Computer Models
For
Fire and Smoke

Model Name: BRANZFIRE

Version: 2000.12

Classification: Zone Model

Very Short Description: A zone model to predict the environment in a compartmented structure.

Modeler(s), Organization(s): Colleen Wade, Building Research Association of New Zealand.

User's Guide: A User's Guide to BRANZFIRE Software, Building Research Association of New Zealand. (2000).

Technical References: BRANZFIRE Technical Reference Guide, Building Research Association of New Zealand. (2000).

Wade, C.A. A Theoretical Model for Fire Spread in a Room Corridor Configuration. *Paper presented at the 3rd International Conference on Performance Based Codes and Fire Safety Design Methods.* Lund, Sweden. (2000).

Validation References: (all of the following papers cite experimental comparisons with the model):

Dowling, V., McArthur, N.A., Webb, A.K., Leonard, J.E., and Blackmore, J. Large Scale Fire Tests on Three Building Materials. Proceedings 3rd International Conference on Fire Research and Engineering, Chicago (1999).

Wade, C.A., LeBlanc, D., Ierardi, J., and Barnett, J. A Room-Corner Fire Growth and Zone Model for Lining Materials. *Proceedings - 2nd International Conference on Fire Research and Engineering*. Maryland. (1997).

Wade, C.A and Barnett, J.R. A Room-Corner Fire Model Including Fire Growth on Linings and Enclosure Smoke-Filling. *Journal of Fire Protection Engineering*. 8(4) pp 27-36. (1997).

Wade, C.A. A Room Fire Model Incorporating Fire Growth on Combustible Lining Materials. Master of Science Thesis. Worcester Polytechnic Institute, USA. BRANZ Reprint 139. Building Research Association of New Zealand. (1996).

Availability: Available from http://www.branz.org.nz/PandS/FireResearch/software.htm.

Price: To be advised.
60-day fully functional trial-ware free of charge.

Necessary Hardware: Runs under Windows **95, 98, 2000** and NT. Pentium II CPU or faster recommended.

Computer Language: Microsoft Visual Basic 6.0

Size: Approximately 10MB of disk space, and 16MB of RAM required.

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Detailed Description:

BRANZFIRE is a zone model including flame spread options on walls and ceilings and is used to calculate the time dependent distribution of smoke, fire gases and heat throughout a collection of connected compartments during a fire. In BRANZFIRE, each compartment is divided into two layers. The modeling equations used in BRANZFIRE take the mathematical form of an initial value problem for a system of ordinary differential equations (ODE). These equations are derived using the conservation of mass, the conservation of energy, the ideal gas law and relations for density and internal energy. These equations predict as functions of time quantities such as pressure, layer heights and temperatures given the accumulation of mass and enthalpy in each of the two layers. The BRANZFIRE model then solves of a set of ODE's to compute the environment in each compartment and a collection of algorithms to compute the mass and enthalpy source terms. The model incorporates the evolution of species, such as carbon monoxide, which are important to the safety of individuals subjected to a fire environment.

Version 2000.12 models up to 10 compartments, unlimited number of vents, mechanical extract or supply to/from the exterior, optional ignition and flame spread on walls and ceilings, multiple plumes and fires, sprinklers and detectors, visibility through smoke based on optical density, and calculation of fractional effective dose based on oxygen, carbon dioxide and carbon monoxide concentrations. The geometry includes variable area/height relations with an option for a sloping ceiling, material properties and fire object databases, two-layered walls, and flow through wall openings and holes in floor/ceiling connections.

The flame-spread algorithms are based on thermal flame spread theory. Both upward (wind-aided) and lateral flame spread is modeled. Ignition is predicted making use of the Flux Time Product method based on analysis of cone calorimeter time to ignition data. Heat release contribution by linings is determined based on the calculated pyrolysis area and time dependent heat release data from cone calorimeter tests.

The program allows results to be viewed in graphs or tabular form, and will save results directly to an Excel spreadsheet with automatic generation of Excel charts for selected variables (for users with Microsoft Excel installed).