FIRE AUSTRALIA2025

Sprinkler Protection in Housing for People with Disabilities

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Acknowledgements

Thank you to Mark Whybro and the Home Fire Sprinkler Coalition Australia

Disclaimer: Views expressed in this presentation are my personal opinions and do not represent Arup or the HFSCA.

Housing

- The number of residential dwellings in the December quarter of 2024 was 11,294,300 for a population of 27,309,396
- Dwelling types are:
  - Ordinary detached houses,
  - Houses with offices,
  - Houses with flats,
  - Rural residential houses,
  - Semi-detached, row and terrace houses,
  - Townhouses, and
  - Flats, units and apartments.

https://www.abs.gov.au/statistics/economy/price-indexes-and-inflation/total-value-dwellings/latest-release

Disability

- A person is considered to have disability if they have any limitation, restriction or impairment which restricts everyday activities and has lasted, or is likely to last, for six months or more.
- In 2022, 5.5 million Australians (21.4%) had disability
- Almost 4.8 million people (87.4%) had a limitation with at least one of the core activities of communication, mobility or self-care, and/or a schooling or employment restriction.
- 7.9% of all Australians had a profound or severe disability

https://www.abs.gov.au/statistics/health/disability/disability-ageing-and-carers-australia-summary-findings/latest-release

Independent Living

The Federal Government and every State and Territory has policies for independent living for people with disabilities.

Australia's Disability Strategy 2021-2031

Importance of providing support for people with disabilities to live independently and participate fully in the community.

- We all benefit from a more inclusive Australia where everyone has the same opportunity to participate – both socially and economically.
- We know that people with disability achieve the best outcomes when they have access to the same services and facilities as the broader community.

https://www.ndis.gov.au/understanding/australias-disability-strategy-2021-2031

Equity in Fire Safety

Fire Safety for all

- Evacuation
- Fire detection and occupant warning
- Fire protection

Disabilities

- Movement
- Vision
- Hearing
- Cognitive
- etc.

Residential Fires

- In Australia between July 2003 to June 2017 there were 810 preventable residential fire fatality incidents that resulted in 900 cases of fatality.
- From the NSW data from 2016 – 2021, there were 30,891 structure fire, the largest proportion of structure fire were in Class 1a dwellings 54.6% (16,866):
    - Resulting in 1,630 injuries and 71 fatalities from the fires in Class 1a dwellings.
    - The fire spread beyond the room of origin in 3,488 of these structure fires.
- A structure fire was 2.2 times more likely to result in fatality in a Class 1a (residential) building compared to all other building classes
- 41% of the disabled residents living in Grenfell Tower died (of the 72 people who died in total, 15 were disabled)

L. Coates, et al., *"Preventable residential fire fatalities in Australia July 2003 to June 2017"*, Bushfire and Natural Hazards CRC, Melbourne, 2019
D. K. Pooley, R. Lam and P. Duong, *"FRNSW Adverse Structure Fire Outcomes 2016 -2021"*, Fire and Rescue NSW, 2023.

Efficacy of Sprinklers

Of the residential fire incidents in Class 1a dwellings in NSW during 2005 to 2014 fire sprinkler systems were present in 0.9% of fire-related incidents.

The presence of fire sprinklers significantly reduces the likelihood:

- A fire will spread beyond the object or room of fire origin, and
- Of injury and fatality in a residential dwelling fire.

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NFPA Study of the fire events in fire sprinkler protected homes,

