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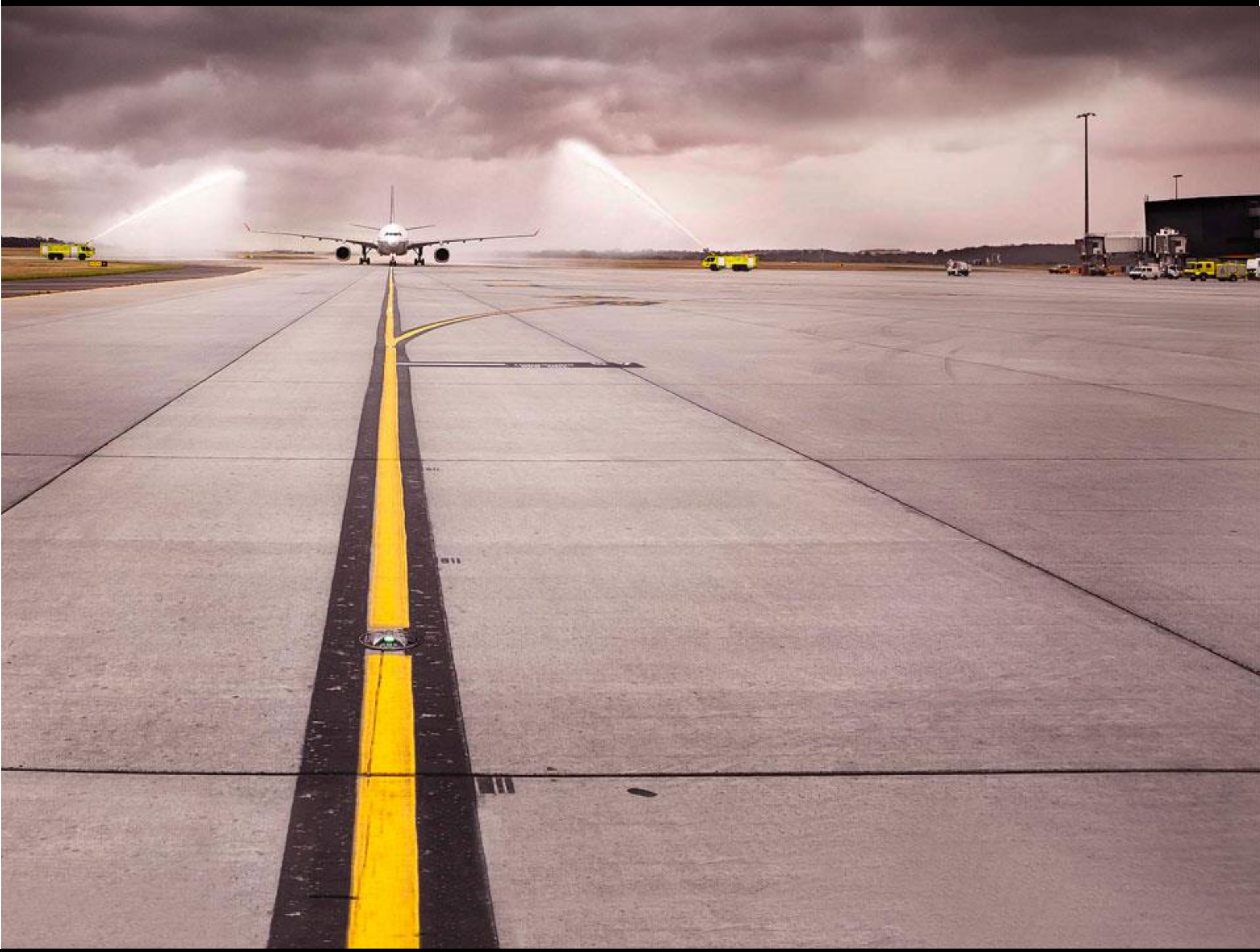

# The Melbourne Airport Precinct

# Fire Safety Strategy

This document defines and informs the outcomes for fire safety within the Melbourne Airport Precinct. It addresses the fire safety for building structures but excludes aircrafts or other vehicles using the precinct zone. The fire safety strategy sets the parameters for the design, approval, construction and ongoing management of fire safety within the Melbourne Airport Precinct. It has been developed using a fire risk based engineering approach and includes identification of the criteria, methodology and performance necessary to achieve the fire safety policy defined by the APAM Board.

The primary objective of the fire safety strategy is to deliver a level of fire safety which reduces fire risk so far as is reasonably practicable. It is acknowledged that absolute fire safety with a zero fire risk outcome is not achievable from either an engineering perspective or cost accountability, and while occupant safety is the paramount objective of the strategy, the customer experience is also an essential element in the development of fire safety solutions for the airport.

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This document was developed in conjunction between Australia Pacific Airports Corporation (APAM) and Lehr Consultant International Australia Pty Ltd (LCI).

# CONTENTS

# SECTION 1. PREAMBLE

## 1.1 BACKGROUND

This Melbourne Airport Precinct Fire Safety Strategy is a revision to the strategy prepared in 2015 to include Terminal T4 in the Airport Precinct Fire Safety Strategy, incorporate the Fire Sprinkler Water Separation Project, and address changes to the BCA and Australian Standards. This document has been developed in preparation of the planned terminal expansions and growth in customer projections which will drive the fire safety challenges over the next 10 years. The benefits to be derived from advancements in fire safety and risk engineering are anticipated to be fully captured through this fire safety strategy, in particular with regard to fire risk reduction and customer experience within the airport precinct.

## 1.2 APAM FIRE SAFETY POLICY

The corporate fire safety policy issued by APAM Board is reproduced in Annexure B. The Policy is implemented through the APAM Fire Safety Committee, and this Melbourne Airport Precinct Fire Safety Strategy is intended to satisfy the APAM fire safety policy.

## 1.3 FIRE SAFETY OBJECTIVE

The fire safety objective and associated elements of the risk based approach are outlined in Figure 1.2:

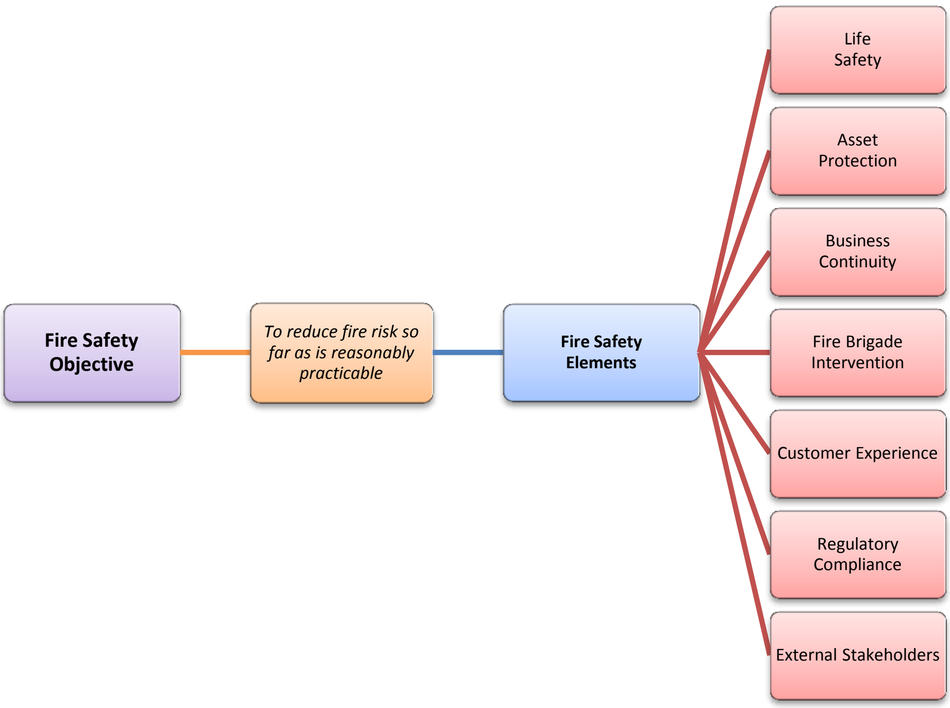


**Figure 1.1: Airport Fire Safety Objective & Elements**

The fire safety objective is to '*reduce fire risk so far as is reasonably practicable*' and is defined through a number of fire safety elements. The elements used in establishing the basis of the fire safety strategy are those in relation to life safety together with policy direction from the Fire Safety Committee.

The fire safety elements are further defined:

- To safeguard people from illness or injury from fire, including passengers, public, visitors, staff, management, contractors and emergency response personnel.
- To minimise fire damage to building structure, fabric and contents.
- To mitigate business interruption in the event of fire and from the systems implemented for fire safety.
- To maintain the functional and operational requirements of the business and support the customer experience philosophy.
- To facilitate fire brigade intervention through essential building services for fire response personnel.
- To incorporate Government and Community expectations for the Melbourne Airport Precinct as an essential infrastructure and resource in Victoria and Australia.
- To achieve regulatory compliance.
- To incorporate the requests of relevant partners and stakeholders.

These strategic elements are holistically addressed through implementation of the overall strategy and in the context of design solutions for specific projects and / or issues, noting that each element in isolation is unlikely to satisfy the fire safety objective. For example, regulatory compliance is not used as the sole criteria for fire safety at the airport because the building regulations do not adequately address holistic fire risk issues such as:

- Changes to existing buildings.
- Fire precautions / prevention policies and procedures.
- Staff training.
- Security measures.
- Corporate policy.
- Construction areas.

Each of these components will have an impact on the level of fire safety and can therefore contribute to a reduction in fire risk. The fire safety elements have thus been defined as the basis of the strategic fire risk approach.

## 1.4 LIMITATIONS

The fire safety strategy has limitations on scope and application so as to establish the boundaries for fire safety design and to enable corresponding design disciplines to address any shortfall.

The fire safety strategy has not been developed for events other than fire, although the provisions designed for fire safety may mitigate risks associated with other emergencies; for example the emergency warning system can be manually operated for evacuation relating to any emergency. The limitations to fire safety are outlined and described below.

The fire safety strategy does not include specific design consideration for fire resulting from terrorism, deliberate acts of sabotage of the fire protection systems, multiple simultaneous ignition sources, or the use of fire accelerants or civil disturbance / acts of violence. Fire resulting from such incidents may be mitigated by the fire safety provisions installed, but the prevention of these types of scenarios are managed through Airport Security and enforcement arrangements and associated features which are designed specifically for such risks. These high levels of security at the airport are considered to reduce the likelihood of such incidents.

Arson fires of the type that are deliberately ignited using a single ignition source; i.e. have no incipient growth phase, are addressed within the strategy through the selection of scenarios which include initiation and growth of flaming fires to sprinkler activation. However the strategy is primarily designed to mitigate accidental fires.

The fire safety strategy may not satisfy performance levels for fire resulting from natural disasters such as earthquakes and cyclones. The damage caused during such events may be substantial or catastrophic and cannot be quantified by the relevant designers, and therefore the impact to fire safety is not able to be addressed.

The fire safety strategy is based on estimations of fire load which are characteristic of the airport environment. This includes consideration of goods generally. As part of the strategy, dangerous goods are required to comply with the relevant legislation for storage and handling, and this will be an assumption adopted in the fire safety design approach at the airport.

## 1.5 Scope

The Melbourne Airport Fire Precinct Safety Strategy applies to the area defined in Figure 1.2.

For the purposes of establishing the strategy, four (4) separate categories are defined within the Melbourne Airport Precinct:

Category 1. Terminals and those relating to the customer process; i.e. to include reference to multi-level carparks, future rail terminal, connected hotels, etc.

Category 2. Essential terminal infrastructure; i.e. to include TSB, Data Centres, airfield lighting, etc.

Category 3. Landside buildings; i.e. individual commercial construction.

Category 4. Non-APAM managed Airservices buildings.

Each category has different fire safety risks and challenges which are addressed herein.

## 1.6 Regulatory Compliance Framework

The following documents reference the regulatory and compliance framework for the airport precinct, and are subject to revision from time to time:

- Victoria Building Act 1993 & Building Regulations 2006.
- National Construction Code Volume 1 (Building Code of Australia 2016).
- Federal Government Airports Act.

## 1.7 Fire Engineering References

Documents relevant to the preparation of fire safety design solutions include:

- International Fire Engineering Guidelines (IFEG), Australian Building Codes Board, 2005
- AS/NZS ISO 31000:2009 Risk Management
- Engineers Australia Society of Fire Safety: Code of Practice for Fire Safety Design, Certification & Peer Review in Accordance with the Building Code of Australia, 11 June 2003

- Position on the Role of Registered Practitioners in Fire Safety Engineering, Version 2, 15 February 2011.
- NFPA 415; Standard on Airport Terminal Buildings, Fueling Ramp Drainage, and Loading Walkways
- NFPA 101; Life Safety Code

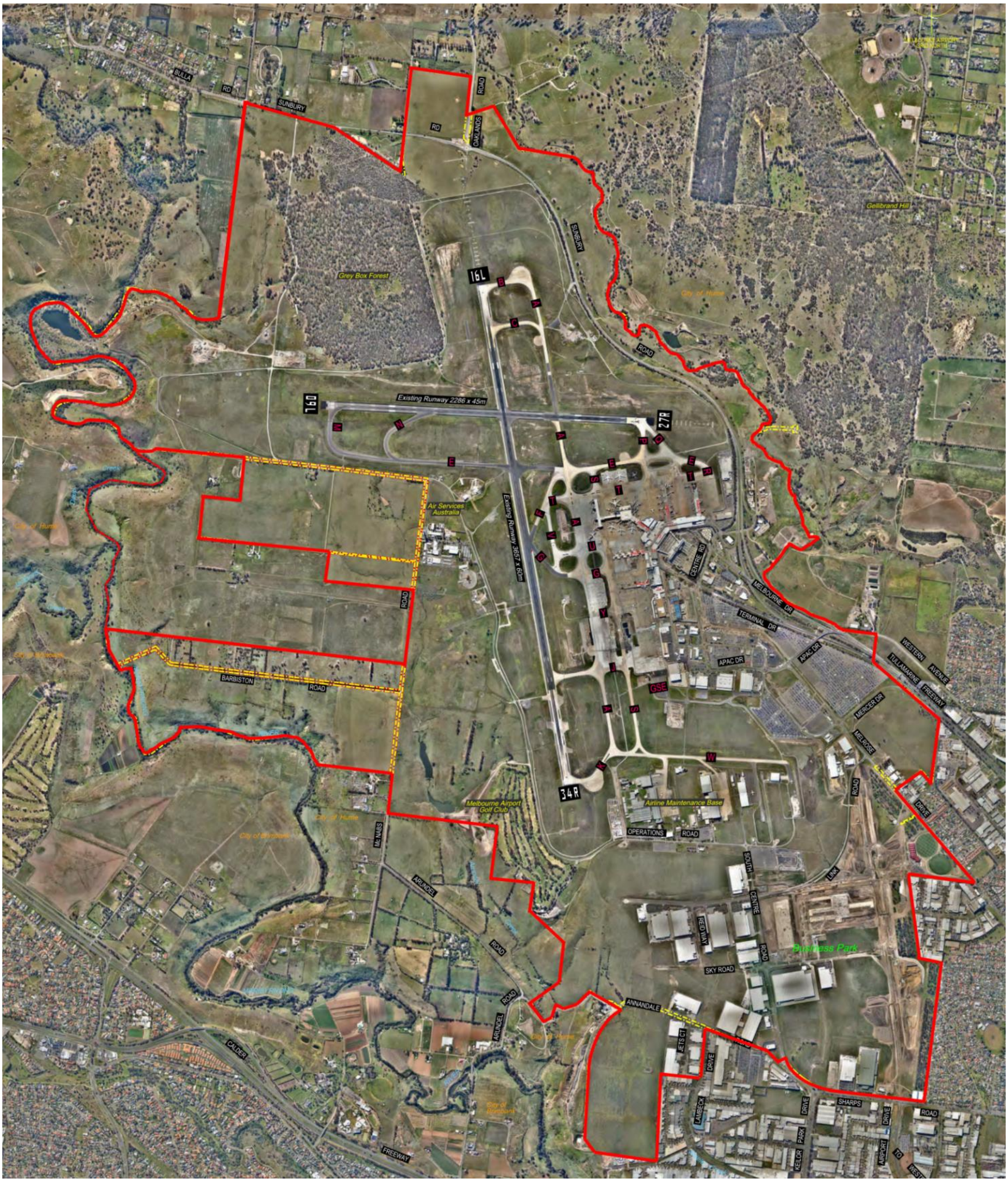


**Figure 1.2: Airport Precinct Boundary (—)**

## 1.8 FIRE SAFETY STAKEHOLDERS

Key fire safety stakeholders are:

- APAM Fire & Life Safety Manager
- APAM Fire Safety Adviser
- Airport Building Controller
- Airservices Australia – Aviation Rescue & Fire Fighting

Stakeholders for individual projects are consulted through the project design team and at the discretion of the APAM Fire & Life Safety Manager and may include other internal and external stakeholders such as personnel from individual APAM Departments, Metropolitan Fire Brigade, Insurer, etc.

## 1.9 IMPLEMENTATION METHODOLOGY

### 1.9.1 Category 1

The fire safety strategy for Category 1 buildings is to be implemented for all projects through the methodology outlined in Figure 1.3.

The intent of the implementation methodology for Category 1 buildings is described below:

1. Fire safety provisions specified in the design criteria (SECTION 3) and fire safety sub-system (SECTION 4) may be used to achieve the level of fire safety sought by APAM; i.e. APAM will accept the design as satisfying the fire safety strategy based on compliance with SECTION 3 and SECTION 4.

2. There are some aspects of the design solution which must always be assessed quantitatively to satisfy the fire safety strategy; i.e. for example design of smoke exhaust capacity and egress provisions will be based on population, geometry and nominated fire severity which will be specific to the project area.

3. All aspects of the design must be assessed against the BCA performance provisions for compliance and acceptance of stakeholders, even if they satisfy the criteria in SECTION 3 & SECTION 4; i.e. compliance with the BCA DtS provisions will not be acceptable as the sole basis of satisfying the fire safety strategy.

4. The project may be extensive and therefore encompass future opportunities or significant changes to the terminal buildings. Therefore the criteria specified in SECTION 3 & SECTION 4 may be insufficient, and justification for alternatives is sought. This requires further expansion of the fire engineering concepts to include factors identified in the concept design diagrams in SECTION 6 within the methodology. A thorough and detailed fire safety and risk engineering process, acceptance through stakeholders and APAM approvals will be required to further these opportunities.

5. All fire safety provisions are necessary unless considered and agreed through the stakeholder consultation and approval process as being 'unreasonable'. Where amendments to the strategy are necessary for specific project purposes or reasons, these shall be fully documented and justified on a fire safety risk engineering basis and are subject to approval of the APAM Fire & Life Safety Manager prior to acceptance.

