

Fire Safety Assessment of At-Risk Groups

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Abstract : Older people and people with disabilities are recognized as at-risk groups when it comes to egress and travel from hazard zone to safe places. One's disability can negatively influence her or his escape time, and this becomes even more important when people from this target group live alone. This research deals with the fire safety of mentioned people's buildings by means of probabilistic methods. For this purpose, fire safety is addressed by modeling the egress of our target group from a hazardous zone to a safe zone. A common type of detached house with a prevalent plan has been chosen for safety analysis, and a limit state function has been developed according to the time-line evacuation model, which is based on a two-zone and smoke development model. An analytical computer model (B-Risk) is used to consider smoke development. Since most of the involved parameters in the fire development model pose uncertainty, an appropriate probability distribution function has been considered for each one of the variables with indeterministic nature. To achieve safety and reliability for the at-risk groups, the fire safety index method has been chosen to define the probability of failure (causalities) and safety index (beta index). An improved harmony search meta-heuristic optimization algorithm has been used to define the beta index. Sensitivity analysis has been done to define the most important and effective parameters for the fire safety of the at-risk group. Results showed an area of openings and intervals to egress exits are more important in buildings, and the safety of people would improve with increasing dimensions of occupant space (building). Fire growth is more critical compared to other parameters in the home without a detector and fire distinguishing system, but in a home equipped with these facilities, it is less important. Type of disabilities has a great effect on the safety level of people who live in the same home layout, and people with visual impairment encounter more risk of capturing compared to visual and movement disabilities.

Keywords : fire safety, at-risk groups, zone model, egress time, uncertainty

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