Protocols for Mitigating Cladding Risk

PMCR Interventions

F.04 – Interventions to Detect and Alert

Interventions are required to mitigate the risk to life safety posed by the presence of combustible cladding on the facades on Class 2 and Class 3 Victorian buildings.

The Victorian Government has developed a method for:

- assessing the risk presented by combustible cladding; and
- introducing targeted interventions to bring buildings to an acceptable level of cladding risk.

The **15** related risk mitigation interventions that may be applied fall into **five** categories:

1. Interventions to suppress fires;
2. Interventions to reduce cladding fuel;
3. Interventions to address energy ignitions;
4. **Interventions to detect fire and alert; and**
5. Interventions to assist safe egress.

This document provides information about those **interventions designed to detect fire and alert people**.

It is designed to assist those assessing a building's cladding risk and deciding how to intervene to reduce cladding risk to an acceptable level.

Version 2

Date: 13 March 2024

Aboriginal acknowledgement

Cladding Safety Victoria respectfully acknowledges the Traditional Owners and custodians of the land and water upon which we rely. We pay our respects to their Elders past, present and emerging. We recognise and value the ongoing contribution of Aboriginal people and communities to Victorian life. We embrace the spirit of reconciliation, working towards equality of outcomes and an equal voice.

Application of Minister's Guideline 15

These documents contain information, advice and support issued by CSV pursuant to Minister's Guideline 15 - Remediation Work Proposals for Mitigating Cladding Risk for Buildings Containing Combustible External Cladding. Municipal building surveyors and private building surveyors must have regard to the information, advice and support contained in these documents when fulfilling their functions under the Act and the Regulations in connection with Combustible External Cladding on buildings:

a) which are classified as Class 2 or Class 3 by the National Construction Code or contain any component which is classified as Class 2 or Class 3;

b) for which the work for the construction of the building was completed or an occupancy permit or certificate of final inspection was issued before 1 February 2021; and

c) which have Combustible External Cladding.

For the purposes of MG-15, Combustible External Cladding means:

a) aluminium composite panels (ACP) with a polymer core which is installed as external cladding, lining or attachments as part of an external wall system; and

b) expanded polystyrene (EPS) products used in an external insulation and finish (rendered) wall system.

Disclaimer

These documents have been prepared by experts across fire engineering, fire safety, building surveying and architectural fields. These documents demonstrate CSV's methodology for developing Remediation Work Proposals which are intended to address risks associated with Combustible External Cladding on Class 2 and Class 3 buildings in Victoria. These technical documents are complex and should only be applied by persons who understand how the entire series might apply to any particular building. Apartment owners may wish to contact CSV or their Municipal Building Surveyor to discuss how these principles have been or will be applied to their building.

CSV reserves the right to modify the content of these documents as may be reasonably necessary. Please ensure that you are using the most up to date version of these documents.

Document Notes

The Protocols for Mitigating Cladding Risk (**PMCR**) is an approach developed by Cladding Safety Victoria (**CSV**) on behalf of the Victorian Government to consistently and systematically address the risk posed by the presence of combustible cladding on Class 2 and Class 3 buildings (being multi-storey residential structures). For-many buildings, combustible cladding on the facade:

- does not present a high enough level of risk to warrant substantial or complete removal of the cladding; but
- presents enough risk to warrant a tailored package of risk mitigation interventions to be introduced that provide a proportionate response to the risk.

A set of documents has been assembled to describe the purpose, establishment, method, findings and application of the PMCR. The full set of PMCR documents and their relationship to each other is illustrated in a diagram in *Appendix A: PMCR document set and flow diagram.*

There are **seven** related streams of technical document in the PMCR document set:

A. Authorisation	Codifies the Victorian Government decisions that enable PMCR activation.
B. CRPM Methodology	Specifies the Cladding Risk Prioritisation Model (CRPM) method used for assessing cladding risk and assigning buildings to three risk levels.
C. PMCR Foundation	Defines the PMCR method, objectives and the key design tasks.
D. Support Packages	Captures the relevant risk knowledge and science-based findings necessary to systemise and calibrate PMCR application.
E. CSV Cladding Risk Policy	Establishes key CSV policy positions in relation to cladding risk.
F. PMCR Interventions	Identifies and describes the interventions that the PMCR method can employ to mitigate risk associated with combustible cladding.
G. Implementation	Specifies the standards and procedures that guide PMCR application.

This current document is one of a suite of PMCR Intervention Reports that describe how and when targeted risk mitigation interventions are applied to make building occupants safer.

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Abbreviations

Term	Meaning
ACP-PE	Aluminium Composite Panel with a polyethylene core
ASE	Alarm Signalling Equipment
BOWS	Building Occupant Warning System
Cladding Cluster	A group of SOUs being connected with combustible cladding as identified by IF-SCAN
CRMF	Cladding Risk Mitigation Framework
CSV	Cladding Safety Victoria
EPS	Expanded Polystyrene
FDAS	Fire Detection Alarm System
FDCIE	Fire Detection Control and Indication Equipment
Framework	Cladding Risk Mitigation Framework (CRMF)
FRV	Fire Rescue Victoria
IF-SCAN	Initial Fire Spread in Cladding Assessment Number
MBS	Municipal Building Surveyor
MG-15	Minister's Guideline 15
NCC	National Construction Code
NFPA	National Fire Protection Association
PMCR	Protocols for Mitigating Cladding Risk
RIS	Rise in storeys
RWP	Remediation Work Proposal
SOU	Sole Occupancy Unit – as defined in the National Construction Code

1 Introduction

When a building has combustible cladding on the facade, an **intervention** may be necessary to enhance life safety and reduce cladding fire risk to an acceptable level.

The level of risk created by the presence of combustible cladding typically varies from building to building. Accordingly, a decision to **intervene** and the extent of **intervention** required must also vary.

The Victorian Government has authorised the use of **15 interventions** to mitigate cladding risk. The authority for their use is contained in *Minister's Guideline 15* (**MG-15**) and supported by the *Cladding Risk Mitigation Framework (***Framework***)*.

The Guideline and Framework are intended to:

- support Municipal Building Surveyors (**MBS**) in rating the cladding risk of a building and determining what level of intervention is required to ensure that the building has achieved an Acceptable Cladding Risk; and
- inform owners about how their building is assessed with regard to cladding risk and the structured way in which Remediation Work Proposals are developed to bring their building to an acceptable level of cladding risk.

Cladding Safety Victoria (**CSV**) is assisting MBSs and owners by providing information about the cladding risk associated with each building and the steps necessary to remedy that risk. This information is provided in the form of a Remediation Work Proposal (**RWP**), that applies the cladding risk methodologies developed by CSV over three years.

A threat barrier analysis can be used to represent how risk-mitigating actions can function to respond to a problem. The CSV method employs this analysis technique to identify the central problem (the 'top event'), in this case a cladding fire, and depict how risk associated with the problem can be mitigated through the implementations of barriers (interventions) designed to control the key hazards identified.

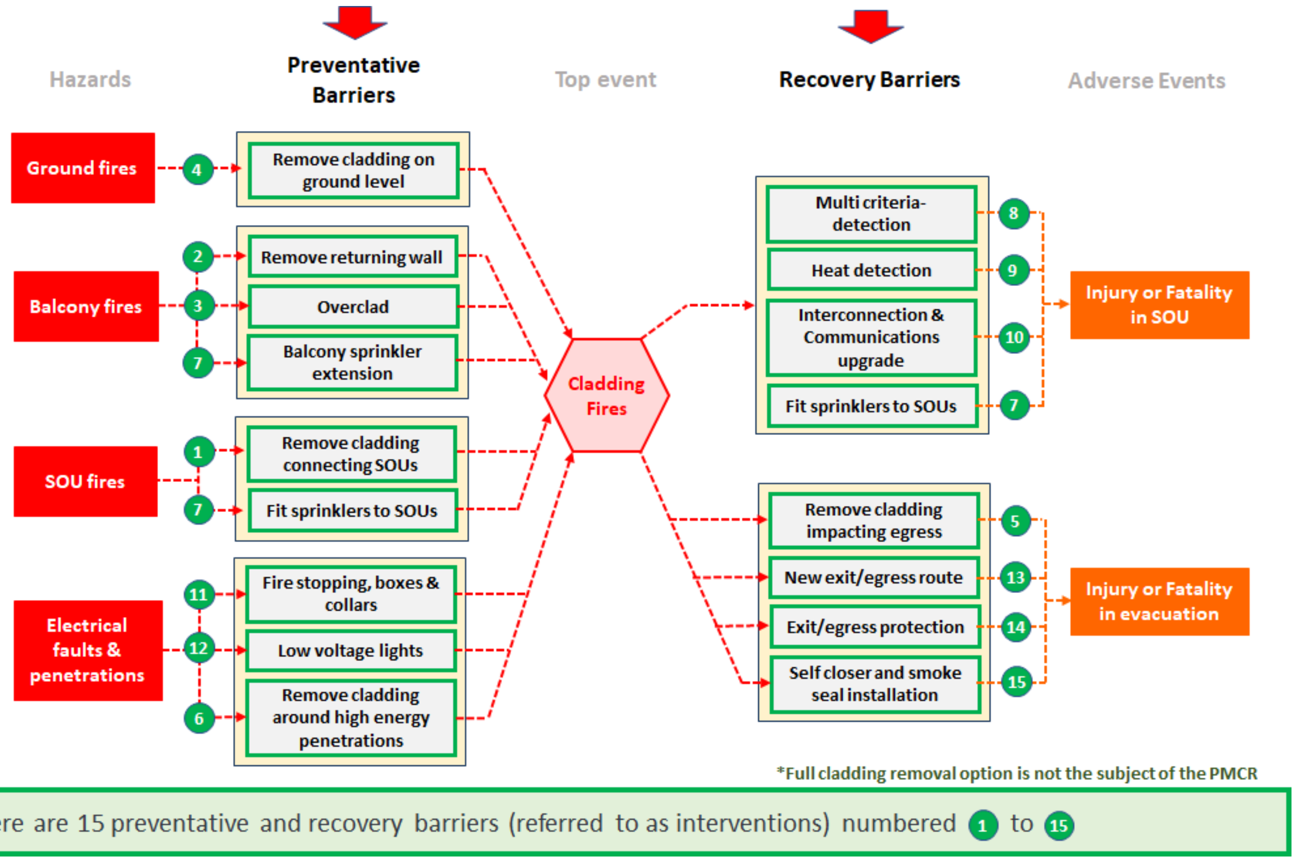


Figure 1: Threat barrier analysis

The 15 interventions in the threat barrier analysis act in different ways to mitigate cladding fire risk.

Each intervention may:

- Respond to one or more of the four identified hazards;
- Function to prevent an ignition source from spreading fire to cladding (i.e. interventions that reduce the likelihood of a fire igniting cladding); and/or
- Function to reduce the adverse impacts for building occupants once a fire has reached cladding (i.e. interventions that reduce the consequences of a cladding fire).

Any risk mitigation solution designed under the Framework must target credible hazards on a building and balance both cladding ignition likelihood and consequence considerations.

1.1 Purpose

This report provides information about interventions that are available to reduce the cladding risk on Victorian multi-dwelling residential buildings (Class 2 and Class 3) to an acceptable level.

The 15 interventions function to reduce cladding risk in one of five discernible ways.

