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DESIGN RESOURCE

3.10

Circulation
3.10 Elevators

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1. Overview

A passenger elevator is typically the most convenient form of travel between floors of a building for those who cannot or prefer not to use stairways or escalators. Usability issues that should be addressed in elevator design include: the capacity of the elevators, the space available in the cab, the positions and ease of control and communication, space for entry and exit, safety provisions to prevent doors from closing on passengers, and opening and closing times.

The invention of elevators enabled the construction of buildings higher than 3-4 floors, the maximum height that most adults can comfortably walk stairs, especially when carrying burdens. Elevators also enable small children to access multi-story buildings easily without being carried by parents. Elevators are also critically important for people with mobility impairments, who represent 13.7% of the total population (CDCP, 2020). Without elevators, the upper stories of buildings would be inaccessible to many people with such impairments, especially those who use wheelchairs. Building users with strollers, wheeled carts or carrying bulky or heavy objects benefit from the use and accessibility of elevators.

2. Issues to Consider

Types of Users and Uses of the Elevator: Building types often determine the types of users who inhabit them. For example, a low-rise apartment complex, a social security office building and a contemporary art museum will all have different user populations. The user population, in turn, determines the importance of elevators in building use. A low-rise apartment building may need to have an elevator large enough for families to travel together and accommodate moving furniture and appliances. Social security offices cater to an older population, many of whom will have difficulty using stairs. An art museum needs to move very large objects, even if the volume of visitors is low. Thus, it may need a much larger elevator than that required by accessibility codes. In all these buildings, there may be multiple wheelchair users or people with physical impairments in the elevator at the same time. The size of the building and its type will determine the capacity of elevators needed and how frequently they need to serve each floor. Thus, the designer and the building owner need to carefully evaluate the number and size of elevators needed. It is important to consider the need for more than one elevator, even in small buildings, since mechanical parts wear out and elevators will break down at some time, especially when they are used frequently and are left unsupervised. For example, elevators at busy transit stations are used very frequently. With only one elevator, a breakdown can strand people at one level and require trained emergency staff to come and evacuate non-ambulant individuals.

Restricted Access: It is common to restrict access to elevators in many buildings. An art museum may restrict use of a freight elevator to the public. Hotels often require guests to use swipe cards to access elevators. In the U.S., accessibility codes do not allow freight elevators to be an accessible means of access unless they are equipped like a passenger elevator. Such elevators should not be located only where it is convenient for movement of freight, e.g., at a service entry. If there are restrictions on use, they should be posted, and signs should direct people to the nearest passenger elevator intended for unrestricted use. Card or fob readers can be used to restrict access to different floors in the building to control access to spaces needing higher levels of security.

There are some unspoken rules of elevator etiquette that can lead to lapses in security. Examples include holding the elevator door open for someone rushing in or pressing floor

buttons for others in the elevator. Such actions mitigate the success of security systems in the elevator and require a higher level of security (Silva). Where security is a major concern, elevators should be located behind a secure perimeter and access through the perimeter needs to be accessible to people with disabilities.

Location in Relation to Other Circulation Methods: Elevators can be used as a means of emergency egress but only if they are designed to serve that function. Where elevators are not designed for emergency egress, they automatically return to the ground floor and shut down. In emergencies, people tend to exit the building the way they came in, which is usually using elevators. Thus, elevators and at least one emergency stairway or refuge should be located together to prevent people from getting trapped in the interior of a building during a fire or other emergency. Design Resource *3.1 Wayfinding*, provides more information on how to plan elevators and emergency egress in a building.

People with Anxiety or Vertigo: People going into a small space, particularly when surrounded by strangers, can feel an increased level of anxiety. Claustrophobia can cause people to have panic attacks or an increased sense of dread when they use the elevator. Waiting long times for elevators increases anxiety, especially when users are under pressure due to time constraints. VA patients, for example, may have higher levels of stress than other types of patients since there is often a long wait time to be seen for appointments (Morin, 2011). Traveling on a tight schedule or passengers rushing to make appointments on time are already anxious and waiting just adds to their stress. Distractions can reduce stress and make elevators more pleasant. Music, views out through glazing, and display screens are used to provide distractions and relieve claustrophobic symptoms. Today, flat screens can even be programed to show a view outside. But, for people who experience vertigo, or height-triggered anxiety, glazing may also produce stress, particularly if the elevators are moving at high speed. Closed elevators can also be provided as an alternative where dramatic views out are desired.

Usability of Controls and Information: Elevator controls have standardized symbols for key controls, e.g. floor numbers, door close/open buttons, emergency communications, etc. Accessibility regulations require raised characters and symbols as well as Braille. Regulations also require audible output for feedback and floor identification when doors open. However, controls and instructions can be confusing. For example, in high rise buildings, some elevators may only serve a zone of floors and others may serve the entire building. There may be a transfer floor where passengers have to disembark and switch to a different elevator bank to reach the upper zone. In some buildings, especially those with subterranean parking garages, passengers can only access the main lobby floor from the garage where they obtain an access card or switch to a different bank. Unfamiliar technologies can also be confusing.