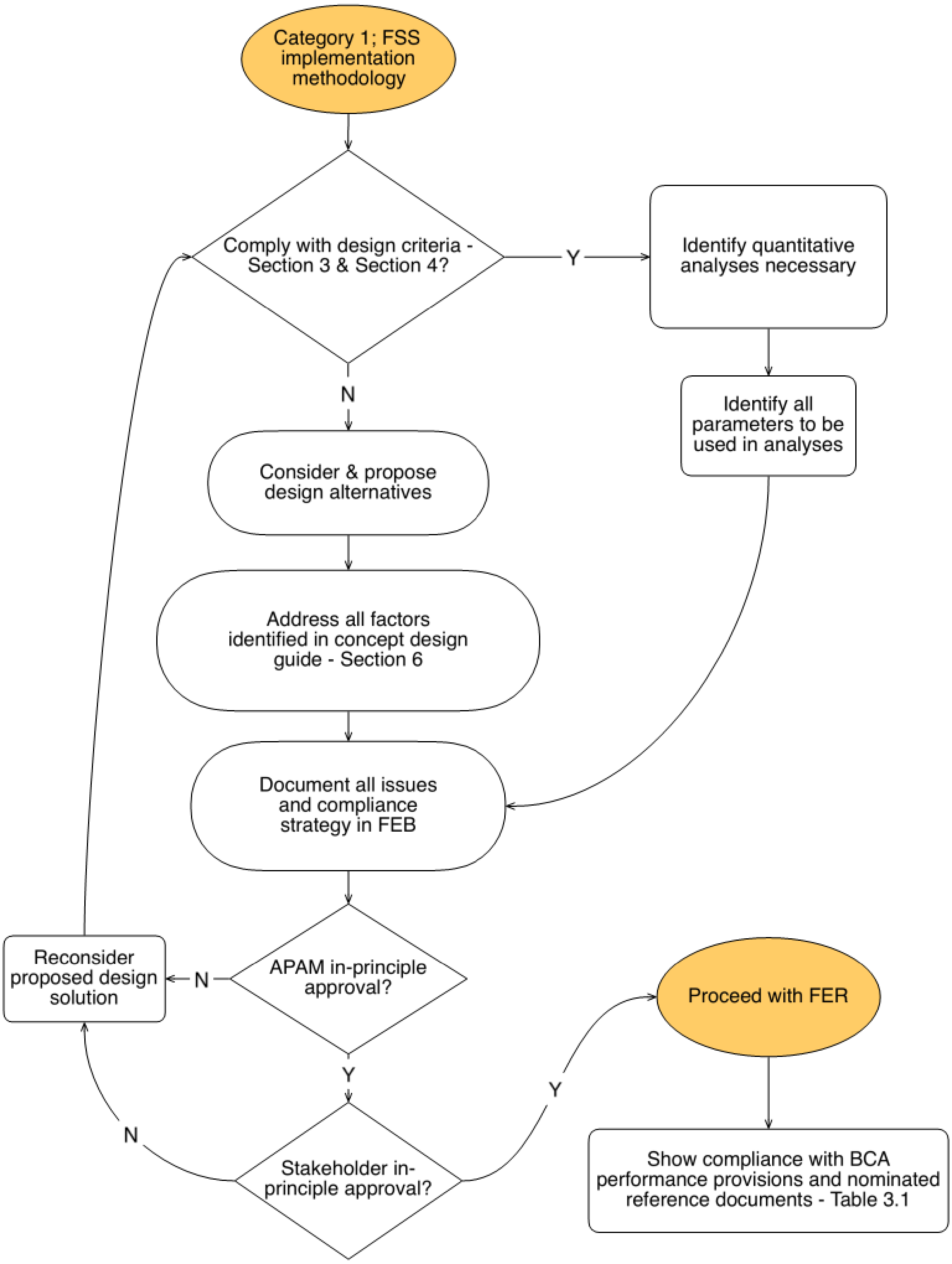


**Figure 1.3: Implementation methodology for Category 1 buildings**

### 1.9.2 Category 2

The fire safety strategy for Category 2 buildings is implemented through BCA compliance plus any additional fire safety systems to satisfy APAM asset and business protection, as determined through the stakeholder consultation and approval processes, and as justified by detailed fire safety and risk engineering.

### 1.9.3 Category 3 & 4

The fire safety strategy for Category 3 and 4 buildings is implemented through BCA compliance which includes any variations to the BCA DtS provisions and associated Alternative Solutions as determined and agreed through the stakeholder consultation and approval processes.

## 1.10 APPROVAL

The Melbourne Airport Precinct Fire Safety Strategy is ratified through the APAM Fire Safety Committee.

Acceptance of fire safety for individual projects rests with the APAM Fire & Life Safety Manager based on compliance with this document and other fire design requirements referenced or issued by APAM.

## 1.11 MANAGEMENT-IN-USE

This document defines the framework to plan, design and implement fire safety provisions which meet the fire safety objective of APAM. The strategy must be implemented holistically and therefore must be utilised across the precinct.

The strategy describes the key performance, design, operation and maintenance issues relevant to each fire safety system, and should be reviewed periodically to reflect changes in the environment, building, occupancy, fire safety systems and technology.

# SECTION 2. FIRE SAFETY & RISK ENGINEERING

## 2.1 INTRODUCTION

The fire safety risk process adopted for the airport precinct is precaution based; i.e. risk mitigation measures and features will be considered and implemented unless it is unreasonable to do so. The assessment of reasonableness is satisfied through the International Fire Engineering Guidelines[1] (IFEG) stakeholder process and generally follows the concept of disproportionality; i.e. a demonstration that the cost involved in reducing the fire risk further would be significantly disproportionate to the safety benefit gained.

As identified previously, the fire risk cannot be totally eliminated as inherent risks will remain wherever buildings contain equipment and services, and the building is operated for the benefit and comfort of people and their possessions.

This document outlines fire safety and risk profile for each of the airport precinct categories identified in Section 1.5, and provides the parameters to be adopted for design, approval, implementation and ongoing management in use. The steps adopted for the fire safety risk approach are outlined in Figure 2.1[2], which is then characterised through reference to each of the fire safety elements applicable to a Category.


**Figure 2.1: Fire Risk Approach**

[1] International Fire Engineering Guidelines (IFEG), Australian Building Codes Board, 2005
[2] Implications for Fire Engineering Design of the Australian Model WHS Legislation, G.E. Francis et al, SFPE Conference Papers 2014.

## 2.2 FIRE HAZARD IDENTIFICATION

The fire hazards shall be determined for individual projects and comprise identification of:

- Fire scenarios
- Evacuation scenarios
- System operation, reliability and failure modes

## 2.3 CRITICAL FIRE HAZARDS

The critical fire hazards shall be determined for individual projects and include the following analyses:

- An assessment of tenability conditions for fires based on sprinkler activation and sprinkler failure modes
- An assessment of tenability in public spaces with all fire safety systems operating as designed, and shall be equivalent to indefinite tenability as accepted by stakeholders
- An assessment of conditions arising for a fire location which prevents evacuation through an egress point within the fire affected evacuation zone
- An assessment of sprinkler system performance to life safety
- An assessment of detection system performance to life safety
- An assessment of structural adequacy to fire brigade intervention

## 2.4 IDENTIFICATION & ASSESSMENT OF PRECAUTIONS

Practicable precautions are identified and assessed for each critical fire hazard based on the implementation methodology applicable to the Category of building. Reasonable precautions must be identified as part of this assessment methodology, the adoption of which is ratified through the stakeholder consultation and approval processes.

Precautions assessed as part of this fire risk based approach will include those nominated in this document, prescribed standards and other technical references cited by the FSE. Critical fire hazards identified must be mitigated in the design solution for individual projects.

## 2.5 SELECTION OF PRECAUTIONS

The fire safety engineer is responsible for identifying the range of precautions available through workshops / discussions with the project design team, and identifying the precautions that are necessary and reasonable for further consideration. Reasonably practicable precautions must be implemented; this is ratified through the stakeholder consultation and approval processes.

## 2.6 QUALITY ASSURANCE; COMMISSIONING, MAINTENANCE & AUDITS

The fire safety engineer is responsible for delivery of the fire safety strategy through the various stages of the project, and APAM is responsible for ongoing maintenance and audit of the fire safety provisions upon completion and handover.

## 2.7 Category 1

Category 1 represents the buildings involved with the customer experience at the airport, and includes all buildings associated with the transfer and processing of customers from arrival at the airport to departure through the terminal gate. Category 1 buildings include the terminals and all associated interconnected buildings such as carparks, connected hotels, etc. These buildings represent the most complex fire safety challenges at the airport and require high levels of analysis and justification, with the fire safety objective achieved through a holistic approach incorporating fire safety risk engineering so as to quantify the level of fire performance.

Category 1 buildings encompass all the fire safety elements of the strategy and fire safety design, implementation and on-going management must comply with this document. The process for fire safety in relation to Category 1 buildings is outlined in Figure 2.2 to identify compliance with all key criteria necessary to satisfy APAM fire safety deliverables.

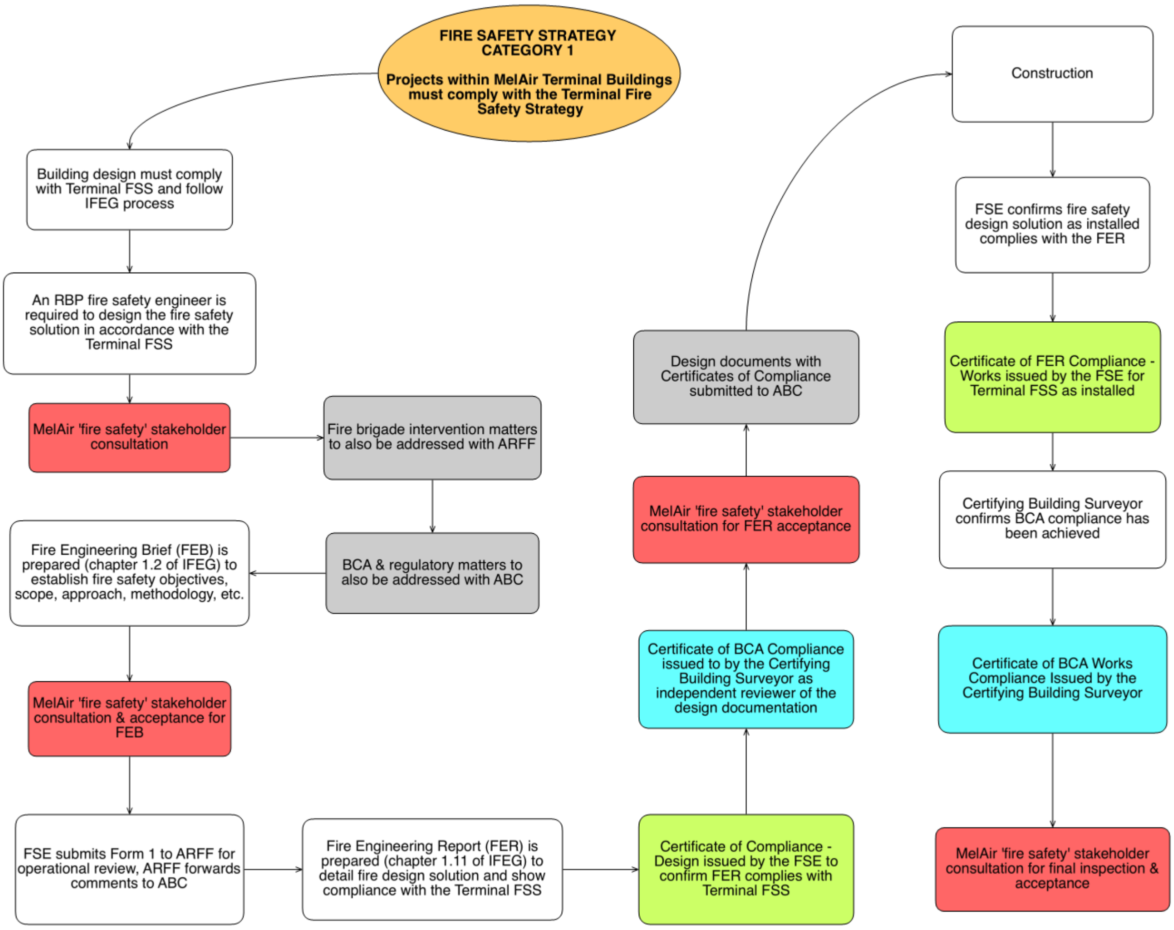


**Figure 2.2: Category 1 & 2 fire safety process**

The design process is required to comply with the IFEG[1] and Engineers Australia Society of Fire Safety documents, as released and / or updated from time to time[3]. The process and checks require the fire safety engineer and building certifier to confirm via compliance certificates that the fire safety design / approval and final installation comply with the fire safety strategy and BCA.

[3] Engineers Australia Society of Fire Safety: Code of Practice for Fire Safety Design, Certification & Peer Review in Accordance with the Building Code of Australia, 11 June 2003; & Position on the Role of Registered Practitioners in Fire Safety Engineering, Version 2, 15 February 2011; & other design guides released.

## 2.8 CATEGORY 2

Category 2 buildings represent essential airport infrastructure which are necessary to support the operation and function of Category 1 buildings and are located remotely from the terminals. These structures include the Terminal Services Buildings, Data Centres, Plant infrastructure, Airfield lighting, etc. Category 2 buildings require fire safety and risk engineering to establish the necessary precautions for asset protection and business continuity purposes.

The process for fire safety in relation to Category 2 buildings will follow that outlined in Figure 2.2 to identify the key asset and business criteria necessary to satisfy APAM fire safety deliverables.

## 2.9 CATEGORY 3

Category 3 buildings represent individual landside buildings which have no direct relationship with the terminals or customer experience and are an APAM managed asset. Landside buildings include those within the Airport Business Park, individual businesses and complexes, etc. Category 3 buildings are required to comply with the minimum requirements of the Building Code of Australia, and no additional technical fire safety provisions are mandated.

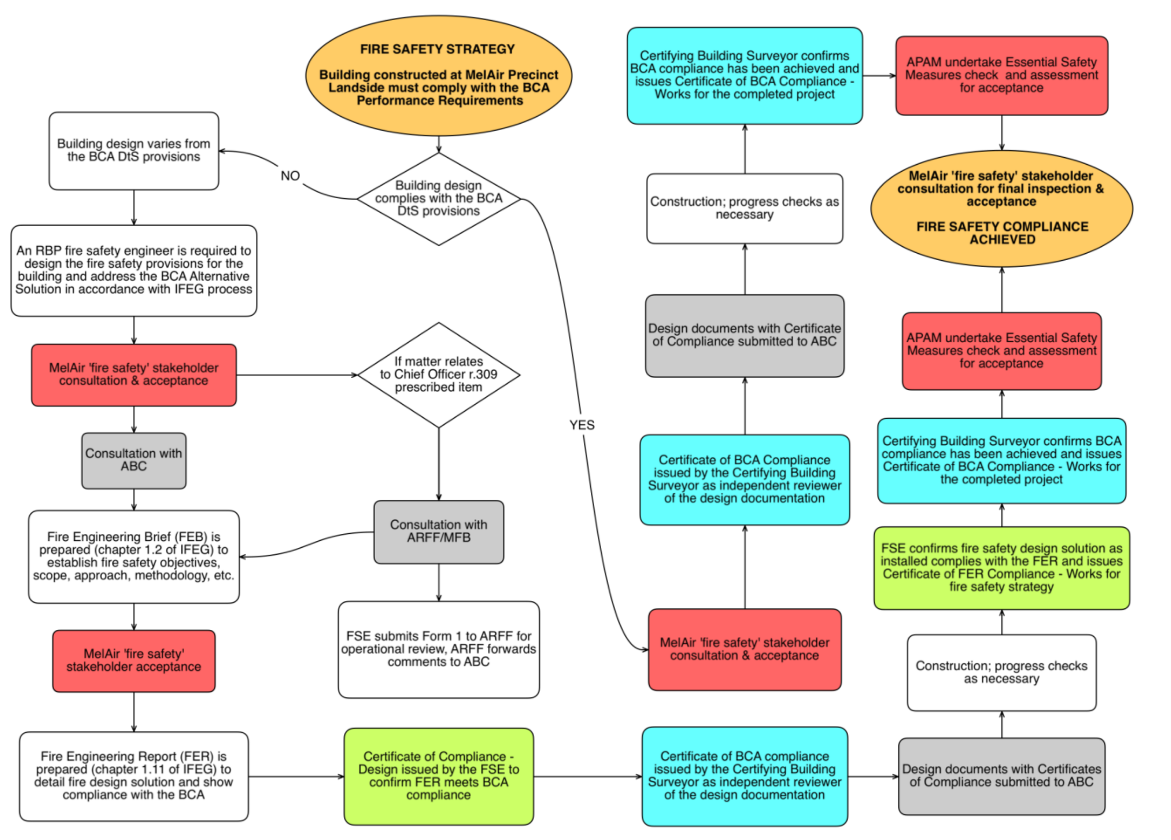


**Figure 2.3: Category 3 fire safety process**

The process for fire safety in relation to Category 3 buildings is outlined in Figure 2.3 to identify the checks necessary to satisfy APAM that BCA compliance has been achieved. These checks require the fire safety engineer and building certifier to confirm via compliance certificates that the fire safety design / approval and final installation comply with the BCA.

## 2.10 Category 4

Category 4 buildings are non-APAM managed buildings. These require APAM input but are not owned or managed by the airport. Category 4 buildings are required to comply with the minimum requirements of the Building Code of Australia and any other fire safety provisions specified by relevant stakeholders, in particular the Airport Building Controller and Airservices Australia.

## 2.11 Fire Design Approval

The essential gates associated with the *approval of the fire safety solution* are colour coded in Figure 2.2 and Figure 2.3, as defined in Table 2.1 below. It is the responsibility of the project fire safety engineer to ensure these approval steps are articulated to the project team and achieved for an individual project:

**Table 2.1 – Colour code legend for Figure 2.2 and Figure 2.3**

| | |
|---|---|
| MelAir 'fire safety' stakeholder group | MelAir fire safety stakeholder group for a specific project will include:<br>• APAM Fire & Life Safety Manager (and/or Fire Safety Adviser)<br>• Project manager<br>• Project fire safety engineer<br>• Project certifying building surveyor |
| External stakeholders (ABC / ARFF) | External stakeholders will always include the Airport Building Controller and Aviation Rescue and Fire-Fighting personnel. Other external stakeholders such as insurer, MFB, etc. may be required for a specific project. |
| Certificates issued by fire safety engineer | A certificate of compliance – Design is to be provided by the fire safety engineer at the completion of the design process. A Certificate of Compliance – Works is to be provided by the fire safety engineer at the completion of the project.<br>These Certificates are provided in Annexure C |
| Certificates issued by certifying building surveyor | A certificate of BCA compliance is to be provided by the certifying building surveyor and submitted to the ABC at the time of lodgment for Building Permit. A Certificate of Compliance – Works is to be provided by the certifying building surveyor upon completion of the installation and prior to submission to the ABC for Occupancy or final inspection certificate.<br>These Certificates are provided in Annexure C. |

Any additional stakeholders for individual projects will be determined by the APAM Fire & Life Safety Manager in conjunction with the project manager.

## 2.12 Project Design Process and Fire Safety Approval

The APAM MAPP process includes 4 phases which will typically be relevant to the fire safety design and implementation:

- Phase 3; Feasibility
- Phase 4; Schematic Design
- Phase 5; Design Development
- Phase 6; Implement / Construct

The IFEG process comprising the stakeholder consultation and preparation of the fire engineering brief and fire engineering report may not fit seamlessly into the MAPP process; however the fire safety engineer is responsible to deliver documents in accordance with both criteria. In addition, the following tasks are expected to be undertaken by the fire safety engineer through a project:

- design review and confirmation of fire safety integration through other documents
- preparation of a construction fire safety plan
- progress inspections to check on fire safety implementation
- final inspection and report

A suggested task based approach for fire safety in relation to the APAM MAPP is outlined in Figure 2.4, noting this is advisory and may vary depending upon the particular project and design tasks required to be completed. The delivery of key fire design documents are also indicated and will often occur at MAPP interfaces, however the construction methodology and staging will also influence when fire design documents can be finalised and issued.

