Computer Models For Fire and Smoke

Model Name: BRANZFIRE

Version: 2012.1

Date: August 2013

Classification: Zone Model

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

Modeler(s), Organization(s): Colleen Wade, BRANZ Ltd, New Zealand.

User's Guide: A User's Guide to BRANZFIRE. BRANZ, New Zealand. (2004). http://www.branz.co.nz/cms_display.php?sn=74&st=1

Technical References: BRANZFIRE Technical Reference Guide. Study Report No 92. BRANZ, New Zealand. (2004). http://www.branz.co.nz/cms_display.php?sn=74&st=1&pg=9457

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

Wade, C.A. BRANZFIRE Compilation of Verification Data. BRANZ, New Zealand. (2007). http://www.branz.co.nz/cms_display.php?sn=74&st=1&pg=9457

Wade, C.A. and Robbins, A.P. 2008. SR195 Smoke filling in large spaces using BRANZFIRE. BRANZ Study Report No 195. BRANZ Ltd, Judgeford.

Wade C.A. Spearpoint, M, Bittern, A., and Tsai, K (Wei-Heng). 2007. Assessing the Sprinkler Activation Predictive Capability of the BRANZFIRE Fire Model. *Fire Technology* v43. p175-193.

Robbins, A.P. and Wade, C.A. 2007. Soot Yield Values for Modelling Purposes – Residential Occupancies. BRANZ Study Report No 185. BRANZ Ltd, Judgeford.

Wade, C.A. 2006. Fire hazard assessment of wall and ceiling fire spread in rooms. Chapter 5 in Flammability testing of materials used in construction, transport and mining. V. B. Apte (ed). Woodhouse Publishing Limited, Cambridge England.

Apte, V.B., Bui, A., Paroz, B., Wade, C.A., Webb, A.K. and Dowling, V.P. 2004. An assessment of fire growth models – BRANZFIRE and FDS against CSIRO fire tests on combustible linings in a room. In proceedings Interflam 10th International Fire Science and Engineering Conference. Interscience Communications Ltd.

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).

Parry, R., Wade, C.A., and Spearpoint, M. Implementing a glass fracture module in the BRANZFIRE model. *Journal of Fire Protection Engineering.* 13(1) (2003).

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).

Availability: Download at http://www.branzfire.com or
http://www.branz.co.nz/cms_display.php?sn=74&st=1

Model Actively Supported?: No. Model functionality has been included and extended in the alternative B-RISK fire model (supported).

Price: Free

Necessary Hardware: PC with OS - Windows 9x, 2000, NT, XP, Windows 7.

Computer Language: Microsoft Visual Basic 6.0

Size: Full installation file ~ 40 MB.

Contact Information: Colleen Wade, BRANZ Ltd Private Bag 50908, Porirua City, New Zealand. Phone +64 4 2371178, email – branzfire@branz.co.nz

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 CO, HCN and soot which are important to the safety of individuals subjected to a fire environment.

Version 2012.1 models up to 12 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).