Common Mitigation Solutions for Conveyance Systems

<i>Solutions and Options</i>	<i>Coastal Flood</i>	<i>Riverine Flood</i>
Mitigation Solution: Protect		
Option 1: For Elevators	✓	✓
Option 2: For Escalators and Moving Walkways	✓	✓
Option 3: For Lifts	✓	✓

Mitigation Solution: Protect

Option 1: For Elevators

Some measures can be taken to protect elevators against hurricane and flood damage. When evaluating mitigation measures for elevators, consider the following:

- Design elevator shafts that extend below the flood protection level to resist flood forces. Consider dry floodproofing shafts to make them substantially impermeable and add equipment such as sump pumps to eliminate seepage.
- Raise as many elevator components as possible above the flood protection level.
- For hydraulic elevators, elevate the cab, equipment room, hydraulic pump, hydraulic reservoir and electrical control panel.
- For traction elevators, elevate the cab, equipment room, counterweight and roller guides, hoist cable, limit switches, electric hoist motor and electrical control panel.
- Wherever possible outside of Zone V or Coastal A Zones, protect components below the flood protection level by dry floodproofing in water-resistant enclosures.
- Where elevation and dry floodproofing are not possible, protect components below the flood protection level by using flood-damage-resistant materials or coatings.
- Use stainless steel doors and frames, galvanized hardware and galvanic or rust-preventive paint below the flood protection level.
- Consider raising one or more elevators with dedicated standby power so the landing ends on a higher floor. This will cause the bottom of the pit to be above the flood protection level for large critical facilities such as hospitals, where elevators are essential to support operations.
- Install float switches at the bottoms of elevator shafts to prevent cabs from descending into floodwater as shown in Figure 3.4.4.3.

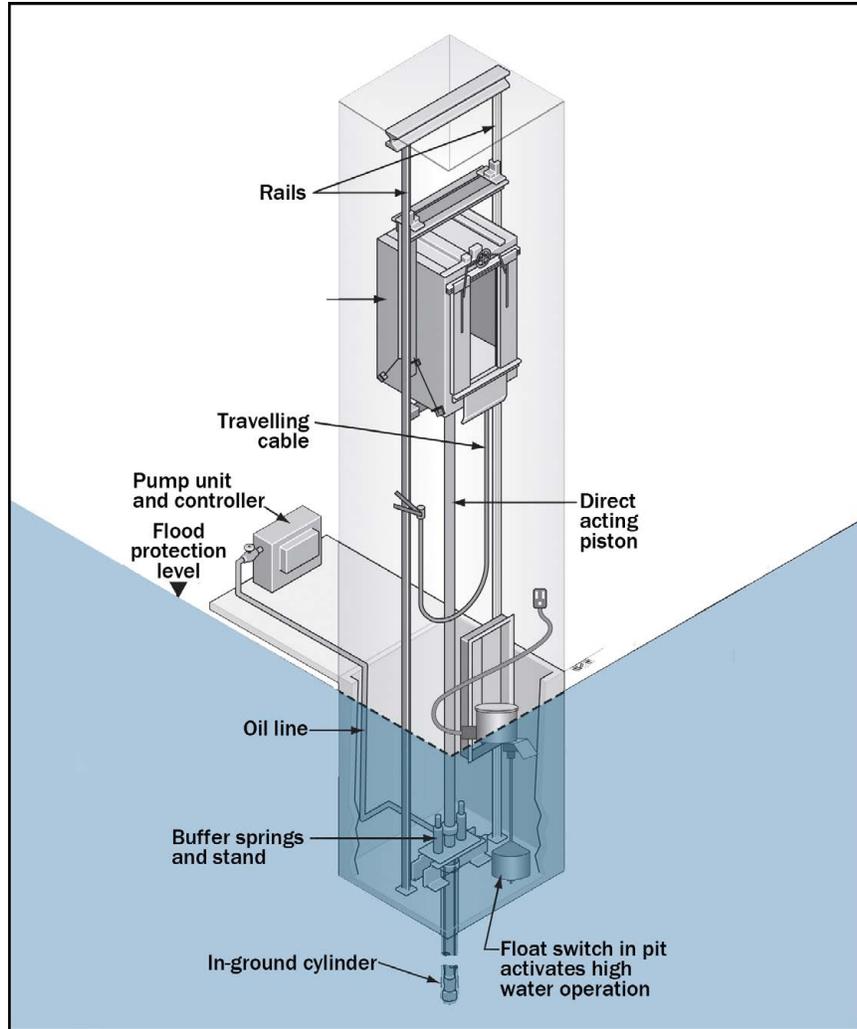
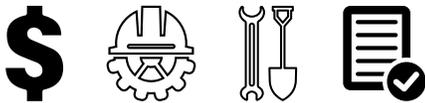


Figure 3.4.4.3. Float switch in pit to stop cab descent. (Source: Otis Elevator Company)

CONSIDERATIONS:

