



# DESIGN RESOURCES

DR-03 Emergency Exit Signs

## Emergency Exits

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**Question:** How should the characteristics of text favor legibility and comprehension of emergency exit signs?

### Issue and Its Importance to Universal Design

The legibility and comprehension of exit signs in buildings is of vital importance to all of us in case of emergency. If the exit signage system is working well, it will help us to determine a safe route out of a building with a minimum of panic. Building occupants most at risk in case of emergency are older adults, the mobility impaired, and those with hearing and/or vision loss. For these groups, detection of fire or emergency may be hindered by their impairments. Smoky conditions may make a sign that is already difficult to read at a distance illegible. To date, little research has been done to confirm either how people behave when evacuating from a building or whether current practice in the design of exit signage is helpful in order to determine an evacuation route. While guidelines have been established through means of consensus, and various authors have determined that panic in a fire is less likely to occur as long as the escape route is logical to the victim (Sime, 1980, Canter et. al. 1980), research findings concerning font size, colour and sign type are not consistent. Guidelines in designing exit signs conflict and may be misleading as there is a lack of evidence based research in this area. A summary of the most recent findings is given below.

### Key Terms



**Figure 1: Directional symbol with high visibility (from Wong & Lo, 2007)**

**Legibility:** Legibility of a font type is determined by how easily it is to distinguish one letter from another in a particular typeface.

**Readability:** Readability is concerned with how the type is laid out. To make a sign readable, words, phrases and blocks of copy must be easy to read at a distance and while moving.

**ADAAG:** Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities

**NFPA:** National Fire Protection Association

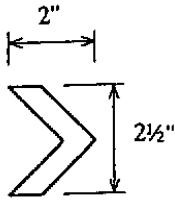
### Existing Research/Evidence

Factors influencing visibility, legibility and readability of text on emergency signage can be regrouped under four categories: font, arrangement, environment and personal.

Please note: The information presented below is research presented in journals and/or government reports. This information comes from several research groups from different countries including the U.S., Canada and China. Standards exist from country to country,

however, no uniform standards between countries currently exist (Collins, Dahir, & Madrzykowski, 1992). No real consensus exists between standards.

In the *font category*, factors such as font size/character height and other factors including the presence of symbols or directional indicators have been found to influence emergency exit signs. Font size is often specified in codes/standards, but the results are not consistent. According to Collins et al. (1992), minimum font sizes can vary between 100 to 152 mm (3.9 to 6 in). The presence of text and symbols on a sign also influences its visibility, and when more than one symbol is present on a sign the visibility decreases (Wong & Lo, 2007). Some directional indicators have also been found to have a greater visibility such as the chevron with tail and the triangle with tail (Wong & Lo, 2007). Some directional indicators, such as the chevron, also are more easily detected and identified (Boyce & Mulder, 1995).



In the *environment category*, several factors have been studied including display type, figure/ground relationships, lighting, and other factors such as smoke. Different types of display signs include conventional signs (incandescent and/or fluorescent signs) and electroluminescent signs. Conventional signs are those that are either illuminated externally (a dedicated light constantly shines on the sign surface) or internally lit (bulbs inside light up the sign's letters). Electroluminescent signs are coated with a non-radioactive, non-toxic substance that is activated by ambient light in the area of the sign. When these two sign types have been compared, it was found that conventional signs had higher luminance and were more visible in smoke-filled conditions (Collins et al., 1992). Figure/ground relationships can be separated into two subcategories in the case of emergency exit signage: translucence vs. opaque and colors. Signs can have either opaque letters OR background, translucent letters OR background, or translucent letters AND background. It has been found that white opaque backgrounds are slightly more visible than translucent backgrounds (Collins et al., 1992; Ouellette, 1993; Wong & Lo, 2007). In regards to the choice of color for the letters, Wong & Lo (2007) found that green letters were slightly more visible than red on a white background, but no statistically significant results have been found. Lighting also influences the visibility of the signs and can be divided into ambient illumination and sign luminosity. Ambient illumination or competing lighting sources have been found to reduce the visibility of the emergency exit signs both in clear conditions (glare) and in smoky conditions (obscure sign by scattered light) and require greater sign luminance (Boyce & Mulder, 1995; Ouellette, 1988, 1993). Sign luminosity also has a great effect on sign visibility both in clear and smoky conditions. In smoke-filled conditions, the highest luminosity is the better (Collins et al., 1992; Ouellette, 1993), whereas in clear conditions the sign luminosity should be reduced to minimize glare (Ouellette, 1993).

