Study on Estimation Method of Optimum Time Interval for Phased Evacuation in a High-rise Building

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In this study, a method to estimate the optimum phased evacuation plan in a high-rise building in case of a large-scale fire is developed. The phased evacuation is a total evacuation method by dividing the evacuation starting timing of each floor into several phases, which can alleviate the congestion in stairs by setting up “waiting-time” before start of evacuation.

The estimation method employed in this study can immediately output the waiting-time and floors to evacuate per phase from inputting values such as the number of stories and dimensions of a high-rise building and a fire floor and the number of evacuees on each floor in a fire scenario. This method can not only alleviate congestion inside stairs, but also allows preferential evacuation for evacuees near a fire floor that has a higher fire risk. In addition, this method has a function to shorten the completion time of the total evacuation by adopting preceded evacuation of evacuees on the lower floor.

This study focuses not only on developing an estimation method for phased evacuation, but also discusses the usefulness of phased evacuation. Though there are two types of total evacuation method: “simultaneous evacuation” and “phased evacuation”, the two questionnaire surveys carried out in this study found that the phased evacuation is more useful compared with simultaneous evacuation.

The first supporting reason is from the questionnaire survey for persons that are in charge of the evacuation plan in high-rise buildings. The questionnaire result shows that currently almost all high-rise building has the plan to conduct the phased evacuation and a majority of high-rise buildings recognizes the suitability of the phased evacuation for a high-rise building due to the viewpoint of alleviating congestion. From these results, the phased evacuation seems to be a rational method for high-rise buildings. On the other hand, these results also show that there are concerns on how to set the waiting-time and evacuation floor per phase. The estimation method developed in this study is expected to contribute to eliminating such concerns.

The second support is from questionnaire survey for participants of an evacuation drill (operated by the phased evacuation) carried out in a 25-story high-rise office building. The analysis of questionnaire results show that compared with the waiting-time before the start of evacuation, the duration of suspended status in stairs induced by congestion has a higher psychological effect on the evacuees and makes them feel uneasy. Taking these results into consideration, the phased evacuation, which can decrease the suspended-time (induced by the congestion) by making the waiting-time, is expected to relieve such negative feeling of the evacuees.