URBAN SPACE DESIGN AND SAFETY EVALUATION FROM THE VIEWPOINT OF EVALUATION BEHAVIOR Of USERS

利用者の避難行動から見た都市空間の安全性評価と設計の検討

Issues on structural behavior and/or physical strength of the structures have been main topics in construction of safe urban facilities. However, with the improvement of engineering technologies and construction materials, strength of the structures, especially in developed countries, has been getting better and better. (Of course, still, we have big problems on existing pre-code revision structures.) To build really safe urban spaces, it is very important to ensure the safety of the users in both normal and emergency situations as well as to secure structural strength. Especially, when users aren't familiar with the space, its importance becomes much higher. Therefore, the space plan of urban facilities should be designed with proper consideration of users' evacuation safety and efficient evacuation guidance should be provided.

In this study, we propose a new philosophy of design of structures, in which urban spaces and facilities are designed from the viewpoint of safety of users considering their evacuation behavior. To discuss the human behavior, we have developed a new computer simulation model in which human evacuation behavior of a lot of evacuees in huge sized facility or space can be easily simulated. This new model can also consider individual personality of the users, effects of disaster such as smoke and fire, and effects of evacuation guidance. Using the model, safety of the spaces and efficiency of evacuation guidance are studied. The method introduced in this study can be applied to design safe urban space and structures in plan from users' evacuation viewpoint, and also, it can be used to understand human behavior, to evaluate the safety of the space and to discuss an optimum evacuation guidance of existing structures in disaster.

Background and Objectives

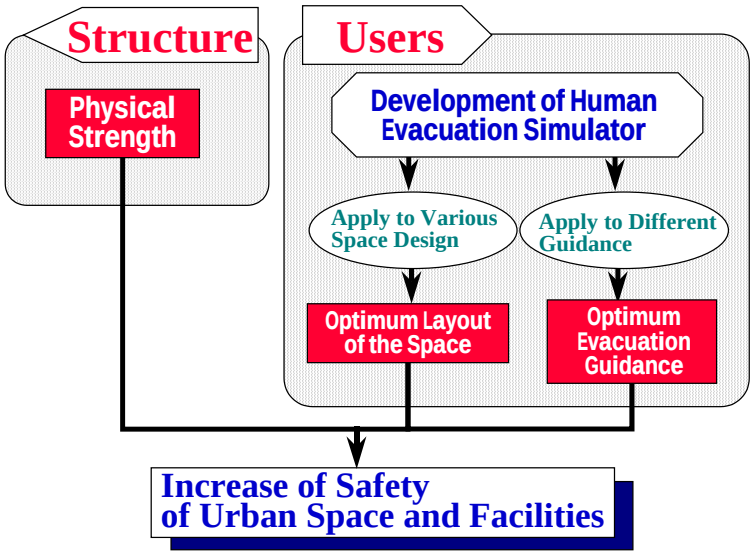
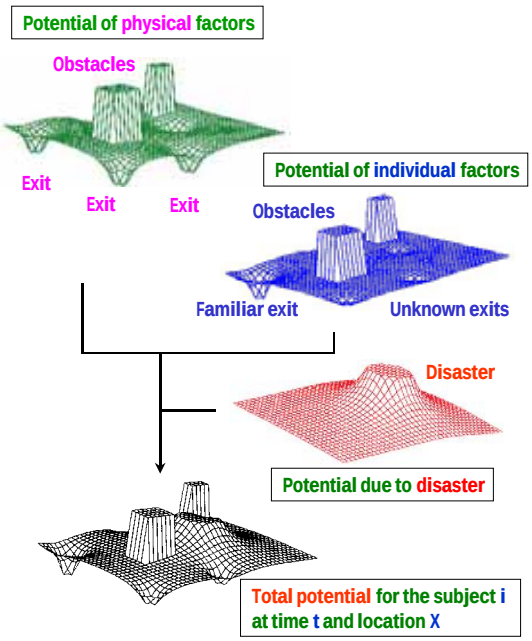
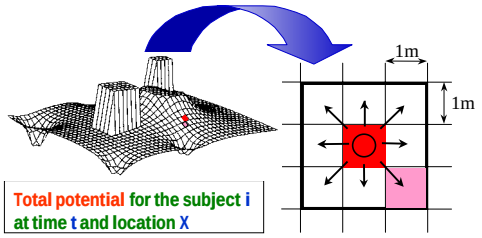


