6.4 MECHANICAL, ELECTRICAL, AND PLUMBING COMPONENTS

6.4.10 ELEVATORS AND ESCALATORS

6.4.10.3 ESCALATORS

Escalators typically span between two floors, and although most escalators run in a straight line, spiral escalators are found in some locations. The failure of any of the component parts of the escalator or escalator equipment could disable the functionality of the system.

TYPICAL CAUSES OF DAMAGE

- The primary components of an escalator system are the steps, chain, inner rail, chain guide, drive gear, handrail, handrail drive, electric motor, and electrical control panel. These components are often supported by a truss that spans between the floors. Any of these components could be damaged if not properly detailed or restrained; failure of any of the component parts could disable the system.
- Escalators, like stairs, may form a strut or brace between adjacent floors unless they are detailed so the system will accommodate inter-story drift. Damage could occur to the skirt, landing plate or other components not detailed to accommodate either an extension or shortening of the distance between the two landings.
- According to survey responses collected by the Division of Occupational Safety and Health Elevator, Tramway, and Ride unit, 65 escalators were damaged in the 1994 Northridge earthquake. It was reported that escalators came off upper supports, and several truss support angles had their bolts sheared off where one truss actually dropped. Glass came out of its supports and shattered, handrails collapsed. In addition, numerous deckboards, skirts and newels were damaged.

Damage Examples

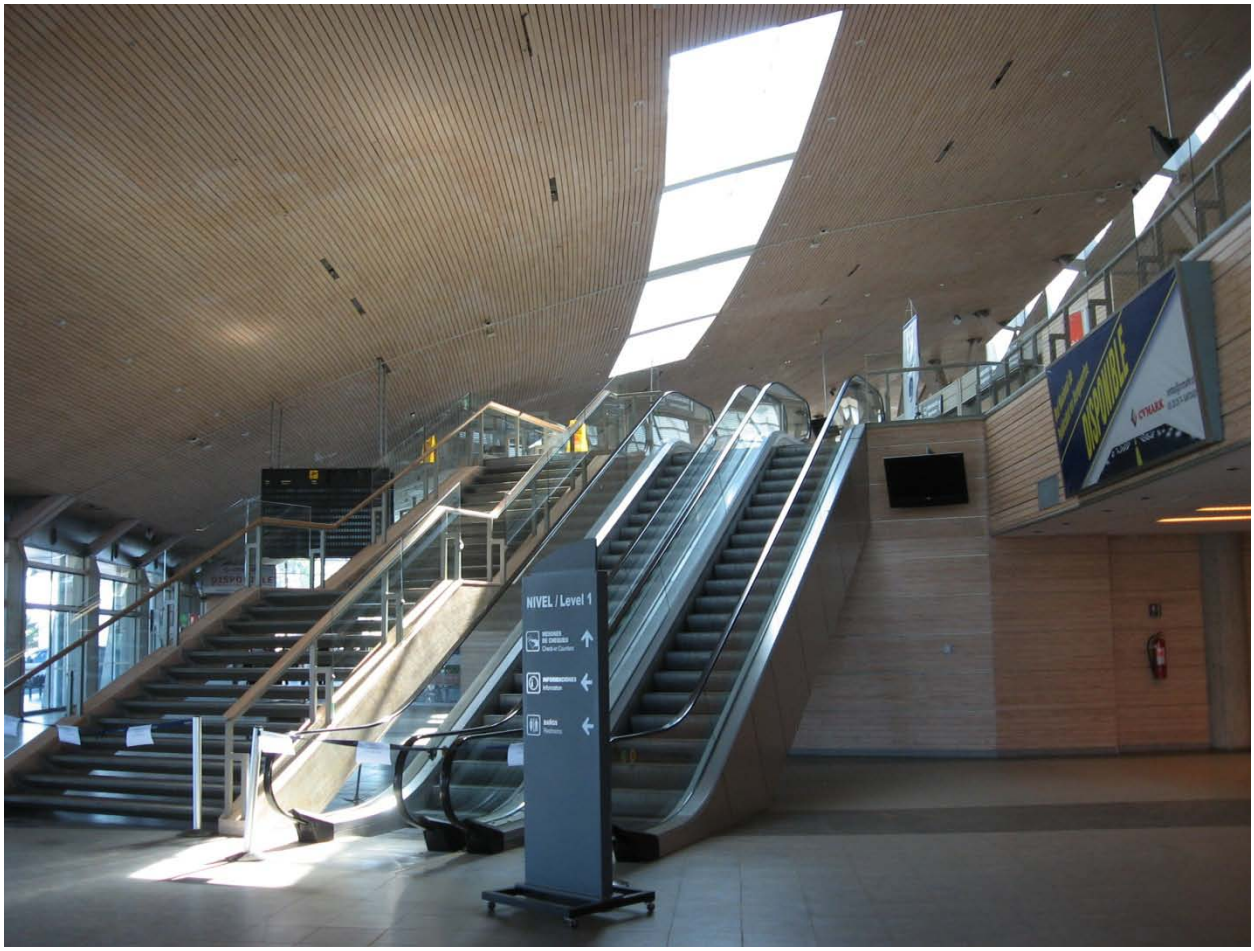

Figure 6.4.10.3-1 Extensive nonstructural damage resulted in the closure of Concepción airport in the 2010 magnitude-8.8 Chile Earthquake; both the stair and escalator were cordoned off to limit access to the upper level although there was no visible damage to the escalator (Photo courtesy of Rodrigo Retamales, Rubén Boroschek & Associates).