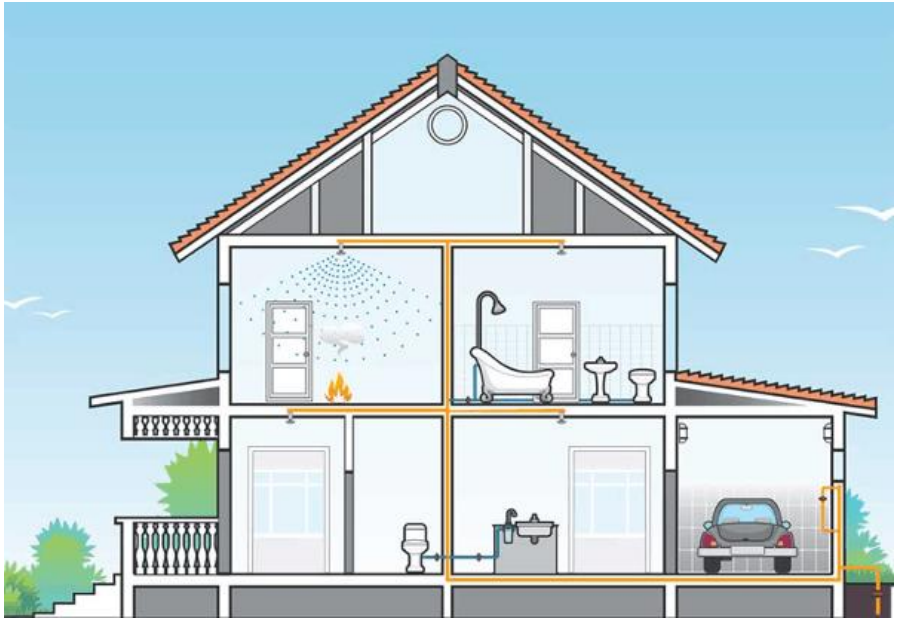
- 95% of the fires were large enough to activate the sprinklers. When they operated, they controlled 97% of these fires.
- In 99.5% one to five sprinkler heads activated.
- In 89.3% only a single head activated.

M. Ahrens, "*US Experience with Sprinklers*," National Fire Protection Association, 2021.
M. Ahrens and R. Maheshwari, "*Home Structure Fires*," National Fire Protection Association , 2021.

Adoption of Home Fire Sprinkler Systems

Removing the Barriers

- Not required by the NCC/ Voluntary
- Accessibility of design standards
- Water authority rules and requirements
- Installation Cost
- Routine Servicing
- Maintenance Cost



NCC Levels of Fire Safety Provisions

Building Classification	Description	Fire Safety Provisions
Class 1a	A detached house. dwellings separated by a fire-resisting wall, including a row house, terrace house, town house or villa unit.	Smoke alarms complying with Part 9.5 of the ABCB Housing Provisions
Class 1b	One or more buildings, which together constitute a boarding house, guest house, hostel or the like.	
Class 2	A building containing two or more sole-occupancy units. Each sole-occupancy unit in a Class 2 building must be a separate dwelling.	Automatic smoke detection and alarm system Building occupant warning system Fire sprinkler system: • RIS of 4 or more • Effective height >25m AS2118.1 • Any Class 3 residential care building
Class 3	A Class 3 building is a residential building providing long-term or transient accommodation for a number of unrelated persons. Class 3 buildings include the following: • Accommodation for the aged, children, or people with disability. • A residential care building.	
Class 9c	A Class 9 building is a building of a public nature. Class 9a — health care building Class 9c — a residential care building.	Automatic smoke detection and alarm system Building occupant warning system Fire sprinkler system

NCC Objectives

NCC Volume Two – Class 1 Buildings

Part H3 Fire Safety

Introduction states, this Part is intended to ***minimise*** the risk of illness, injury or loss of life occurring due to fire.

The Objective is to—

a) safeguard the occupants from illness or injury by **alerting** them of a fire in the building so that they may safely evacuate; and

b) avoid the spread of fire.

NCC Volume One – Class 2-9 Buildings

Part E

Introduction states, this Part focuses on provision of fire-fighting equipment which ***can enable occupants to fight the fire in its early stages and/or evacuate the building safely***, facilitate fire brigade intervention and minimise the risk of fire spread between buildings.

The Objective of this Part is to—

a) safeguard occupants from illness or injury **while evacuating** during a fire; and

b) provide facilities for occupants and the fire brigade to undertake fire-fighting operations; and

c) prevent the spread of fire between buildings.

AS2118.5 – 2008 Home Fire Sprinkler Systems

Objective:

… this standard is expected to delay and possibly prevent flashover… and **to improve the likelihood** of occupants escaping or evacuating.

