Engineering Practice Guide for Preventing Fire Spread

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Contents

- What motivated the preparation of this Guide
- Preventing internal fire spread via glazing
  - Prevention methods (DtS and Performance Solution)
  - Develop your own method (if brave enough)
- Preventing external fire spread via glazing
  - Several key parameters to note

What happened?

ENGINEERS AUSTRALIA
SOCIETY OF FIRE SAFETY
NSW CHAPTER

Dear Society of Fire Safety Members,

The NSW Chapter of the Society of Fire Safety (SFS) invites members and associated professionals to attend an upcoming Technical Information Session:

"Protection of Glazing"

Date: 15 April 2015

Time: 4:00 pm – 6:00 pm. Please arrive by 3.45 pm.

Venue: Auditorium, Engineers Australia, Ground Level, 8 Thomas Street, Chatswood

What happened?

The seminar topic will be presented as detailed below followed by a discussion session.

Haydn Lewis will address the following:

a) Expand on Peter Gardner's presentation from February,
b) Discuss the history behind Table CV1,
c) Discuss how to use Table CV1 to determine the level of radiation received by future developments and assumptions made in this process,
d) Discuss how radiation assessments are undertaken in other parts of the world and what we could do differently, and
e) Promote an open discussion of the various methodologies used within the industry and the importance of developing a practice note.

MC Hui will present an overview on common types of glazing used in building construction; fire resistant glazing systems; mechanism of glazing breakage; prediction of glazing breakage; performance of various types of glazing in fire including radiant heat attenuation; how to protect glazing with sprinklers; as well as a brief discussion on WS window sprinklers.

Brendan Kennedy will address the limitations and impracticality of sprinklers on toughened glass, reasons behind the withdrawal of approvals for these systems in 2011 and the regular confusion at the construction and certification stages when used.

What happened?

- This Engineering Practice Guide serves to provide supplementary and complementary information and design methodology to the IFEG for preventing fire spread between buildings
- During the early working group meetings, it was identified there were two distinct issues, one being the use of WS sprinkler to protect glazing to achieve an FRL internally, and the other being the radiation from/to the neighbour building via the external unprotected glazed openings

Preventing Internal fire spread via glazing

- From time to time, there could be situations that glazed elements are used for fire separation purposes, such as an internal glazed fire-isolated stair or a wall with some, or entirely, glazed elements which serves to fire separate two compartments. Solutions include:
- Fire rated glass (DtS if the required FRL is achieved)
- Fire curtains and shutters (DtS if the required FRL is achieved)
- Wall wetting sprinklers (Performance Solution)

Proprietary wall-wetting sprinkler system

- It works

Other systems?

- Can we not use the proprietary system?
  - Glazing type: At least 6 mm thick toughened or heat strengthened glass (better thermal shock resistance)
  - No (horizontal) transoms on glazing which obstruct water flow
  - No foreign objects on glazing which could obstruct water flow
  - Glazing can't be too high that could lead to water flow bifurcation
- Sprinkler spray pattern, location of deflector, and spacing between sprinklers do not lead to dry spots on the glazing
- Pony wall / other physical barrier to prevent thermal shock

Preventing External fire spread via glazing

- Most buildings have glazed windows in the external walls
  - Natural lighting
  - Natural ventilation
  - Aesthetics
  - Different sizes (influence on the amount of radiant heat emitted)
  - Different aspect ratios (influence on external flame length)
  - Different configuration (fixed closed, casement, sliding, awning)
  - Different mounting methods

Preventing External fire spread via glazing

- A fully developed fire may lead to failure (fall out) of part or all of the glazing in the external wall
- The opening in the external wall then becomes a fire source that could lead to fire spread to the floor above or to a neighbour building
- Need to demonstrate and justify why external fire spread is not expected to occur (assumed total failure of glazing)

