PROGRESS REPORT ON RISK, HAZARD AND EVACUATION IN JAPAN

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INTRODUCTION

Progress in the field of risk analysis, hazard evaluation and evacuation modeling since the 10th UJNR panel is reviewed. There seems to be little development of new research program comparable to Fire Safety Design Method or Fire Risk Evaluation Method which were presented in the ninth panel. After the 10th panel meeting, the annual meeting o f Architectural Institute of Japan 1988 and the annual conference of Japanese Association of Fire Science and Engineering 1989 took place and several papers on this field were reported.

1. ANNUAL MEETING OF A.I.J. 1988

The group of Tokyo Science University reported on human behavior in residential fire.(1.1) This is an analysis of the investigation data by the fire service department of a local authority and refers to the relation between the human behavior in fire and the conditions of fire when it is perceived.

Ref.(1.2) which was partly introduced in the progress report for the 10th panel, is a study based on the memories of subjects who have passed through a route like a maze.

Mr. Takahashi and others compared human behavioral data observed in a real theater with the BRI evacuation model for fire safety design and reported the good agreement of the model.(1.3)

Dr. Sekizawa related residential fires in Japan with those in the U.S. using Fire Investigation Report by the Fire Defense Agency in Japan and the Fire in the United States, edit.2, 1982.7 by USFA (1.4)

Dr. Tsujimoto studied on the concept of risk analysis such as the problem of uncertainty and randomness, the difference of relative and absolute criteria of the degree of risk, and the relation between risk and risk perception.(1.5) Comparing building fire risk with other sorts of risk such as aircraft/ automobile accidents and home casualties in staircases, he and his colleagues also reported that the acceptable level of risk for public facilities becomes lower as time goes, while that for private house stays always constant.(1.6)

Kobe University group headed by Dr. Murosaki proposed a calculation model of fire awareness time which is assumed to be the required time for a night watcher to reach each door of bed room.(1.7) The distribution of calculated times was validated with the result of human behavioral tests in a real building.

2. ANNUAL CONFERENCE OF J.A.F.S.E. 1989

Dr. Tsujimoto and his group estimated fire risk of building fire on the basis of fire statistic data by Tokyo Fire Department and Housing Survey of Japan by the Management and Coordination Agency.(2.1) Fire outbreak rate(number of fire buildings per year/total number of existing buildings) and burned floor area by size of building, by construction method and by completion year are calculated. A part of this result is quoted in Mr. Hagiwara's presentation in this session.(3.1)

Dr. Sekizawa analyzed residential fires with fatalities and clarified that around 70% of the dead are weak people like aged or handicapped.(2.2) This research will be explained by himself in this session.

3. OTHERS

Some papers on this topic were submitted also to the 1989 annual meeting of A.I.J. but most of them were the continuation of the above mentioned works. Among them, Mr. I. Hagiwara and Dr. I. Tsukagoshi reported a part of the Ministry of Construction's five year project entitled "Development of New Technology for Wood Frame Building"(3.1). It proposes a method for evaluating fire loss by the expected value of burned floor area calculated as a function of the fire outbreak rate of each room, the distribution of starting time of fire fighting and the frequency of the use of building materials. Details are to be presented by the author in this session.

Prof. T. Hirano of the University of Tokyo proposed an attractive approach for analyzing loss prevention. He developed a concept to evaluate the effectiveness of different types of disaster preparedness by means of cost-effectiveness theory. He applied the proposed procedure to the evaluation of expense for loss prevention against oil reservoir tank fire. It seems that the general nature of his concept enables us to apply it to other different cases including building fire.

4. OVERVIEW

Looking through all of these papers, the general tendency can be summarized as follows:

(1) In the researches 1.1, 1.4, 1.6, 2.1, 2.2 and 3.1, fire statistic data are analyzed to utilize as the data source for risk evaluation model or to compare the characteristics of fires in various categories. As the progress of international exchange of information in the field of fire science, it will become more and more important to standardize methods of survey and indices of statistics or to have a way of data conversion.

(2) As seen in 1.1, 1.4, 2.1, 2.2 and 3.1, number of researchers are focusing their attention on the analysis of residential fire. In the background of this tendency, we can find two great problems namely the evacuation problem of aged or handicapped and the problem of mass fire in wood house built up areas. For the former, it is required to study more carefully human behaviors in fire and for the latter, to have an adequate method for evaluating risk of combustible constructions.

(3) Concept of building design method and risk assessment are pursued in the papers 1.5, 1.6, 3.2 3.4 and 3.5, among which the joint project by Drs. J. Hall and A. Sekizawa gives us useful informations for our future works.(3.4) They compared related works in the U.S. and Japan in the common format and clarified the concepts for fire risk analysis model. This will be discussed in this meeting together with Dr. T. Tanaka's report which describes the concept of fire safety design system.(3.5)

REFERENCE

1. Summary of Technical Papers of Annual Meetings, Architectural Institute of Japan 1988:

   1.1 M. Baba, S. Sugawa, S. Tanaka & K. Kawagoe "Investigation of Human Behavior in Residential Fire"
   1.2 M. Minagawa, K. Kishitani, S. Sugawara & M. Yoon "A Study on Human Behavior on a Highly Complicated Evacuation Route: Ⅱ. Perceptional Disturbances Dued from Corner Angles: Ⅲ. Perceptional Impact Evaluation Dued from Directional Axis Distortion of Guidance Map"
   1.3 K. Takahashi, T. Tanaka & S. Wataya "A Method of Predicting Evacuation in Theater"
   1.4 A. Sekizawa "Comparative Analysis on the Characteristics of Residential Fires between the United States and Japan"
   1.5 M. Tsujimoto "A Methodology of Risk Assessment Method for Building Fire"
   1.6 T. Ishikawa, M. Tsujimoto & H. Kakegawa "A Research on Fluctuation of Risk with Time: Part 1. Definition and Calculation of Risk: Part 2. Fluctuation with Time and Consideration of Risk"
   1.7 M.Murosaki, K.Ohnishi and Terasawa "A Study on Computation Model for Time of Fire Awareness"

2. Annual conference of the Japanese Association of Fire Science and Engineering 1989

   2.1 H. Kakegawa, T. Nagaoka & M. Tsujimoto "Estimation of Fire Risk Utilizing buildings and fires Data Base: Part 2. Fire Risk of Residential Building in Tokyo Metropolis"
   2.2 A.Sekizawa "An Analysis on Fatalities' Characteristics of Residential Fire"

3. Papers for the 11th UJNR panel

   3.1 I. Hagiwara & I. Tsukagoshi "Simulation of Fire Propagation in a Wood Frame House"
   3.2 T. Hirano "Effectiveness Evaluation of Expense for Loss Prevention" to be presented at the International Conference on Safety and Loss Prevention in the Chemical and Oil Processing Industries; Oct. 23-27, 1989; Singapore
   3.3 S. Sekizawa "Analysis on Fatalities' Characteristics of Residential Fires"
   3.4 J. Hall & A. Sekizawa "Fire Risk Analysis: General Conceptual Framework for Describing Models"
   3.5 T. Tanaka "Concept of Performance Design System for Building Fire Safety"