The documentation developed by CSV to support the implementation of the Victorian Government's Framework, includes information to guide MBSs and owners in determining how and when to apply particular interventions.

The information is packaged in five related volumes, one for each category of interventions, as represented in the diagram on the right.

In selecting particular interventions, it is important to understand:

- The ignition hazards that an intervention is responding to;
- The benefit to safety of applying an intervention;
- When an intervention is required to be applied; and
- Any considerations that must be made to guide the selection and installation of an intervention.

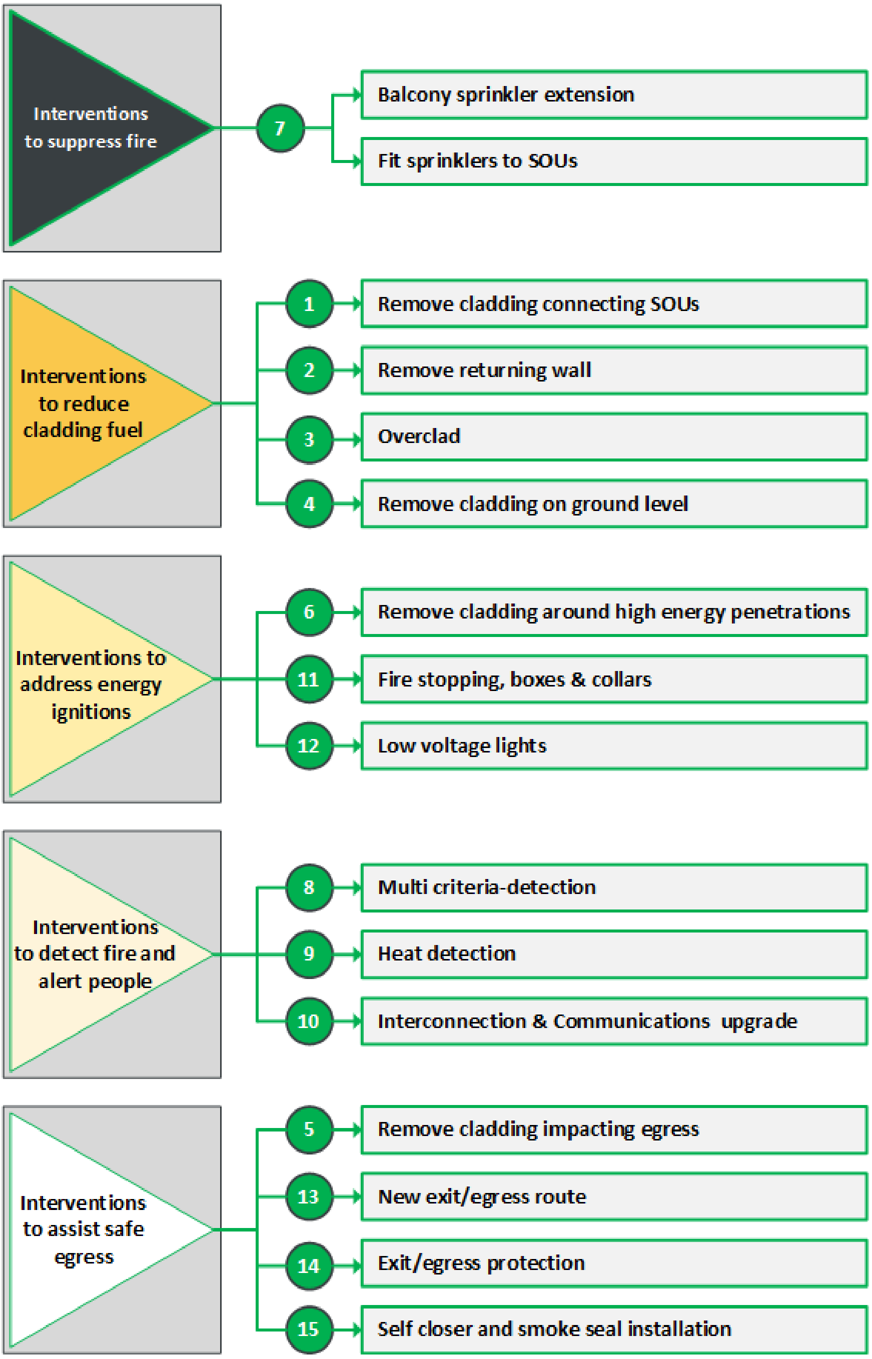


Figure 2: Thematic set of interventions

This report focuses only on interventions to detect fire and alert people.

2 Fire detection and alarm systems – interventions

Interventions, as known through PMCR, are select changes and treatments that may be enacted on a building as part of remediation work to mitigate undue risk caused through the retainage of combustible cladding.

Utilising elements of Fire Detection and Alarm Systems (**FDAS**) as PMCR solutions are paramount to a successful solution as it forms the risk reduction property of applying a recovery barrier. To effectively, and most proportionately implement these systems into a wide range of building and cladding configurations, FDAS elements used throughout the PMCR have been broken down into three main intervention components

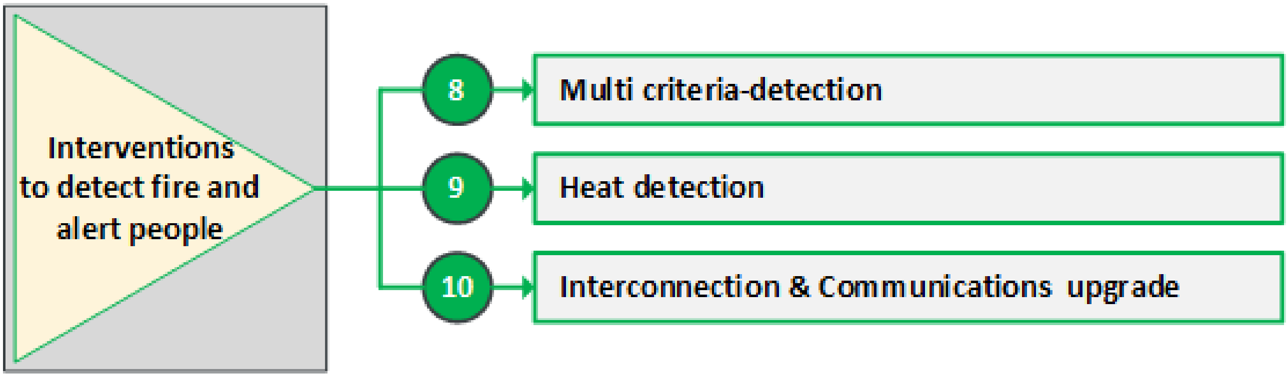


Figure 3: Interventions to detect fire and alert people

2.1 Intervention 8 – Multi-criteria detection

"Install multi-criteria detection to internal areas adjacent cladding (other than kitchens)"

Intervention 8 is the first FDAS type intervention introduced in the framework and calls for the installation of both smoke and heat detection components to certain SOU rooms impacted by the cladding cluster. This intervention can be satisfactorily met though installation of either a single multi-criteria detector or two separately housed smoke and heat detection units.

The intent of this intervention is to reduce the consequence of a cladding fire through early occupant warning. This early warning is enacted via BOWS activation from heat detection and local SOU sounders for the smoke detection.

Additionally, where the BOWS has been activated and an ASE is also a requirement, the ASE shall notify the fire brigade to initiate emergency response.

2.2 Intervention 9 – Heat detection

"Install heat detection to areas adjacent cladding"

Intervention 9, heat detection, requires installation of heat/thermal detection in certain areas adjacent to cladding that is retained to SOUs forming a cladding cluster. The intent is to also reduce the consequence of a cladding fire through early occupant warning via local alarm, BOWS and, if applicable, ASE activation.

Fixed temperature and rate of rise detection is preferable for areas such as kitchens that are prone to smoke. Thermal/heat detectors respond to heat only and do not sense smoke. This reduces the chances of spurious alarms occurring.

2.3 Intervention 10 – Interconnection and communications upgrade

"Interconnection of a buildings detection and alarm system, including the capacity of the system to communicate with external monitoring facilities"

Intervention 10 discusses the interconnection and communications that is required of an FDAS to function as is expected in a PMCR solution so as to facilitate appropriate risk reduction. This can be broken into three main components:

1. Smoke detection – each device must be interconnected with the other SOU-local smoke detection devices so that a collective alarm activates throughout the entire SOU.
2. Heat detection – heat detection is required to have a direct transmission pathway to initiate the BOWS, and where applicable the ASE, when above threshold heat is detected. **Note: *This includes automatic sprinklers systems (except FPAA101D and FPAA101H).***
3. Multi-criteria detection – the combined components (smoke and heat) must satisfy their respective detection interconnectivity and transmission pathway requirements.
4. Alarm Signalling Equipment – An ASE is required to notify relevant fire authorities so that emergency response can begin. Certain exclusionary events may see an ASE not required. These will be discussed in *G.03 – Cladding Remediation Standards*.

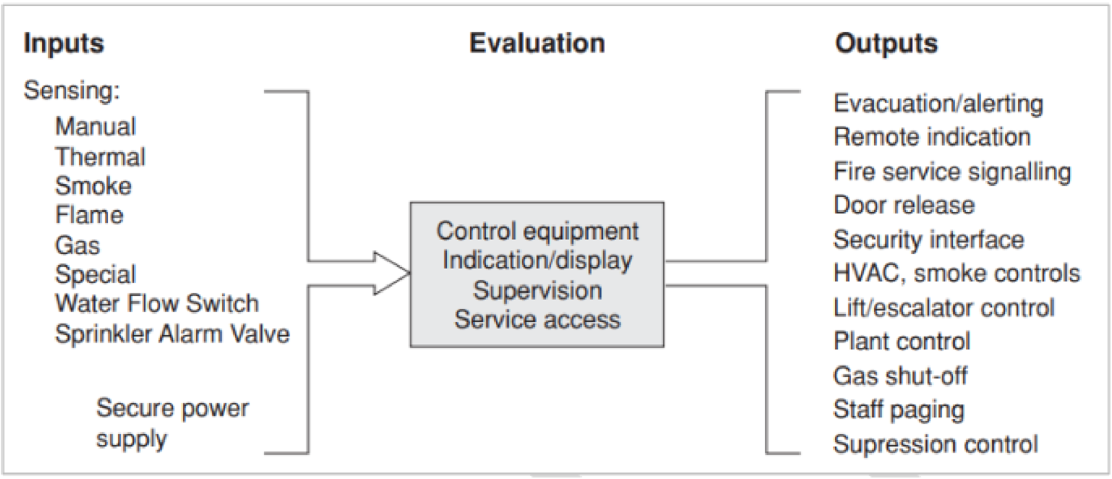


Figure 4: Indicative communication paths possible from detector initiation through to an outcome [1].

An understanding of the building's fire safety strategy is required to best facilitate the level of interconnectivity that should be installed as part of this intervention. This will inform what areas should receive alerts and warnings upon activation of the BOWS. Furthermore, the zones and cladding clusters within a building required to be considered for alarm will be building specific, and the extent to which the brigade is to be notified requires consideration.