Verification Methods

- BCA CV1 and CV2 methods

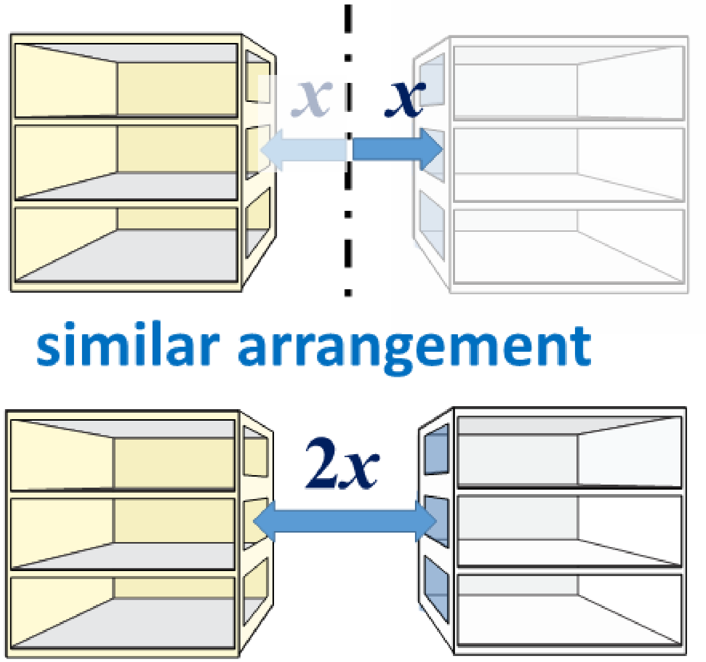


Table CV1

Column 1	Column 2
Location	Heat Flux (kW/m^2)
On boundary	80
1 m from boundary	40
3 m from boundary	20
6 m from boundary	10

same values

Table CV2

Column 1	Column 2
Distance between buildings	Heat Flux (kW/m^2)
0 m	80
2 m	40
6 m	20
12 m	10

Courtesy of Dr. Weng Poh (2017 FPAA / SFS conference)

Verification Methods

- BCA CV1 and CV2 methods

Is CV1 consistent with CV2?

- Part (b) "spread from" - **YES**
- Part (a) "spread to" - **NO**
  - CV2 criteria = 1-point check
  - CV1 criteria = 4-point check
  - treatment of distance (d) differs
  - **Discrepancies increased with decreasing d**

Courtesy of Dr. Weng Poh

Verification Methods

- BCA CV1 and CV2 methods

Is CV1 consistent with reality?

NO

- Criteria can be represented by single panel
  - For T =1000C, ε =1.0
  - Panel (approx): A = 21 m, B = 1 m, d = 0.8 m
- But the panel is not a realistic one

