Fire Brigade Intervention Model (FBIM) – General Provisions

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Author: FRV Fire Safety Advisory Group

Sponsor: Community Safety Technical Department

Authorised by: Director, Fire Safety

1. PURPOSE

The purpose of this guideline is to provide advice relative to when the Fire Brigade Intervention Model (FBIM) should be carried out and the information required to undertake the model. The model can be sourced via the Australasian Fire and Emergency Services Authorities Council (AFAC) website: www.afac.com.au.

2. BCA REQUIREMENTS

In 1996, a performance based building code[1] was introduced in Australia. To ensure that the fire brigades' functional role was maintained in the building code, a method of quantifying the fire brigades' role was required. In response to this issue, AFAC formed a Performance Based Fire Engineering Committee. This committee developed a model that determines the time taken by a fire brigade to undertake its activities at a fire scene.

In addition to the objectives and functional statements of the Building Code of Australia (BCA), the following performance requirements are specific to fire brigade intervention:

- **CP1** Structural stability during a fire
- **CP2** Avoiding Spread of fire
- **CP9** Access provided to and around a building for fire brigade vehicles and personnel
- **DP5** Fire isolated exits
- **EP1.3** Fire hydrants
- **EP1.5** Firefighting equipment in a building under construction
- **EP1.6** Facilities to coordinate fire brigade intervention
- **EP2.2** Evacuation time of occupants
- **EP3.2** Emergency lifts
- **GP4.4** Fire safety system in an alpine area.

[1] Australian Building Codes Board – The Building Code of Australia, Vol. 1, Class 2 to Class 9 Buildings

3. WHAT IS FBIM AND WHEN IS IT REQUIRED

The "Fire Brigade Intervention Model" [2] is an event-based methodology, which quantifies fire brigade activities employed during a fire from time of notification through to control and extinguishment. It has been primarily developed for use in fire engineering design in a performance-based regulatory environment so that the functional role of a fire brigade can be effectively incorporated into the building design process. It establishes a structured framework necessary to both determine and measure fire brigade activities on a timeline basis. It interacts with the outputs of other sub-systems which model events such as fire growth, smoke spread, fire spread, detection and suppression, as well as occupant evacuation. The model has been developed for use of specific site characteristics and is applicable to most fire scenarios. As the expertise of the local fire brigade will be incorporated in the input parameters, it is valid for most brigade types, crew sizes and resource limitations.

The Fire Brigade Intervention Model should be considered as an appropriate tool when analysing a design's performance against the performance requirements of the BCA. The FBIM should also be used in conjunction with other fire safety systems to optimise the fire safety strategy for a building/site and completes the fire engineering analysis by ensuring a rigorous and thorough fire risk management approach. Specific environments, such as subterranean, may require additional considerations when conducting an FBIM assessment. Furthermore, the FBIM should always be conducted in liaison with, and/or verified with the relevant fire service Fire Safety Department.

4. "TO THE DEGREE NECESSARY"

It is considered that the relevant performance requirements are satisfied when fire brigade intervention has been adequately addressed as part of an engineering analysis. This assessment should identify the activities necessary for the fire brigade to conduct their statutory role:

- search and rescue
- containment of fire, including exposure protection
- fire extinguishment
- property protection
- environmental protection.

FRV's interpretation of the extent to which the relevant performance requirements need to be addressed can be explained as follows:

"to the degree necessary"

- given a reasonable time to rescue occupants prior to building collapse and the onset of conditions going beyond hazardous for firefighters, as described in Section 6.2 of this guideline (Hazardous Conditions).
- be provided with the necessary equipment, systems and water quantities to effectively carry out firefighting activities.