SEISMIC MITIGATION CONSIDERATIONS

- Each of the components of an escalator system need to be detailed to accommodate movement, or restrained and anchored to prevent damage in an earthquake. The system must be designed to accommodate the anticipated inter-story drift between the two connected floors. Where a truss is used to span between the two floors, the bearing seats should allow movement at one or both ends. Components such as the rail supports, handrails, landing plates, and skirts must be detailed to accommodate lateral deformations. All of the mechanical and electrical equipment needs to be properly anchored or restrained.
- Escalators have traditionally been designed to run continuously, whether they are in use or not. Some more energy efficient escalators operate on an intermittent basis and are triggered by the presence of passengers but otherwise are in a standby idle mode.
- All escalators should be inspected by qualified personnel following an earthquake. Unlike elevators, escalators typically function as a usable stair when they are not operating and could be used to facilitate evacuation following an earthquake.
- Elevator and escalator safety is governed by the prescriptive requirements in ASME A17.1, *Safety Code for Elevators and Escalators* (ASME, 2007a), a document that is continually evolving to reflect new elevator and escalator technologies. Local or state jurisdictions may have other elevator and escalator requirements.
- The internet provides information regarding escalators. Websites such as http://science.howstuffworks.com/transport/engines-equipment/escalator.htm describe the workings of escalators and provide links to other resources
- Some escalator models are offered with a seismic option; check for appropriate equipment before purchasing a new escalator.

Mitigation Details

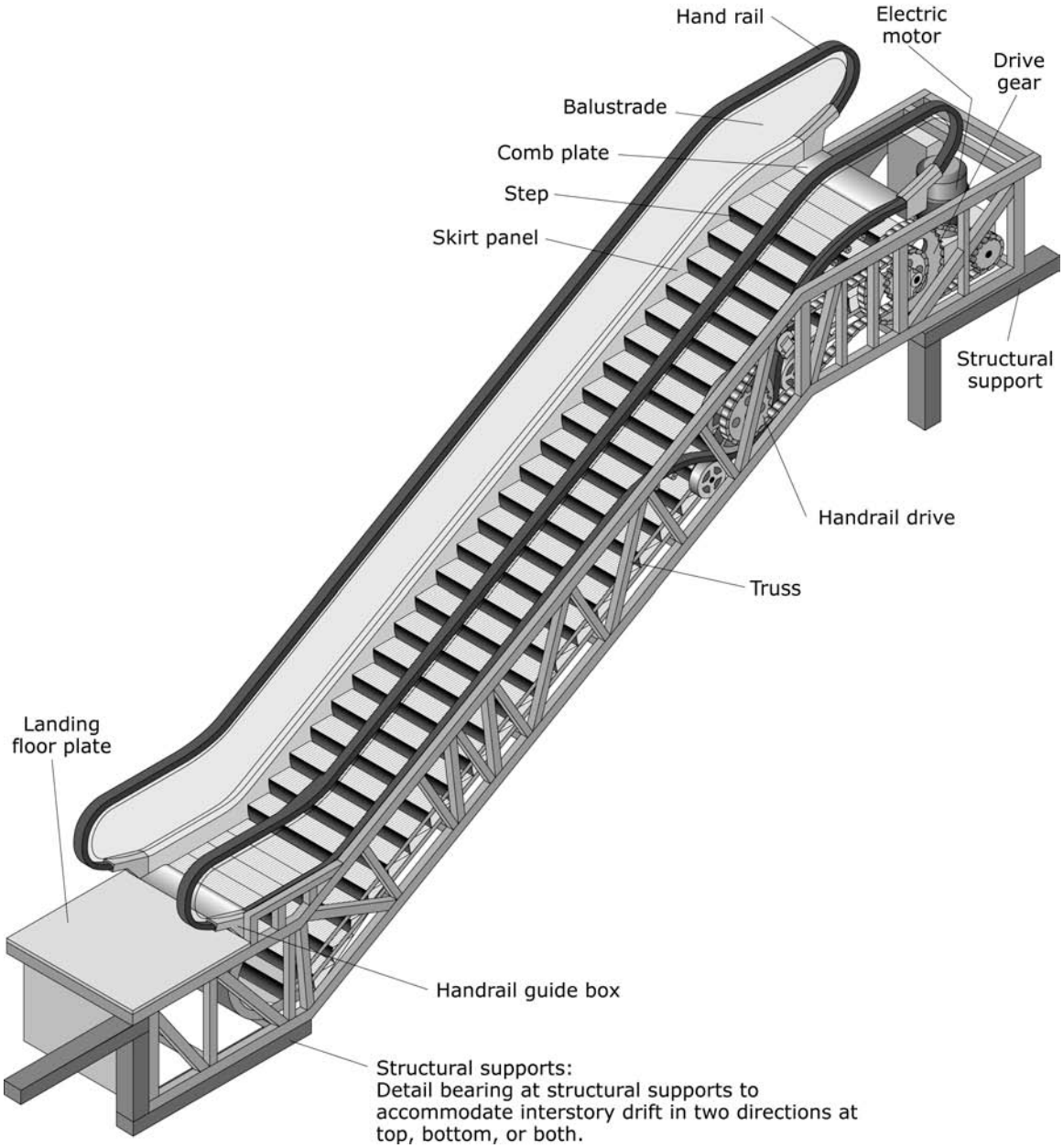

Figure 6.4.10.3-2 Schematic view of escalator (ER).