Courtesy of Dr. Weng Poh

Verification Methods

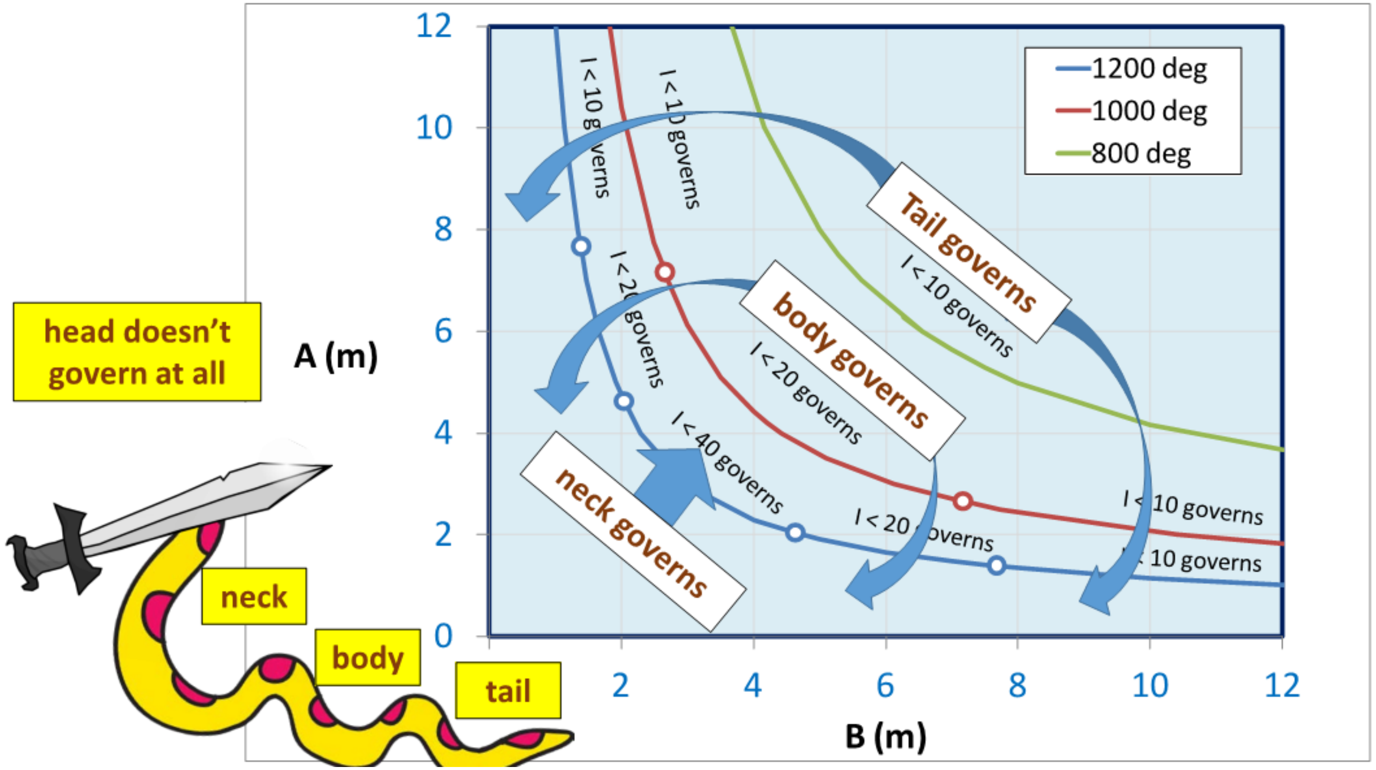
- BCA CV1 and CV2 methods

Is CV1 consistent with DtS?

- **No**

(If no, what are the limits?)

- as previously shown



Courtesy of Dr. Weng Poh

Verification Methods

- BCA CV1 and CV2 methods

CV1 and CV2 are WRONG!

- CV1 ≠ CV2
- CV1 ≠ reality
- CV1 ≠ DtS

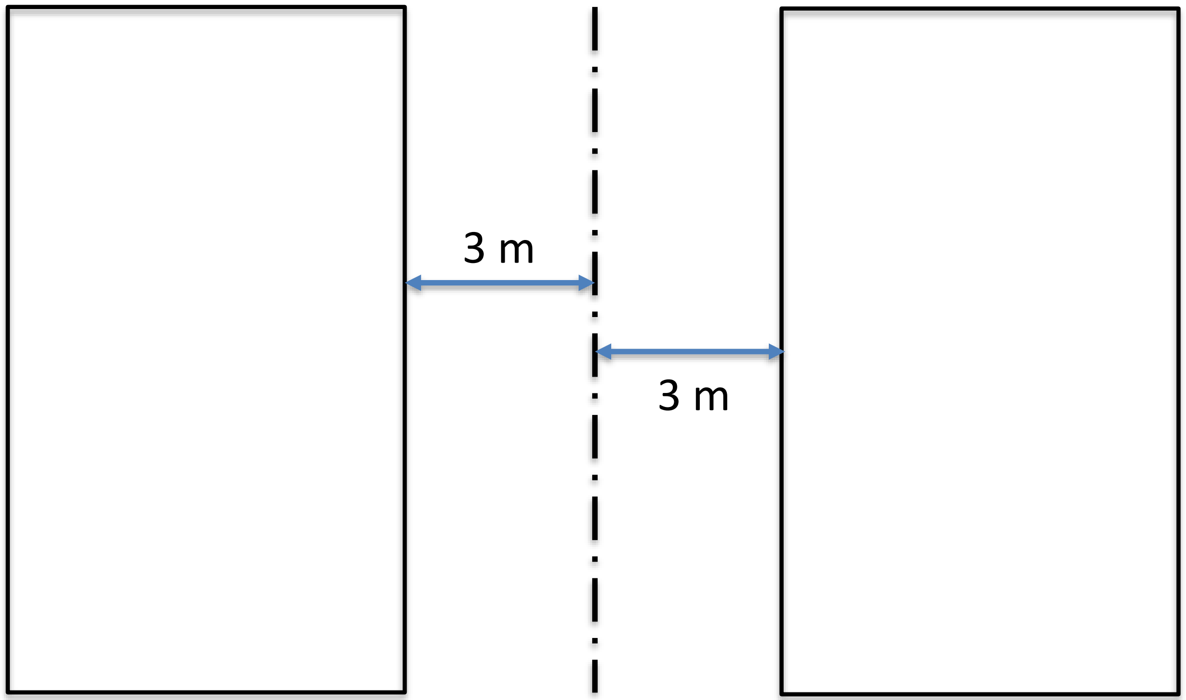
- We can further dissect them and produce more and more complicated analysis results that fit
- But what we need is a correct model that produces simple results