“Destination dispatch” systems are being utilized more often, especially in high rise buildings ("Destination Dispatch Elevator Basics," 2018). These systems have many advantages for the passenger, including people with disabilities and other specific user groups. They can reduce both waiting and travel times through algorithms that assign passengers and adjust to demand in real time. They also can be used to identify the type of passenger and use that information to customize trips, for example, adjust the algorithm to account for slower moving people. But without prior experience, they can be confusing, especially for people who are blind. This type of elevator may not have any controls in the car itself. Passengers enter their destination floor using a panel in the elevator lobby and the system directs them to the elevator assigned to them and automatically stops on the designated floor. The lack of controls inside the elevator can create anxiety due to lack of control.

At present, elevator systems are not designed to interface with wifi or cellular telephone service. Such technology would significantly improve emergency communications, allowing passengers

to use their own devices. But such systems should not be the only available way to reach emergency services since not every passenger will have a working phone and sufficient battery capacity.

The following isUD™ Design Resources also have information relevant for elevator design*: 2.1 Clear Floor Space, 2.2 Turning Space, 2.4 Reach targets, 3.1 Wayfinding, 3.2 Signs, 3.3 Circulation Spaces, 3.6 Doors, 4.1 Illumination.*

3. Related Standards

ICC/ANSI A117.1 2017 Standards - 407 Elevators This standard is referenced in most local and state building codes for the technical specifications on accessibility of buildings. As of this writing, the standard is being updated, including the addition of new provisions for destination dispatch elevators.

ADA 2010 Standards - 407 Elevators This standard applies to all public buildings and common spaces in multifamily housing, including the elevators. It has not been updated since 2010 and has some slight differences in comparison to ICC A117.1.

International Building Code (IBC) (2017), This is the national model building code that provides the criteria for building elements, including elevators; the IBC references the ICC/ANSI A117.1 for the technical requirements.

ASME A17.1/CSA B44 This standard is the “Safety Code for Elevators and Escalators.” It is an engineering standard developed by the National Elevator Industry, Inc. (NEII), an industry trade association. ASME A17.1 is adopted by every jurisdiction in the U.S. and Canada. The standard includes requirements for moving walkways.

4. Measurement and Verification

Elevators and lobbies can be verified for their conformance to space clearance requirements of accessibility standards and UD guidelines by measuring clear floor space, maneuvering space, access to controls and emergency equipment. In addition, attention needs to be given to the slip resistance of floor products, the safety of glazing, the volume and intelligibility of announcements, the readability of text, illumination and visibility of controls and signs. Critical visual information should stand out in the visual field and audible announcements must be loud enough to hear over background noise.

5. Design Considerations

i. *All elevators have sufficient space for all people to enter, operate controls, and exit.* If the elevator has one door, then there should be a large enough space for a wheeled mobility device user to turn around. If the elevator has doors on both ends, then operating controls should be on both sides of the elevators. The volume of traffic, number of elevators, and maximum acceptable waiting time will often dictate a larger space than needed by wheelchair users. Where many wheelchair users, baggage carts or strollers, are expected, for example, in an airport, long term care facility, or hospital, providing enough space to accommodate more than one device is a good practice.

ii. *Elevators have doors on both ends, allowing users to pass through without needing to turn around inside.* Turning would require more space in an elevator for a wheeled mobility device user. A minimum sized elevator like the one pictured in Figure 1, may be

appropriate for certain offices and apartment buildings. Although it does not allow turning in a wheeled mobility device, the passthrough design increases ease of use, provided the upper floors of a building have lobbies on the opposite side as the entry floor. A pass-through elevator is also beneficial where furniture and large equipment are moved frequently.

iii. *Elevators allow people who use a wheeled mobility device to complete a 180-degree turn.* Elevators with one door need to allow wheeled mobility device users to turn around. See *isUD™ Design Resource 2.2 Turning Space* for recommended sizes. More space needs to be added to accommodate other passengers at the same time. This supports social integration but it is also an important safety concern.

iv. *Elevators with security access controls (e.g. swipe card, key fob, biometrics, etc.) allow floor section before and after authorization, and provide clear feedback when access is not authorized.* The access controls should be placed so that a wheeled mobility device user can see feedback provided by the device and enough space should be provided to reduce congestion. The access controls should also be placed so that passengers can travel directly to the elevator.

v. *Elevators have an adjacent waiting area at all discharge levels that does not conflict with the circulation space.* People waiting outside the elevator will need to wait for passengers exit. These locations are ideal places for seating to encourage social interaction.

vi. *Elevators are monitored by an employee who can provide assistance if needed.* In cases of emergency, two-way communication system, preferably without a headset, should connect to personnel who can provide assistance and, if not, at least reassurance while waiting for assistance. Employees, especially those within facilities or maintenance, should be trained and equipped to assist those in need.

vii.

6. References

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