RESNA Position Paper on the Use of Evacuation Chairs

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INTRODUCTION

The purpose of this document is to share information on options available regarding emergency stair travel devices used by individuals with disabilities during evacuations, as well as to provide evidence from the literature supporting the use of track-type evacuation chairs. It is not intended to replace professional judgment related to specific occupants and building environments.

BACKGROUND

Emergency evacuation by individuals with disabilities from buildings of all types, but especially from high-rises[1], has received consistent attention from the international life safety community. Regarding interest from the general public, attention has been focused on the issue following the attacks on the World Trade Center in 1993 and 2001 (Juillet, 1993; Shields et al, 2009).

Evacuation by all building occupants involves recognition of the situation and the need to evacuate, and horizontal and / or vertical movement along an evacuation route to the floor of discharge. Regarding vertical travel, travel along stairs is likely to be involved. Where elevators are present, life safety codes have prohibited their use, leaving stairways as the approved route. Although code changes are being considered for elevators having specific features and routing algorithms, their use will add to the routes available, not replace stairway use. Depending on the building, as well as the type and location of the incident, use of stairs for evacuation must be considered (NFPA, 2007).

An evacuation plan for occupants of a high-rise, or of a building of any height where the use of stairs is involved, may include horizontal travel to an area of rescue assistance, where life safety personnel can assist with travel along stairs, if necessary. The use of stairs by individuals unable to traverse stairs for emergency evacuation can be addressed through the use of an emergency stair travel device.

Emergency stair travel devices have an identity in life safety codes. The National Fire Protection Association (NFPA) refers to emergency stair travel devices in 2015 editions of the NFPA 101-Life Safety Code and NFPA 5000-Building Construction and Safety Code (NFPA, 2015a; NFPA, 2015b).

Emergency stair travel devices vary in design, but can be categorized as carry-type, track-type, and sled-type (Hedman, 2009). Devices in these three main design categories have distinctly different features, and are marketed for use in different environments.

[1] As defined by NFPA 101:2015, “a building where the floor of an occupiable story is greater than 23 m (75 ft) above the lowest level of fire department vehicle access.”

One type of emergency stair travel device, track-type evacuation chairs, is recognized as part of an effective emergency plan enabling individuals with disabilities to exit a building safely (NFPA, 2007; Steinfeld, 2006). Their use has been documented in evacuation drills, emergency events, and accessible building design (Bruyere, 2002; Davis, 2005; Meenan, 2007; Tsouderos, 2007; Product Review, 2009).

STAKEHOLDERS

All individuals who have an interest or specific role in safe evacuation from buildings are stakeholders regarding emergency stair travel device use. Building occupants with disabilities are certainly a part of this group. These individuals would include those with mobility impairment addressed via wheelchair use, as well as other impairments which may limit travel down stairs (e.g., cardiac, respiratory, sensory). These impairments may or may not be evident, and individuals themselves would decide whether or not to self-identify as part of an evacuation plan, when such exists, for a specific building.

Assistive Technology service providers are stakeholders, in that they would be asked by consumers about the devices, or be asked to make recommendations based on a consumer's abilities and the building environment.

Consultants regarding emergency management, life safety, and security are also stakeholders. A sound knowledge base on the devices is needed, to make recommendations appropriate for specific environments and the mix of building occupants.

Building owners and managers, responsible for the equipping of a building for safety, are stakeholders. This group may be investigating emergency stair travel device use proactively, may be responding to interest expressed by building occupants, or may be responding to local ordinances which require their provision.

Employers are stakeholders, as they attempt to outfit their offices or facilities with equipment appropriate for their employees, or in response to a request for accommodation by a specific employee.

Municipalities are stakeholders, as they make decisions on the outfitting of public spaces such as city or villages halls, community centers, libraries, etc.

Fire and life safety services are important stakeholders, as they outfit their vehicles to assist individuals with evacuation or transport to medical services. For this group, performance is important but also the ability to store the device within limited space on the vehicles.

As educational systems (K-12, colleges, and universities) ensure that their buildings are accessible for academic and extramural activities, acquisition of emergency stair travel devices are considered.

Occupants and professionals associated with several types of large facilities are also stakeholders. These include hotels, conference centers, theme parks, and sports/entertainment venues (i.e., arenas and stadiums).