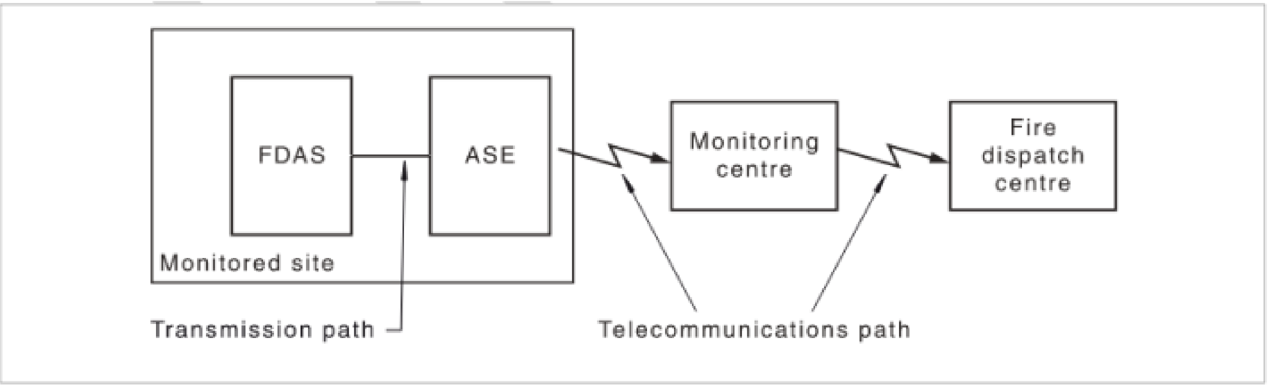


Figure 5: Indicative communication paths possible from FDAS initiation through to an outcome [2]

2.4 Considerations of intervention

When implementing any FDAS solution, the following consideration themes must be addressed to ensure that each intervention provides a proportionate response to the cladding risk without including any additional deleterious consequences.

FDAS design principles

These design principles form the fundamental benchmark for what is expected when looking to employ any form of FDAS intervention. Any solution component that includes an FDAS element should be implemented so that:

1. It provides the earliest possible detection of a fire hazard that may impinge upon cladding.
2. It provides the earliest possible warning to occupants of a building that a cladding fire is imminent or occurring.
3. It provides the earliest possible signal to brigade or monitoring agency that a genuine fire event has occurred.
4. Installation cannot compromise or negatively impact an existing building’s fire safety strategy.
5. Installation should not increase the occurrence of spurious alarms.

Highest benefit through prioritisation

To most effectively impact a PMCR solution, fire detection and alarm system-based intervention must aim to provide the greatest benefit whilst mitigating negative effects i.e., installing the least number of devices, providing least disruption to occupants etc. To achieve this, FDAS-based intervention would be considered to provide the greatest benefit when it incorporates the following considerations, in order of their prioritisation:

Life-safety risk reduction

The greatest consideration when implementing FDAS is to consider the life-safety risk reduction, as the primary function of these systems is to provide timely warning to occupants. Where FDAS is applied to a SOU, it should be ensured that the presence of smoke detection within the SOU will minimise the risk to occupants.

Cost and time reduction

If an option is available to apply a FDAS solution in a quicker time frame, whilst providing at least the same life-safety benefit, then the solution that will take less time should be chosen. Likewise, if the cost of one certain system is cheaper than another, yet produces the same life-safety benefit, then the cheaper option should be chosen.

Disruption reduction

Consideration should be given to the disruption caused to building occupants during solution implementation. So long as an equivalent level of life-safety benefit is achieved, the solution that disrupts residents the least should be considered the most appropriate.

The order of these benefits implies that the primary concern during rectification solution design should be of life safety. Cost/time and disruption reduction are always secondary to any life safety concerns.

2.5 What are Fire Detection and Alarm Systems (FDAS)?

Class 2 and Class 3 buildings are required to be equipped with an automatic warning upon the detection of smoke and flame to enable the timely facilitation of necessary early-stage firefighting and/or evacuation procedures [3]. This warning can be provided by either local smoke alarms to a Sole Occupancy Unit (**SOU**) or throughout the entire building via a smoke detector that is integrated into a building wide alarm. Both of these act as the Fire Detection Alarm System (**FDAS**), which functions as the heat and smoke component of a Building Occupant Warning System (**BOWS**).

FDAS refers to a system comprising control and indicating equipment, which when specifically arranged is capable of detecting, indicating, and providing signals to occupants in the event of a building fire. The main components of a Fire Detection and Alarm System are:

- Smoke detection and alarm systems
- Heat detection systems
- Alarms and Sounders
- Fire Indicator Panels (**FIP**)
- Alarm Signalling Equipment (**ASE**)

Additionally, automatic sprinkler systems, whilst not a part of the fire detection and alarm system, may also trigger the BOWS and as such, will influence the level to which the FDAS need be installed to meet PMCR interventions[1]. Further measures may also be included in FDAS systems either to meet additional building requirements or to purely increase the systems interface with occupants. Such additions can be:

- Manual Call Points (**MCP)**; and
- Alarm Acknowledgement Facilities (**AAF**).

The importance of these systems is inherently clear, and literature heavily supports that the implementation of these system is crucial, not only to meet regulation, but to save human life [4].

Reports from Fire Rescue Victoria indicate that of the 12 preventable fire fatalities for the 2021-2022 financial year, only 33% of the properties involved had a working smoke alarm. Moreover, of all recorded fires resulting in a fatality, half of the fatalities occurred in bedrooms where occupants were sleeping. This indicates not only the increased danger that is present in SOU bedrooms but also that occupants are not likely to wake through olfactory cues in a flaming or smouldering fire [5].

[1] Sprinklers are primarily discussed in F.01 – Interventions to suppress fire, and therefore are not discussed in this document.

Additional data to further highlight the necessity of FDAS are:

1. ***Fire Rescue Victoria (FRV) Annual Report 2021-2022***

   72% of house fires that result in fatal loss of life begin in bedrooms and living areas [6].

2. ***Metropolitan Fire Brigade (MFB) Annual Report 2019-2020***

   Between the years of 2009-10 and 2018-2019, there was on average, 1244 residential building fires per year [7].

3. ***Fire and Rescue NSW***

   Occupants are twice as likely to die in a house fire if there are no working smoke alarms installed [8].

4. ***National Fire Protection Association (NFPA)***

   The death rate per 1000 reported home fires was 55% lower in homes that had working smoke alarms in comparison to homes that did not [9].

From this, it is evident that enhancing a building's active fire safety systems though improved detection and alarm installation significantly increases the likelihood of occupants surviving a fire in an SOU.

3 Detecting fire and alerting occupants: when to apply interventions

To assess whether an FDAS intervention is required in the solution design of a building, it must first have progressed to the stage where all relevant information has been gathered, it has been marked up for combustible cladding clusters, and an IF-SCAN has been assigned.

Once this has been achieved, and the building is ready for solution implementation, FDAS intervention can be facilitated via two PMCR pathways, which are:

1. a prescribed standard policy solution; or
2. a non-standard solution.

The 'when' to apply is determined by first assigning a proportionate risk profile to each of a building's clusters, and then allocating them to one of the two pathways mentioned above. Figure 6 details the four cladding risk profiles that a building and cluster can be attributed to. The designation of risk profiles and how they are assigned can be found in G.01 Implementation Procedures or G.03 Cladding Remediation Standards, with a summary defined on the right.

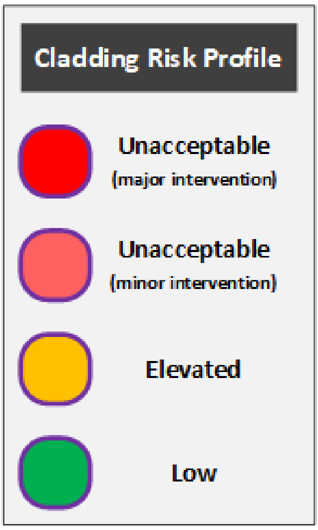


Figure 6: Cladding risk

Cluster risk

The aim of specifying a cluster risk type is on the basis that cluster risk is the most accurate representation of the inherent risk posed from fire spreading on cladding facades that adjoin SOUs. It is therefore the first stage in the assessment of potential remediation work whereby reference is made to the treatment of external combustible cladding clusters immediately contacting SOUs. This is measured in Cladding Fire Spread Risk (CFSR), and the corresponding response typologies range from A-I.

To determine the cluster typology, reference can be made to the risk response typology shown in table 1, which distinguishes the cluster risk as a function of:

- Whether an SOU is sprinkler protected;
- The uppermost SOU of the clusters on a building - rise in storeys (RIS);
- Type of combustible cladding present; and
- Cladding Fire Spread Risk (CFSR).

Sprinkler Status	Policy Response Type	Cluster Fire Spread Risk (CFSR)	RIS	Cladding Type
SOUs ARE sprinkler protected	A	0-2	ALL	Both
	B1	3	Up to 4	Both
	B2	3	5+	Both
	C1	4-6	Up to 4	Both
	C2	4-6	5+	Both
	D	7+	ALL	Both
SOUs ARE NOT sprinkler protected	E	0-1	ALL	Both
	F	2	ALL	Both
	G	3-4	Up to 4	Both
	H	3-4	5+	Both
	I	5+	ALL	Both

Table 1: Cluster risk type

Building risk

Building risk refers to the risk incurred via elements of cladding that affect the greater building, rather than any individual SOUs. An example of this is combustible external wall cladding that affects occupants egressing the building, or high energy fuel loads of cladding at ground level exits and egress paths.

Design philosophies

Remediation Work Proposals have incorporated design philosophies to simplify the complexity of interventions. At its core, a design philosophy aims to identify the predominant theme of a buildings cluster interventions and allow for this to be scaled to other clusters of the same building where it is viable. It is critical however that a design philosophy, at minimum, provides an equivalent risk reduction as what the corresponding typology would have otherwise.

This classification aids in providing a proportional risk response category so that parity can be maintained between similar buildings and their remediation solutions.

3.1 Standard application – prescriptive standard policy

Due to the expected repetition of solution designs being overtly similar, CSV has made the decision to apply a prescriptive standard to PMCR solutions so that a greater cohort can act to progress PMCR activities more efficiently and effectively. For this reason, each of the typologies have had prescriptive solutions attributed to them to treat the most commonly observed cluster configurations more proportionately. Table 2 shows the cluster risk types as 'Policy Response Types", and designates the prescriptive methods required to satisfy each risk type.