Courtesy of Dr. Weng Poh

Verification Methods

- BCA CV1 and CV2 methods

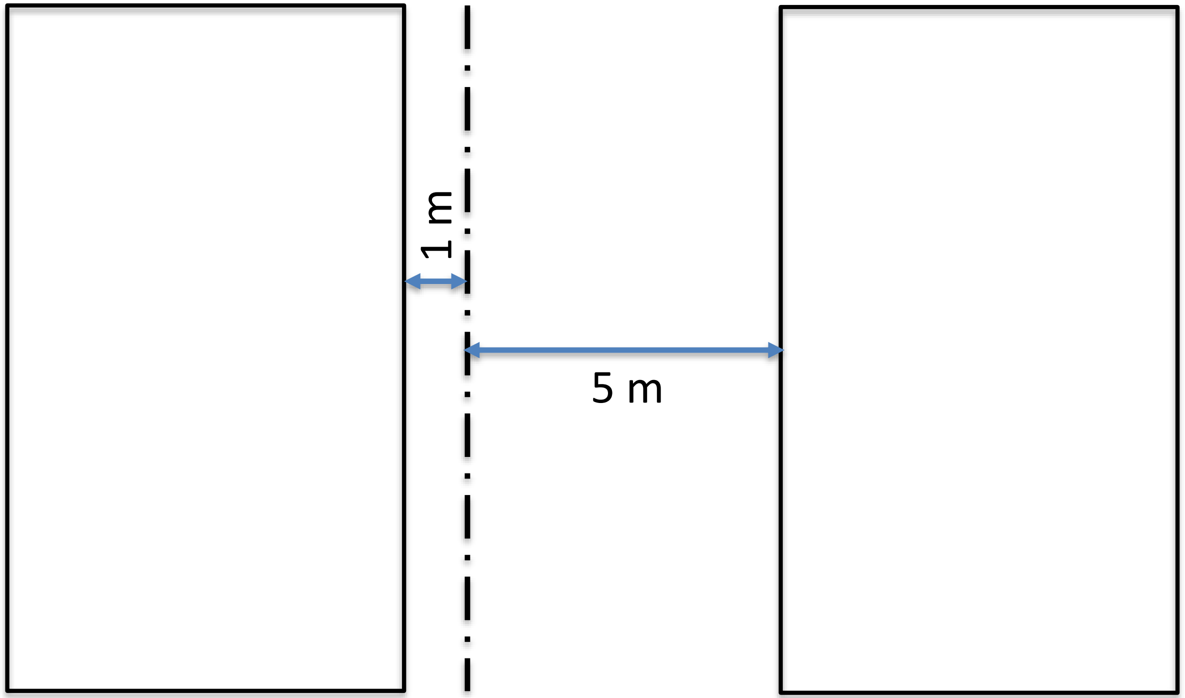
Opening protection not required for both buildings



Verification Methods

- BCA CV1 and CV2 methods

Opening protection is required for the left hand side building



Fire Engineering Method

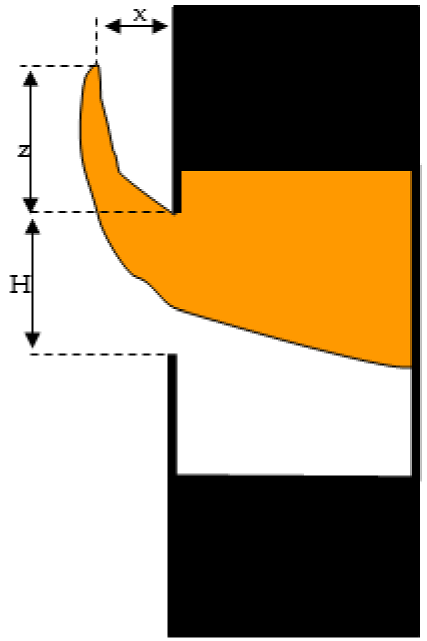
- Key parameter on fire spread between buildings via radiant heat transfer.
  - $E = \sigma \varepsilon T^4$ (Stefan-Boltzmann constant and emissivity)
  - Radiant heat flux $\propto T^4$; temperature of the heat source highly influential.
  - 830, 900, 1000, 1100, or 1200 °C?
  - Post-flashover temperature depends on fire load and ventilation (Fully developed fires – two kind of behaviour; An Introduction to Fire Dynamics, 3rd edition, Figure 10.5, pp. 395).

Fire Engineering Method

- External flame projection – include or exclude?
- Temperature of flame? (decreasing with height according to Margaret Law's correlation)

Fire Engineering Method

- View factor (aka configuration factor)
  - Single fire source – readily available
  - Multiple fire sources (window + flame) at different temperatures?



Fire Engineering Method

- Fire protection measures
  - Similar to that for internal fire spread via glazing.
  - Blade walls.
  - Note: BCA Specification on wall wetting sprinklers in Clause C3.4 poorly written.

Engineering Practice Guide for Preventing Fire Spread

- Anyone interested to join the working group is welcome.

SFS 25th Anniversary

- The Society of Fire Safety was inaugurated by the first meeting of the National Board on 22 August 1994.
- Stay tuned for the forthcoming national activities in around August 2019 to celebrate this milestone.
- Let me know if you have any ideas and proposals.

Thank you

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