Fig. 1 Towards safer urban space and facilities



(a) Concept of potential model used in the simulation

Fig. 2 Potential model used in the simulation



(b) Selection of moving direction

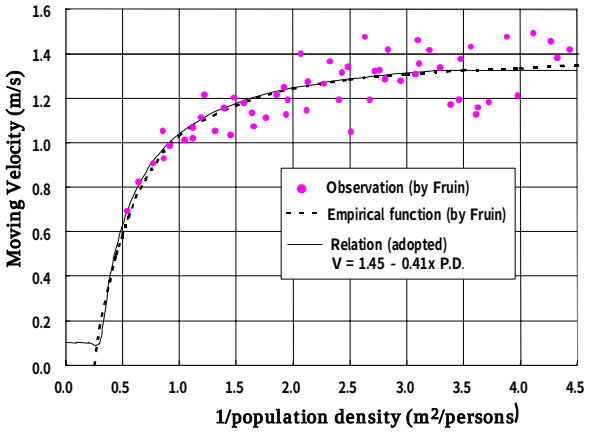


Fig. 3 Relation between moving velocity and population density (P.D.) [Fruin, 1974]

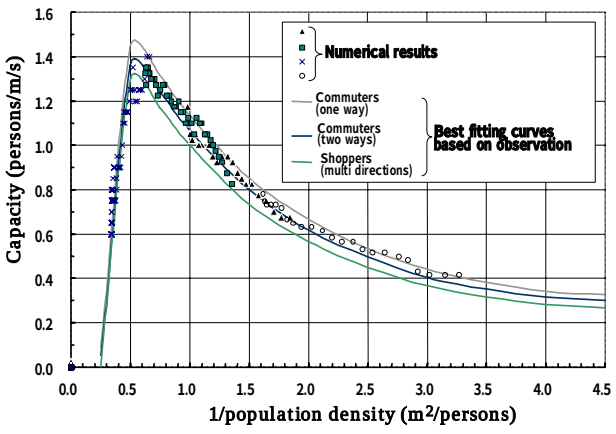


Fig. 4 Comparison between observation and numerical results

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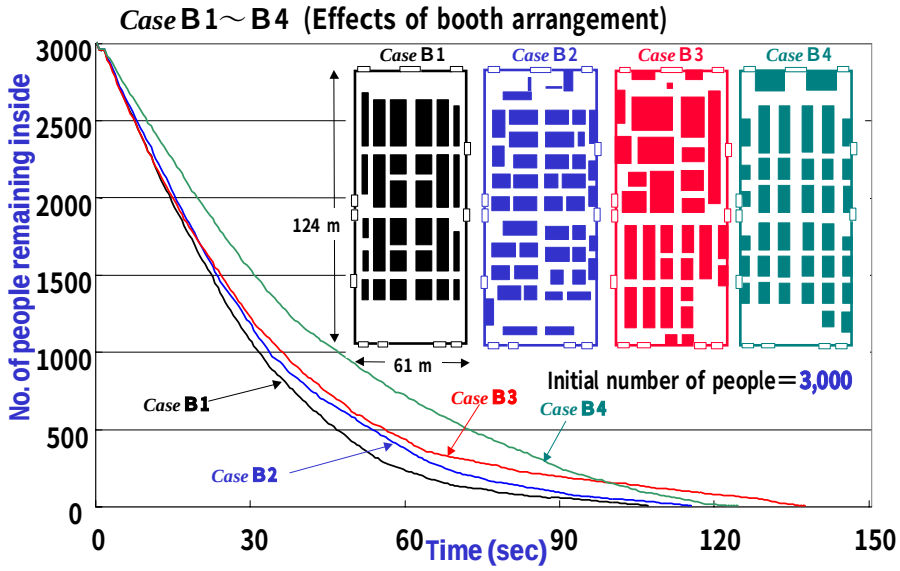
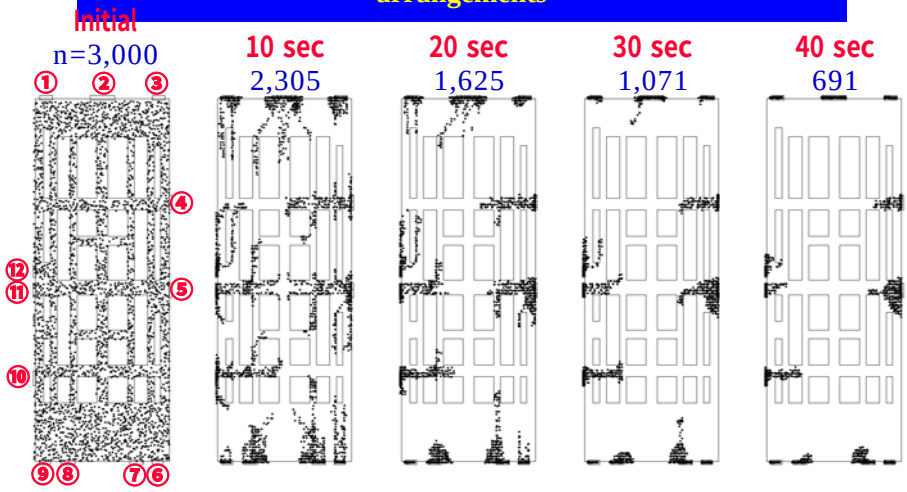