Sprinkler Status	Policy Response Type	Cluster Fire Spread Risk (CFSR)	RIS	Cladding Type	Cluster Responses						
					Sprinkler Installation		Detection & Alerting		Penetrations		Cladding Removal
					in SOUs	on balconies	Smoke Detection (bedrooms)	Smoke & heat detection	Remediation of lights, walls, and cladding		Targeted Cladding Removal
SOUs **ARE** sprinkler protected	A	0-2	ALL	Both	Existing						✓
	B1	3	Up to 4	Both	Existing		✓	✓	✓		✓
	B2	3	5+	Both	Existing	✓	✓	✓			✓
	C1	4-6	Up to 4	Both	Existing		✓	✓	✓		✓
	C2	4-6	5+	Both	Existing	✓	✓	✓			✓
	D	7+	ALL	Both	Existing					Or	✓
SOUs **ARE NOT** sprinkler protected	E	0-1	ALL	Both							✓
	F	2	ALL	Both			✓	✓	✓		✓
	G	3-4	Up to 4	Both	P		✓	✓	✓		✓
	H	3-4	5+	Both	P	✓	✓	✓			✓
	I	5+	ALL	Both							✓

Table 2: Prescriptive response solutions

Sprinkler Status	Policy Response Type	Cluster Fire Spread Risk (CFSR)	RIS	Cladding Type	Building Response Exits & Egress Ensure safe path of exit
SOUs **ARE** sprinkler protected	A	0-2	ALL	Both	✓
	B1	3	Up to 4	Both	✓
	B2	3	5+	Both	✓
	C1	4-6	Up to 4	Both	✓
	C2	4-6	5+	Both	✓
	D	7+	ALL	Both	✓
SOUs **ARE NOT** sprinkler protected	E	0-1	ALL	Both	✓
	F	2	ALL	Both	✓
	G	3-4	Up to 4	EPS	✓
	H	3-4	5+	EPS	✓
	I	5+	ALL	Both	✓

Table 3: Prescriptive building response solutions

The prescriptive response solutions provided are from G.03 Cladding Remediation Standards, where greater detail is provided to each solution, for FDAS and others, to provide a holistic view of the solution. Additionally, it is important to consider various factors, all of which are specified in section 5 of the same document. These factors, which include:

1. departures
2. concessions
3. recommendations

have the potential to impact the typical response suggested. Therefore, it's advisable to refer to these specific sections when looking to apply standard typologies as a solution.

When primarily focusing on the FDAS components of solutions for clusters, only seven cluster types require intervention. These seven can be summarised as seen below in tables 4 and 5.

Note: The codes of room types in table 4 and 5 can be found at *Appendix B: SOU Codification*

Table 4: Sprinkler protected building – FDAS solutions

<table>
<tr><td></td><td colspan="6">SOUs ARE sprinkler protected</td></tr>
<tr><td></td><td colspan="6">ACP/EPS</td></tr>
<tr><td>Policy Response Type:</td><td>A</td><td>B1</td><td>B2</td><td>C1</td><td>C2</td><td>D</td></tr>
<tr><td>CFSR</td><td>0-2</td><td>3</td><td>3</td><td>4-6</td><td>4-6</td><td>7+</td></tr>
<tr><td>Smoke detection</td><td rowspan="3">No FDAS Action Required – Risk is deemed too low to require intervention.</td><td colspan="4">1A (bedrooms) – Provide smoke detection to external doors and windows.
1A & 1B (bedrooms) – Ensure the location of smoke detection within the SOU is positioned so as to detect smoke that may impact the path between the bedroom(s) and the SOU exit.
1C (bedrooms) – Provide smoke detection to external doors and windows.</td><td rowspan="3">No FDAS Action Required –
Significant Targeted Cladding removal will mitigate the risk.</td></tr>
<tr><td>Heat detection</td><td colspan="4" rowspan="2">BOWS - Ensure heat/thermal detection exists between the external cladding hazard and the SOU exit in a common space within the SOU that activates BOWS.</td></tr>
<tr><td>BOWS connectivity</td></tr>
</table>

Table 5: Non-sprinkler protected- FDAS solutions

<table>
<tr><td></td><td colspan="6">SOUs ARE NOT sprinkler protected</td></tr>
<tr><td></td><td colspan="6">ACP/EPS</td></tr>
<tr><td>Policy Response Type:</td><td>E</td><td colspan="2">F</td><td>G</td><td>H</td><td>I</td></tr>
<tr><td>CFSR</td><td>0-1</td><td>2V</td><td>2H</td><td>3-4</td><td>3-4</td><td>5+</td></tr>
<tr><td>Smoke detection</td><td rowspan="3">No FDAS Action Required – Risk is deemed too low to require intervention.</td><td>1A (bedrooms) – Provide smoke detection to external doors and windows.
1A & 1B (bedrooms) – Ensure the location of smoke detection within the SOU is positioned so as to detect smoke that may impact the path between the bedroom(s) and the SOU exit.
1C (bedrooms) – Provide smoke detection external doors and windows.</td><td colspan="3">1A (bedrooms) – Provide smoke detection to external doors and windows.
1A & 1B (bedrooms) – Ensure the location of smoke detection within the SOU is positioned so as to detect smoke that may impact the path between the bedroom(s) and the SOU exit.
1C (bedrooms) – Provide smoke detection to external doors and windows.</td><td rowspan="3">No FDAS Action Required –
Significant Targeted Cladding removal will mitigate the risk.</td></tr>
<tr><td>Heat detection</td><td>1A (bedrooms) – Lower - Provide thermal detection to external doors and windows.
2A (living/kitchen Space) – Lower – Install thermal detection.</td><td colspan="3">Must meet BOWS requirements as specified below.</td></tr>
<tr><td>BOWS connectivity</td><td>BOWS – Ensure thermal detection exists between the external cladding hazard and the SOU Exit within the SOU.</td><td>BOWS – Ensure that BOWS activation is possible to each floor level of the cluster via either:
i) Ensuring thermal detection exists between the external cladding hazard and SOU exit in a common space within the SOU; or
ii) Smoke seepage from the SOU reaches the common use corridor detection (that activates BOWS).</td><td colspan="2">BOWS – Ensure thermal detection exists between the external cladding hazard and the SOU Exit in a common space within the SOU.</td></tr>
</table>

3.2 Nonstandard application – other solutions

It is acknowledged that the PMCR may not adequately provide solutions for all buildings and/or all clusters, as it was designed to capture the vast majority of similar building/cluster configurations. With this in consideration, the PMCR also allows for nonstandard solutions to RWPs. To determine when this type of solution is appropriate, the building must still have been completely marked up, had an IF-SCAN assigned **AND** have had the cluster risk types identified.

If after designating the cluster risk the interventions do not proportionately capture the required risk reduction or there is a more appropriate solution available (regarding risk, cost-time, disruption reduction etc.), a non-standard solution will be developed. In these instances, the designer has complete discretion in creation of this solution2, however a registered fire safety engineer must supervise the solution designer during development of the solution before it can be issued as part of an RWP.

[2] The solution designer must still use PMCR intervention material to design the solution.

4 Detecting fire and alerting occupants: how to apply the interventions

This section discusses methods in which PMCR design solution components are required to be installed when they are prescribed as part of a solution. Both intent and physical application of each main component will be explained to provide clarity regarding standard installation, types and connectivity requirements.

4.1 Implementation of smoke detection

1. Smoke detection can be in any form that meets deemed-to-satisfy provision of the NCC.
2. The positioning must meet PMCR requirements.
3. Transmission pathways and interconnectivity must conform also with PMCR provisions.

4.1.1 Intent

The intent of smoke detection is:

1. To protect sleeping occupants from smoke ingress from combustible cladding that enters via external doors and windows.
2. To protect the pathway from both incident and non-incident bedrooms to the SOU exit (1B bedrooms).

4.1.2 Location and positioning

The positioning of smoke detection should be where the earliest indication of smoke can be detected. As per the intent, if detection is prescribed to the bedroom opening, it must:

1. Be positioned within 300mm to 1500mm from the midpoint of opening so that it is perpendicular to the opening. ***If the bedroom has multiple openings, still only one smoke detector is required, but it must be positioned at a midpoint between the openings.***
2. Where existing smoke detection is found in a bedroom that would have otherwise been prescribed smoke detection through PMCR, the location is not needed to be changed.
3. Where smoke detection is to be installed for 1B's, detection must be positioned so that the risk of the egress path, from the bedroom to the SOU exit, becoming untenable upon use is minimised.

4.2 Implementation of heat detection

4. Heat detection can be in any form that meets deemed-to-satisfy provision of the NCC.
5. The positioning must meet PMCR requirements.
6. Transmission pathways and interconnectivity must conform also with PMCR provisions.

4.2.1 Intent

The intent of heat (thermal) detection in PMCR solutions is to provide a building wide alarm so that necessary evacuation procedures and emergency response can begin. The decision to implement heat detection is made with consideration to:

- An increased prevalence of spurious alarms from smoke in kitchen/living areas from smoke alarms; and
- Where the severity of a fire can triggers heat detection, it is deemed dangerous enough to elicit BOWS activation.

Installation of heat detection has two objectives, which are:

1. To provide early warning to SOUs above of a fire below; and
2. To alert BOWS of fire to the internal area of an SOU.

4.2.2 Location and positioning

With consideration again towards intent, the location of heat detection is required to be so that earliest notification can be made. The positioning of these detectors, where prescribed to an external door or window, must:

1. Be positioned within 300-1500mm from the midpoint of opening so that it is perpendicular to the opening. ***If the SOU has multiple impacted openings, it must be considered if multiple devices are required, or if a single device is able to be positioned at a midpoint between the openings to provide equivalent detection benefit.***

Where heat detection is instead required to "exist between external cladding hazard and SOU Exit in a common space within the SOU" positioning must otherwise be in accordance with the relevant BCA specification – Smoke detection and alarm systems.

Additionally, irrespective of where the heat detection is prescribed:

2. Where existing heat detection is found in a room that would have been prescribed heat detection, the location is not needed to be changed so long as the existing heat detection satisfies the PMCRs prescribed intent.

4.3 Implementation of multi-criteria detection

7. Multi-criteria detection can be in any form that meets deemed-to-satisfy provision of the NCC.
8. The positioning must meet PMCR requirements.
9. Transmission pathways and interconnectivity must conform also with PMCR provisions.

4.3.1 Intent

The intent of multi-criteria detection in PMCR solutions is to highlight that in some instances both smoke and heat detection is required. To satisfy a PMCR solution, where multi-criteria detection is required, either a multi-criteria detector or both smoke and heat detection devices must be installed.

4.3.2 Location and positioning

When installing smoke and heat individually, refer to their respective sections above for location and positioning. For multi-criteria detection, it must be located similarly to heat detection, which is:

1. Be positioned within 300-1500mm from the midpoint of opening so that it is perpendicular to the opening. ***If the SOU has multiple impacted openings, still only one multi-criteria detector (or one of each smoke & heat detection) is required, but it must be positioned at a midpoint between the openings.***
2. Where existing detection is found in a room that would have been prescribed multi-criteria detection, the location of that component is not needed to be changed.

4.4 Types of devices

Smoke and heat/thermal detection as per PMCR only prescribe the mode of detection, not the device or system type. Any accredited device is permitted provided it meets all other PMCR requirements such as correct transmission pathways, intent, and interconnectivity requirements. Where multi-criteria detection is prescribed, it is only a requirement to install both modes of detection, not the number of devices used to meet the requirement.

4.5 Interconnectivity and transmission pathways

For all solutions, standard or other, it is a requirement for transmission pathways and connectivity of devices to be configured to the following set of rules. This is to ensure that the intention of implementation is met once a device is installed.

Table 6: Interconnectivity and transmission pathways rules

Interconnectivity and alarm transmission pathways	
Smoke detection	▪ Smoke detection or components with smoke detection installed to an SOU must only be configured so that detection of smoke triggers local SOU alarm. ▪ Smoke detection must be interconnected within an SOU so that all smoke detection devices and sounders collectively activate when smoke is detected by any single device.
Heat detection	▪ Heat detection or components with heat detection (such as sprinkler heads) must be configured so that activation triggers a BOWS alarm that sounds throughout the entire building.
Multi-criteria detection	▪ The combined components (smoke and heat) must satisfy their respective detection interconnectivity and transmission pathway requirements.