Design criteria:

Home sprinkler systems shall be hydraulically designed to provide a flow of at least **50 L/min** from **each sprinkler**. The sprinkler coverage, minimum pressure and flow requirements for approved home sprinklers (see Clause 4.3.1) shall be in accordance with the sprinkler approval listing details specified in the manufacturer's data sheets.

The number of sprinklers assumed to be in **simultaneous operation** shall be **two**. The design flow for the sprinkler system shall be not less than **100 L/min plus an additional 12 L/min** for possible simultaneous domestic demand from such appliances as washing machines and dishwashers…

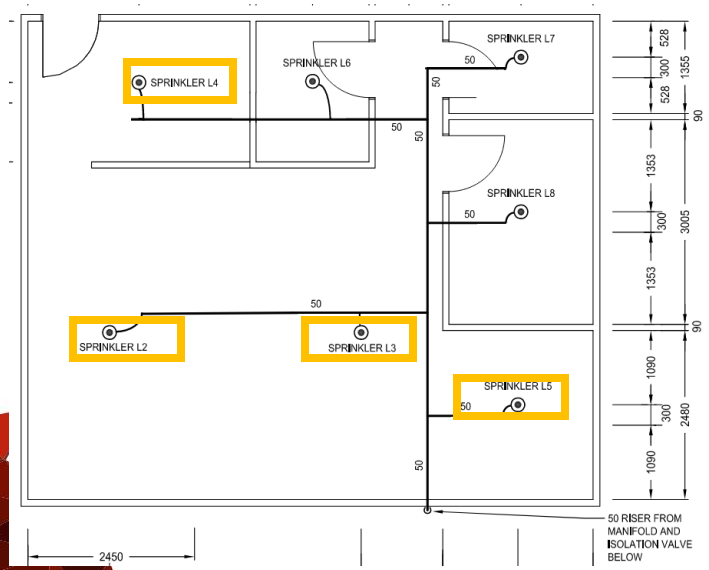
Alternative Home Fire Sprinkler System Design

Research for the Home Fire Sprinkler Coalition Australia

- Development of a safe, reliable, cost-effective and fit-for-purpose automatic home fire sprinkler system for Class 1a buildings (homes).
- What is the effect of changing the basis of design to, the operation of the most hydraulically disadvantaged **single (one) sprinkler head**, operating at a flow rate and residual pressure necessary to achieve the desired sprinkler spacing (coverage) in accordance with the sprinkler head's listing.

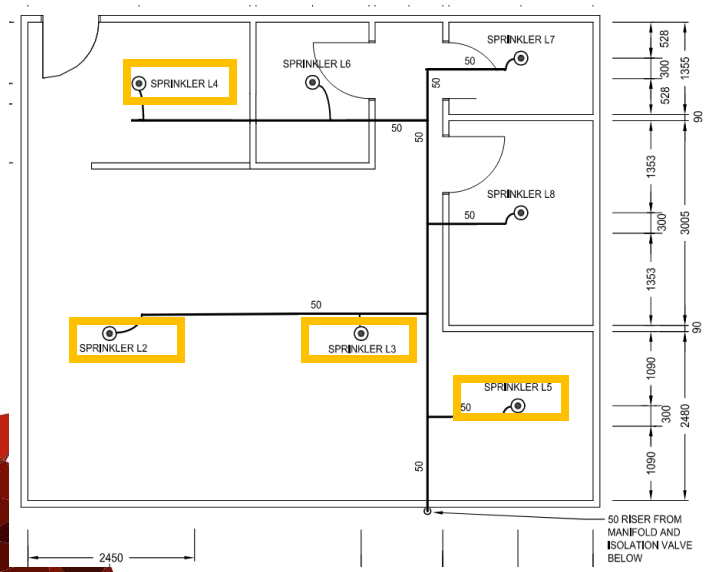
Alternative Home Fire Sprinkler System Design