Fig. 5 Effects on evacuation due to different booth arrangements



Each dot represents a person trying to evacuate from the exhibition hall.
The value of 'n' is the total number of people remaining inside the hall.

Fig. 6 Distribution of users remaining inside hall (Case B1)

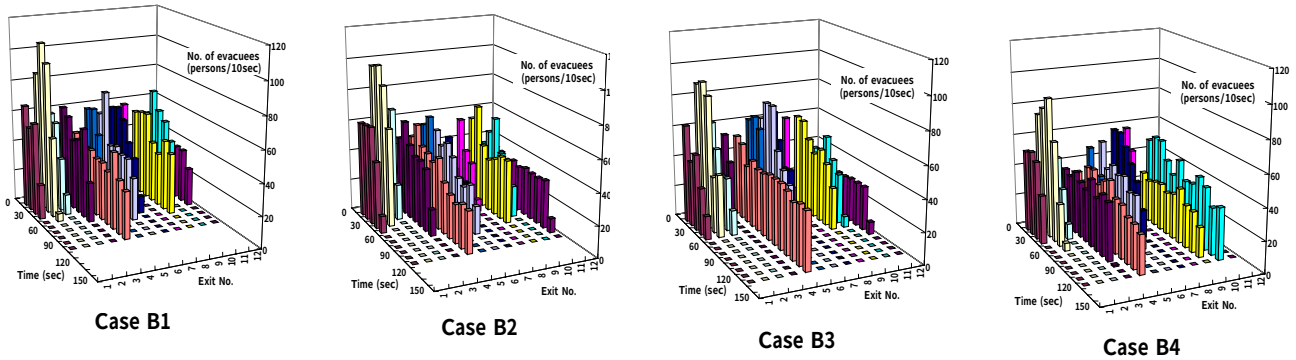


Fig. 7 Changes of the numbers of evacuees at each exit due to different booth arrangements