Personnel at facilities which address medical and rehabilitation needs, including hospitals and nursing homes, have unique factors which may affect their selection of emergency stair travel devices. These include the medical stability of the occupants, transport of any life support equipment, and whether or not the evacuees can be secured in a seated position.

Individuals with disabilities live in a variety of settings in the community, including assisted living centers, group homes, and single-family homes/apartments/condominiums. Outfitting of these living environments involves consideration of the occupants of the devices, and those identified to assist with evacuation procedures.

Clearly, the use of emergency stair travel devices is of high importance to individuals with disabilities and life safety personnel. The stakeholder list is evidence that the use of emergency stair travel devices is also of importance to building personnel, emergency management teams, family members, and co-workers. These groups will include experienced and novice users.

EQUIPMENT

Of the three design types noted, each has a presence in life safety and building environments.

Carry-type devices vary from fabric slings to metal chairs with carry handles. Costs vary accordingly, and all have the requirement of full support for the occupant by two to four operators. Transfers occur at the approximate height of wheelchair seat levels for most carry-type devices.

Track-type devices offer the possibility of single-operator use, with descent usually controlled via the friction present between a rubber belt and the track. One model offers additional control via a speed governor and brake. As such, the operator is not required to support the weight of the device and occupant, only the force to guide the occupant and device down the stairs. Transfers occur at the approximate height of wheelchair seat levels for most track-type devices.

Sled-type devices offer the lowest cost, but require the occupant to be either in a supine position, or in a seated position at floor level. This introduces the requirement of a transfer to the floor level. During operation and using attached straps, the lead operator must guide the occupant through turns at landings, and the following operator must ease the occupant and device down the stair sections. For most sled-type devices, the following operator provides all required resistance to the sled and occupant sliding down the stairs. Sled-type devices are often marketed to hospitals, where patients may not be stable in a seated position.

RECOMMENDATIONS

Based on research, product design features, needs of life safety professionals, and requirements of the environments themselves, several recommendations can be made with the goal of maximizing the achievement of safe evacuation during emergencies.

Recommendation 1
For building occupants who can be in a seated position, track-type evacuation chairs should be utilized.

Any device which is effective in assisting individuals to safety is of value, however research indicates that the track-type evacuation chairs offer distinct advantages.

Fredericks et al (2002a; 2002b) and Butt et al (2002) documented the advantage of track-type evacuation chairs over carry-type evacuation chairs for the operator, through significantly lower compression forces at the L5/S1 area of the spine, reducing the probability for low back disorders. The lower compression forces were again present in a later study by Fredericks et al (2006), where the influence of track-type frame design was investigated.

Adams and Galea (2011) studied the use of four different evacuation devices: a track-type chair, carry-type chair, stretcher, and drag mattress along an evacuation route in a hospital. Participants were able to achieve the highest speeds along a hallway with the track-type chair and carry-type chair (1.5 m / sec) and highest speeds along the stairs with the track-type chair (0.81 m / sec). The researchers noted that the track-type chair was able to be operated by one individual, whereas the carry-type chair required 3-4 individuals.

Researchers have studied the demands on firefighters operating a total of 14 carry-type, track-type, and sled-type devices (Lavender, 2011; Lavender, 2013; Mehta, 2015). A fire service training mannequin was loaded in each device as it was taken down 1-1/2 flights of stairs, including 2 landings. Several advantages of track-type evacuation chair use were identified. First, track-type chairs are able to be used by a single operator. This enables life safety personnel to be dispatched more quickly to all individuals who may require assistance in an emergency evacuation. Second, travel speeds along the stairs are within the range observed for the general population. While the track system provides friction to prevent free travel down the stairs, a pace matching that of other evacuees is possible. Third, travel through landings can be relatively efficient. Although travel through a landing is slower than along the stairs, if a track-type chair has an adequate wheeled base, it can be moved through the 180-degree turn efficiently. Fourth, the work required on the part of the operator, based on design, can be reasonable. The operator is not required to support the weight of the occupant at any time, and adjustable handles enable the device to be maneuvered safely.

For environments where occupants cannot achieve a seated position, sled-type devices are a reasonable option.

Recommendation 2
When selecting a track-type evacuation chair, preference should be given to devices which comply with the ANSI/RESNA ED-1 Standard.

Compliance with the ED-1 Standard ensures that the device has passed test requirements for minimum weight capacity, maneuverability, forward stability, and lateral stability. It is the only standard which exists for evacuation chairs.