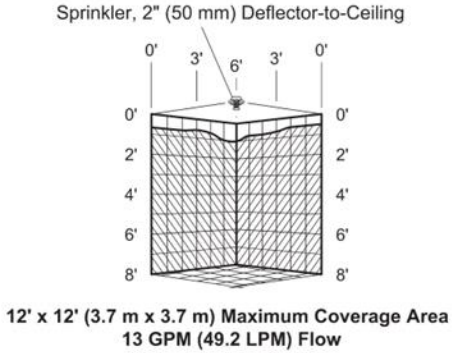
Fire Sprinkler System Design

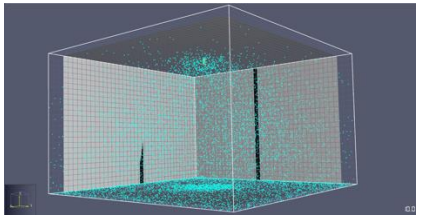


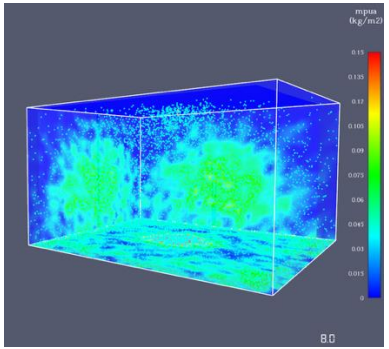
Scenario	Pressure [kPa]	Approximate Flow [L/min]	% Listed Pressure	% Listed Flow
Tyco Series LFII Residential Sprinklers listed pressure and flow				
4.9m x 4.9m coverage	48	49.2	-	-
Minimum static pressure at the source (meter) to achieve 1 head operating at 49.2L/min and 48kPa i.e. 110kPa				
1 head operating	51	50	106%	102%
2 heads operating	33	40 at each head	69%	81%
3 heads operating	21	32 at each head	44%	65%
4 heads operating	14	26 at each head	29%	53%

Using FDS to demonstrate efficacy of the system









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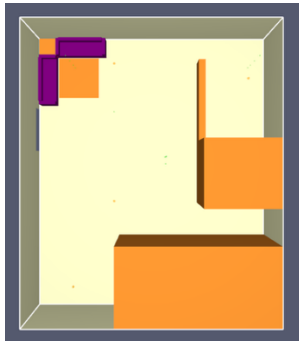

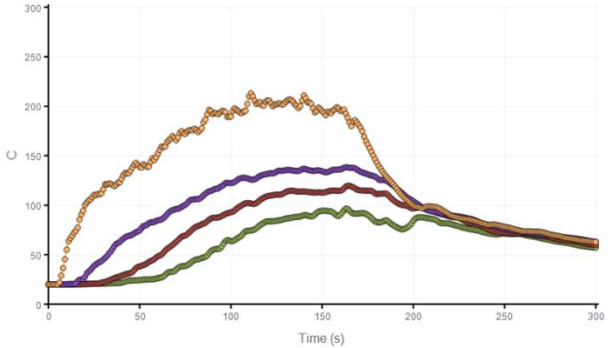

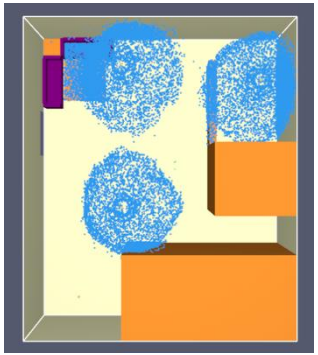

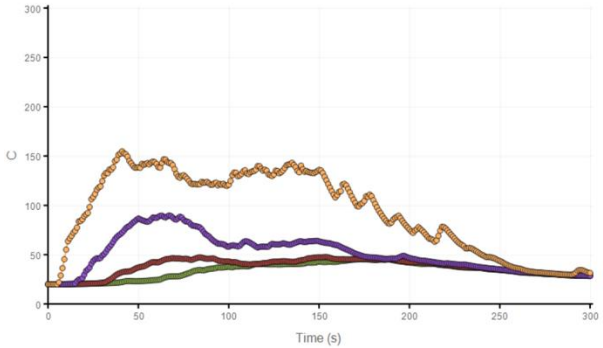

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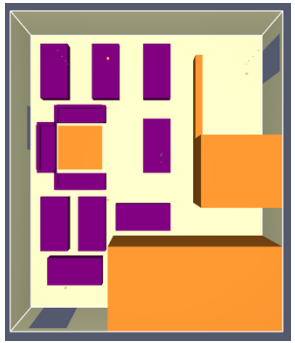