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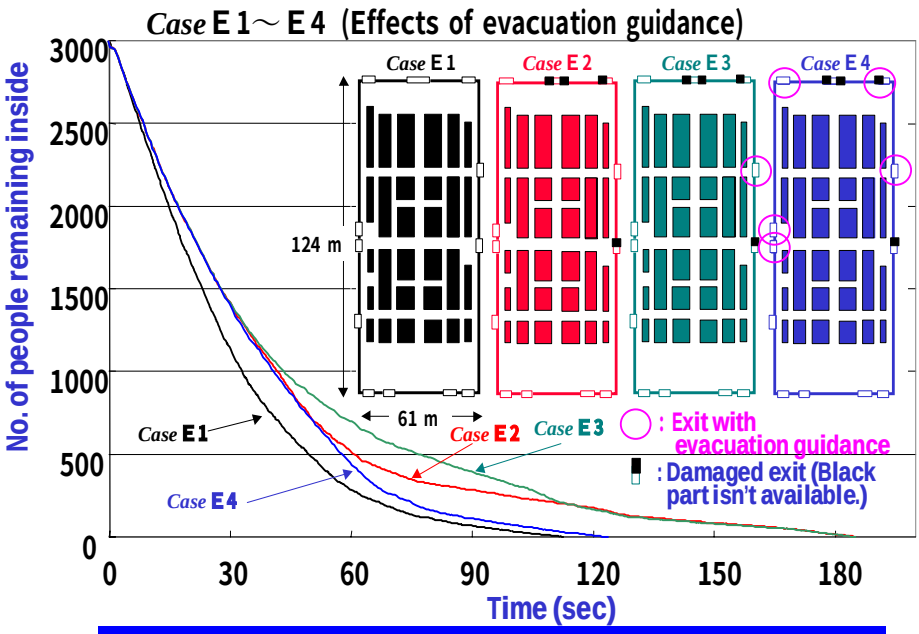
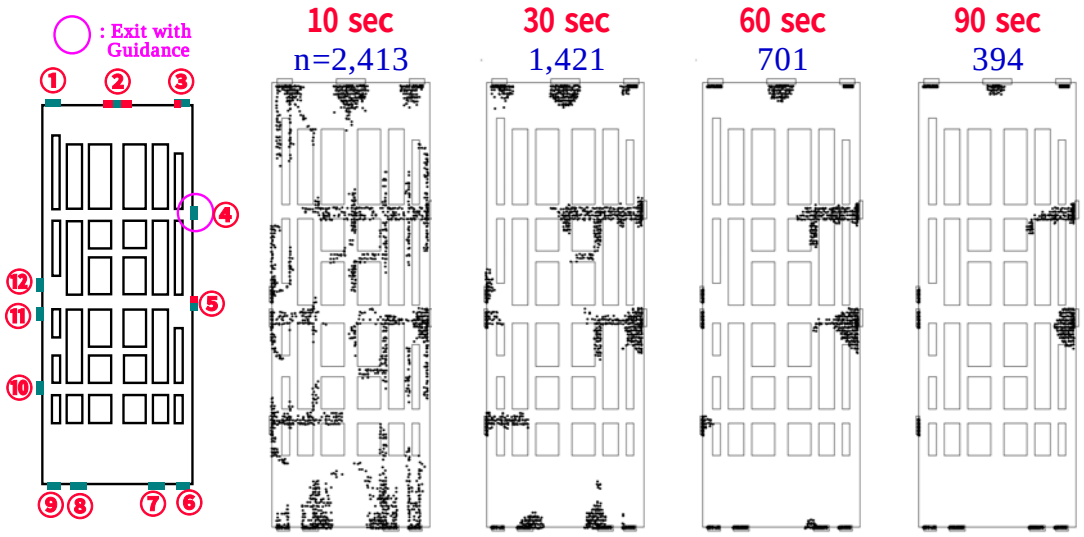


Fig. 8 Effects on evacuation efficiency of evacuation guidance



Each dot represents a person trying to evacuate from the exhibition hall.
The value of 'n' is the total number of people remaining inside the hall.

Fig. 9 Distribution of users remaining inside hall (Case E3)

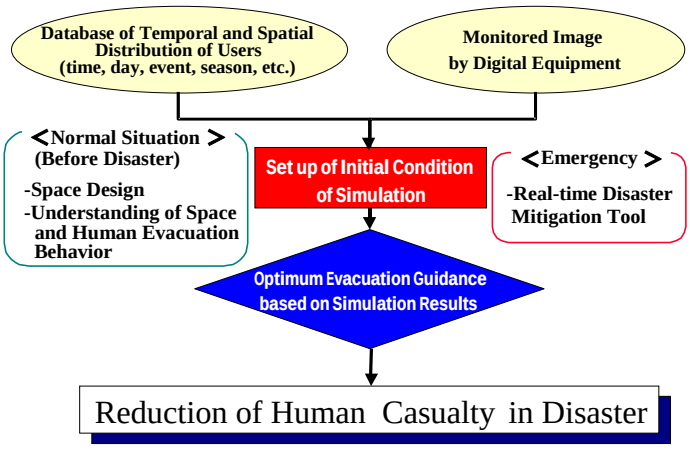


Fig. 10 Towards practical implementation

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