5 Cladding scenarios – standard typology responses

In reference to the pathways and response typologies listed earlier, this section explores commonly observed risk configurations on buildings that are PMCR eligible and address how each FDAS-based intervention would be evaluated for efficacy in each area of an SOU for each scenario.

To re-visit, the FDAS based interventions are:

- Intervention 8: Multi-criteria Detection
- Intervention 9: Heat Detection
- Intervention 10: Interconnection & Communications Upgrade

While a combination of interventions 8-10 must be applied to all impacted areas of SOUs that are a part of a cladding cluster, there will be variability in fire risk factors, and as such, different practices of application will become advantageous.

It is, however, important to note that for the purposes of risk mitigation to CSV's elevated building stock, there will also be instances where the as-built, already installed detection and alarm systems reach pre-defined PMCR sufficiency standards and as such, will not require ESM-based intervention. Furthermore, whilst the purpose of the following scenarios is to identify the risk reduction approach for commonly observed cladding cluster arrangements, it is important to recognise that this section is intended to aid interpretation of CSVs decision making in relation to how risk is perceived and mitigated. Due to the varying complexity of building design parameters and current fire safety systems, it is simply not feasible to endorse a single solution and as such, extenuating circumstance may require analysis and solution not discussed here.

To distinguish the scenarios that observe different risk profiles and subsequently, have different solution recommendations, we will break them into the following parameters that were introduced in section 3.1.

SOU area categorised by their usage type:

1. Bedroom
2. Non-sleeping areas (except for laundry, bathroom, or toilet)
3. Laundry, bathroom, and toilet

Area/room positioning relative to the cladding cluster:

A. Combustible cladding exists to the external doors and windows of the room AND is also a part of a cluster.
B. This room does not have openings to the cluster; however, it is in an SOU that contacts the cluster.
C. This SOU area does not belong to a cladding cluster; however, it is positioned within 1 floor of the top of the cluster in a position that is likely to see it impacted by smoke from the cluster in the event of a fire.

Examples of room codification can be found in Appendix C.

5.1 Non-sprinkler led solutions – for low risk, non-sprinkler protected buildings

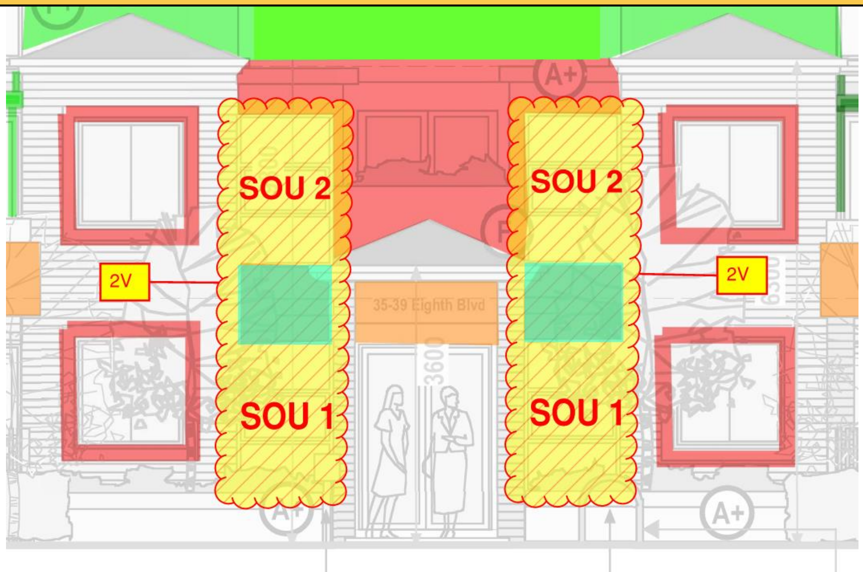
Buildings that are not sprinkler protected **AND** are not eligible for sprinkler protection as a part of a standard response will have the greatest amount of FDAS intervention. This directly relates only to one typology, Type F, which can be further refined into two categories depending on its configuration. The two types are:

- **Vertical configurations:** these configurations are considered to present the greatest risk through natural flame and smoke propagation direction.
- **Horizontal configurations:** these are prevalent configurations on buildings and present a lower risk profile than verticals.

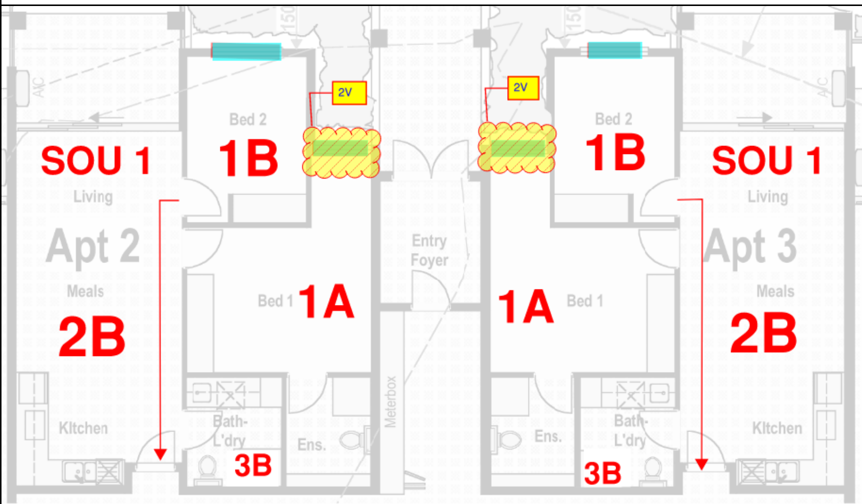
This section provides examples of common type F clusters that have vertical configuration (2V) or horizontal configurations (2H).

Each example will first display the cluster as a fully marked up plan before the solution is then shown and discussed.

5.1.1 Type F – 2V

<table>
<tr><th colspan="3">Cluster Markups</th></tr>
<tr><td>Face of Cluster</td><td>


</td><td>We can see that either side of the entrance to the apartment building is a Vertical cluster with a CFSR of two (2V).

The combustible cladding element impacting the cluster is highlighted blue.</td></tr>
<tr><td>Floor Plan - Lower</td><td>


</td><td>Both lower SOU have been marked up so that each of the rooms have a corresponding code relating to cladding risk.

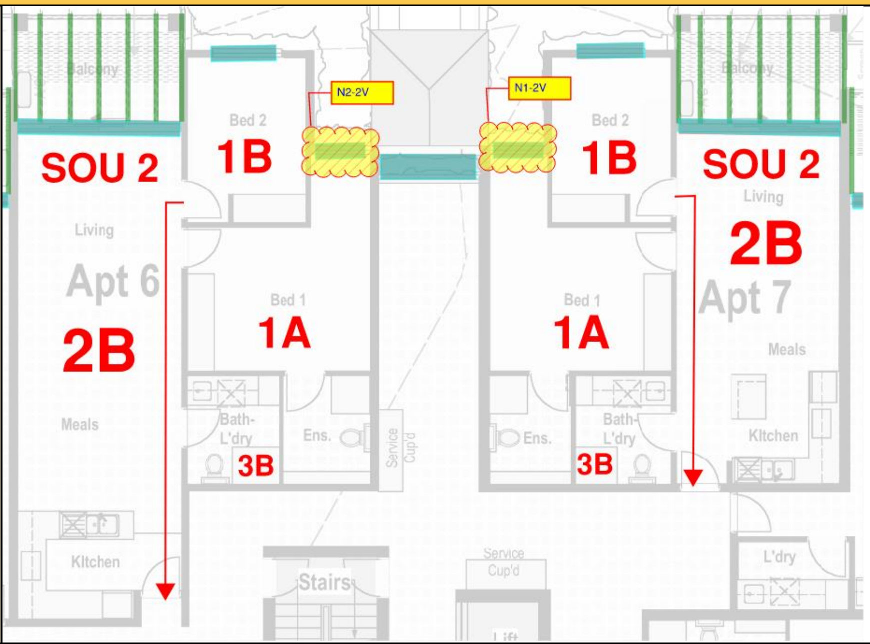
On this cluster, the only opening (window) impacted is to the 1A room.

Additionally, both 1A and 1B rooms also require protection in the form of early detection to allow safe SOU egress.

The red arrow represents the pathway that 1B occupants require be kept tenable to exit the SOU.</td></tr>
</table>

Cluster Markups

Floor Plan - Upper



Both upper SOUs have been marked up and have also had their cladding risk codification applied.

On this cluster, it is again only a single 1A opening (window) being directly impacted.

Additionally, both 1A and 1B rooms also require protection in the form of early detection to allow safe SOU egress.

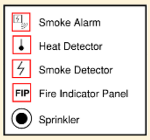
The red arrow represents the pathway that 1B occupants require be kept tenable to exit the SOU.

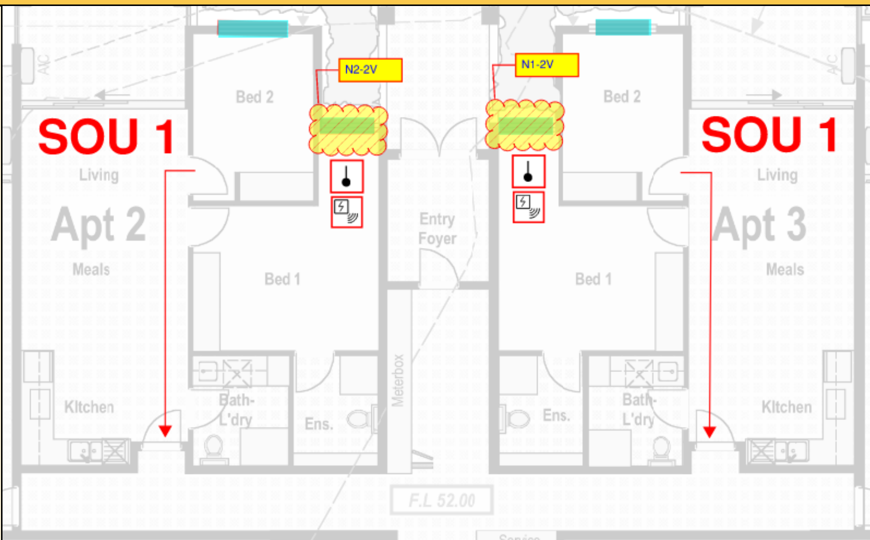
It is important to emphasise that the key focus of these solutions is to protect sleeping occupants, and subsequently the most prevalent codifications discussed will be 1A and 1B rooms.

For 1A rooms, the intention is to protect the occupant via installation of detection to the opening inside the room, as this is adjacent to where the cladding resides. For 1B rooms, rather than installing detection inside the rooms, we look to ensure that there is a path for these occupants to safely egress to the SOU exit. For this pathway to be considered safe, the occupant must be alerted of smoke or flame prior this pathway being obstructed to a hazardous level.

