Computer Models
For
Fire and Smoke

Model Name: EESCAPE (Emergency Escape)

Very Short Description: Evacuation of multistory buildings via staircases in case of fire; optimization of escape route dimensions

Modeler, Organization: Ezel KENDIK, Cobau Ltd. Argentinierstr. 28/11, 1040 Austria

References:

1. Kendik, E., Determination of the Evacuation Time Pertinent to the Protected Area Factor in the Event of Total Evacuation of High-rise Office Buildings via Staircases. Fire Safety Journal, 5 (1983) p. 223.
2. Kendik, E., Die Berechnung der Personenstrome als Grundlage fur die Bemessung von Gehwegen in Gebauden und um Gebaude. (Assessment of Escape Route in and around Buildings) Dissertation Ph.D. Technical University of Vienna, June 1984.
3. Kendik, E., Assessment of Escape Routes in Buildings and a Design Method for Calculating Pedestrian Movement. National Fire Protection Association/Society of Fire Protection Engineers Annual Meeting, May 13-16, 1985, Chicago, Illinois, U.S.A. Published as Society of Fire Engineers Technology Report 85.4 by SFPE, Boston, Massachusetts, U.S.A. 1985.
4. Kendik, E., Methods of Design for Means of Egress: Towards a Quantitative comparison of National Code Requirements. Invited paper presented at the First International Symposium on Fire Safety Science hosted by the National Bureau of Standards, Washington, D.C., Maryland, U.S.A., Oct. 7-11, 1985. Published in the Fire Safety Science – Proceedings of the First International Symposium. Edited by Cecile E. Grant and Patrick J. Pagni. Hemisphere Publishing Corporation, November 1985, U.S.A.
5. Kendik, E., Designing Escape Routes in Buildings. Fire Technology, Volume 22, Number 4. Quincy, Massachusetts, U.S.A., November 1986.

6. Predtechenskii, W.M., Milinski, A.I., Planning of Foot Traffic Flow in Buildings, NBS by Amerind Publishing Co., Pvt. Ltd., New Delhi, 1978.
Seeger, P.G., and John, R., Untersuchung der Raumungsablaufe in Gebaeuden als Grundlage fur die Ausbildung von Rettungswegen, Teil III: Reale Raumungsversuche (Real Evacuation Tests) Stuttgart, Informationszentrum fur Raum und Bau der FgG, 1978.

Availability: Organization operates for outside user.

Hardware: IBM compatible PC

Language: GW Basic

Size: 34,500 Bytes

Detailed Description:

Kendik's egress model addresses the time sequence from the time at which people start to evacuate the floors until they reach the outside or an approved refuge area in the building. The model copes with the problem of potential congestion on stairs and through exits, including the interdependencies between adjacent egress way elements, which appear to be a major problem, especially in dense populations.

It can predict open plan type buildings, as well as building with corridors, and corridors with several intersections.

The model has been calibrated against the data from the evacuation tests carried out by the Forschungsstelle fuer Brandschutztechnik at the University of Karlsruhe. [(7)] If the following simplifications

1. The length I of the partial flow built up by the occupants of each floor (defined between the first and the last persons of the flow) is assumed to be equivalent to the greatest travel distance along the corridor;

2. The number of persons as well as the escape route configurations are identical on each story; and

3. Each partial flow attempts to evacuate simultaneously, and enters the staircase at the same instant.

Are introduced into the general model, the flow movement via staircases in multistory buildings shows some regularities:

1. If the evacuation time on the corridor of each floor is less than the evacuation time on the stairs per floor, then the partial flows from each floor can leave the building without interaction.

2. If the evacuation time on the corridor of each floor exceeds the evacuation time on the stairs per floor, then the partial flows from each floor encounter the rest of the evacuees entering the staircase on the landing of the story below. Even though this event causes the increase of density on the stairs, the capacity of the main flow remains under the maximum value, which indicates that the stair width is still adequate to handle the merged flow.

3. If the value of the specific flow on the stairs exceeds the maximum during the merging of the partial flows at the story (n-1), congestion occurs on the stairs as well as the entry to the staircase.

The program enables the user to change the dimensions of the building's means of egress and the occupant load easily and work out the influence of the variation on the complete circulation system. Furthermore, by comparing the safe evacuation time with the predicted evacuation times (floor evacuation times or the total evacuation time) the program makes it possible to optimize the escape route dimensions.

The method differes from the other egress models mainly in its flexibility in predicting the variation of the physical flow parameters during the course of the movement. In this it doues not assign fixed values to the flow density or velocity for each individual or separate groups but considers them to be a single group of a certain mean density on each section of the escape route.

Limitations:

The model doesn't consider the time prior to people becoming aware of the fire nor their decision-making processes.