[2] Australian Building Codes Board – The Building Code of Australia, Vol. 1, Class 2 to Class 9 Buildings

5. HOW CAN FBIM BE USED?

The FRIM can be used as a whole or in part to create a timeline of events. Below is a list of how FBIM has been used in the past:

- determine whether an internal or external attack on the fire is a possible decision. Dependent upon detection, alarm, notification and environmental conditions
- determine time at which the fire brigade arrives on scene and is ready to conduct search and rescue activities in addition to assistance with evacuation
- due to reduced access and egress provisions, review the impact of such provisions on fire brigade activities in relation to occupant evacuation (i.e. single fire stairs)
- as a result of omitting automatic suppression systems, a review of hydrant requirements in relation to fire brigade intervention, building design and fire load
- depending on the time of arrival, ascertain the extent of which the fire brigade can supplement the manual operation of fire safety systems and emergency response procedures (i.e. tunnels)
- determine whether proposed designs provide opportunities for fire brigade intervention to control fire spread (i.e. to show that compartments remote from the fire and adjoining properties can be protected, therefore providing additional redundancy in the design)
- to confirm the robustness of the alternative solution.

6. EXPOSURE LIMITS FOR FIREFIGHTERS

The critical factors of the environment which affect firefighters and their equipment are:

- air temperature
- visibility
- humidity
- incident thermal radiation
- air flow passing the firefighter
- time for which they are exposed.

The following information has been obtained from a paper written in the *Fire Journal*, January 1995. This project has been carried out by the UK Home Office Fire Experimental Unit.

These results are based on firefighters dressed in standard A26 tunics with over-trousers to an equivalent specification, fire hoods, gloves, helmets, rubber boots and breather apparatus. All conditions are relative to a height of 1500mm above floor level and visibility to be no less than 10 metres.

The following results apply in the below conditions:

6.1. Routine Condition

Elevated temperatures but not direct thermal radiation.

- Maximum Time: 25 minutes
- Maximum Air Temperature: 100ºC (in lower layer)
- Maximum Radiation: 1kW/m^2.

6.2. Hazardous Condition

When firefighters would be expected to operate for a short period of time in high temperatures in combination with direct thermal radiation.

- Maximum Time: 10 minutes
- Maximum Air Temperature: 120ºC (in lower layer)
- Maximum Radiation: 3kW/m².

6.3. Extreme Condition

These conditions would be encountered in a snatch rescue situation or a retreat from a flashover.

- Maximum Time: 1 minute
- Maximum Air Temperature: 160ºC (in lower layer)
- Maximum Radiation: 4-4.5kW/m².

6.4. Critical Conditions

Firefighters would not be expected to operate in these conditions, but could be encountered. Considered to be life threatening.

- Time: < 1 minute
- Air Temperature: > 235ºC (in lower layer)
- Radiation: > 10kW/m².

Where a design relies on firefighters carrying out an internal fire attack and/or search and rescue, the building design should facilitate conditions that do not exceed limits contained within Section 6.2 of this guideline (Hazardous Conditions).

7. CHECKLIST FOR CARRYING OUT THE FIRE BRIGADE INTERVENTION MODEL

Below is a list of items/information that may be required to undertake a FBIM:

- the aim/purpose of carrying out the FBIM
- Fire Engineering Report
- heat release rate over time analysis
- drawings of site, evacuations and floor plans
- building description, including site address
- Fire Services' (Appliance) Assignment Rule
- building Class
- occupant type(s)
- floor area(s)
- fire load(s)
- fire safety system(s)
- location of fire safety equipment, including fire indicator panel, internal and/or external hydrants, booster connections and control valves.

8. CONCLUSION

The FBIM developed by AFAC may be applied to satisfy objectives and performance requirements of the BCA, in relation to fire brigade intervention.

Further assistance and advice on the implementation of the FBIM can be obtained from FRV's Community Safety Technical Department (CSTD). Where FRV are requested to conduct an FBIM on behalf of a third party, an FRV Fire Protection Report Application Form should be forwarded to CSTD.

9. FURTHER REFERENCES

FRV Fire Safety Guideline *GL-20 – Fire brigade intervention model (FBIM) – dangerous goods sites and major hazard facilities*

www.afac.com.au