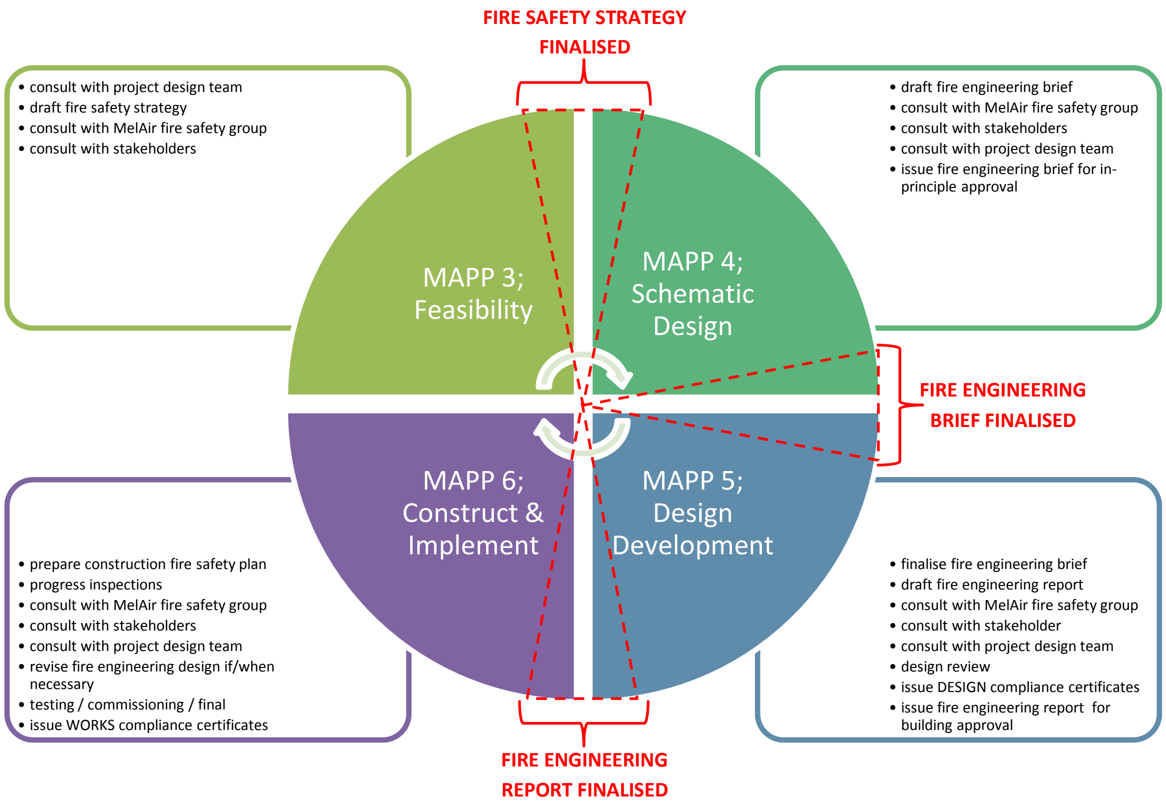


**Figure 2.4: Coordination of fire safety tasks and deliverables with MAPP**

# SECTION 3. DESIGN CRITERIA

## 3.1 CATEGORY 1 – TERMINAL BUILDINGS

### 3.1.1 Design Compliance References

The design references listed in Table 3.1 are to be used for fire safety assessment of the terminal buildings. The fire safety engineer must show that these design references are satisfied in formulating the design solution.

*NOTE; The reference in Table 3.1 to BCA Section A0 is only intended to clarify that the fire safety strategy for the terminal buildings does not rely on compliance with the BCA DtS clauses to achieve the fire safety objective; i.e. that comparison with or assessment to the DtS provisions is not accepted by APAM as an adequate basis for satisfying the fire safety strategy for the terminal buildings.

**Table 3.1 – Design references**

| Reference | Description / relevance |
|---|---|
| **Building Code of Australia** | |
| BCA Section A0* | A0.5(b)(i), A0.8, A0.9(a) & (b), A0.10(b) & (c) |
| BCA Section C | CP1, CP2, CP4, CP5, CP6, CP7, CP8, CP9 |
| BCA Section D | DP2(b), DP4, DP5, DP6, DP7, DP9 |
| BCA Section E1 | EP1.1, EP1.2, EP1.3, EP1.4, EP1.5, EP1.6 |
| BCA Section E2 | EP2.2 |
| BCA Section E3 | EP3.1, EP3.2, EP3.3 |
| BCA Section E4 | EP4.1, EP4.2, EP4.3 |
| **NFPA 415; Standard on Airport Terminal Buildings, Fueling Ramp Drainage, and Loading Walkways** | |
| 3.3.1 Aircraft Fueling Ramps | Adopt definition |
| 3.3.2 Aircraft Loading Walkways | Adopt definition |
| 3.3.3 Airport Ramp | Adopt definition |
| 3.3.5 Potential Fuel Spill Points | Adopt definition |
| 4.1.5.1 & 4.1.5.3 Glazing Material – Covered Openings Facing the Ramp | Adopt design intent, fire risk assessment to be undertaken to determine necessity for protection to external glazing from apron hazard. |
| 5.1 Aircraft Fueling Ramp Slope and Drain Design & Annex A | Adopt design intent, refer clause 3.1.2 below. |
| 6 Aircraft loading walkways | Adopt design intent, refer clause 3.1.3 below. |
| 6.2 Requirements for all Aircraft Loading Walkways | Refer Table 3.7 criteria for lining materials, refer clause 3.1.3 below. |
| 6.3 Materials | External surfaces shall be of non-combustible materials. Structural FRL is not required. |
| 6.5 Fire Suppression Systems | Refer clause 3.1.3 below. Sprinkler protection to the underside of the aircraft loading walkways is not required unless fuel load is present or proposed. |

| NFPA 101; Life Safety Code | |
|---|---|
| Chapter 5 – Performance Based Option | May be used for guidance in conjunction with the fire safety and risk engineering approach, specifically:<br>• 5.4 Design specifications and other conditions<br>• 5.5 Design scenarios<br>• 5.6 Evaluation of proposed designs<br>• 5.7 Safety factors |
| Chapters 12 & 13 – New & Existing Assembly Occupancies | May be used for guidance in conjunction with the fire safety and risk engineering approach. |
| Annex A – Explanatory Material | May be used for guidance in conjunction with the fire safety and risk engineering approach; i.e.<br>• Table A.7.3.1.2 – Airport Terminal Occupant Load Factors<br>• Section A.12.4.1.3 – Factors to be considered in a life safety evaluation<br>• Section A.22.1.1.1.5 – Consideration of Customs lock-up facilities |
| **NFPA 550; Guide to the Fire Safety Concepts Tree** | |
| All | May be used for guidance in conjunction with the holistic approach to fire safety and risk engineering. |
| **APAM Technical Standards** | |
| MAS-FPR-001 – Fire Protection, Public Address/EWIS & Hearing Loops | Mandatory compliance |
| | |

### 3.1.2 Aircraft Fueling Ramp Drainage

NFPA 415 does not nominate a minimum distance of fuel spill trenches from terminal buildings; however prescribes that the apron shall slope away from the terminal. A 15 m separation distance is nominated for fuel drainage inlets, and this is therefore adopted for the Melbourne Airport fuel trenches (albeit drainage inlets differ from trenches). The radiation impact of a fuel trench fire to the terminal building façade must be analysed as part of the fire engineering design.

Fuel spill trenches or drainage point locations within undercroft areas of the terminal buildings are not acceptable on a fire risk basis.

Fuel spill trenches or drainage points located within 30 m of the terminal building façade must be analysed for fire impact as part of the fire engineering design. Consideration of materials, external drenchers, etc. is to be considered where appropriate to the project design and fire risk.

Where apron slope is away from the terminal, assess radiation impact to façade from a pool fire or from trench fire at fuel drain / spill capture points.

Where apron slope toward the terminal is an existing condition, adopt 15 m as the minimum distance from the façade for drain / capture of spilt fuel. Assess radiation impact to the façade from a fuel trench fire at this location and develop appropriate recommendations and protection.

### 3.1.3 Aircraft loading walkways

Smoke detection is required through fixed links and luffing bridges but not aero-bridges. These shall be on a separate detection zone for indication at the FIP.

Smoke detection activation will initiate shut down of the local mechanical systems serving the aircraft loading walkways but will not initiate the emergency warning system.

Sprinkler protection within the terminal building shall be extended to the arrival / departure doors of the aircraft loading walkway. Sprinkler protection is not required within aircraft loading walkways, however may be installed within fixed links connected to the terminal building provided substantial doors separate sprinkler protected and non-sprinkler protected areas. This must be addressed as part of the fire engineering design.

Emergency warning (EWIS) speakers are not required for aircraft loading walkways due to complexity of automatic operation depending upon use (loading / unloading) and position (arrivals / departures).

Emergency procedures relating to aircraft loading walkways will rely on staff and fire warden invention, and depends upon the fire location, the use (loading / unloading passengers) and position (arrivals / departures mode).

Evacuation diagrams shall be positioned at each end of each aircraft loading walkway and at each level. The evacuation diagram shall individually address the evacuation requirements on the basis of the loading walkway being in that operational position; i.e. in arrival or departure mode.

### 3.1.4 Design Approach

Refer also Section 1.9.1. FSE must determine, for each project, which references from Table 3.1 are relevant to the project, which are not relevant and why they are not relevant. This summary must form part of the consultation process and be identified in the FEB.

The fire safety and risk engineering design must follow the approach and methodology contained within the International Fire Engineering Guidelines, the SFS Code of Practice, and SFS Practice Guidelines issued for professionals.

The design criteria identified within Table 3.2 to Table 3.8 will be the initial assessment benchmark for the terminal buildings, and will therefore be considered by APAM as an acceptable basis for the design of the terminal buildings. These must be justified for each project against the applicable design references contained in Table 3.1, and agreed with the stakeholders through the consultation and approval processes. The design criteria identified within Table 3.2 to Table 3.8 includes quantitative analyses where necessary, for example the design of smoke exhaust capacity and egress provisions will be based on population, geometry and nominated fire severity which will be specific to the project area. Individual sub-system design issues are outlined in SECTION 4; these specify features which are mandatory components of the design. SECTIONS 3 & 4 should be read together; SECTION 3 for design criteria, SECTION 4 outlines sub-system features.

If the project scope includes future opportunities, is extensive or results in significant changes to the terminal buildings, the base design criteria may be insufficient. In these projects the fire engineering concepts shall include factors identified in the concept diagrams in SECTION 6.

The design approach includes a responsibility for the fire safety engineer to demonstrate robustness in the methodology based on fire risk. This must be fully justified within the analyses, for example fire protection system reliability estimations, design redundancy, scenario selection, design margins / factors, etc.

In general, the latest design standards / amendments are expected to be adopted for new works except where they are incompatible with the existing system installations. The fire safety engineer is responsible to assess any such differences and agree the approach with the Fire & Life Safety Manager and other stakeholders on a project by project basis. Generic BCA Performance

Assessments have been prepared for common issues; these are identified further in this document in the relevant Sections.

### 3.1.5 Design Criteria Tables

**Table 3.2 – Smoke Detection**

| Terminal Reference | Smoke Detection Design Criteria* |
|---|---|
| Low ceiling / slab heights | Point type |
| High ceilings / open spaces | Point type + aspirated |
| Mixed low / high ceiling spaces | Point type + aspirated |
| Vertical connections (not enclosed) | Point type + aspirated |
| Concealed spaces | Point type + remote indicators |

Note to Table 3.2; *Smoke detection compliance will be in accordance with AS 1670.1 and includes double knock as per APAM Technical Standards. The necessity for aspirated smoke detection is to be assessed to establish satisfactory system performance for tenability, evacuation, smoke exhaust and emergency response.

Refer to Section 4.4 & 4.5 for sub-system features, and Section 6.4 for concept design guidance relating to the smoke detection system.

The smoke detection system within terminal buildings is primarily installed to earlier versions of AS 1670.1. Compliance with AS 1670.1 – 2015 as referenced in the BCA 2016 may not be achieved in all aspects, refer also to Performance Assessment LCI Ref: 17167-FER01.

**Table 3.3 – Fire Sprinkler System**

| Terminal Reference Area | Sprinkler Hazard Design Criteria* |
|---|---|
| Offices[#] & plant areas | OH 1 |
| Back of house | OH 3 or HH for applicable risks |
| All other areas | OH 3 |

Notes to Table 3.3; *Fire sprinkler system compliance will be in accordance with AS 2118.1 and APAM Technical Standards, with OH 3 the default sprinkler hazard design basis for the terminal buildings. Fast response sprinklers shall be installed throughout.

*Fire sprinkler water supply comprises dedicated supply nodes to serve sprinkler control valves. These are located strategically around the terminal and cannot be altered without approval from the Fire & Life Safety Manager. Any new SCV shall be located within an existing valve set and coverage restricted to a single level of the terminal to serve not more than 4,500 $m^2$ in floor area. Subsidiary valves with drain provisions are required for each concessionaire and specific retail zones.

[#]OH 1 for offices refers the specific office floor(s) within the terminal buildings; offices within other terminal areas shall be designed within the OH3 classification to allow future flexibility.

Refer to Sections 4.6 and 4.7 for sub-system features, and Section 6.5 for concept design guidance relating to the fire sprinkler system.

The fire sprinkler system within terminal buildings is primarily installed to earlier versions of AS 2118.1. Compliance with AS 2118.1 – 1999 as referenced in the BCA 2016 may not be achieved in all aspects, refer also to Performance Assessment LCI Ref: 17167-FER01.

**Table 3.4 – Emergency Warning System**

| Terminal Reference Area | Emergency Warning Design Criteria* |
|---|---|
| All internal areas | Sound System & Intercom System for Emergency Purposes |
| All public areas | Audible & visual devices in accordance with AS 1428.2 clauses 18.2.1, 18.2.2 & 18.2.3;<br>Hearing augmentation loops in accordance with AS 1428.2 clause 21.1;<br>Blue strobe and coded message for fire warden emergency response; |

Notes to

Table 3.4; *The emergency warning system is integral with the terminal PA and sound system and will be in accordance with AS 1670.4 and APAM Technical Standards. The emergency warning system is initiated upon double knock smoke detector activation or dual device activation as per APAM Technical Standards.

Refer to Section 4.5 and 4.8 for sub-system features, and Section 6.6 for concept design guidance relating to the emergency warning system.

The emergency warning and intercommunication system within terminal buildings is primarily installed to earlier versions of AS 1670.4. Compliance with AS 1670.4 – 2015 as referenced in the BCA 2016 may not be achieved in all aspects, refer also to Performance Assessment LCI Ref: 17167-FER01.

**Table 3.5 – Structural FRL**

| Terminal Reference Area | FRL Design Criteria* |
|---|---|
| All internal structure supporting floor slabs | 60 minutes |
| All internal areas supporting the roof only | No applied FRL unless structure contained in non-sprinkler protected enclosure |
| Sprinkler protected apron areas (unenclosed) | No applied FRL |
| Enclosures containing high risk equipment / services; or<br>Non-sprinkler protected enclosures | 120 minutes |

Notes to Table 3.5; *Structural FRL applies to primary beams and columns, except where supporting the roof only, and applied protection shall extend to the secondary beams for at least 500 mm of the primary-secondary connection points.

*The FRL design criteria may be varied if demonstrated through fire safety and risk engineering assessment. Analyses for FRL shall be based on fully developed fires with sprinkler failure scenarios, and may include consideration of fire severity based on fire load and other construction features provided the parameters are fully justified, detailed in the FEB and agreed with stakeholders, in particular outlining potential implications for FRL protection if future occupancy changes occur. The consequences to the business and assets arising from potential structural damage must also be included in the analyses.

**Table 3.6 – Fire & Smoke Compartmentation**

| Terminal Reference Area | Compartmentation Design Criteria* |
|---|---|
| Enclosures containing high risk equipment / services; or<br>Non-sprinkler protected enclosures | 120 minutes |

| Terminal Reference Area | Compartmentation Design Criteria* |
|---|---|
| Floor slabs | 120 minutes |
| Services penetrations through floor slabs | Smoke proof – electrical cables (intumescent pillows); plumbing (fire mastic); etc. |
| Nominated barrier locations (refer zone diagrams) | Smoke proof |
| Penetrations for baggage systems | Exempt |

Notes to Table 3.6:

*Fire compartmentation is generally not a requirement of the fire safety strategy due to the functional necessity for large open spaces and connections throughout the terminals. However the integrity of floors to resist fire damage is essential to enable staged evacuation and fire brigade intervention over prolonged periods, and for business / asset protection. Therefore floor slabs shall be designed to achieve 120 minutes fire rating and include protection of service penetrations.

*Where security demarcation lines can be utilised for fire safety benefits, smoke proof construction is identified on zone diagrams. In particular, these are constructed to protect high occupancy areas and for multi-level connections. These locations shall be retained accordingly and details such as construction, AHUs, dampers and fire mode operation to be assessed by the fire safety engineer and approved by the Fire & Life Safety Manager.

*Fire rated shafts / risers are not a requirement of the fire safety strategy due to the lack of common services locations within the terminals. The fire safety performance is achieved through smoke protection of services passing through the floor slab. The location and requirement for passive devices is addressed within the Barriers Strategy and diagrams reference ??

*Baggage system operation and reliability is an essential function of the airport and penetrations which facilitate the baggage system performance and reliability are exempt from fire protection under the fire safety strategy. The baggage system will cease operation under the double knock system, refer Section 4.5.

Refer to Section 4.12 for sub-system features, and Section 6.10 for concept design guidance relating to FRL.

**Table 3.7 – Lining Materials**

| Terminal Reference | Materials Design Criteria* |
|---|---|
| Fire isolated exits / stairs & fire control rooms | Material Group 1; CRF 2.2 kW/m$^2$ |
| Defined public corridors & aircraft loading walkways | Material Group 1 & 2; CRF 1.2 kW/m$^2$ |
| All other areas | Material Group 1, 2 & 3; CRF 1.2 kW/m$^2$ |
| Wall & ceiling insulation# | Non-combustible materials |
| External façade# | Non-combustible materials |

Notes to Table 3.7; *Material Groups & CRF determined as per BCA. Non-combustible is determined in accordance with AS 1530.1.

*The terminal buildings comprise many 'path of travel' options and 'egress routes' which are not intended to be defined as public corridors under the fire strategy for the purposes of Table 3.7, for example arrivals corridor, concourses, level 2 office corridor, etc. A public corridor under the fire strategy is considered to be a corridor which provides a direct connection from an occupied area to a fire isolated exit, and should be identified by the FSE and defined as part of the stakeholder consultation process.

#The combustibility of wall & ceiling insulation (including soffit boards) and external façade materials may be assessed through fire safety and risk engineering for individual products based on specific material fire test data and adjacent fire hazards analyses, so as to consider the contribution of binders, sealants, insulation, etc. Materials used in the façade shall be non-combustible. Refer also to Section 3.1.2 for external hazards associated with fueling systems.

Refer to Section 4.12 for sub-system features, and Section 6.10 for concept design guidance relating to lining materials.

