

1 **RESNA POSITION PAPER**
2 **ON THE USE OF**
3 **EVACUATION CHAIRS**

4
5
6 **Introduction**

7 Emergency evacuation by individuals with disabilities from buildings of all types,
8 but especially from high-rises¹, has received consistent attention from the
9 international life safety community. Regarding interest from the general public,
10 attention has been focused on the issue following the attacks on the World Trade
11 Center in 1993 and 2001 (Juillet, 1993; Shields et al, 2009).

12
13 Evacuation by all building occupants involves recognition of the situation and the
14 need to evacuate, and horizontal and / or vertical movement along an evacuation
15 route to the floor of discharge. Regarding vertical travel, travel along stairs is
16 likely to be involved. Where elevators are present, life safety codes have
17 prohibited their use, leaving stairways as the approved route. Although code
18 changes are being considered for elevators having specific features and routing
19 algorithms, their use will add to the routes available, not replace stairway use.
20 Depending on the building, as well as the type and location of the incident, use of
21 stairs for evacuation must be considered.

22
23 An evacuation plan for occupants of a high-rise, or of a building of any height
24 where the use of stairs is involved, may include horizontal travel to an area of
25 rescue assistance, where life safety personnel can assist with travel along stairs,
26 if necessary. The use of stairs by individuals unable to traverse stairs for
27 emergency evacuation can be addressed through the use of an emergency stair
28 travel device.

29
30 Emergency stair travel devices vary in design, but can be categorized as carry-
31 type, track-type, and sled-type (Hedman, 2009). Devices in these three main
32 design categories have distinctly different features, and are marketed for use in
33 different environments.

34
35 Emergency stair travel devices have an identity in life safety codes. The National
36 Fire Protection Association (NFPA) refers to emergency stair travel devices in
37 2015 editions of the NFPA 101-Life Safety Code and NFPA 5000-Building
38 Construction and Safety Code.

39
40 One type of emergency stair travel device, track-type evacuation chairs, are
41 recognized as part of an effective emergency plan enabling individuals with
42 disabilities to exit a building safely (NFPA, 2007; Steinfeld, 2006). Their use has
43 been documented in evacuation drills, emergency events, and accessible

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."

44 building design (Bruyere, 2002; Davis, 2005; Meenan, 2007; Tsouderos, 2007;
45 Product Review, 2009).

46

47 **Stakeholders**

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

56

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

60

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

65

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

71

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

75

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

78

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

83

84 As school systems (K-12 and universities) ensure that their buildings are
85 accessible for academic and extramural activities, acquisition of emergency stair
86 travel devices are to be considered.

87

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

91
92 Personnel at facilities which address medical and rehabilitation needs, including
93 hospitals and nursing homes, have unique factors which may affect their
94 selection of emergency stair travel devices. These include the medical stability
95 of the occupants, transport of any life support equipment, and whether or not the
96 evacuees can be secured in a seated position.

97
98 Individuals with disabilities live in a variety of settings in the community, including
99 assisted living centers, group homes, and single-family
100 homes/apartments/condominiums. Outfitting of these living environments
101 involves consideration of the occupants of the devices, and those identified to
102 assist with evacuation procedures.

103
104 Clearly, the use of emergency stair travel devices is of high importance to
105 individuals with disabilities and life safety personnel. The stakeholder list is
106 evidence that the use of emergency stair travel devices is also of importance to
107 building personnel, emergency management teams, family members, and co-
108 workers. These groups will include experienced and novice users.

109 110 **Equipment**

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

113
114 Carry-type devices vary from fabric slings to metal chairs with carry handles.
115 Costs vary accordingly, and all have the requirement of full support for the
116 occupant by two to four operators.

117
118 Track-type devices offer the possibility of single-operator use, with descent
119 usually controlled via the friction present between a rubber belt and the track.
120 One model offers additional control via a speed governor and brake.

121
122 Sled-type devices offer the lowest cost, but require the occupant to be either in a
123 supine position, or in a seated position near the floor. This introduces the
124 requirement of a transfer to the floor level by individuals providing assistance.
125 Sled-type devices are often marketed to hospitals, where patients perhaps are
126 not stable in a seated position.

127 128 **Recommendations**

129 Based on research, product design features, and the need to life safety
130 professionals and the environments themselves, several recommendations can
131 be made with the goal of maximizing the achievement of safe evacuation during
132 emergencies.

133

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

137
138 Any device which is effective in assisting individuals to safety is of value,
139 however research indicates that the track-type evacuation chairs offer distinct
140 advantages.

141
142 Fredericks et al (2002a; 2002b) and Butt et al (2002) documented the advantage
143 of track-type evacuation chairs over carry-type evacuation chairs, through
144 significantly lower compression forces at the L5/S1 area of the spine, reducing
145 the probability for low back disorders. The lower compression forces were
146 present in a later study by Fredericks et al (2006), where the influence of track-
147 type frame design was investigated.