Interventions

Floor Plan - Lower



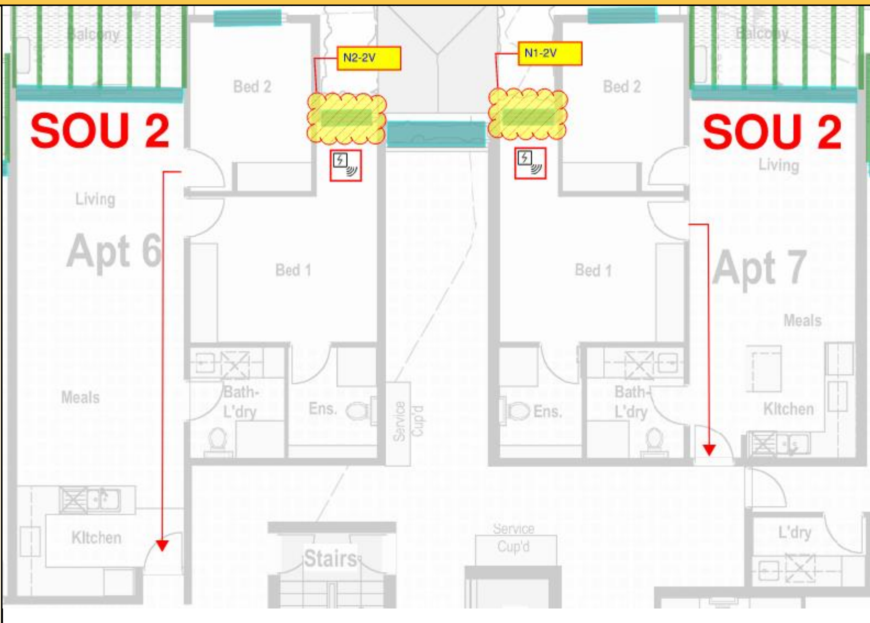


Going through G.03 – Cladding Remediation Standards, it can be seen that the required interventions are:

1A Lower – Provide smoke and heat detection to opening.

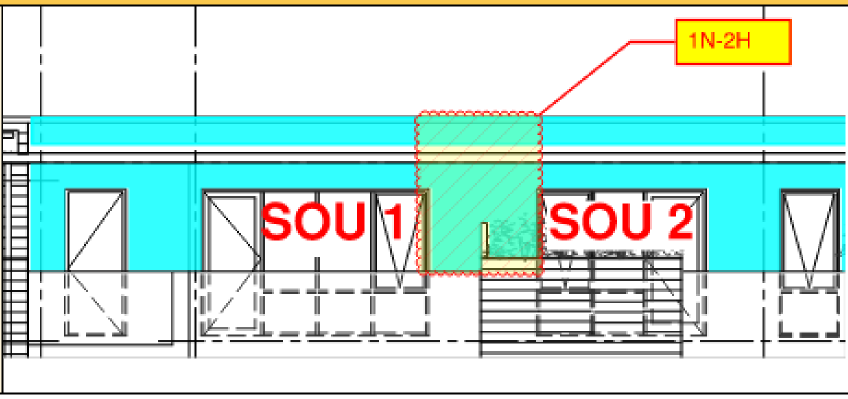
1A & 1B (Bedrooms) – Ensure the location of smoke detection within the SOU is positioned so as to detect smoke that may impact the path between the bedroom(s) and the SOU exit.

BOWS – Ensure thermal detection exists between cladding and SOU exit within the SOU.

Interventions		
Floor Plan - Upper		Going through G.03 – Cladding Remediation Standards, it can be seen that the required interventions are: **1A Upper** – Provide smoke detection to opening. **1A & 1B (Bedrooms)** – Ensure the location of smoke detection within the SOU is positioned so as to detect smoke that may impact the path between the bedroom(s) and the SOU exit. **BOWS –** Ensure thermal detection exists between cladding and SOU exit within the SOU.
Secondary Standards	There are no secondary standards applicable for this cluster.	

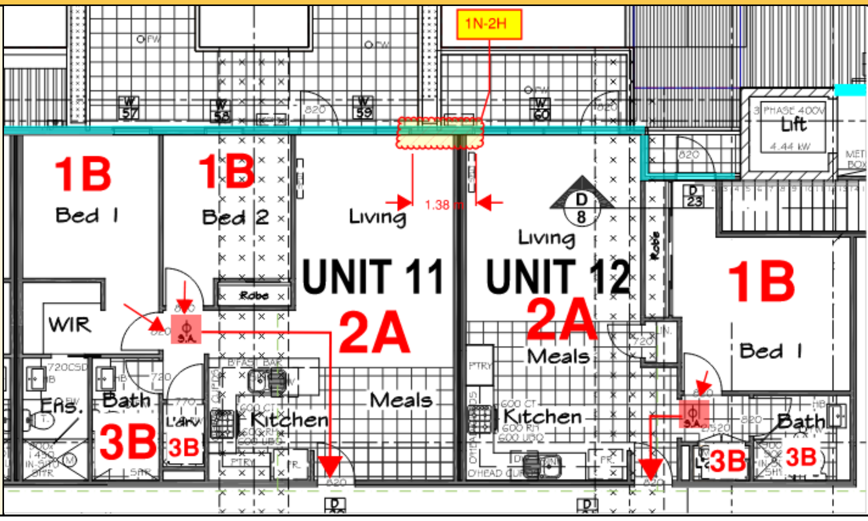
Rationale
Lower: The installation of smoke detection to the 1A opening satisfies requirements for both 1A and 1B as detection is facilitated in the 1A room which also notifies 1B prior to the pathway being obscured (as the smoke detection sounds locally to the whole SOU). Additionally, the heat detector acts to provide early warning to above occupants of potential flashover events as the heat detection transmission pathway is to the BOWS. **Upper:** The smoke detection installed to the 1A opening facilitates detection as seen in the lower floors and therefore satisfies PMCR requirements. In this instance however, it must be ensured that heat detection exists in a common space within the SOU to facilitate BOWS alarm if fire spread increases in severity.

5.1.2 Type F – 2H

Cluster Markups		
Face of Cluster		This diagram shows the combustible cladding spread across two SOUs in a horizontal configuration, giving a CFSR of two (2H). The combustible cladding element impacting the cluster is highlighted blue.

Cluster Markups

Floor Plan



Both SOUs have been marked up and had their cladding risk codification applied.

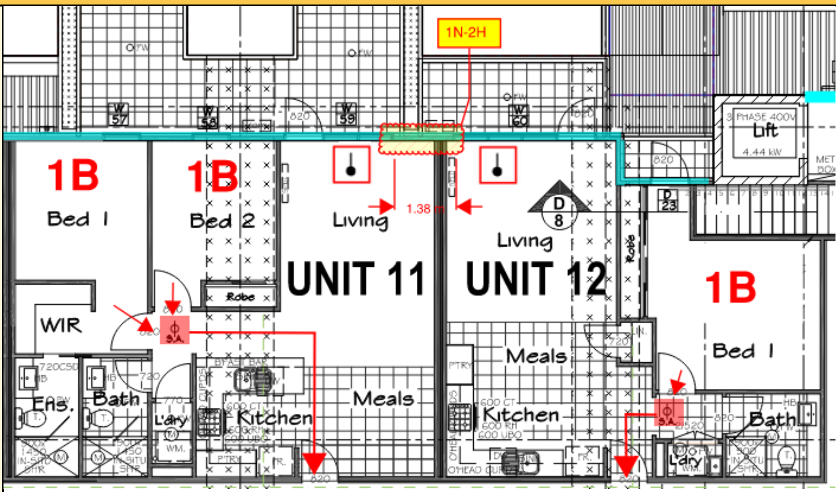
On this cluster, the impacted opening connects to a 2A room.

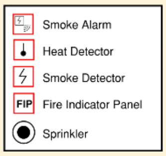
Additionally, both 1A and 1B rooms also require protection in the form of early detection to allow safe SOU egress.

The red arrow represents the exit pathway that 1B occupants require detection prior to.

Interventions

Floor Plan





As per *G.03 – Cladding Remediation Standards*, the applicable FDAS interventions are:

1A & 1B (Bedrooms) – Ensure the location of smoke detection within the SOU is positioned so as to detect smoke that may impact the path between the bedroom(s) and the SOU exit.

BOWS – Ensure BOWS activation is possible to each floor level of the cluster. This can be via:

1. Thermal detection
2. Smoke seepage to the common use corridor detection (that activates BOWS)

Secondary Standards

The 'ensure protocols' must change to 'install protocols' for the BOWS thermal requirement as neither 1 or 2 can be satisfied. This sees a heat detector installed in each SOU.

Rationale

The rationale for 2H interventions are primarily focused on bedroom protection and BOWS activation. In this instance, only 1B bedrooms exist, and an existing smoke alarm along the egress pathway satisfies PMCR intervention. The BOWS activation could not be met as smoke seals exist on the SOU exit door, and no heat detector existed in the SOU. Therefore, the only required FDAS intervention is a heat detector "between the external cladding hazard and the SOU Exit in a common space within the SOU". The heat detector has been placed nearby the opening as it is in a position able to provide the earliest form of detection from a cladding fire.

5.2 Sprinkler led solutions – for sprinkler protected buildings and high risk, non-sprinkler protected buildings

Buildings that either have sprinklers or are eligible for sprinkler protection through the PMCR have less FDAS intervention components compared to other solutions. This is on the basis that they are sprinkler led and have a proportionate life safety benefit observed from the sprinklers that FDAS simply is not as heavily required.

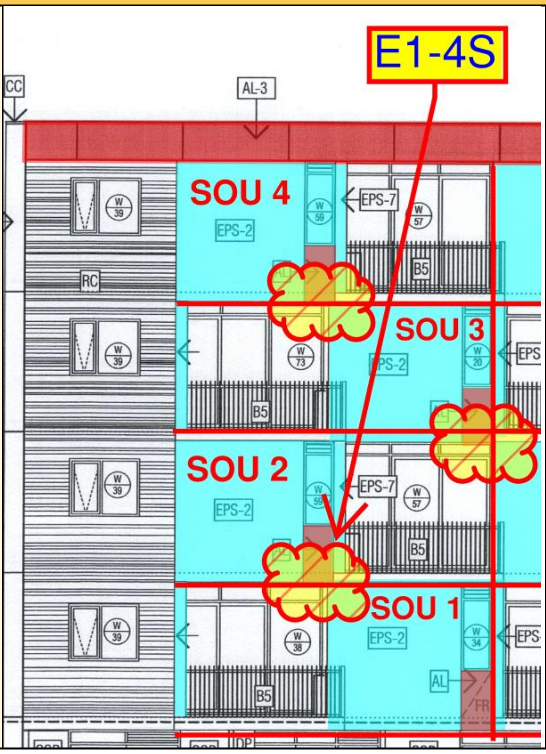
This cohort of typologies is larger than in 5.1, with five different typologies existing. However, in terms of FDAS intervention, many of these typologies are identical or similar. The typologies of this section are:

- **Non-sprinkler protected buildings** - Type G, Type H; and
- **Sprinkler protected buildings** - Type B & Type C.

This section provides examples of common type G clusters, as well as portions of type H. This is due to the similarity between typologies being discussed, meaning that it would otherwise be duplication of information. Again, following the structure from 5.1, each example will first display the cluster as a fully marked up plan before the solution is then shown and discussed.