**Table 3.8 – Population**

| Terminal Reference | Population Design Criteria* |
|---|---|
| Departures check-in | 1 $m^2$/person for queuing areas, 9 $m^2$/person other area |
| Retail / marketplace | 4.5 $m^2$/person |
| Concourse | 9 $m^2$/person (to be reviewed) |
| Gate lounge | 1.5 $m^2$/person |
| Airline lounge | 4 $m^2$/person |
| Baggage reclaim | 1 $m^2$/person around carousels (3 m depth), 9 $m^2$/person other areas |
| Arrivals hall | 4 $m^2$/person |
| Emigration / Immigration | 1 $m^2$/person for queuing areas, 9 $m^2$/person other areas |
| Offices | 10 $m^2$/person and / or workstations |
| Back of house | 30 $m^2$/person |

Notes to Table 3.8; *Population densities are identified for design evaluation purposes only and are not relevant as the basis for occupancy of the terminal buildings. These criteria do not correlate with occupant health & safety, amenity, ventilation, facilities, etc. and terminal occupancy will be the decision of airport planners and approval authorities.

*The population density design criteria are minimum and a load factor may be necessary for evacuation calculations, the population used for fire safety purposes shall be specified in the FEB and agreed with stakeholders.

*Detailed computer evacuation modelling is to be undertaken and assessed against tenability analyses. Model parameters are to be fully justified, detailed in the FEB and agreed with stakeholders, in particular the defined egress routes which must be identified and maintained under the strategy.

*Any projects which alter the existing egress system will require fire risk engineering to confirm acceptance of the alterations.

**Table 3.9 – Smoke Exhaust**

| Terminal Reference | Smoke Exhaust Design Criteria* |
|---|---|
| Departures check-in | Indefinite tenability |
| Retail / marketplace | Indefinite tenability |
| Concourse | To be assessed for tenability in relation to egress paths and the location of smoke plumes from adjoining retail tenancies / kiosks<br>Generally indefinite tenability |
| Gate lounge | To be assessed for tenability in relation to evacuation / egress paths |

| Terminal Reference | Smoke Exhaust Design Criteria* |
|---|---|
| Airline lounge | To be assessed for tenability in relation to evacuation / egress paths |
| Baggage reclaim | Indefinite tenability |
| Arrivals | Indefinite tenability |
| Emigration / Immigration | Indefinite tenability |

Notes to Table 3.9; *Indefinite tenability is determined with fire safety systems operating as designed; i.e. sprinkler controlled with smoke exhaust operating upon detection.

*Detailed fire and smoke modelling is to be undertaken for tenability analyses and unless otherwise agreed will be Computational Fluid Dynamics approach. Model parameters are to be fully justified, detailed in the FEB and agreed with stakeholders.

Refer to Section 4.11 for sub-system features, and Section 6.9 for concept design guidance relating to smoke exhaust systems.

**Table 3.10 – Fire Severity**

| Terminal Reference | Fire Severity Design Criteria* |
|---|---|
| Departures check-in | Medium $t^2$ |
| Retail tenancies / marketplace | Fast $t^2$ |
| Concourse | Slow $t^2$ |
| Gate lounge | Medium $t^2$ |
| Airline lounge | Medium $t^2$ |
| Baggage reclaim | Baggage fire or medium $t^2$ |
| Arrivals | Medium $t^2$ |
| Emigration / Immigration | Medium $t^2$ |

Notes to Table 3.10; *Fire severity design criteria given is for guidance and may be optimised where specific test data or acceptable reference material is used to quantify the fire growth for a particular risk. This shall be fully justified, detailed in the FEB and agreed with stakeholders, in particular the potential implications for future occupancy changes if fire severity is limited.

*Design criteria for an area shall be based on the most appropriate fire risk based on agreement with the stakeholders.

*All fire severity analyses shall include steady state conditions following sprinkler activation with an additional 45 seconds; this allows for model limitations and system inefficiencies.

Other fire safety systems to be incorporated and assessed within the fire safety design will include:

- Impact of emergency response and procedures; refer to Sections 4.3 & 6.3.
- Egress provisions; refer to Sections 4.9 & 4.10 for sub-system features, and Sections 6.7 & 6.8 for concept design guidance relating to egress, which must also address egress routes, horizontal and vertical egress, assembly areas, security arrangements, etc.
- Fire brigade intervention; refer to Section 4.14 for sub-system features, and Section 6.12 for concept design guidance relating to fire brigade response and activities.
- Occupant suppression systems; refer to Section 4.13 for sub-system features, and Section 6.11 for concept design guidance relating to occupant suppression, which must also address response and training requirements.

- Special fire hazards or systems applicable to the area or project; for example dangerous goods storage, gas suppression systems for airport critical systems such as communications rooms, data centres, etc.

## 3.2 Special Hazard Systems

The fire protection requirements of special hazards are identified within the APAM Fire Technical Standards and include Gas Suppression Systems and Kitchen Hood Exhaust Systems. The design criteria of these systems are defined in the APAM Technical Standards.

## 3.3 Category 2 – Essential Terminal Infrastructure Buildings

The BCA is to be used for fire safety assessment of essential terminal infrastructure buildings. However the stakeholder process will include the potential for additional measures, based on fire safety and risk engineering justification, to address the asset and business risk to the terminal buildings associated with a fire in these facilities. The FSE is responsible to ensure this aspect of the design outcome is clearly articulated to the project team and is addressed through the fire approval processes. The holistic design approach for fire safety and risk necessitates that the fire safety design must include the BCA compliance with any Alternative Solutions in conjunction with the asset and business protection.

## 3.4 Category 3 & 4 – APAM Managed & Non-Managed Buildings

Category 3 & 4 buildings relate to non-APAM operated buildings, and these may either be managed by APAM through lease arrangements or are non-APAM managed, for example Airservices buildings. The BCA is to be used for fire safety assessment and compliance of these stand-alone buildings. The stakeholder consultation and approval processes includes checks and sign-offs to capture APAM requirements for design and construction compliance. The FSE is responsible to ensure this process and design outcome is clearly articulated to the project team and is addressed through the fire approval.

# SECTION 4. FIRE SAFETY SUB-SYSTEMS

## 4.1 INTRODUCTION

The minimum requirements for fire safety sub-systems are defined for the terminal buildings only. The requirements for other buildings will be determined through compliance with the BCA and on an individual building and project basis.

This Section of the fire safety strategy identifies the system design provisions which are considered mandatory necessary to satisfy the strategy.

## 4.2 FIRE PREVENTION

Fire prevention is designed to eliminate the fire risk so far as reasonably practicable by implementing policies and procedures which prevent ignition. Fire prevention represents the basic tenet of fire safety – prevent fire ignition. Melbourne Airport has developed a comprehensive array of fire prevention measures which achieve a culture of awareness and compliance, these include:

- Preparation of Fire Safety Guidelines
- Hot work permit system
- Fire system isolation procedures
- Precautions during construction
- Emergency Control and Fire Warden responsibilities
- Security measures
- Contractors Handbook
- Essential services maintenance
- Record keeping
- Fire Safety Manual

The majority of these are managed through the fire safety committee and management and therefore require no additional input from a project design perspective; Table 4.1 identifies the components which must be implemented as part of all projects.

**Table 4.1 – Fire Prevention**

| **Mandatory Items** |
|---|
| APAM fire safety guidelines |
| Hot work permit system |
| System impairment procedures |
| Precautions during construction |

Ongoing compliance and update of fire prevention is managed by the APAM Fire Safety Committee to prepare, implement, review, maintain and report.

Refer Section 6.2 for concept design issues relevant to fire prevention.

## 4.3 Emergency Response

Emergency response is achieved through the Melbourne Airport Emergency Plan, which is managed and approved by the Airport Emergency Planning Strategic Committee. The Airport Emergency Plan details the arrangements to cope with the impact of any emergency (including fire) requiring a multi-agency or multi-disciplinary response, and considers public safety, the security environment and airport operations. The Airport Emergency Plan provides a strategy for the timely, measured and coordinated response to and relief from a fire emergency at Melbourne Airport to reduce the fire risk so far as is reasonably practicable. It includes emergency response of management, wardens, staff, security, agencies and fire brigade.

Emergency response requires no additional input from a project design perspective; Table 4.2 identifies the components of emergency response which are mandated through all projects.

**Table 4.2 – Emergency Response**

| **Mandatory Items** |
|---|
| Evacuation zones, boundaries can only be altered via thorough consultation and APAM acceptance |
| Blue strobes |
| WIP's |
| Evacuation diagrams |

Ongoing compliance and update of emergency response is managed through the AEP to prepare, implement, review, maintain and report.

Refer Section 6.3 for concept design issues relevant to emergency response.

## 4.4 Smoke Detection System

The smoke detection system is designed to deliver early activation of a fire and as an interface to initiate other fire safety systems. The smoke detection system shall comply with APAM Technical Standards, and is managed by the APAM Fire & Life Safety Manager. Table 3.2 identifies which smoke detection type should be considered to obtain adequate detection performance and reliability within the strategy and for ongoing management in use, and Table 4.3 the mandatory features required for all projects.

**Table 4.3 – Smoke Detection**

| **Mandatory Items** |
|---|
| AS 1670.1 smoke detection layout |
| AS 1670.1 smoke detection layout at 20m spacing + aspirated smoke detection in large public spaces |
| Point type smoke detection to concealed spaces |
| Double knock detector activation for emergency warning |
| Fire protection interfaces as per Table 4.4 |
| Graphics system updates |

The function of the smoke detection system is critical for the holistic approach through the interface and initiation of other fire safety systems as defined in Table 4.4, which must be incorporated through the system design and commissioning processes.

**Table 4.4 – Smoke Detection System Interface Chart**

| | Function | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Emergency response | Alarm monitoring | Fire brigade notification | Emergency Warning (Double Knock system) | Hearing loops | Door releases | Stair pressurization | Mechanical fire mode | Smoke exhaust fans | Damper operation | Smoke curtains | Plant/equipment shutdown | Gas/Fuel isolation | Gas suppression release | Lift fire mode |
| **Smoke Detector Activation*** | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |

Refer Section 6.4 for concept design issues relevant to the smoke detection system and future opportunities which may be considered within project works. These features include criteria for design, configuration, integration, implementation and maintenance.

## 4.5 Double Knock (Dual) Detection – Emergency Warning

The evacuation strategy comprises two (2) phases to reduce reliance on fire wardens and human intervention in the event of a fire incident, to minimise the impact of nuisance alarms on the strategy, and as a response to customer focus approach. This evacuation strategy follows outcomes arising from a terminal evacuation exercise in June 2014 which identified circumstances in which emergency response delays could occur. The phases depend on how many smoke/heat detectors are in alarm and whether sprinkler activation has occurred. A description of each phase of the evacuation strategy is outlined below.

1. Evacuation strategy Phase 1; a single smoke/heat detector in alarm will initiate the following:
    - Fire Brigade
    - Fire Graphics
    - Smoke control system
    - Blue strobe via Fire Indicator Panel
2. Evacuation strategy Phase 2; more than 1 smoke/heat detector in alarm which occurs in the same zone OR fire sprinkler activation will initiate the following:
    - Phase 1 response
    - Zone alarm signal sent to EWIS, system remains in Auto
    - EWIS starts the Alert tone automatically and cascades as required
    - Security locked doors required for egress in fire effected zone automatically unlock
    - Vertical lifts receive fire alarm and return to Ground (or other defined floor level) for fire affected zone
    - Baggage system

Refer to Figure 4.1 below for an illustration of the double knock detector activation.


**Figure 4.1: Double knock (dual) fire alarm procedures**

The double knock arrangement is justified through statistical analyses of fire alarms wherein spurious alarms are almost exclusively single smoke/heat detector activation occurrences. These single device activations have a potentially significant impact on the business and customer experience while creating doubt with the reliability and response to real fire alarms. The emergency response will continue for single device activations via the blue strobes and coded messages, with communication via WIP as necessary. However for Phase 1 procedures the emergency warning system will not be initiated.

In the case of a double knock (dual) smoke/heat detector alarm in the same evacuation zone, or sprinkler system activation, Phase 2 procedures will be initiated and the Emergency Warning System will automatically commence the alarm sequence; i.e. Alert tone in the fire affected zone for 90 seconds, followed by Evacuation tone in the fire affected zone and Alert tone in the adjacent zone. This process will continue to cascade throughout the Terminal, based on the evacuation zones. The Phase 2 procedures will also release security locked “required exit doors” and activate lift recall sequence (return to ground floor) in the fire effect zone. The vertical lifts for the fire affected zone will receive a fire alarm and to ensure occupants do not evacuate via the vertical lifts. Lifts should not be used in the event of fire, unless the fire brigade utilise the fire fighter control override.

## 4.6 Automatic Fire Sprinkler System

The automatic fire sprinkler system is designed to extinguish or at least control a fire so as to minimise fire severity and prevent the development and migration of high temperatures and products of combustion. The automatic fire sprinkler system is the backbone of the fire safety strategy and together with the smoke detection system form the basis of all other system designs. The fire sprinkler system shall comply with APAM Technical Standards, and is managed by the APAM Fire & Life Safety Manager with the mandatory features of the system outlined in Table 4.5.

**Table 4.5 – Sprinkler System**

| **Mandatory Items** |
|---|
| All areas sprinkler protected unless approved by the Fire & Life Safety Manager |
| AS 2118.1 OH3 design criteria throughout except where high hazard is prescribed |
| AS 2118.1 OH1 for office levels & intermediate spaces containing baggage equipment |
| Fast response sprinklers throughout |
| Separate SCV for retail zones, individual subsidiary valve with drain facility for each F&B concessionaire |
| Building expansions to incorporate separate SCV for each 4,500 $m^2$ floor area and for each level |
| Separate water supply nodes at strategic locations around the terminal |

Refer Section 6.5 for concept design issues relevant to the sprinkler system and future opportunities which may be considered within project works. These features include criteria for design, configuration, integration, implementation and maintenance.

## 4.7 Fire Water Supply & Fire Main Configuration

The water supply serving the airport precinct comprises 3 distinct reticulation systems – a 'terminal precinct', a 'maintenance precinct' and a 'business park precinct'. Each precinct has separate water supply and tapping arrangements; the Terminal Precinct contains dedicated water storage and pumping equipment that serves the entire terminal and surrounds from south of the terminal buildings to Airside Rd and APAC Drive and west of the terminal buildings to Operations Rd and the fire station.

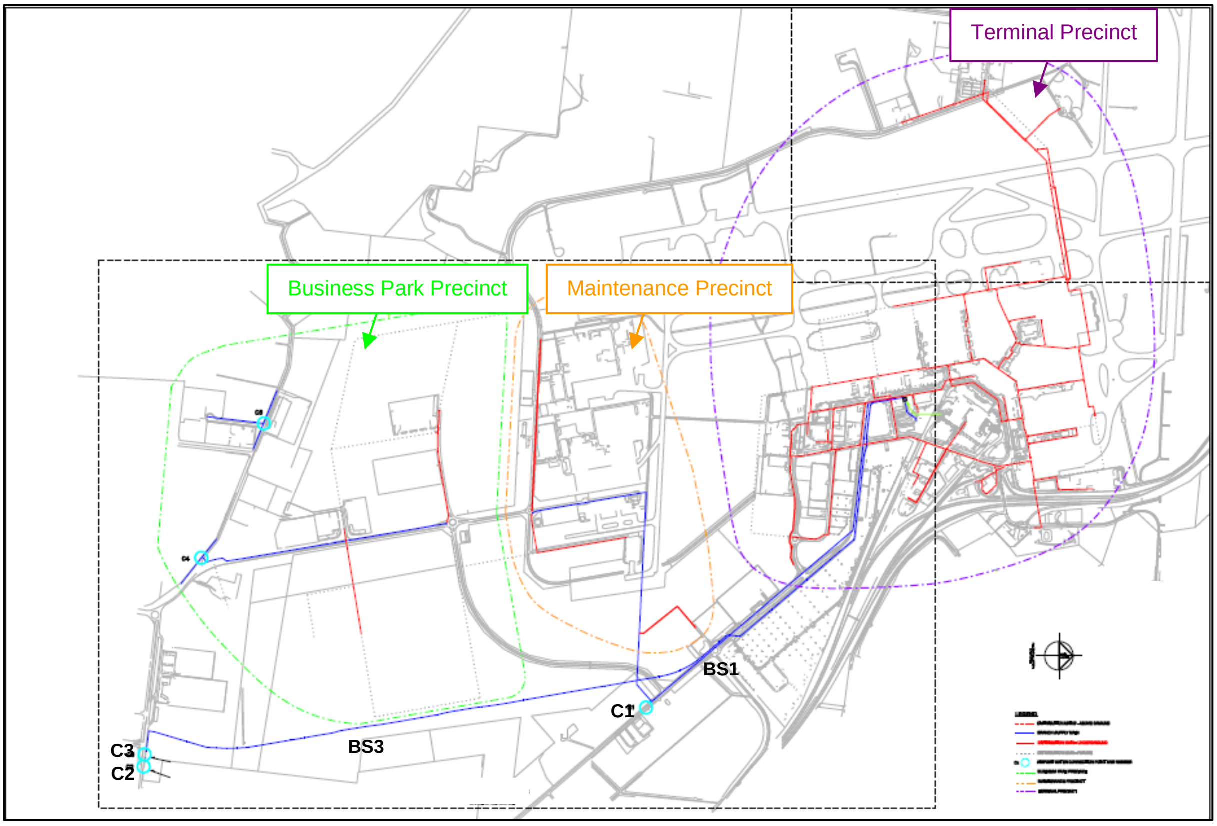


**Figure 4.2: Airport Precinct water supply configuration**

The water supply serving the Terminal Precinct comprises airport water connection point C1 (Melrose Dve) serving branch supply 1 (BS1), and airport water connections C2 (Silvan connection) and C3 (Greenvale connection) serving branch supply 3 (BS3). Under normal conditions, C1 provides approximately 25% of the terminal precinct demand, and C2/C3 provides approximately 75% of the terminal precinct demand. BS1 and BS3 serve Terminal Supply 1 (TS1) and Terminal Supply 3 (TS3). Refer to Figure 4.2 for general overview of the water supply arrangement described above.

The Southern Pump Station, shown in Figure 4.3, delivers water to the Terminal Precinct from the water authority mains through a series of electric variable speed pumps. The pumps are controlled through a PLC to start/stop as demand varies, reticulation pressure is maintained below a maximum of ~550 kPa with flow up to ~200 L/s available if all pumps are running. The system delivers pressure and flow characteristics on demand for the entire Terminal Precinct reticulation.

**Figure 4.3: Southern Pump Station**

The variable speed electric pumps are supplemented by a diesel backup generator, with the diesel fire pump (refer below) an additional redundancy (automatic start) should the domestic pump electric supply system and generator failure, or for failure/malfunction of the pump controller.

The fire protection systems for individual buildings within the Maintenance and Business Park Precincts are served from the mains described previously, either through individual tappings to each building and/or tanks/fire pumps.

The fire protection systems for the Terminal Precinct are configured as follows:

Fire sprinkler water is independently served by water supply nodes at the following locations within the terminal precinct:

- Sprinkler supply node 1; location D14 – to serve T2 & Gates sprinkler control valves
- Sprinkler supply node 2; location F11 – to serve T3, T4 and Building 64 sprinkler control valves
- Sprinkler supply node 3; location Gate 38 – to serve T1 sprinkler control valves
- Sprinkler supply node 4; location TSB3 – to serve Tri-Gen sprinkler control valves

These sprinkler water supply node locations and connected sprinkler control valves are shown indicatively in Figure 4.4.