Finally, personal factors such as the age of the reader, language and other factors including eye sensitivity can influence the visibility of emergency exit signs. Wong & Lo (2007) found that older observers needed larger signs. In the case of Chinese observers, it has been found that the English word EXIT has a higher visibility than the Chinese word (Wong & Lo, 2007). Also the irritability of smoke can affect the visibility of the sign (Jin, 2002).

## Best Practices/Practical Applications



Subway Stations



Medical Facilities



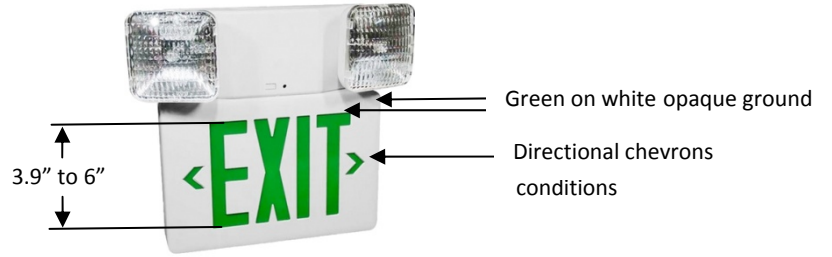
Office Buildings

These basic guidelines provide a summary of the evidence.

- Ideally no more than one symbol should be use in addition to the text.
- Larger characters should be favored.
- If directional symbols are necessary, chevron, chevron with tail or triangle with tail should be favored.
- White opaque backgrounds should be used with green or red translucent letters.
- Competing lighting sources should be minimized in the vicinity of emergency exit signs.
- For best legibility, characters should contrast with their background by at least 70 percent. (ADAAG)

Emergency exit signs should have two modes of operation: lower luminosity for smoke-free conditions and higher luminosity for smoke conditions.

**Design Guidelines**



Characteristic	Recommendation	Research Needs
Font size	3.9 to 6 in.	<ul style="list-style-type: none"> <li>More research required. Findings inconsistent across studies.</li> </ul>
Text and symbols	No more than 1 symbol with text	<ul style="list-style-type: none"> <li>Existing research on this variable is fairly strong.</li> </ul>
Directional indicators	Chevron with tail or triangle with tail	<ul style="list-style-type: none"> <li>Existing research on this variable is fairly strong.</li> </ul>
Translucent/opaque	White opaque backgrounds more visible than translucent	<ul style="list-style-type: none"> <li>Existing research on this variable is fairly strong.</li> </ul>
Luminosity	Highest best for smoke-filled environments, lower level in daily use to reduce glare	<ul style="list-style-type: none"> <li>Existing research on this variable is fairly strong.</li> </ul>
Sign type	Conventional signs have higher luminance and are more visible in smoke-filled conditions	<ul style="list-style-type: none"> <li>More evidence required.</li> </ul>
Color	Green slightly easier to read on white background	<ul style="list-style-type: none"> <li>More evidence required. Findings inconclusive.</li> </ul>

## ADAAG/NFPA/OHSA Emergency Exit Sign Guidelines

	ADAAG	NFPA/OHSA	Research	Difference
Letter Height*	Min. 3"	Min. 6"	3"-6"	Up to 50%
Character proportion:				
Letter width: height	Between 3:5 and 1:1		5:7	5% difference
Stroke w:h	Between 1:5 and 1:10		1:6 or 1:8	4% difference
Illumination	External: 10 to 30 ft-candles	External: Internal:		
Placement	Internal:  60" from floor to center of sign Braille on sign	5 ft-candles  80" from floor to bottom of sign Braille not required		
Directional Indicator	Not required	Required but no symbol specified	chevron with tail or triangle with tail	
Contrast	70%	70%	70%	No difference

\*The size of characters is dependent on "the viewing distance from which they are to be read. The minimum height is measured using an upper case X. Lower case characters are permitted."

## References

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Wong, L. T., & Lo, K. C. (2007). Experimental study on visibility of exit signs in buildings. *Building and Environment*, 42(4), 1836-1842.



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