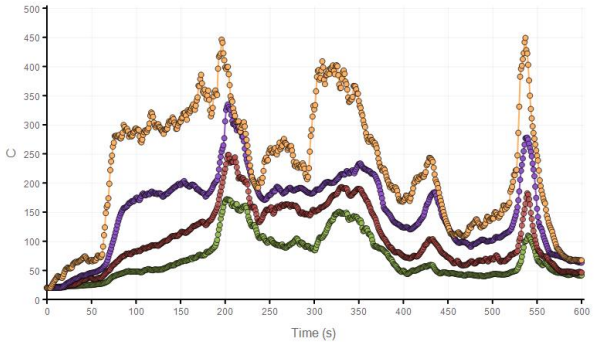

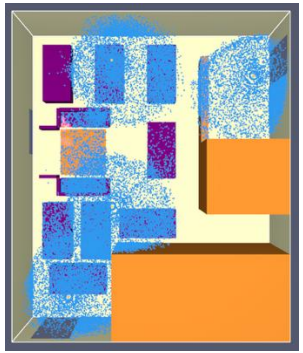

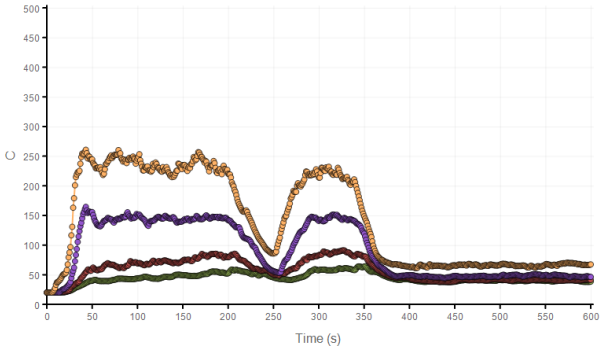

Modelling Limitations/ Observations

- Models were validated against large/full scale testing. Check the modelling was appropriately conservative.
- Simulations did not exactly replicate the full scale fire tests, but provide good insight on the expected behaviour of the fire sprinkler system under different conditions.
- Modelling assumptions and simplifications that may have contributed to the discrepancy.
- A number of studies could be undertaken on various modelling parameters to refine the model so it can more closely replicate a ‘real fire scenario’.
- CFD modelling can be used to test combinations of a variety of sprinkler designs, room/ dwelling configurations and fuel package configurations to stress test the sprinkler system and its’s design criteria.

Findings

- The modelling shows that in situations where there may be multiple sprinklers in a room the alternative design criteria was not as effective at reducing the room temperatures due to the lower water pressure and flows from each sprinkler head. Resulting in either: more heads operating; the same number of sprinklers in the room activated but with lower pressure and flows from each sprinkler head.
- Despite the reduced performance the modelling demonstrated that the sprinkler system the alternative design criteria was effective in controlling fire growth, and spread, resulting in conditions better than a non-sprinkler protected simulation.
- Despite the pressure and flow at each sprinkler head being a fraction of the sprinkler head's listed pressure and flow, the fire sprinkler system reduced the temperatures within the room and maintained conditions in the room such that flashover did not occur.

Adoption versus Efficacy

- Objective: To **improve** the likelihood of occupants escaping or evacuating.
- A home sprinkler system could benefit all people not just persons with disability.
- Are the currently available standards the ‘luxury model’?
- Fire sprinklers even if they do not ultimately control a fire can:
  - Improve the chances of evacuation - lower temperature, slow fire spread.
  - Allow for fire brigade intervention / rescue.

Versus

Thank You

https://homefiresprinklers.org.au/resources/research/