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Alireza Soltanzadeh, Matin Alaghmandan, Hossein Soltanzadeh

www.elsevier.com/locate/jobe

PII: S2352-7102(17)30321-2
DOI: https://doi.org/10.1016/j.jobe.2018.05.029
Reference: JOBE506

To appear in: *Journal of Building Engineering*

Received date: 10 June 2017
Revised date: 23 May 2018
Accepted date: 29 May 2018

Cite this article as: Alireza Soltanzadeh, Matin Alaghmandan and Hossein Soltanzadeh, Performance evaluation of refuge floors in combination with egress components in high-rise buildings, *Journal of Building Engineering,* https://doi.org/10.1016/j.jobe.2018.05.029

Performance evaluation of refuge floors in combination with egress components in high-rise buildings

Alireza Soltanzadeh[a,*], Matin Alaghmandan[b], Hossein Soltanzadeh[c]

[a]Department of Architectural Technology, Faculty of Architecture, College of Fine Arts, University of Tehran, Tehran, IRAN.
[b]School of Architecture and Urbanism, Shahid Beheshti University, Tehran, IRAN.
[c]Dep. of Architecture, Architecture and Urban Design Faculty, Islamic Azad University, Central Tehran Branch, IRAN.
*Corresponding author: +989128119238; E-mail address: soltanzadeh.alireza@gmail.com

Abstract

In recent decades, the number of high-rise buildings has increased. It is therefore essential that emergency evacuation should be taken into account for conditions such as fire, explosion, and terrorist attacks. This research aims to evaluate the performance of the emergency egress components in the architectural design of high-rise buildings. This assessment includes the number and location of stairs and elevators, and most importantly, the number and dimensions of the refuge areas. The main question of this study is: What is the relationship between the number of elevators and emergency stairs with the number and location of refuge areas in a high-rise building for finding the optimal time of emergency egress? In this research, the simulation and modeling methods are used as well as the library data collection method. The research considers 12 different scenarios to investigate the optimal time of emergency egress in a 40-storey high-rise office building. The simulations are done using an algorithm written by the Pathfinder software. The independent variables are the number of elevators, stairs, and refuge floors, and the dependent variable is the most number of people left in the standard time of an hour in the simulation. Results of the research show that in a 40-storey building, having a refuge floor in the middle, will allow more people to be evacuated. That could be feasible by making less nodes in the refuge floor plan that prevent the formation of long queues for the use of elevators.

Abbreviations

MEP, Mechanical, Electrical, and Plumbing; **HVAC,** Heating, Ventilation and Air Conditioning; **SFPE,** Society of Fire Protection Engineers; **SD,** Standard Deviation; **NFPA,** National Fire Protection Association; **NIST,** National Institute of Standards and Technology

Keywords: High-rise building, evacuation, simulation, egress time, refuge floor, pathfinder.

1. Introduction