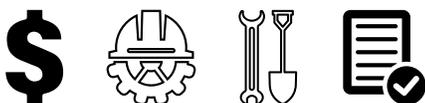


Option 2: For Escalators and Moving Walkways

Mitigation measures can be implemented to help protect escalators and moving walkways from flood damage. While many escalators and moving walkways are located inside buildings, some are partially or fully outside. When evaluating mitigation for escalators and moving walkways, consider the following:

- Mitigation is best achieved by elevating as many components as possible above the flood protection level. Most indoor escalator and moving walkway components can be located at or above the flood protection level. See Fact Sheet 3.2, *Walls and Openings*, for information about protecting indoor systems by mitigating the building envelope. See Fact Sheet 3.4.2, *Building Utility Systems—Electrical*, for additional information about mitigation for electrical system components.
- For outdoor escalator and moving walkway components, use one or more of the following measures to reduce damage:
 - Use flood damage-resistant materials for outdoor escalator components at or above the flood protection level but exposed to weather.
 - Install sump pumps to limit water accumulation at escalator landings.
 - Design and construct escalator components located below the flood protection level like those located in the escalator pit to facilitate post-flood repair and restoration. The escalator pit contains equipment such as an oil/water separator, switches, and an escalator motor.
- To reduce flood risk to escalator pits, consider the following:
 - Elevate vulnerable components as high as practical to reduce flood risks.
 - Consider placing electrical equipment in NEMA 6P-rated (water-resistant) enclosures.
 - Dry floodproof the escalator pit.
 - Install sump pumps in the pit to prevent water buildup from seepage. Size sump pumps and discharge piping to remove the maximum amount of seepage from the total area of the facility that could drain into the escalator pit. When retrofitting existing facilities, make sure that the penetrations into the pit are sealed and the sump discharge piping releases water above the flood protection level. When that is not possible, install check valves to prevent floodwaters from backflowing into the pit.
 - Use corrosion-resistant components or coatings wherever possible for equipment in the pit.
- Place electrical and mechanical equipment in rooftop penthouses designed to resist wind forces for the geographic area.

CONSIDERATIONS:



Option 3: For Lifts

Lifts are used to get people from one level to another when it's not possible to install a ramp to move people between floors. Lifts include vertical passenger lifts and inclined stair lifts, as shown in Figure 3.4.4.4. Passenger lifts differ from elevators in that elevators have fully enclosed cabs while passenger lifts typically have open cabs with panels on the sides of the platform. Stair lifts are motorized seats attached to a fixed track located near the stair rail to carry people up and down stairs. VPLs move people in wheelchairs or scooters between levels of a building.

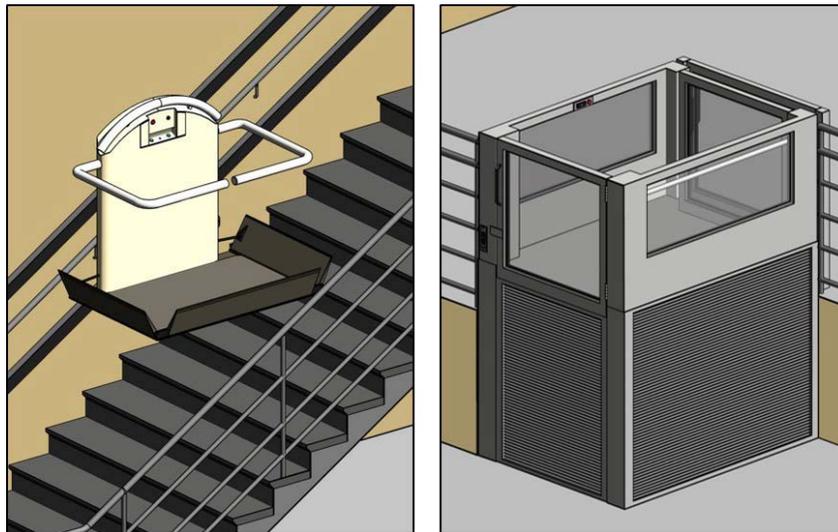


Figure 3.4.4.4. Inclined (left) and vertical (right) platform lifts move people between floors of a building. (U.S. Access Board, 2015)

The most effective lift mitigation is to elevate as many of the components as possible above the flood protection level. See Fact Sheet 3.4.2, *Building Utility Systems—Electrical*, for additional information about mitigation for electrical system components.

- For passenger lifts, place hoist cables and lift controls above the flood protection level and use flood-damage-resistant materials such as aluminum or stainless steel for hoist beams and passenger lift cages.
- Stair lifts typically are inside buildings, so there is little risk from outside elements, such as wind or wind-borne debris. Elevate as many components as possible above the flood protection level.
- Place VPLs inside the building and above the flood protection level whenever possible to protect them from flood damage.

CONSIDERATIONS:



REFERENCES:

Detailed information on hurricane mitigation of building mechanical systems can be found in these publications. Much of the residential information applies to non-residential buildings as well.

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