These fire sprinkler water supply nodes include dual compartment static water tanks and electric / diesel fire pumpsets, with hydraulic capacity to provide AS 2118.1 HH design discharge criteria as appropriate to the sprinkler control valve requirements. This sprinkler water supply configuration has the following reliability features:

- Sprinkler water supply is separate from hydrant water supply.
- Single point failure for terminal precinct sprinkler systems is removed.
- Each supply node has dual tank with electric and diesel pump options, automatic infill to the tanks from the terminal precinct water reticulation.
- In the event of failure to any individual sprinkler water supply node, manual bypass facilities are available at each tank/pump location to enable sprinkler control valves to be fed from the terminal precinct water reticulation.
- The Southern pump station diesel fire pump is available to deliver fire system pressure and flow directly to the terminal precinct water reticulation (automatic backup to the variable speed domestic electric pumps); this pump can also be manually started if required.
- Individual and system wide booster assemblies are provided for fire brigade intervention.

Apron fire hydrants remain connected to the terminal precinct water reticulation; these are available as feed hydrants for fire brigade appliances. Hydraulic performance is based on available pressure and flow of the terminal precinct water supply network, either via the domestic variable speed pumps or backup diesel fire pump. These hydrants can be boosted from the Southern pump station booster assembly. The apron fire hydrants will achieve minimum CASA requirements for airport fire hydrants and will be used as a water source for fire appliances; i.e. equivalent to towns mains fire hydrants.

Internal fire hydrants will be connected to dedicated fire mains fed from the terminal precinct water reticulation. Booster connections are provided at strategic locations, located adjacent to the sprinkler water supply nodes where feasible, to serve the internal fire hydrants. These hydrants can be used as attack hydrants by the attending fire brigade and through direct boosting, pressure and flow can be controlled. Unassisted hydraulic performance is based on available pressure and flow of the terminal precinct water supply network, either via the domestic variable speed pumps or backup diesel fire pump.

The water supply arrangement and configuration has been agreed with stakeholders, in particular ARFF based on their reliance on the water supply integrity for fire-fighting activities.

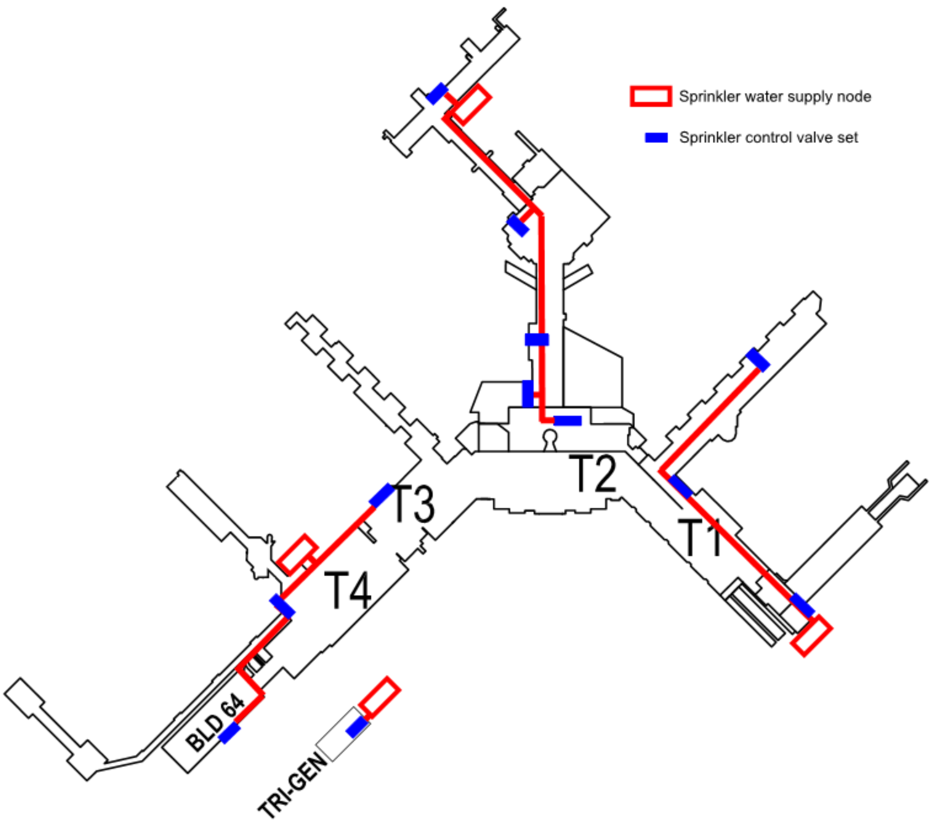


**Figure 4.4: Indicative locations of sprinkler water supply nodes**

## 4.8 Emergency Warning System

The emergency warning system is designed to enable information to be conveyed in a timely manner for occupant evacuation and emergency management. The emergency warning system shall comply with AS 1670.4 and APAM Technical Standards and is an integrated terminal public address and sound system, and is managed by the APAM Fire & Life Safety Manager. The design and installation of the emergency warning system is strictly controlled within the terminal due to the interfaces and programming with the public address system and specialised nature of the system and equipment. The total emergency warning system comprises mandatory features, as outlined in Table 4.6. Additional system performance measures mandated within the design include:

- Hearing augmentation loops and audible / visual alarms for vision and hearing impaired warning in public areas
- Strobe systems for high ambient noise areas such as baggage handling and apron areas
- Coded message and blue strobe light system for emergency response

**Table 4.6 – Emergency Warning System**

| Mandatory Items |
|---|
| Evacuation zone boundaries & speaker circuits and equipment |
| Integrated sound, visual and intercom system via Bosch Praesidio including programming |
| WIP's and blue strobes for emergency response |
| Hearing augmentation loops in public areas |

Refer Section 6.6 for concept design issues relevant to the emergency warning system and future opportunities which may be considered within project works. These features include criteria for design, configuration, integration, implementation and maintenance.

## 4.9 Egress Strategy and Exit Provisions

The egress strategy is based on defined evacuation zones within the terminal buildings:

- which complement airport functional operations and constraints
- which are zoned with other fire safety systems to form an integrated robust solution
- which enable a staged evacuation to be implemented
- which have multiple egress options and access to Emergency Assembly Areas
- which are analysed individually and holistically

**Table 4.7 – Egress System**

| **Mandatory Items** |
|---|
| Retention of existing egress paths and exits unless stakeholder acceptance of alternatives |
| Exit door operation as per details in section 4.9.1 below |
| Signage 'FIRE SAFETY DOOR, KEEP CLEAR' in minimum size 50 mm lettering |

Refer Section 6.7 for concept design issues relevant to the egress system and future opportunities which may be considered within project works, noting that egress provisions are also constrained by the security requirements which must be implemented for airside safety. These features include criteria for design, configuration, integration, implementation and maintenance.

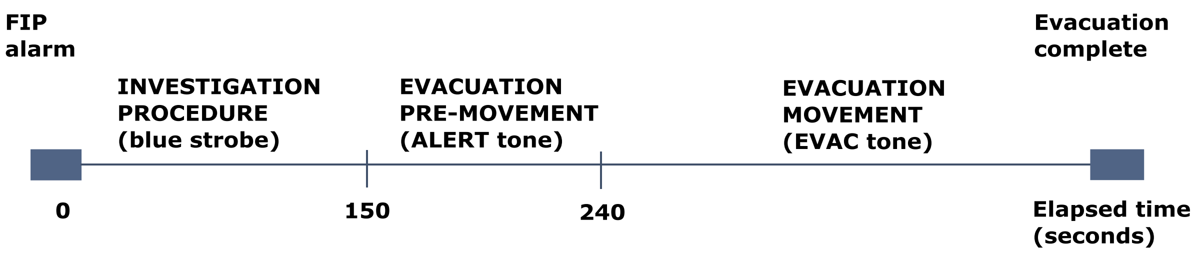


**Figure 4.5: Evacuation procedure**

The evacuation strategy is based on the following components:

1. An investigation period of 150 seconds from alarm notification, when blue strobe lights are activated for fire warden response, representing a pre-determined verification period prior to initiating the ALERT or EVACUATE tones.

2. An ALERT tone and/or voice over messages for a period of 90 seconds.

3. An EVACUATE tone following elapse of 240 seconds from alarm notification or upon confirmation of a real fire.

For the majority of scenarios the MECP will be in automatic mode, however as the ACC is fully manned they may manage an evacuation manually based upon the specifics and responses to an incident. In automatic mode, automatic cascade sequences are provided within the programming logic. The cascade sequence is detailed in the Fire Safety Manual.

#### 4.9.1 Exit Door Operation

Required signed exit doors must achieve the following:

1. The door must always be readily openable without a key or release on fire alarm from the side that faces a person seeking egress.

2. The door must have a break glass release or similar if secured, and either fail safe open (disengaged) or include a battery backup. Green break glass release devices will be progressively installed throughout the terminals.

3. The door hardware must comprise a single hand downward action on a single device which is located between 900 mm and 1,100 mm from the floor and if an exit from a public area:

   - be such that the hand of a person who cannot grip will not slip from the handle during the operation of the latch; and

     - have a clearance between the handle and the back plate or door face at the centre grip section of the handle of not less than 35 mm and not more than 45 mm; or

     - a single hand pushing action on a single device which is located between 900 mm and 1,200 mm from the floor

### 4.10 Emergency Lighting and Exit Signs

The emergency lighting and exit sign system is designed to identify travel paths and exits and to illuminate egress routes and exit points in the event of power failure. Emergency lighting and exit signs shall comply with APAM Technical Standards, and is managed by the APAM Fire & Life Safety Manager with mandatory measures outlined in Table 4.8.

**Table 4.8 – Emergency lighting & exit signs**

| Mandatory Items |
|---|
| Running man pictorial exit signs |
| Oversize exit signs in public spaces |
| Central computer monitored configuration |
| Not required within concessionaires less than 300 $m^2$ |
| Not required within individual offices or rooms |
| LED fittings required |
| Exit signs not required in toilets, emergency lights required in toilets |

Refer Section 6.8 for concept design issues relevant to the emergency lighting and exit signs and future opportunities which may be considered within project works. These features include criteria for design, configuration, integration, implementation and maintenance.

### 4.11 Smoke Management

The smoke management system is designed to minimise the production and migration of smoke and contain and exhaust smoke from the source. The smoke management system includes multiple design features to reduce the fire risk so far as reasonably practicable, as outlined below:

- Sprinkler system to minimise smoke developed, noting that smoke management cannot be achieved for an uncontrolled fire

- Smoke zones designed holistically to complement evacuation zones

- Mechanical zones designed holistically to complement smoke zones
- Passive constraints and features to limit migration and contain smoke
- Mechanical smoke exhaust fans to extract the smoke to outside
- Addressable detectors with mechanical fire mode configuration to minimise smoke spread through equipment ducting and assist smoke containment strategies
- Compartmentation and ventilation options where suitable for the area

The smoke management system is to be designed from first principles based on sound fire safety and risk engineering analyses and will be specific to the individual area of the terminal and include consideration for geometry, construction, bounding surfaces, adjoining zones, etc. The mandatory provisions relating to mechanical systems are outlined in Section 4.11.1.

Refer Section 6.9 for concept design issues relevant to the smoke management system and future opportunities which may be considered within project works. These features include criteria for design, configuration, integration, implementation and maintenance.

### 4.11.1 Mechanical Systems

The mechanical systems comprise dedicated smoke exhaust equipment and fire mode configuration of AHU to restrict spread, primarily based on defined smoke zones within each evacuation zones. Compliance with AS 1668.1 is not generally applicable or relevant but is referenced for specific items or features.

Smoke exhaust capacity for all public areas is determined through quantitative analyses and will require detailed fire and risk engineering using Computational Fluid Dynamics modelling unless fully justified and agreed with stakeholders.

Smoke exhaust fans shall comply with AS 1668.1 with regard to materials and construction; i.e. rated to operate at temperatures of 300$^{o}$C for 30 minutes with fan and motor equipment wiring in accordance with AS 1668.1 and AS 3013.

Supply air systems used for pressurisation and protection of egress paths, such as pressurised stairs or corridors, shall comply with AS 1668.1 with regard to materials and construction; i.e. fan and motor equipment and supply air detector wiring in accordance with AS 1668.1 and AS 3013.

These systems, where specified in the fire matrix, are designed to create pressure differentials across smoke zone boundaries. No specific construction materials apply to AHU.

Mechanical control functions are MSSB relay controlled with logic to match the required operation via signals from the FIP network using fire rated cables. In some instances, the BMS will control some ancillary functions such as damper position, gas heater shut-off and minor mechanical system not fed directly from a MSSB. The configuration and arrangement of fire and smoke dampers is specified in the fire safety manual.

The fire mode matrix is based systems within defined smoke zones which form part of each evacuation zone. Table 4.9 outlines the strategy however the airport terminal building is complex and the mechanical fire mode configuration will need to be reviewed in all areas based on the following objectives:

1. To maintain tenability within the terminal
2. To minimise smoke spread from the smoke zone of fire origin
3. To capture and exhaust smoke from the smoke zone of fire origin

The assessment of AHU to operate within the fire mode matrix is outlined in Figure 4.6. It is intended that other units will continue to run in fire mode and have no specific role in the mechanical strategy.

**Table 4.9 – Strategy for mechanical fire mode configuration**

| **Smoke zone in alarm (no void openings)** | **Adjacent smoke zone** |
|---|---|
| AHU shuts down<br>SEF starts | Horizontal zone AHU shuts down<br>Vertical zone AHU continue in current mode<br>Individual retail / concessionaire FCUs may continue in current mode |
| **Smoke zone in alarm (voids in smoke zone)** | **Adjacent smoke zone** |
| AHU shuts down<br>SEF starts | Horizontal zone AHU shuts down<br>Vertical zone AHU starts in 100% OA |
| **Smoke zone in alarm (bounded by fire/smoke walls)** | **Adjacent smoke zone** |
| AHU shuts down<br>SEF starts | AHU starts in 100% OA |

Smoke exhaust fans shall be manually controlled at the FFCP by a single switch per zone with each fan having individual LED indicators for run, stop and fault conditions.

Supply air fans used for pressurisation and protection of egress systems, such as pressurised stairs or corridors, shall be individual fan control switches and LED indicators for run, stop and fault conditions at the FFCP.

AHU nominated in the fire matrix to operate on 100% outside air in fire mode shall have supply air detectors installed and be manually controlled at the FFCP by a single switch per zone with a common LED indicator. The indicator shows "fault" if one or more fans are in fault; the indicator shows "running" if more than 50% of the fans are operating. In each zone where a single switch controls multiple fans, power contactors shall be configured so that a single fan failure does not cause total failure of the equipment in that zone.

AHU nominated in the fire matrix to shut down in fire mode do not require a supply air detector, switches or LED indicators at the FFCP.

Toilet and kitchen exhaust systems may continue in current mode under zone fire alarm activation and do not require detectors, switches or LED indicators at the FFCP.

Kitchen exhaust systems require specific construction and configuration arrangements which are specified in the relevant Fire Safety Guideline; this includes local fire interfacing within the tenancy.

The fire matrix, block diagram and FFCP labelling template is contained within the Fire Safety Manual. These must be updated for any project which varies or alters the configuration or AHU contained.

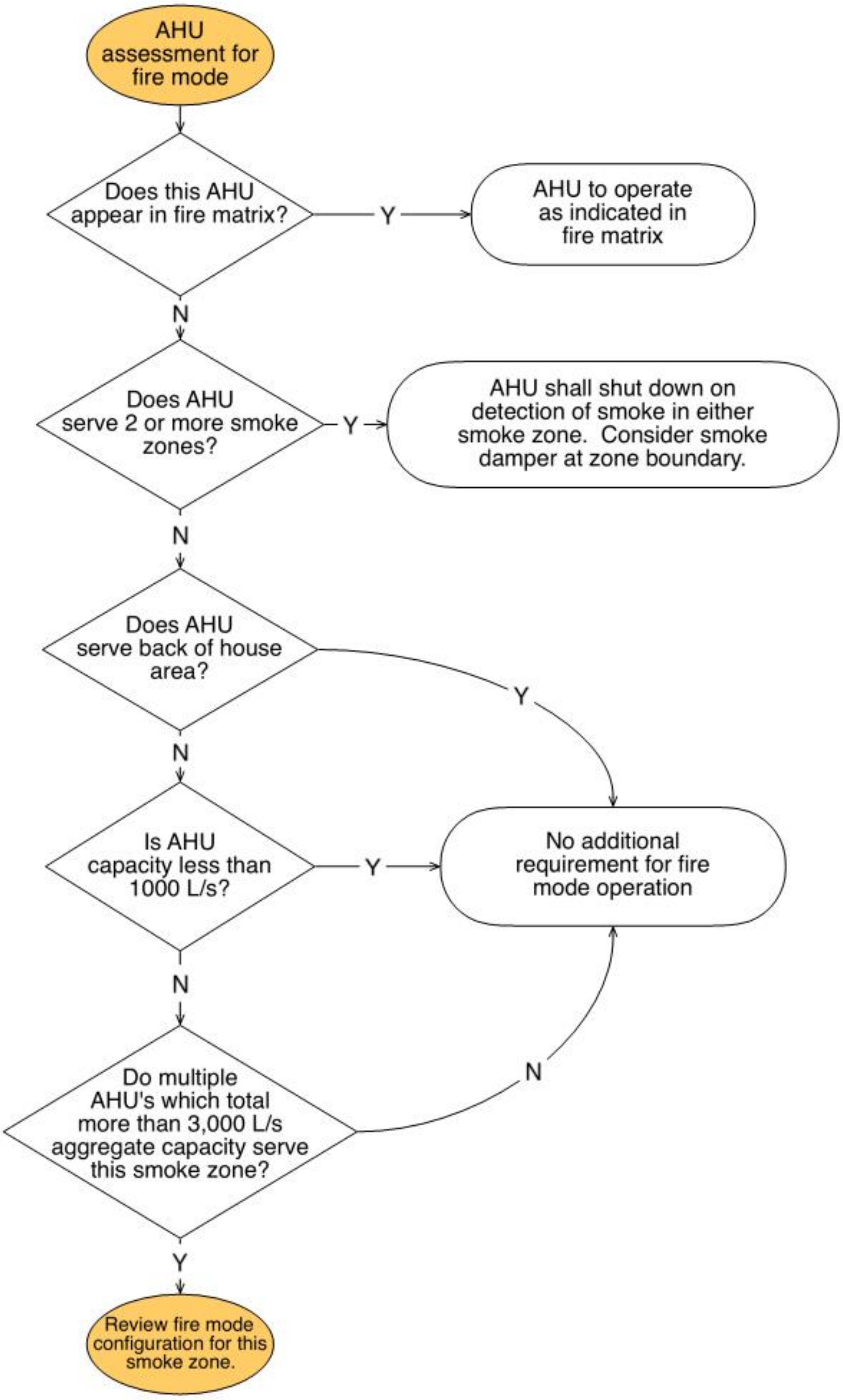


**Figure 4.6: Assessment of AHU for fire mode configuration**

## 4.12 STRUCTURAL PROTECTION AND MATERIALS LIMITATIONS

The protection and associated materials used in construction are defined within the strategy to provide fire resistance levels to the structure and to limit fire severity and spread:

- Applied fire protection to columns and primary beams
- Specified criteria and methods to determine fire hazards associated with floor linings and coverings, and wall and ceiling linings

The structural protection features are primarily for asset protection and business continuity purposes and have limited benefits to life safety of terminal occupants however materials limitations can have a significant impact on fire severity and is therefore critical for tenability. :

Structural protection includes minimum FRL based on the terminal reference areas as identified in Table 3.5, and limitations of construction lining materials are identified in Table 3.7. No further mandatory provisions exist however the design solution used must still be assessed for compliance with the BCA performance requirements as the criteria which are acceptable to APAM under the strategy may vary from the BCA DtS provisions. Discussions and agreement with ARFF to confirm fire brigade intervention issues will also be required for all assessments in relation to structural protection and materials limitations.