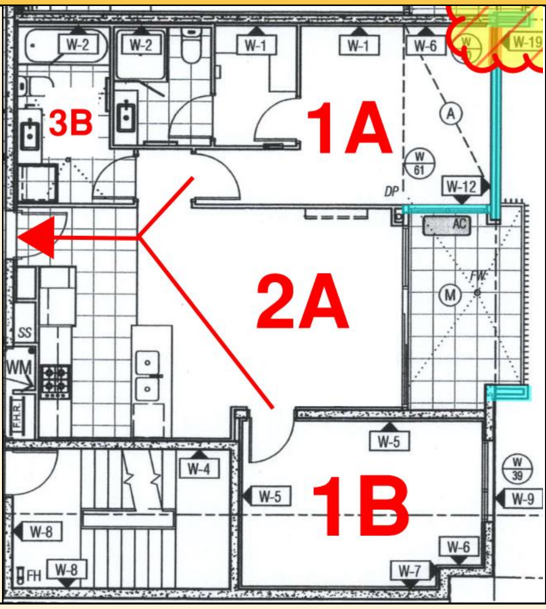
5.2.1 Types G & H – 3-4 CFSR, all stories

For this example, we will only discuss a sample floor plan of a building as it is unnecessary to explain each of them due to their inherent similarity.

Cluster Markups		
Face of Cluster		Here, a special (S) configuration is observed that spreads to a maximum of four SOUs from each ignition source.

Cluster Markups

Floor Plan – SOU 1



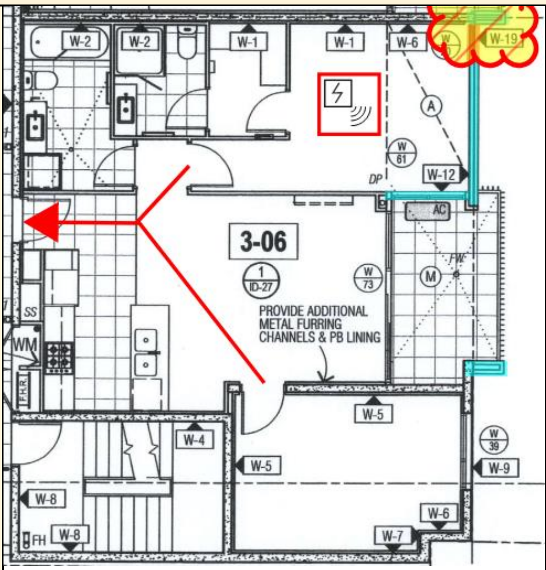
Marked up, it can be seen that the opening is directly impacting a bedroom and the kitchen/living space.

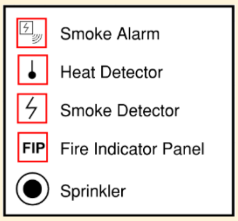
Both the 1A and 1B room require protection in the form of early detection to allow safe SOU egress.

Whilst not discussed in this example or document, it is important to mention that this typology **WILL** see sprinklers installed as the main PMCR intervention.

Interventions

Floor Plan – SOU 1





The solution of this typology is sprinkler led and has little FDAS components. Eligible components are:

1A – Provide smoke detection to the external doors and windows.

1A & 1B (Bedrooms) – Ensure the location of smoke detection within the SOU is positioned so as to detect smoke that may impact the path between the bedroom(s) and the SOU exit.

BOWS – Ensure thermal detection exists between cladding hazard and SOU exit in a common space within the SOU.

Rationale

Given the larger risk and higher classification (**Unacceptable**), there is only a single FDAS component (on top of the sprinkler installation) that is definitely required for installation. This is due to the reliance on sprinkler adoption providing a proportionate risk response. There are still two 'ensure protocols' (heat and smoke detection) that must be met to avoid two more devices being installed. As the SOU is required to be sprinkler protected as per its typology, so as long as it is not a FPAA101D system, the thermal component of the sprinkler is sufficient to meet PMCR thermal requirements.

5.2.2 Types B & C – 3-6 CFSR, all stories

Referring to section 5, the two main themes of intervention are solutions are either sprinkler led or FDAS led. Section 5.1 discussed FDAS led, and 5.2 discussed sprinkler led solutions with FDAS elements as ancillary protection measures. Types B and C share solution theme with 5.2.1 and therefore do not need to have examples shown. Additionally, there is no variation in the response between type B and C regarding PMCR solution design.

To re-iterate, these types (sprinkler led solutions) only provide response to bedroom spaces (1A, 1B, 1C) and involve only smoke detection, as thermal requirements exist in the sprinkler system.

6 References

[1] NFPA, Fire Protection Handbook, Massachusetts: Quincy, 2008.

[2] "Fire detection, warning, control; and intercom systems – System design, installation and commissioning, Part 3: Fire alarm monitoring AS 1670.3-2018," 2018.

[3] National Construction Code, *Volume One - Building Code of Australia,* Canberra: Australian Building Codes Board , 2022.

[4] R. Shah, P. Satam, M. A. Sayyed and P. Salvi, "Wireless Smoke Detector and Fire Alarm System," *International Research Journal,* vol. 6, no. 1, pp. 1407-1412, 2019.

[5] CIBSE, Guide E - Fire Engineering (2nd Edition), CIBSE, 2003, p. 183.

[6] Fire Rescue Victoria, "Annual Report," Victorian Government , Melbourne, 2021-2022.

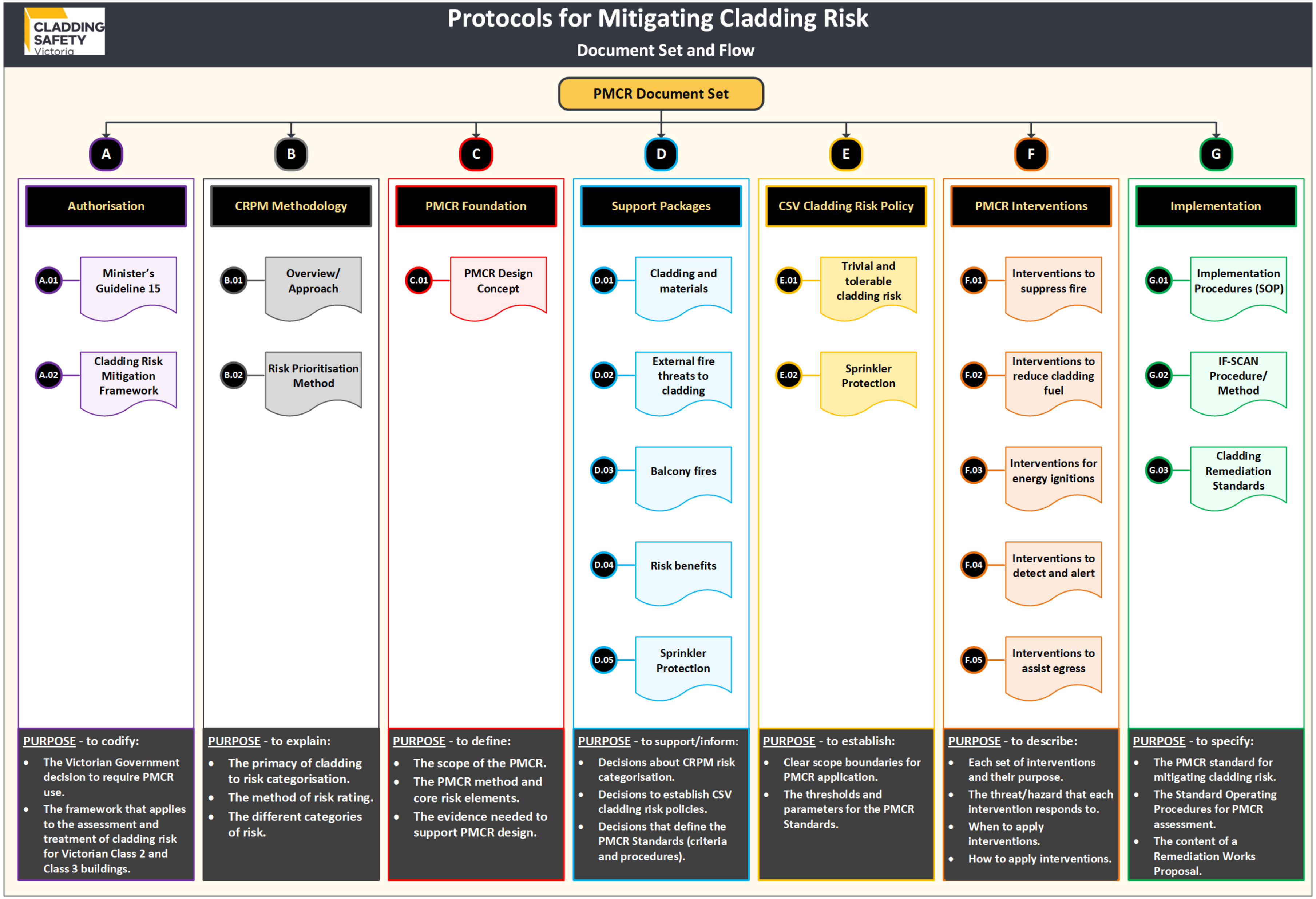
[7] Melbourne Fire Brigade, "MFB Annual Report," Melbourne Fire Brigade , Melbourne , 2019-2020.

[8] Fire and Rescue NSW, "Smoke Alarms," Fire and Rescue NSW, 2023. [Online]. Available: https://www.fire.nsw.gov.au/page.php?id=80. [Accessed 16 August 2023].

[9] M. Ahrens, "Smoke Alarms in US Home Fires," NFPA, 2021.

Appendices

Appendix A: PMCR document set and flow



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Appendix B: SOU codification

In response to the vast and complex configurations of not only SOU size and geometry, but also of how that SOU interacts with combustible cladding, CSV have implemented a codification scheme to help most accurately characterise the risk posed to occupants of any SOU. For this reason, CSV have categorised SOU rooms into three types (1, 2, 3) and the interactions of these spaces with the cladding into another three (A, B, C). A brief description of this codification can be seen below, with visual aid and examples following.

SOU area

- **1** - Bedroom
- **2** - Non-sleeping areas (except bathroom, laundry, toilet)
- **3** - Bathroom, laundry, toilet

Room position relative to the cluster

- **A** - Combustible cladding exists around the external doors or windows of the room **AND** is also a part of a cluster.
- **B** - This room does not have external doors or windows to the cluster; however, it is in an SOU that contains the cluster.
- **C** - This SOU area is not a part of a cladding cluster; however, it is within 1 floor from the top of the cluster in a position likely to see it impacted by smoke in the event of fire

Note: Where rooms are isolatable (with a door), and it is feasible to be considered a sleeping area (studies, repurposed bedrooms) CSVs worst case risk approach will treat these areas as bedrooms.

"A" Types

Type "A" configurations represent the worst-case risk in the PMCR. These are areas that have combustible cladding that exists around the external doors and windows of the room and are also a part of a cluster. Depending on the cluster assessment, and the inherent risk posed to occupant safety through a plausible cluster fire, various levels of detection are required.

Intention:

There are three main intentions for type "A" areas depending on room type (1, 2, 3). Firstly, bedrooms that are identified as A's (1A), require smoke detection to the impacted openings. Secondly, type 1&2 (1A & 2A) rooms may require heat/thermal detection where it is plausible that flashover may occur and subsequently impact an above SOU(s). Finally, type 3 areas (3A) require a form of detection that minimises the risk to SOU occupants through notification of fire before fire or smoke obstructs the path to the SOU exit in such a way as to make it untenable.

Type "A" rooms are defined as:

A - Combustible cladding exists around the external doors or windows of the room **AND** is also a part of a cluster.

In the below example, the blue sections represent combustible cladding. The rooms that interface the combustible cladding may become type "A's" depending on how the cluster comes to be formed.