The minimum rated weight capacity for an ED-1 compliant device is 159 kg (350 lb) to recognize the current data on body weight. Devices must be able to be maneuvered through a 180-degree turn on a middle landing, with landing length and width dimensions as stipulated by building codes (e.g., a 72"-wide x 36"-long middle landing for a 36"-wide stairway; NFPA 101-2015, 7.2.2.3.2.4). Stability is tested with a loaded device on an inclined surface, in both the forward and lateral directions (e.g., for downward travel device configuration, 40 degrees forward without losing contact with support surface). Presentations on the development of the ED-1 Standard have been provided at several key disability and life safety conferences, and have been well-received (Hedman, 2012; Hedman, 2009; Lavender et al, 2011).

Recommendation 3
When outfitting a building accessed by the public for goods and services for emergency stair travel devices, the goal of the allocation of at least one device at each floor of each stairway is recommended.

Several factors indicate that each floor along each stairway should be equipped with a stair descent device. First, the number of individuals with a disability affecting ambulation is significant, estimated at over 20 million individuals (6.9%) of the non-institutionalized population in the United States (Erickson et al, 2014). With an emphasis on living independently in the community, and access to goods, services, and employment under the Americans with Disabilities Act, the presence of individuals with disabilities is likely. Second, there may be many individuals who have a disability that is not evident, such as cardiac or respiratory limitations. Third, during an emergency there may be individuals who become injured, and may need an emergency stair travel device to be transported to safety.

Recommendation 4
Where there are known additional building occupants who will need an emergency stair travel device in an evacuation, the acquisition of one device for each should be considered.

The Americans with Disabilities Act has enabled many individuals with disabilities to achieve employment. As individuals with disabilities work in environments accessed by the public for goods and services, their known need for an emergency stair travel device should not reduce the number present for the public at-large. Acquisition of emergency stair travel devices for these employees, stored in a location which makes them readily available for use, will help maximize efficient evacuation for all building occupants.

Together, the recommendations are intended to improve life safety and benefit all stakeholders. Building occupants with disabilities will benefit through the availability of effective devices. Assistive Technology clinicians and consultants will benefit through the ability to more accurately recommend devices to meet the needs of building occupants. Fire and life safety services will be able to outfit their vehicles with effective equipment, and inform the community of best practices as they perform training and outreach. Building owners and managers (including those of municipal, private sector, and educational settings) will be able to provide effective equipment, in adequate numbers, and in proper locations for effective use.

ADDITIONAL SUGGESTED PRACTICES

When introducing equipment to outfit a building for evacuation, mobility devices (e.g., manual wheelchairs) should be obtained to enable occupants to use in order to travel from the stairway at the floor of discharge to the outside and away from the facility.

Some emergency stair travel devices are designed such that they can be operated on horizontal pathways of long distances, other are not. Also, some are designed to support an occupant on a 4-wheeled base, others are not. In all cases, once stair travel to the floor of discharge by one occupant has been achieved, it will be beneficial to the safe evacuation of all building occupants with disabilities if the device were made available for others to use (via the device being brought back upstairs by life safety personnel).

Provision of a mobility device will require a transfer from the emergency stair travel device to the mobility device. The mobility devices should be positioned near the stairway. To achieve this, some building managers have positioned manual wheelchairs on wall brackets immediately outside the stairway.

When considering acquisition of a stair descent device for use, all members of the emergency planning team, and the building occupants who would use the device during an evacuation, should try out the device.
Merely reading through advertisements and training materials is insufficient for informed purchases.

After acquisition, personnel who will be occupants or operators of the device should review all training materials provided by the manufacturer, and try out the device.
A thorough understanding of the device is needed for safe, effective use. By learning about all aspects of the device, the occupants and operators will be knowledgeable about the requirements for deployment, safety features, and operation.

Training opportunities and practice use should be repeated on a regular basis.
Training and practice use will help maintain the knowledge levels, and provide a means for new occupants and operators to become familiar with usage.

SUMMARY

It is RESNA's position that ANSI / RESNA ED-1 – compliant track-type evacuation chairs offer design features beneficial to occupants and operators which include wheelchair-level transfer height, efficient use by a single operator, stability, maneuverability, and travel speeds along stairs matching those of other building occupants. These design features help promote safe, efficient evacuation during emergencies.

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