Refer Section 6.10 for concept design issues relevant to structural fire protection and materials limitations, which may be considered within project works. These features include criteria for design, configuration, integration, implementation and maintenance.

## 4.13 MANUAL FIRE SUPPRESSION SYSTEMS

Manual fire suppression systems comprise 2 primary strategies to reduce the fire risk so far as reasonably practicable:

1. Fire suppression systems for use of occupants (staff) trained in fire extinguishment activities, incorporating portable fire extinguishers and fire hose reels. These systems shall comply with APAM Technical Standards and be designed and located to support the emergency response arrangements and will comply with AS 2444 and AS 2441 respectively, and are managed by the APAM Fire & Life Safety Manager.
2. Fire suppression systems for use of attending fire brigade, incorporating the fire hydrant system, refer also Section 4.14 fire brigade intervention:
   - The fire hydrant system shall comply with APAM Technical Standards and be designed and located to facilitate fire brigade intervention, and is managed by the APAM Fire & Life Safety Manager in consultation with Airservices Aviation Rescue and Fire Fighting.
   - The fire hydrant system is fed from the terminal water supply system and comprises fire hydrants at Apron level connected to the combined water reticulation and to be used as feed hydrants, and terminal fire hydrants served via internal fire hydrant mains connected to the combined water reticulation and to be used as attack hydrants. Booster connections are available throughout the terminal.
   - Hydrant pressure and flow is limited by the terminal water supply system.

The fire water strategy is based on prioritising the sprinkler system water supply as the most essential component within the strategy and creating specific fire hydrant performance solutions for apron level, to serve as feed hydrants to fire appliances, and internal hydrants, to serve as attack hydrants under boost conditions. The fire water supply arrangement is described in Section 4.7.

Refer Section 6.11 for concept design issues relevant to the manual suppression systems including future opportunities which may be considered within project works. These features include criteria for design, configuration, integration, implementation and maintenance.

## 4.14 Fire Brigade Intervention

Fire brigade intervention design refers to systems installed which facilitate fire brigade emergency roles at the airport. The key fire brigade intervention items to be considered through projects are outlined below and are implemented through stakeholder consultation with Airservices Aviation Rescue and Fire Fighting (ARFF):

- Key consultation for projects and coordination for all emergency response activities
- Direct fire alarm notification
- Control and indicating equipment
- Fire control centres and equipment/services contained therein
- Manual fire fighting systems and equipment
- Vehicular access provisions and appliance parking at strategic locations
- Access to all parts of the airport precinct and to all buildings
- Tactical fire plans and fire block plans

Refer Section 6.12 for concept design issues relevant to the fire brigade intervention including future opportunities which may be considered within project works. These features include criteria for design, configuration, integration, implementation and maintenance.

## 4.15 Fire Safety System Description and Maintenance Standards

Table 4.10 summarises the fire safety provisions and outlines the general description for installation and maintenance.

**Table 4.10 – Terminal Buildings – Fire Safety Systems**

| Fire Safety System | General Description & Performance | Maintenance Requirements |
|---|---|---|
| Fire Prevention (refer 4.2) | APAM fire safety policies and procedures. | Review periodically via the APAM Airport Fire Safety Committee. |
| Fire Emergency Response (refer 4.3) | As determined by the Airport Emergency Planning Strategic Committee. | Review periodically via the APAM Airport Fire Safety Committee.<br>Maintain records of drills, participation and results for audit and compliance purposes. |
| Evacuation Zones | The evacuation zones are defined by APAM and will not be altered without approval. | Evacuation diagrams for the relevant zone(s) shall be reviewed after each project to determine whether layout and / or equipment locations are altered. |
| Smoke Detection System (refer 4.4) | The smoke detection system comprises peer to peer network FIP with analogue addressable smoke detectors throughout and aspirated smoke detection in specific areas.<br>An integrated graphics system forms part of the system requirements. | Weekly, monthly and annual tests & checks in accordance with AS 1851 - 2012 for specified schedules. The schedules shall also include tests of the activation of all associated equipment such as AHU, smoke exhaust fans, etc. |

| Fire Safety System | General Description & Performance | Maintenance Requirements |
|---|---|---|
| Automatic Fire Sprinkler System (refer 4.6) | The fire sprinkler system comprises dedicated water supply, sprinkler control valve arrangements with subsidiary valve limitations on floor areas, fast response sprinkler throughout except for special risks fire separated or containing alternative suppression systems.<br>The design criterion is OH3 throughout except HH for storage/high risks and OH1 for office levels. | Monthly, annual, 3 yearly and 6 yearly tests & checks in accordance with AS 1851 - 2012 for specified schedules. |
| Sound & Intercom System for Emergency Purposes (refer 4.8) | The emergency warning system comprises a sound system and intercom system for emergency purposes integrated with the terminal PA and sound system via the Bosch Praesideo system.<br>MECP and SECP are provided in strategic locations to facilitate emergency response.<br>Actuation of alarms in public areas is governed by double knock smoke detection arrangement. | Monthly and 6 monthly tests & checks in accordance with AS 1851 - 2012. Sound pressure levels and strobe light coverage shall be tested 2 yearly and when building alterations occur. |
| Emergency Lights (refer 4.10) | A computer monitored emergency lighting system is installed throughout public areas, egress routes / exits, and critical fire management locations. | 6 monthly and annual tests & checks in accordance with AS/NZS 2293.2 and AS 1851 - 2012. |
| Illuminated exit Signs (refer 4.10) | Computer monitored illuminated exit signs incorporating the 'running man' pictorial are installed throughout to indicate paths of travel to exits. Oversized signs to be installed in all public areas. | 6 monthly and annual tests & checks in accordance with AS/NZS 2293.2 and AS 1851 - 2012. |
| Smoke Management Systems – Passive (refer 4.11) | Passive smoke management includes ceiling reservoirs, smoke baffles and smoke wall barriers including any penetrations passing through them. | Annual visual inspection for deterioration and/or penetrations. |
| Smoke Management Systems – Active (refer 4.11) | Mechanical smoke management includes smoke exhaust fans, fire mode operation, damper mode operation and control systems. | Levels 1, 2, 3 and 4 maintenance schedules as specified in AS 1851 - 2012.<br>Hot smoke tests as appropriate. |
| Exit Doors & Paths of Travel (refer 4.9) | Designated exit doors shall comply with the BCA for door swing and hardware. Doors secured shall release on fire as appropriate and include break glass release devices adjacent.<br>Designated paths of travel shall be kept clear of obstructions. | Annual checks of exit doors and hardware, automatic operation and break glass release. |

| Fire Safety System | General Description & Performance | Maintenance Requirements |
|---|---|---|
| Fire Resistance Levels (refer 4.12) | Fire resistant levels are provided to structural members, and fire resistant barriers are provided to designated areas such as plant rooms, back-of-house and administration areas. | Annual visual inspection for deterioration or penetration of fire barriers and installed fire resistance protection. |
| Lining Materials (refer 4.12) | Construction lining materials to be assessed as part of project works.<br>No requirement for existing materials. | No maintenance following installation and certification as part of project works.<br>Documents to be retained for audit purposes. |
| Occupant Fire Suppression Equipment (refer 4.13) | Portable fire extinguishers and fire hose reels as per emergency response needs and ARFF acceptance. | Maintenance of portable fire extinguishers and fire hose reels in accordance with AS 1851 - 2012 including auditing of tenants. |
| Fire Brigade Intervention (refer 4.14) | Fire hydrant system comprising feed hydrants at Apron, and attack hydrants within the terminal buildings.<br>Fire brigade vehicular access provisions, access points and Fire Control Rooms as determined in consultation with the ARFF.<br>FIP, alarm notification, graphics systems and tactical fire plans. | Maintenance incorporating 6 monthly & annual tests & checks in accordance with AS1851-2012.<br>Annual inspection of access provisions and fire control room to confirm any changes have been approved by ARFF. |

# SECTION 5. IMPLEMENTATION AND DOCUMENT KEEPING

## 5.1 INTRODUCTION

The implementation of fire safety provisions and upkeep of documents is essential within the strategy. Each project has critical timeframes and delivery imperatives however it is incumbent on the fire safety engineer to follow the fire safety design solution from inception to completion, and to make sure the fire safety provisions have been correctly implemented within the project. This is not to suggest that the fire safety engineer is responsible or liable for the compliance of individual systems, however a duty of care exists to confirm that the fire safety provisions installed are sound and operational as assumed within the design solution.

## 5.2 IMPLEMENTATION RESPONSIBILITIES

In addition to the design responsibilities of the FSE, Table 5.1 provides guidance and identifies APAM expectations for the project in relation to the implementation of each of the fire safety systems, noting this will apply to all building Categories 1 – 4 as relevant to the fire safety system and building design. The fire safety engineer should confirm that these tasks are accounted for in the project delivery phases.

**Table 5.1 – Implementation of Fire Safety Systems**

| Fire Safety System | Implementation Expectations |
|---|---|
| Fire Prevention (Section 4.2) | FSE to confirm:<br>• Relevant APAM fire safety policies and procedures implemented during the construction phase<br>• Any limitations or assumptions of the fire engineering report are correct and implemented |
| Fire Emergency Response (Section 4.3) | FSE to confirm:<br>• Blue strobes and WIP's installed & operational<br>• Evacuation diagrams are updated<br>• Tactical fire plans are updated, contain all required information and are accepted by ARFF |
| Evacuation Diagrams | FSE to confirm:<br>• Evacuation diagrams are prepared and / or updated with latest architectural background, contain all required information and are accepted by APAM<br>• Evacuation diagrams are installed |
| Smoke Detection System (Sections 4.4 & 4.5) | FSE to confirm:<br>• Witness and substantiate key commissioning results including interfaces<br>• All areas are protected by smoke detectors (unless alternatives form part of the design solution)<br>• Detection devices operate correctly at CIE (audit check) including double knock configuration<br>• Detection zones correct<br>• Interfaces are correct and operational<br>• ASE connection is confirmed<br>• Graphics system drawings are updated<br>• Detection information is updated in the Fire Safety Manual |

| Fire Safety System | Implementation Expectations |
|---|---|
| Automatic Fire Sprinkler System<br>(Sections 4.6) | FSE to confirm:<br>• Witness and substantiate key commissioning results<br>• All areas are sprinkler protected (unless alternatives form part of the design solution)<br>• Fast response sprinklers are used where specified (audit check)<br>• Sprinkler control valves and subsidiary valves are operational, monitored and conform to design requirements<br>• End of line test installed<br>• Alarm connection is confirmed<br>• Sprinkler Block Plan(s) are updated<br>• Sprinkler information is updated in the Fire Safety Manual |
| Sound & Intercom System for Emergency Purposes<br>(Section 4.8) | FSE to confirm:<br>• Witness and substantiate key commissioning results<br>• Emergency warning corresponds to the evacuation zone<br>• Alert and evacuation tones operate correctly in automatic & manual mode<br>• Emergency warning satisfies double knock configuration<br>• Hearing loops & strobes are provided & operate correctly<br>• Emergency warning information is updated in the Fire Safety Manual |
| Emergency Lights & Illuminated exit Signs<br>(Section 4.10) | FSE to confirm:<br>• All required areas contain emergency lights<br>• All required areas contain exit signs with oversize fittings in public areas |
| Smoke Management Systems – Passive<br>(Section 4.11) | FES to confirm:<br>• Ceiling geometry / reservoirs and smoke baffles satisfy design requirements<br>• Smoke walls achieve compliance including penetrations<br>• Smoke zones are updated in the Fire Safety Manual |
| Smoke Management Systems – Active<br>(Section 4.11) | FSE to confirm:<br>• Witness and substantiate key commissioning results including interfaces<br>• Smoke exhaust fan(s) meet design criteria at the intake<br>• Mechanical fire mode operates correctly including dampers, adjacent zones, fail safe position, etc.<br>• FFCP operates to override fan functions<br>• Fire matrix is updated in the Fire Safety Manual |

| Fire Safety System | Implementation Expectations |
|---|---|
| Exit Doors & Paths of Travel<br>(Section 4.9) | FSE to confirm:<br>• Designated exit doors are operational<br>• Normally locked exit doors release on fire (as designed) and include break glass release (all doors)<br>• Door swing and hardware is acceptable<br>• Designated paths of travel are clear of obstructions<br>• Illuminated exit signs are installed above each exit door<br>• Egress paths and exits are identified in the Fire Safety Manual |
| Fire Resistance Levels<br>(Section 4.12) | FSE to confirm:<br>• Fire resistant levels are provided to nominated structural members to required specifications<br>• Fire resistant barriers are provided to designated areas to required specifications, including doors, etc.<br>• FRL is identified in the Fire Safety Manual |
| Lining Materials<br>(Section 4.12) | FSE to confirm:<br>• Façade material is non-combustible or to specification<br>• Internal lining materials are to specification<br>• Lining material information is updated in the Fire Safety Manual |
| Occupant Fire Suppression Equipment<br>(Section 4.13) | FSE to confirm:<br>• Portable fire extinguishers and fire hose reels are positioned as per designated locations<br>• Signage complies with specification |
| Fire Brigade Intervention<br>(Section 4.14) | FSE to confirm:<br>• Fire hydrants, boosters, etc. are positioned as per designated location<br>• Signage complies with specification<br>• Fire brigade vehicular access provisions and parking spaces confirmed<br>• Fire Control Rooms equipment, content and layout confirmed<br>• Tactical fire plans are updated<br>• ARFF confirm acceptance of all systems |

## 5.3 Document Preparation

The FSE is responsible to ensure Evacuation diagrams and Tactical Fire Plans are updated for the project and as a minimum, must review and confirm acceptance of the documents.

The process for preparation of documents is outlined within the relevant Fire Safety Guideline.

# SECTION 6. FIRE SAFETY ENGINEERING – CONCEPTUAL DESIGN GUIDANCE

## 6.1 INTRODUCTION

This section provides guidance for the issues to be considered within a fire safety engineering design solution which is considered from 1st principles, or where future opportunities exist due to the nature of the project (fire upgrade specific) or for large capital works projects are available or to be investigated within a project.

## 6.2 FIRE PREVENTION

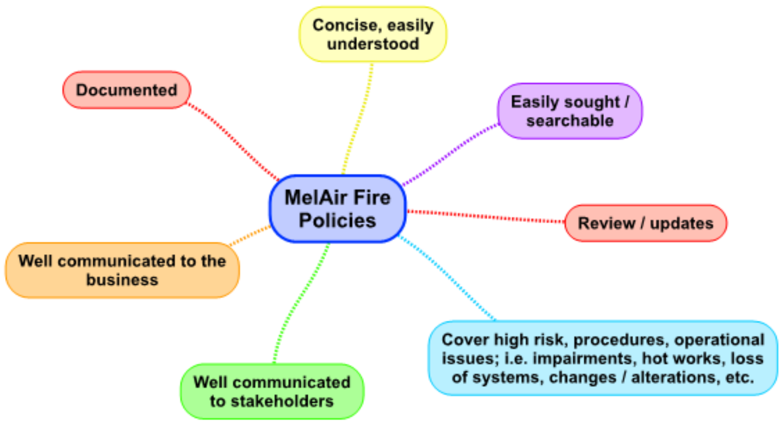


**Figure 6.1: Fire Policies Concept Design Features**

## 6.3 EMERGENCY RESPONSE

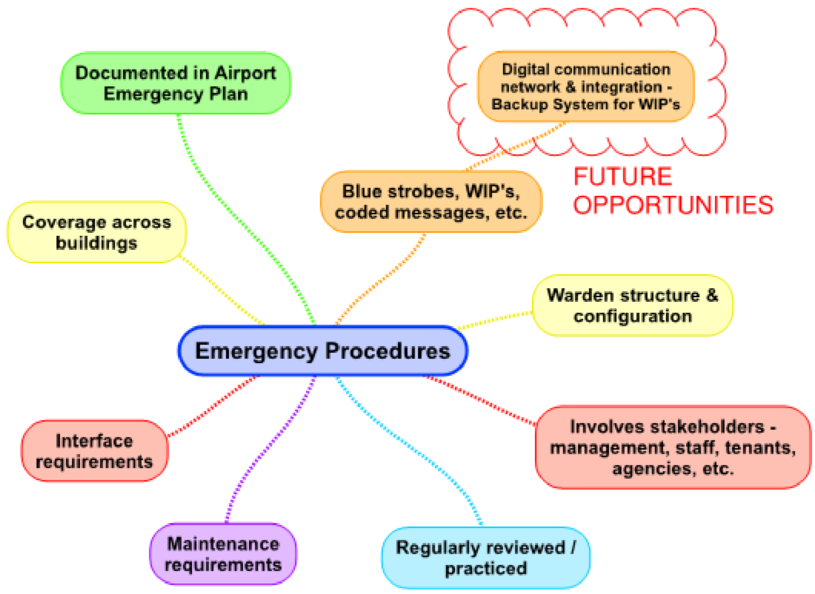


**Figure 6.2: Emergency Procedures Concept Design Features**

The future opportunities cloud identifies the possibility for advanced communication design as back-up for WIP's, and will be considered through the APAM fire safety committee for future projects.