Example:

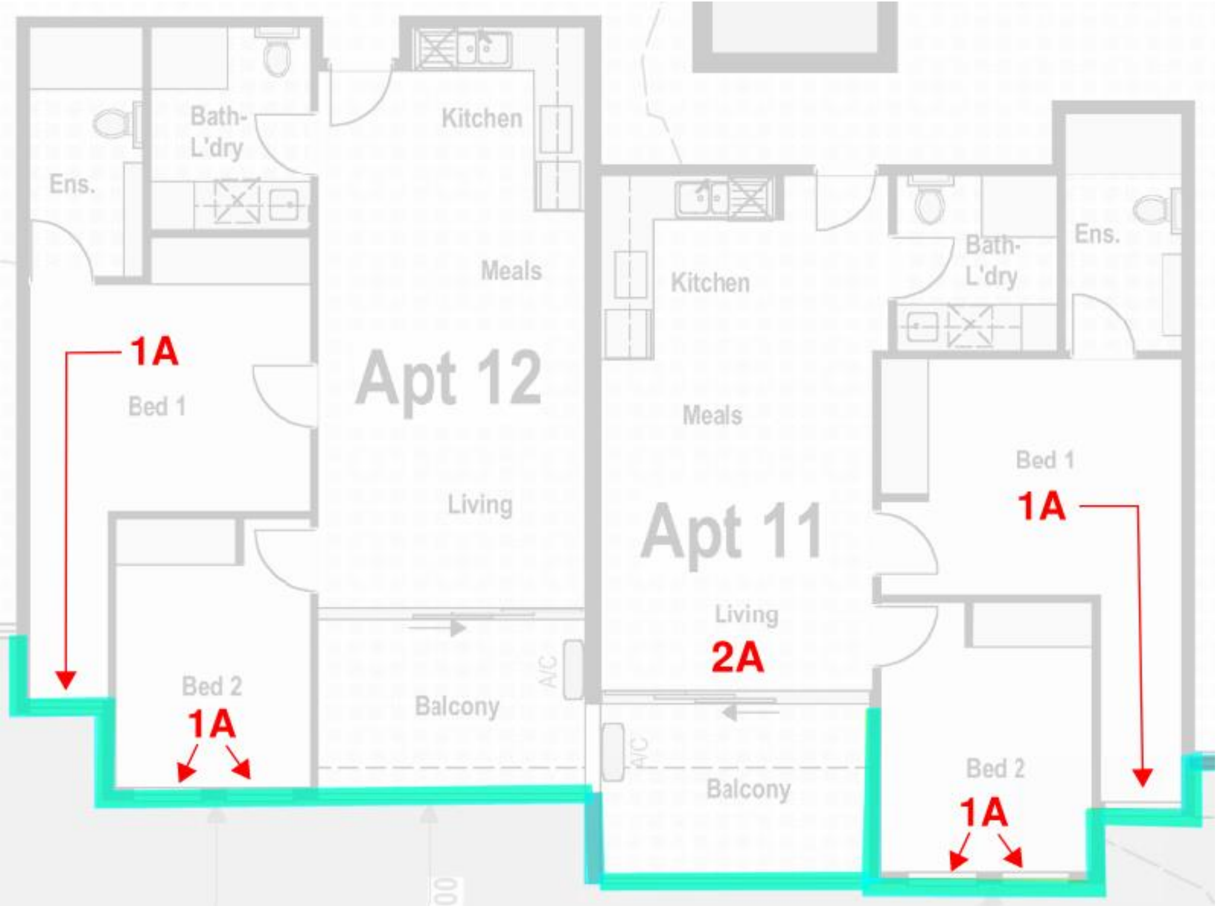

Figure 7: Potential "A" type rooms of a cluster, these have doors or windows that sit directly on combustible cladding but are not yet also a part of a cluster.

Step 1: Regarding the bedrooms in Figure 7, each have external doors or windows connected to combustible cladding but are not yet given a SOU codification as they currently only meet the first condition towards becoming a type “A”, as per Page 30 of this document.

Step 2: Identify where the clusters exist along the facade. In Figure 8, the same floorplate has been used to illustrate how the “change” in the location of the clusters dictates the SOU codification.

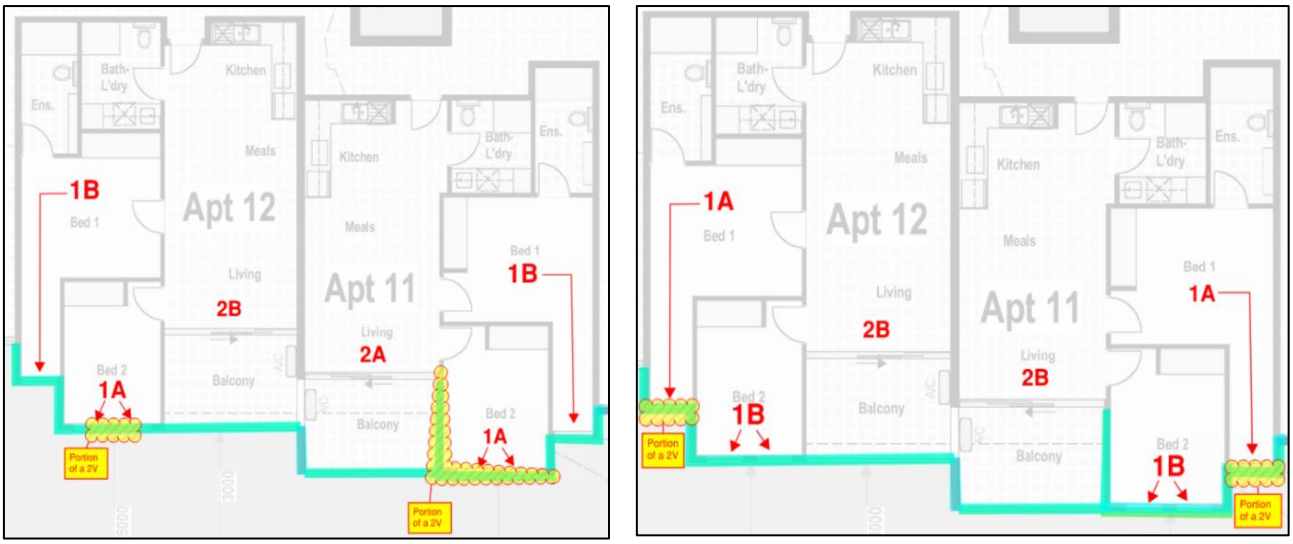

Figure 8: The cluster markup is the second condition to assigning type "A" rooms.

"B" Types

Type "B" rooms are defined as:

B - This room does not have external doors or windows to the cluster; however, it is in an SOU that contains the cluster.

This is all areas of an SOU (that is a part of the cluster) that do not have openings to a cluster. If an SOU has a type "A" room, then every other room that is not also a type "A" becomes a type "B" room. Figure 8 also shows that type "B" rooms may have combustible cladding located on the facade, but if this has not been identified as part of a cluster, and as such is defined as a type "B" room.

Intention:

The principal intention of intervening upon type "B" rooms is to provide smoke detection to an SOU common area(s) so that occupants of bedrooms are given necessary time to evacuate their SOU.

Example:

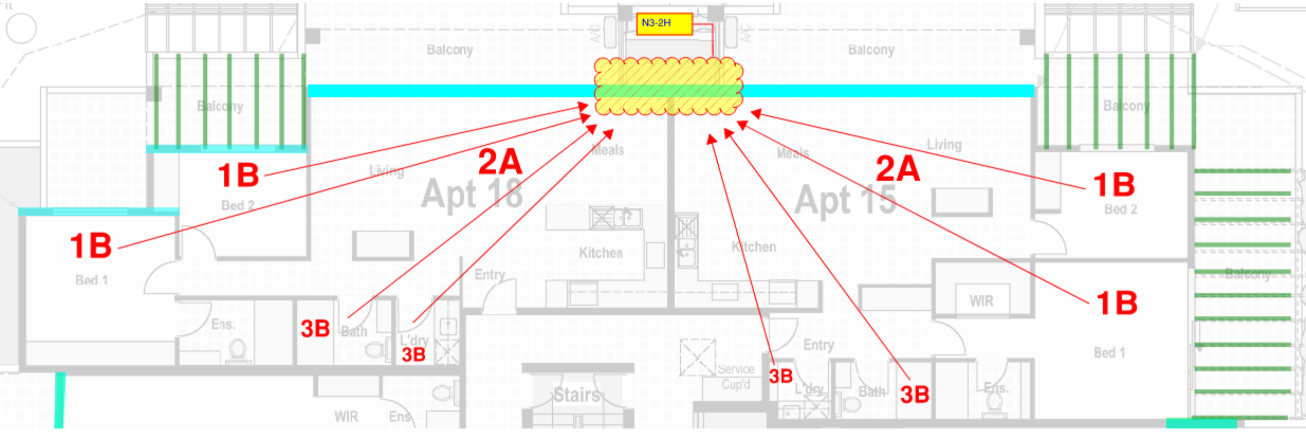

Figure 9: Type "B" rooms of a cluster. The distance from the cluster can be seen here even though cladding (represented in blue) resides on the facades of bedroom in apartment 18.

"C" Types

Type "C" are rooms of an SOU that do not belong to a cluster, however due to cluster/SOU configuration, they are at risk of being significantly impacted by smoke ingress from the below cluster.

Type "C" rooms are defined as:

> **C** - This SOU area is not a part of a cladding cluster; however, it is within 1 floor from the top of the cluster in a position likely to see it impacted by smoke in the event of fire

Therefore, smoke detection is required to type "A" bedrooms, since these spaces house sleeping occupants.

Intention:

Protect type "C" bedrooms from smoke ingress – via smoke detection to the openings of these rooms.

Example:

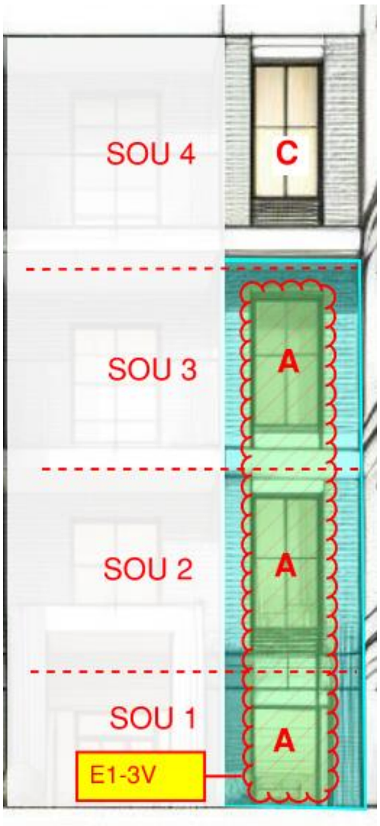

Figure 10: Type "C" above Type "A" - 3V cluster

In the example above (Figure 10), there is no horizontal displacement between SOU facades (the facade is on the same plane), and thus smoke ingress is foreseeable. Therefore, an intervention of Smoke Detection to SOU 4 is required.

In contrast, if for example SOU 4 was set back (in a "wedding cake" formation) by more than 1.5m, smoke ingress would not be likely, and it would not be codified as a type "C" (further details can be found in *G.03 – Cladding Remediation Standards as a secondary standard*).