148
149 Adams and Galea (2011) studied the use of four different evacuation devices: a
150 track-type chair, carry-type chair, stretcher, and drag mattress along an
151 evacuation route in a hospital. Participants were able to achieve the highest
152 speeds along a hallway with the track-type chair and carry-type chair (1.5 m /
153 sec) and highest speeds along the stairs with the track-type chair (0.81 m / sec).
154 The researchers noted that the track-type chair was able to be operated by one
155 individual, whereas the carry-type chair required 3-4 individuals.

156
157 Lavender et al (Lavender, 2011; Lavender, 2013; Mehta, 2014) studied the
158 demands on firefighters operating a total of 14 carry-type, track-type, and sled-
159 type devices. A fire service training mannequin was loaded in each device as it
160 was taken down 1-1/2 flights of stairs, including 2 landings. Several advantages
161 of track-type evacuation chair use were identified. First, track-type chairs are
162 able to be used by a single operator. This enables life safety personnel to be
163 dispatched more quickly to all individuals who may require assistance in an
164 emergency evacuation. Second, travel speeds along the stairs are within the
165 range observed for the general population. While the track system provides
166 friction to prevent free travel down the stairs, a pace matching that of other
167 evacuees is possible. Third, travel through landings can be relatively efficient.
168 Although travel through a landing is slower than along the stairs, if a track-type
169 chair has an adequate wheeled base, it can be moved through the 180-degree
170 turn efficiently. Fourth, the work required on the part of the operator, based on
171 design, can be reasonable. The operator is not required to support the weight of
172 the occupant at any time, and adjustable handles enable the device to be
173 maneuvered safely.

174
175 *Recommendation 2*
176 *When selecting a track-type evacuation chair, preference should be given to*
177 *devices which comply with the ANSI/RESNA ED-1 Standard.*

178

179 Compliance with the ED-1 Standard ensures that the device has passed test
180 requirements for minimum weight capacity, maneuverability, forward stability,
181 and lateral stability. It is the only standard which exists for evacuation chairs.
182

183 The minimum rated weight capacity for an ED-1 compliant device is 159 kg (350
184 lb) to recognize the current data on body weight. Devices must be able to be
185 maneuvered through a 180-degree turn on a middle landing, with landing length
186 and width dimensions as stipulated by building codes. Stability is tested with a
187 loaded device, in both the forward and lateral directions. Presentations on the
188 development of the ED-1 Standard have been provided at several key disability
189 and life safety conferences, and have been well-received (Hedman, 2012;
190 Hedman, 2009; Lavender et al, 2011).
191

192 *Recommendation 3*

193 *When outfitting a building accessed by the public for goods and services for*
194 *emergency stair travel devices, the allocation of at least one device at each floor*
195 *of each stairway is recommended.*
196

197 Several factors indicate that each floor along each stairway should be equipped
198 with a stair descent device. First, the number of individuals with disabilities is
199 significant, estimated at over 37 million individuals (12.1%) of the non-
200 institutionalized population in the United States (Erickson et al, 2014). With an
201 emphasis on living independently in the community, and access to goods,
202 services, and employment under the Americans with Disabilities Act, the
203 presence of individuals with disabilities is likely. Second, there may be many
204 individuals who have a disability that is not evident, such as cardiac or respiratory
205 limitations. Third, during an emergency there may be individuals who become
206 injured, and may need an emergency stair travel device to be transported to
207 safety.
208

209 *Recommendation 4*

210 *Where there are known additional building occupants who will need an*
211 *emergency stair travel device in an evacuation, the acquisition of one device for*
212 *each should be considered.*
213

214 The Americans with Disabilities Act has enabled the many individuals with
215 disabilities to achieve employment. As individuals with disabilities work in
216 environments accessed by the public for goods and services, their known need
217 for an emergency stair travel device should not reduce the number present for
218 the public at-large. Acquisition of emergency stair travel devices for these
219 employees, stored in a location which makes them readily available for use, will
220 help maximize efficient evacuation for all building occupants.
221

222 *Additional Suggested Practices*

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

226
227 Provision of a mobility device will require a transfer from the emergency stair
228 travel device to the mobility device, but it will make the device available for re-use
229 in the building. The mobility devices should be positioned in plain view near the
230 stairway. Some building managers have positioned manual wheelchairs on wall
231 brackets immediately outside the stairway to achieve this.

232
233 *When considering acquisition of a stair descent device for use, all members of*
234 *the emergency planning team should try out the device.*

235 Merely reading through advertisements and training materials is insufficient for
236 informed purchases.

237

238 *All personnel who will be occupants or operators of the device should read*
239 *through all training materials provided by the manufacturer.*

240 A thorough understanding of the device is needed for safe, effective use. By
241 learning about all aspects of the device, the occupants and operators will be
242 knowledgeable about the requirements for deployment, safety features, and
243 operation.

244

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