## 6.4 SMOKE DETECTION SYSTEM

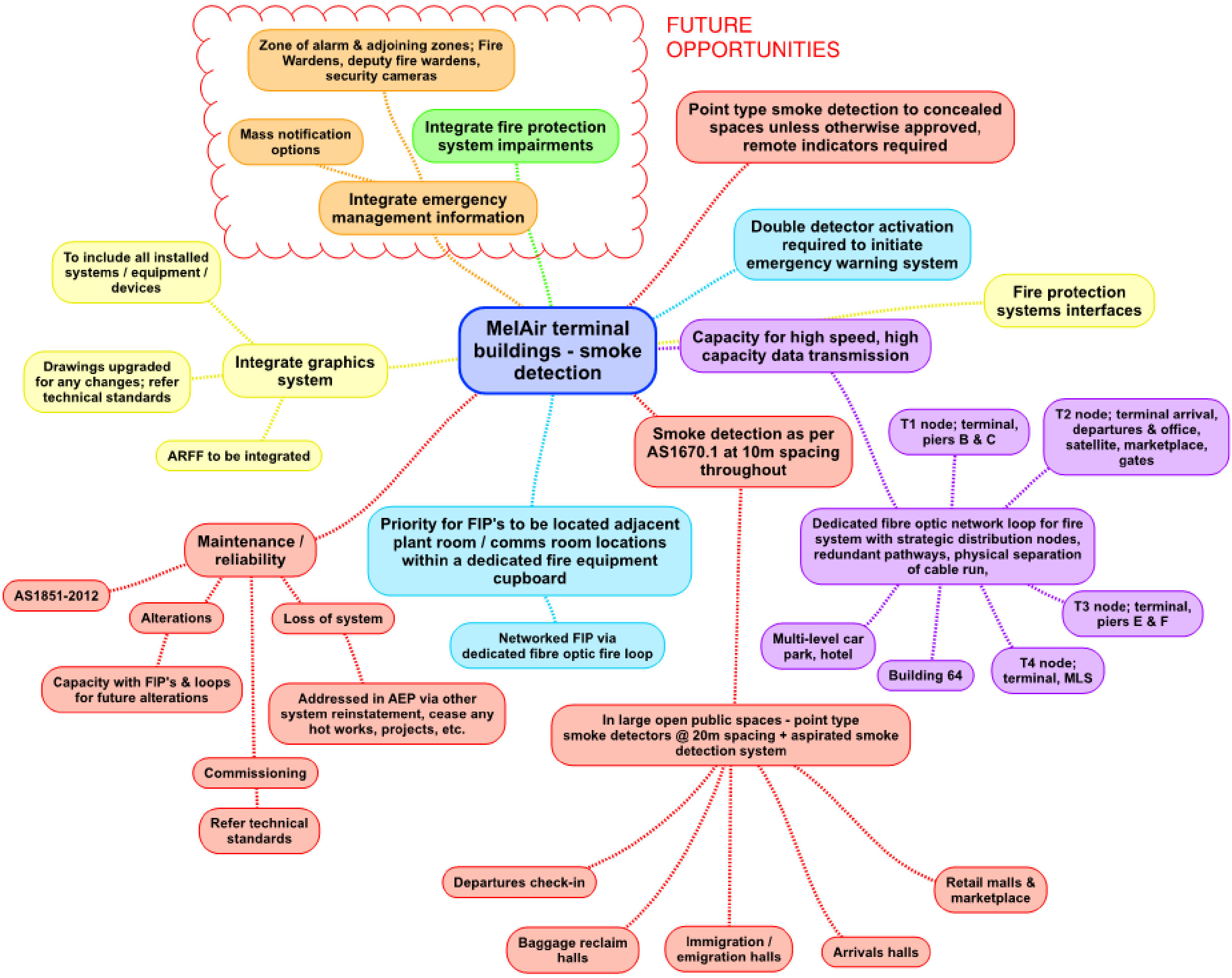


**Figure 6.3: Smoke Detection System Concept Design Features**

## 6.5 AUTOMATIC FIRE SPRINKLER SYSTEM


**Figure 6.4: Fire Sprinkler System Concept Design Features**

## 6.6 Emergency Warning System

The emergency warning system is designed to enable information to be conveyed in a timely manner for occupant evacuation and emergency management. The emergency warning system shall comply with AS 1670.4 and APAM Technical Standards and is an integrated terminal public address and sound system, and is managed by the APAM Fire & Life Safety Manager. Features of the emergency warning system which relate to concept design are outlined in Figure 6.5 and include criteria for design, configuration, integration, implementation and maintenance. Additional performance measures include:

- Hearing augmentation loops and audible / visual alarms for vision and hearing impaired warning in public areas
- Strobe systems for high ambient noise areas such as baggage handling and apron areas
- Coded message and blue strobe light system for emergency response


**Figure 6.5: Emergency Warning System Concept Design Features**

## 6.7 Egress Strategy and Exit Provisions

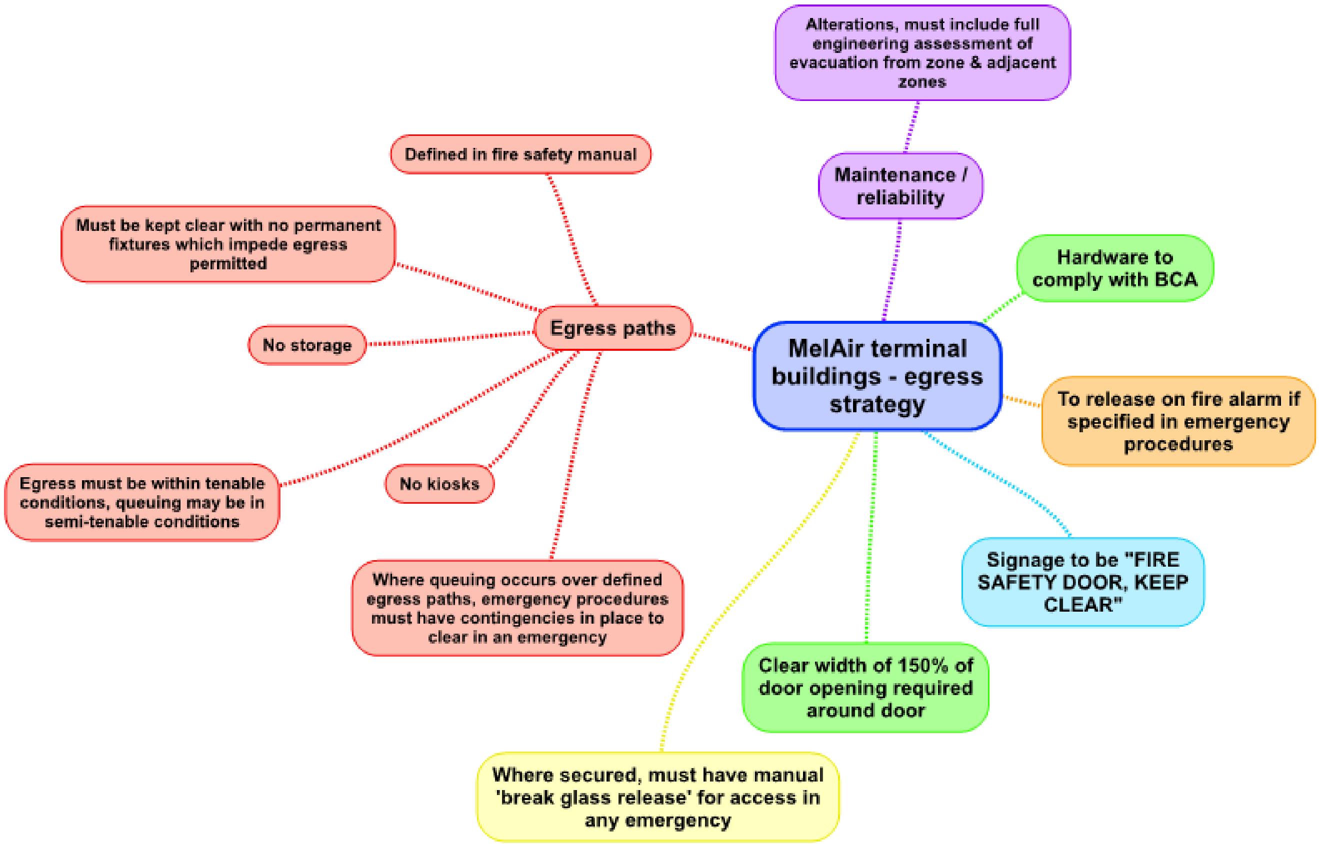


**Figure 6.6: Egress Concept Design Features**

## 6.8 Emergency Lighting and Exit Signs

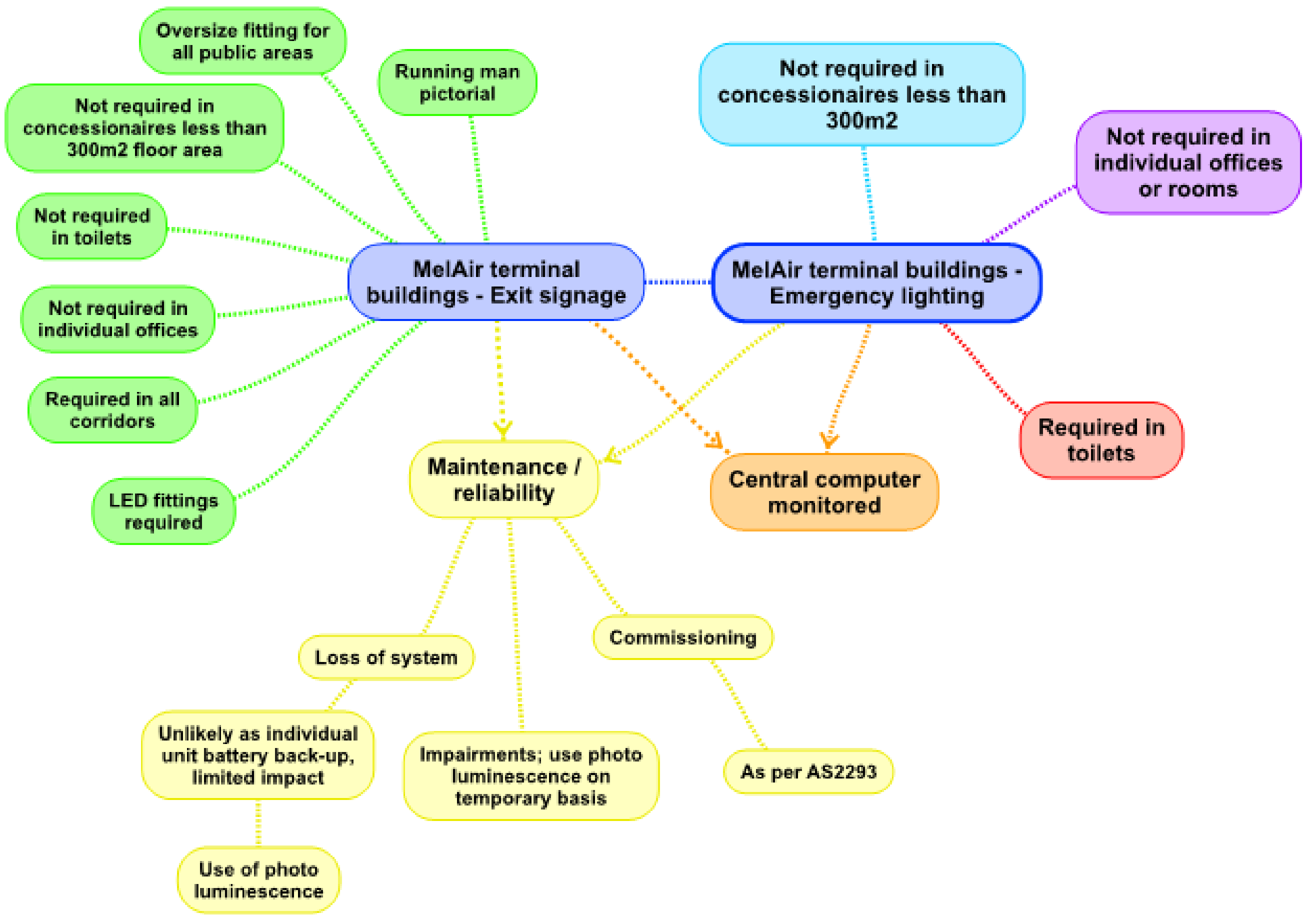


**Figure 6.7: Emergency Lighting and Exit Sign Concept Design Features**

## 6.9 SMOKE MANAGEMENT


**Figure 6.8: Smoke Management Concept Design Features**

## 6.10 Structural Protection and Materials Limitations

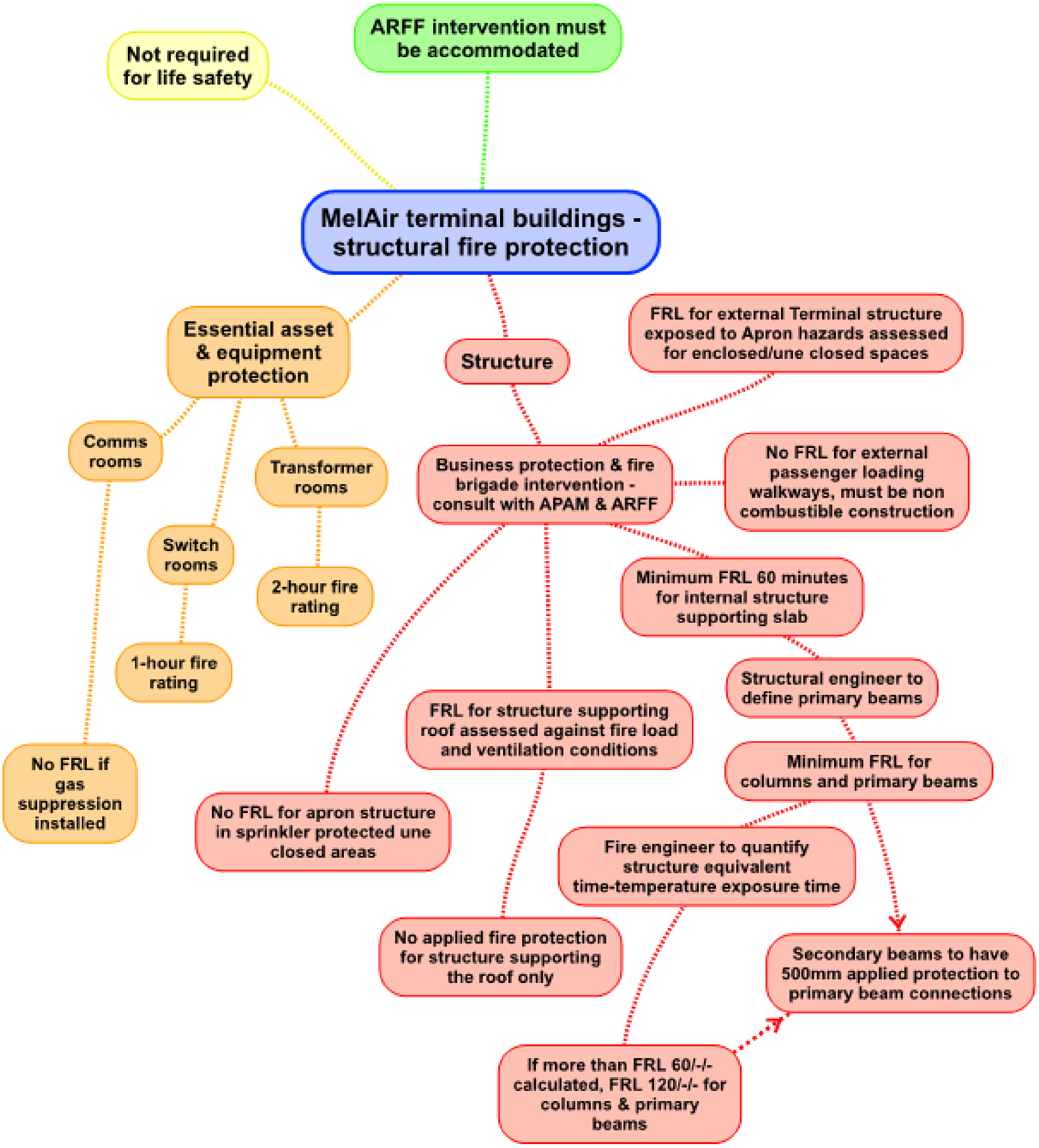


**Figure 6.9: Structural Protection Concept Design Features**

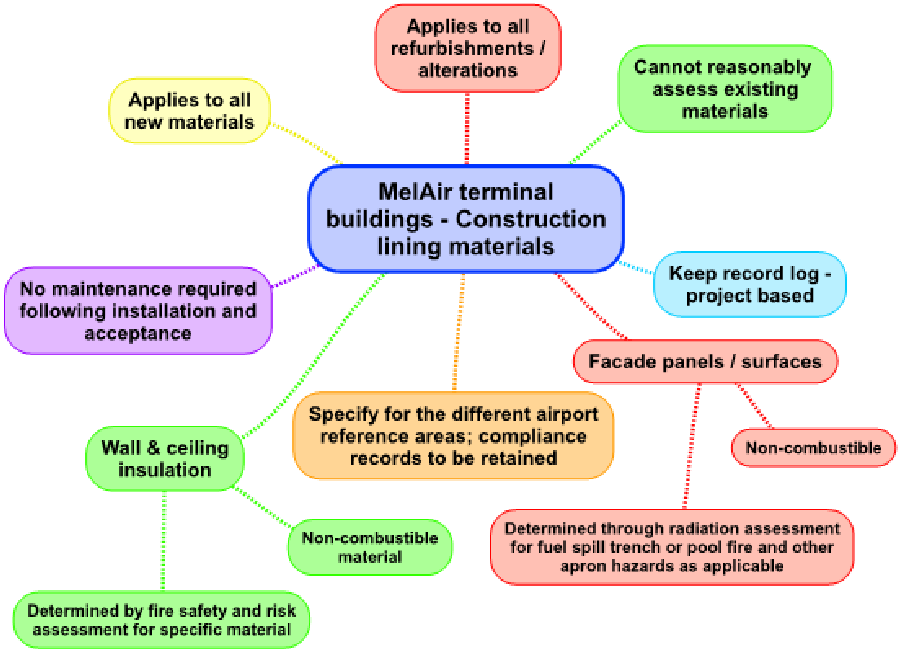


**Figure 6.10: Construction Materials Concept Design Features**

## 6.11 Manual Fire Suppression Systems

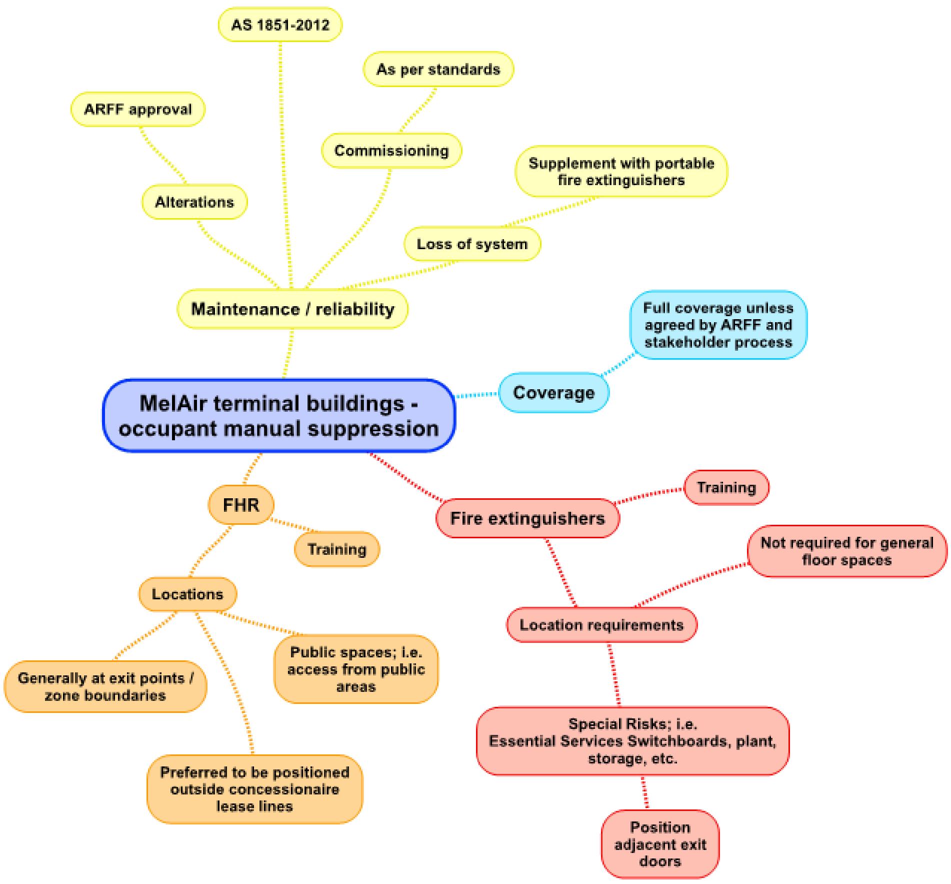


**Figure 6.11: Occupant Suppression Concept Design Features**

## 6.12 Fire Brigade Intervention

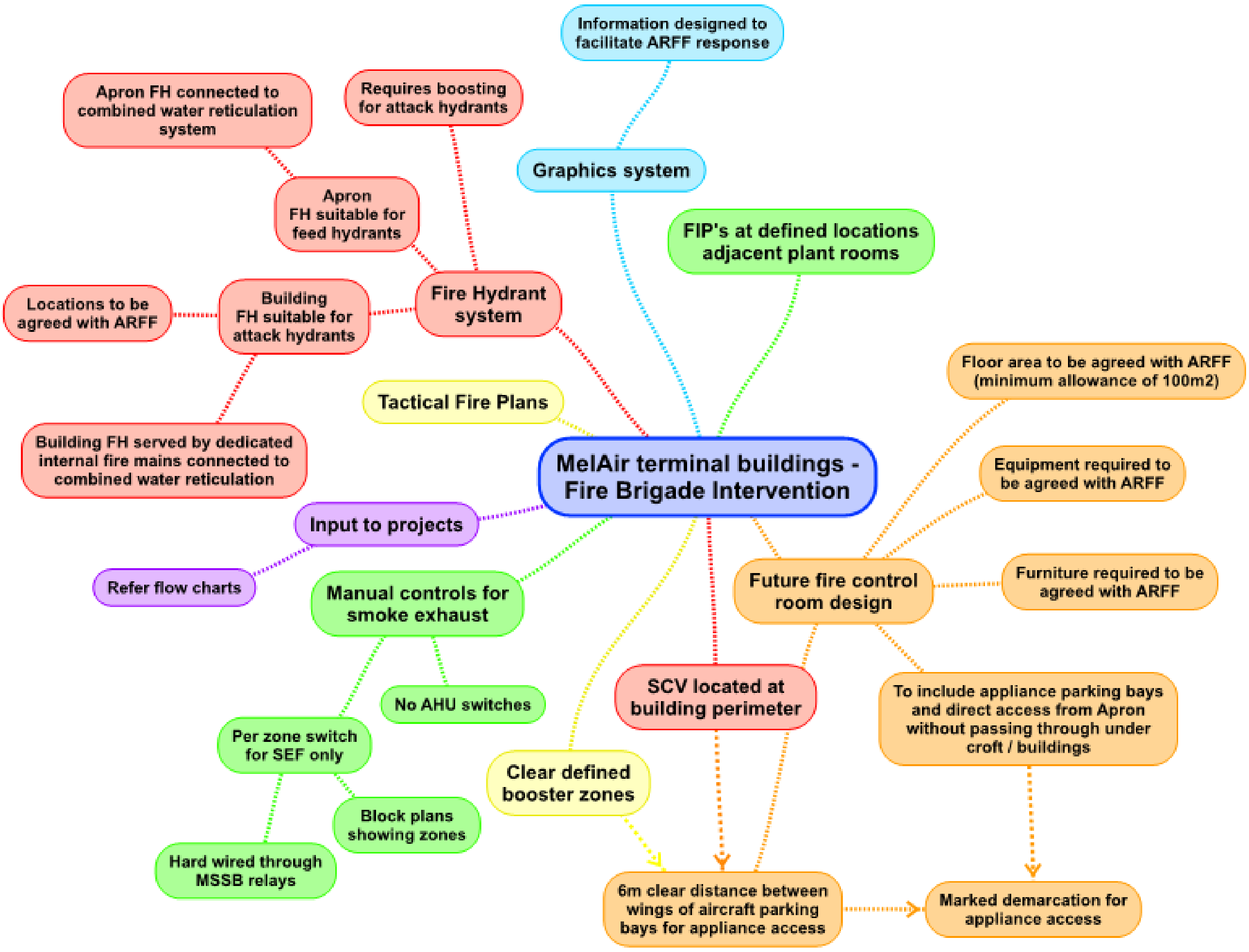


**Figure 6.12: Fire Brigade Intervention Concept Design Features**

# Annexure A Definitions

| Item | Definition |
|---|---|
| ABC | Airport Building Controller |
| ACC | Airport Coordination Centre |
| AEP | Airport Emergency Plan |
| AHU | Air Handling Unit |
| ARFF | Aviation Rescue & Fire Fighting |
| AS/NZS | Australian Standard/New Zealand Standard |
| BCA | Building Code of Australia (current Edition) |
| BGA / BGR | Break Glass Alarm / Break Glass Release |
| CIE | Control & Indicating Equipment |
| DtS | Deemed-to-Satisfy Provisions (of the Building Code of Australia) |
| EAP | Emergency Assembly Point |
| ECO | Emergency Control Organisation |
| EWIS | Emergency Warning & Intercommunication System |
| FEB | Fire Engineering Brief |
| FER | Fire Engineering Report |
| FFCP | Fire Fan Control Panel |
| FIP | Fire Indicator Panel |
| FRL - / - / - | Fire Resistance Level (expressed in minutes for the grading of structural adequacy / integrity / insulation) |
| FSS | Fire Safety Strategy |
| IFEG | International Fire Engineering Guidelines |
| MECP | Master Evacuation Control Panel |
| MAPP | Melbourne Airport Planning Phases |
| MFB | Metropolitan Fire Brigade |
| MSSB | Mechanical Services Switch Board |
| NFPA | National Fire Protection Association |
| SECP | Secondary Evacuation Control Panel |
| SFS | Engineers Australia Society of Fire Safety |
| SSISEP | Sound System and Intercom System for Emergency Purposes |
| TEP | Terminal Evacuation Plan |
| TEPC | Terminal Emergency Planning Committee |
| WIP | Warden Intercom Point |

# Annexure B APAM Fire Safety Policy

## Melbourne Airport Fire Safety Policy

### 1 Scope

This policy and supporting management programs apply across all of Melbourne Airport which is divided into three discrete precincts. These are the Terminal, Landside and Airside precincts.

### 2 Policy

It is the Corporate Policy of Australia Pacific Airports (Melbourne) Pty Ltd, to implement and maintain an effective and efficient Fire Safety Strategy that aims to prevent harm to people or damage to property arising from fire at Melbourne Airport.

This policy is intended to deliver an acceptable level of fire safety risk to individual buildings and facilities through appropriate policies, procedures, design and installation standards and ongoing maintenance.

It is accepted that different buildings and facilities within Melbourne Airport will have different levels of fire safety based on risk to life, asset criticality and business continuity. Therefore we are going beyond Legislation in appropriate cases as the only basis to adequately address areas of the fire risk within existing buildings.

A precautionary and preventative management approach is employed to minimise fire hazards. These are detailed in supporting safety policies, procedures, training, security measures, or other corporate policies combined to reduce the level of inherent fire risk at Melbourne Airport. These elements link and form the Melbourne Airport Fire Safety Strategy, managed by the Melbourne Airport Fire Safety Committee reporting to the Executive Safety Steering Group meeting also informing the APAC Board. THe policy will be reviewed annually.

### 3 Objectives

The five main objectives of the Melbourne Airport Fire Safety Management Policy are to ensure:

- A comprehensive fire risk management strategy and process is implemented to protect people and property
- Fire safety problems are quickly and effectively contained and resolved
- Legal obligations in relation to fire safety and legislation are complied with
- Appropriate training and information is provided and
- Processes are in place for the continuous improvement of fire safety performance.

### 4 Fire Safety Strategy

4.1 Terminals:

The Melbourne Airport Terminal precinct represents the most critical and complex fire risk, a fire safety master strategy has been derived for Terminals 2, 3 and 4 based on fire safety and risk engineering principles. The operational guide is documented in the Melbourne Airport Fire Safety Manual.

Terminal 1 is operated by QANTAS and, as lessee, they manage the fire safety risk as part of that lease agreement. The lessees performance within the facility is monitored to ensure an acceptable level of safety is achieved. Terminal 4 is an isolated building and is managed in line with other Landside buildings for the purposes of fire safety.

4.2 Landside buildings:

The fire safety strategy for all other buildings on the landside precinct is determined by the following or combination thereof as applicable:

1. The Occupancy Permit and any other documents relevant at the time of construction or other statutory requirements relating to occupation of the building;
2. Compliance with Legislation particularly the Building Code of Australia and Australian Standards;
3. Any supplementary issues identified or required by the Airport Building Controller;
4. Additional fire safety and risk engineering to quantify the fire risk or as justified for life safety, asset or business protection reasons
5. Building inspection and monitoring programs
6. Incident reporting, investigation and response procedures
7. Planning and building permit processes.

# Melbourne Airport Fire Safety Policy

4.3 Airside:

The airside precinct fire risks are managed by provision within the Airport Manual and directly supported by the Air Services Aviation Rescue and Fire Fighting service.

## 5 Resources

The following resources are critical elements of the overall strategy:

- Melbourne Airport Fire Safety Committee
- Melbourne Airport Fire Safety Engineer
- Melbourne Airport Fire and Life Safety Coordinator
- Expert fire safety consultancies
- Air Services Australia – Aviation Rescue and Fire Fighting
- Metropolitan Fire Brigade
- Country Fire Authority
- Federal Airport Building Controller
- Melbourne Airport Fire Strategy
- Airport Emergency Plan(s)
- Permit to Work Procedures
- Capital Works Procedures
- Business Continuity Plans and
- Insurances program.

## 6 Performance Measurement

Key performance measures developed by the Fire Safety Committee and monitored by the APAC Board to measure and track performance monthly currently include the number of:

- False Fire alarms
- Actual fire events and
- Fire incidents by type
- Fire incidents by location
- Site inspection compliance program and
- Incident response times.

## 7 Legislative compliance

Melbourne Airport Legislative compliance is supported by the following elements:

- Auditing, inspection and testing regimes
- Participation in the insurers fire safety program
- Legal Services and specialist consultancy advice
- Essential Services maintenance program
- Consultation and compliance with the Federal Airport Building Controller
- Permit to work programs.

## 8 Auditing

The fire strategy is tested for compliance and performance via the following processes:

- Essential Services maintenance and audit program
- Property and Lease Inspection Program
- Retail tenancy inspection program
- Fire Safety performance monitoring
- Clerk of works compliance monitoring
- Fault and incident reporting
- System testing & preventative maintenance testing
- Independent Safety Management System Certification (SafetyMAP) & internal audit program
- Annual review of the property insurances program.

## 9 Reporting

The Chair or nominated proxy of the Fire Safety Committee will inform and escalate issues to the Safety Steering Group of the following items:

- Fire safety performance
- Strategy compliance status
- Auditing results
- guidance on policy.

Approved: Chris Woodruff, CEO - November 2010.

# Annexure C Statements of Compliance

# *Melbourne Airport Precinct*

***FORM A1.0***

# FIRE SAFETY ENGINEER COMPLIANCE STATEMENT - DESIGN

**From**

Individual name (Fire Safety Engineer): Building Practitioner No:

Organisation name:

Postal address: Postcode:

**Project details**

Title:

CP Reference:

Building ID & Brief Project Description:

**Report Reference (submitted for Building Approval):**

Report No: Revision No: Date:

Prepared by: Building Practitioner No:

**Compliance**

(a) I am a registered building practitioner as defined in the Building Act 1993 in the Category of Engineer, Class of Fire Safety Engineer and have the appropriate qualifications and experience.

(b) I have the appropriate expertise and experience to undertake fire safety and risk engineering design against the requirements of the Melbourne Airport Fire Safety Strategy and BCA.

(c) The fire safety provisions have been assessed in accordance with the Melbourne Airport Fire Safety Strategy and BCA.

(d) The fire safety design has included appropriate stakeholder consultation, has been agreed with APAM, ABC and ARFF, and satisfies the methodology and approach described within IFEG and SFS practice notes / guidelines.

(e) I confirm that upon implementation of the fire safety provisions described within the Fire Engineering Report, the design of the building:

   i. Complies with the Melbourne Airport Fire Safety Strategy; and

   ii. Complies with the performance requirements of the BCA; and;

**Signature**

Registration No: EF

Signature: Date:

# *Melbourne Airport Precinct*

***FORM B1.0***

# FIRE SAFETY ENGINEER COMPLIANCE STATEMENT - WORKS

**From**

Individual name (Fire Safety Engineer): Building Practitioner No:

Organisation name:

Postal address: Postcode:

**Project details**

(Attach Fire Safety Engineer Compliance Statement – Design)

(Attach revised FER if amended during construction)

**Document Reference**

Attach Post Construction Inspection Report which substantiates this Statement, for example:

List of documents reviewed in preparation of this Statement

Site or progress inspections undertaken and used in preparation of this Statement

Commissioning and/or system tests witnessed and used in preparation of this Statement

**Compliance**

(a) I am a registered building practitioner as defined in the Building Act 1993 in the Category of Engineer, Class of Fire Safety Engineer and have the appropriate qualifications and experience.

(b) I have the appropriate expertise and experience to undertake site review of the installed systems for compliance against the fire safety and risk engineering design requirements.

(c) The fire safety provisions have been installed in accordance with the approved fire engineering report.

(d) The site review of fire safety provisions has included relevant stakeholders as appropriate to the fire safety provisions.

(e) I confirm that fire safety provisions described within the fire engineering report have been installed within the building and the fire safety systems achieve compliance with:

   i. The fire engineering report; and

   ii. The Melbourne Airport Fire Safety Strategy; and

   iii. The performance requirements of the BCA;

**Signature**

Registration No: EF

Signature: Date:

MELBOURNE AIRPORT

# *Melbourne Airport Precinct*

***FORM A2.0***

# BUILDING CERTIFIER COMPLIANCE STATEMENT

**From**

Individual name (Private Building Surveyor): Building Practitioner No:

Organisation name:

Postal address: Postcode:

**Project details**

Title:

CP Reference:

Building ID & Brief Project Description:

**BCA Regulatory Report Reference:**

Report No: Revision No: Date:

Prepared by: Building Practitioner No:

**Fire Engineering Report Reference:**

Report No: Revision No: Date:

Prepared by: Building Practitioner No:

**Compliance:**

(a) I am a registered building practitioner as defined in the Building Act 1993, in the Category of building surveyor (unlimited) and appointed as private building certifier to the project which the design applies.

(b) I have the appropriate qualifications, expertise and experience to certify compliance with the BCA for this project.

(c) The fire safety provisions have been independently checked through review of the Fire Engineering Report for compliance with the BCA performance requirements.

(d) I certify that the design of the project complies with the performance requirements of the BCA.

**Signature**

Registration No: BSU

Signature: Date:

# *Melbourne Airport Precinct*

***FORM B2.0***

# BUILDING CERTIFIER COMPLIANCE STATEMENT - WORKS

**From**

Individual name (Private Building Surveyor): Building Practitioner No:

Organisation name:

Postal address: Postcode:

**Project details**

(Attach Building Certifier Compliance Statement)

(Attach revised reports if amended during construction)

**Document Reference:**

List any documents prepared or reviewed in preparation of this Statement:

Document Reference: Date:

Document Reference: Date:

Document Reference: Date:

Document Reference: Date:

Document Reference: Date:

**Site Checks Undertaken:**

List any issues inspected on site which relate to this Statement

**Compliance**

(a) I am a registered building practitioner as defined in the Building Act 1993, in the Category of building surveyor (unlimited) and appointed as private certifier to this project.

(b) I have the appropriate qualifications, expertise and experience to certify compliance with the BCA for this project.

(c) The site review of fire safety provisions has confirmed the fire safety provisions have been installed in accordance with the BCA as identified in the approved fire engineering report.

(d) I certify that fire safety provisions for the project have been correctly installed within the building and achieve compliance with the performance requirements of the BCA as identified in the approved fire engineering report.

**Signature**

Registration No: BSU

Signature: Date:

MELBOURNE AIRPORT

# Annexure D Fire Safety Engineer Project Checklist

The responsibility of the fire safety engineer includes facilitating the fire safety strategy through the project delivery phases. The following checklist can be used a guide to ensure that each task has been addressed through the project. This list does not infer the fire safety engineer must complete each task, but to ensure the relevant tasks are part of the project deliverables.

| Task | Action |
|---|---|
| APAM fire safety policies and procedures are implemented during the construction phase | |
| Any limitations and assumptions of the fire engineering report are correct and implemented on site | |
| Blue strobes and WIP locations are accepted for emergency response | |
| Evacuation diagrams are updated with latest architectural background, contain all required information and are accepted by APAM | |
| Tactical fire plans are updated, contain all required information and are accepted by ARFF | |
| ***Detection System*** | |
| All areas are protected by smoke detectors (unless alternatives form part of the design solution) | |
| Detection devices operate correctly at CIE (audit check) including double knock configuration | |
| Detection zones correct | |
| Detection system interfaces are correct and operational | |
| ASE connection is confirmed | |
| Graphics system drawings are updated | |
| Witness and substantiate key commissioning results | |
| Commissioning results including interfaces are checked | |
| ***Sprinkler System*** | |
| All areas are sprinkler protected (unless alternatives form part of the design solution) | |
| Fast response sprinklers are used where specified (audit check) | |
| Sprinkler control valves and subsidiary valves are operational, monitored and conform to design requirements | |
| End of line test installed | |
| Alarm connection is confirmed | |
| Sprinkler Block Plan(s) are updated | |
| Sprinkler information is updated in the Fire Safety Manual | |
| Witness and substantiate key commissioning results | |
| ***Emergency Warning System*** | |
| Emergency warning corresponds to the evacuation zone | |

| Task | Action |
|---|---|
| Alert and evacuation tones operate correctly in automatic & manual mode | |
| Emergency warning satisfies double knock configuration | |
| Hearing loops & strobes are provided & operate correctly | |
| Emergency warning information is updated in the Fire Safety Manual | |
| ***Smoke Exhaust System*** | |
| Ceiling geometry / reservoirs and smoke baffles satisfy design requirements | |
| Smoke walls achieve compliance including penetrations | |
| Smoke zones are updated in the Fire Safety Manual | |
| Witness and substantiate key commissioning results including interfaces | |
| Smoke exhaust fan(s) meet design criteria at the intake | |
| Mechanical fire mode operates correctly including dampers, adjacent zones, fail safe position, etc. | |
| FFCP operates to override fan functions | |
| Fire matrix is updated in the Fire Safety Manual | |
| ***Egress System*** | |
| Designated exit doors are operational | |
| Normally locked exit doors release on fire (as designed) and include break glass release (all doors) | |
| Door swing and hardware is acceptable | |
| Designated paths of travel are clear of obstructions | |
| All required areas contain emergency lights | |
| All required areas and exit doors contain illuminated exit signs with oversize fittings in public areas | |
| Egress paths and exits are identified in the Fire Safety Manual | |
| ***Materials of Construction*** | |
| Fire resistant levels are provided to nominated structural members to required specifications | |
| Fire resistant barriers are provided to designated areas to required specifications, including doors, etc. | |
| FRL is identified in the Fire Safety Manual | |
| Façade material is non-combustible or to specification | |
| Internal lining materials are to specification | |
| Lining material information is updated in the Fire Safety Manual | |
| ***Fire Fighting Equipment*** | |
| Portable fire extinguishers and fire hose reels are positioned as per designated locations | |
| Signage complies with specification | |

| Task | Action |
|---|---|
| Fire hydrants, boosters, etc. are positioned as per designated location | |
| Signage complies with specification | |
| ***Fire Brigade Systems*** | |
| Fire brigade vehicular access provisions and parking spaces confirmed | |
| Fire Control Rooms equipment, content and layout confirmed | |
| Tactical fire plans are updated | |
| ARFF confirm acceptance of all systems | |