Supplementary Guide to the Referral of Performance Solutions for the Use of Combustible Cladding

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1 Introduction

Fires which spread via external wall components and/or attachments have demonstrated a capacity for potentially catastrophic outcomes. The National Construction Code (NCC) Deemed to Satisfy (DtS) solution for external walls of buildings of Type A and Type B construction is that they are required to be non-combustible.

2 Scope

These statements apply to all applications involving a performance solution to justify combustible components in an external wall assembly.

3 Objective

QFES does not stipulate fire engineering methodologies but we are primarily concerned with the design and constructed outcome of the building work, in the context of fire safety performance such that:

- QFES is informed of geometrical conditions (access) and performance aspects (working conditions) considering the challenges that may be presented by a combustible façade during fire brigade intervention.
- QFES may provide advice to the designers of the performance solution in relation to the above.

Section 5.5 of the Queensland Fire and Emergency Services (QFES) Guide to the Referral of Performance Solutions describes the QFES' understanding of the safety concern related to the use of combustible cladding and key operational considerations. Included in this is a **Position Statement** on the Use of Combustible Cladding which includes six (6) Key Requirements that need to be demonstrated in relation to the performance of the cladding rectification solution.

The QFES Position Statement Key Requirements are:

1. Involvement of the combustible cladding in fire does not compromise occupant life safety or prevent the safe evacuation of occupants from the building.
2. Involvement of the combustible cladding in fire does not compromise firefighter life safety or firefighting operations with respect to the notification, access, conditions and equipment required by the QFES.
3. The combustible cladding does not cause or contribute to vertical fire spread beyond the storey of fire origin.
4. The combustible cladding does not cause or contribute to horizontal fire spread beyond the fire compartment of fire origin, or fire spread beyond other fire separating elements of construction.
5. The combustible cladding does not contribute to fire spread between buildings on the same site or to adjoining properties.
6. The combustible cladding does not produce flaming or falling debris which may result in fire spread to storeys below the storey of fire origin and/or that presents a hazard for egressing building occupants, bystanders, or intervening firefighters.

QFES has provided this supplementary guidance to assist in producing submissions which contain sufficient information and analysis to inform QFES to assess the application in relation to Key Requirements.

4 Registration

Fire engineers are responsible for substantiating engineering assessment of combustible cladding performance. The fire engineering approach must be submitted by a fire engineer / fire safety engineer, as specified in the ***Professional Engineers Act 2002*** registered as a Registered Professional Engineer of Queensland (RPEQ) in fire safety and / or fire engineering.

RPEQ's are bound to the Board of Professional Engineers of Queensland (BPEQ) *Code of Practice for Registered Professional Engineers* by the *Professional Engineers Act 2002* (Qld), this Code of Practice requires that RPEQ's work within their area of competence and not misrepresent their competence.

5 Product Details

The components of an external wall assembly may include some or all (but not necessarily limited to) the following components:

- Cladding panels (or rain-shield)
- Insulation
- Cavity barriers and fire stopping
- Window detailing framing and lintel
- Vapour barriers and breather membranes
- Framework, bracketry and fixings
- Backing rod, seals
- Glazing (either as part of the cladding system or within a window adjacent to the cladding)
- Internal lining of the external wall
- Other external wall construction details
- Special Fire Services e.g. External Wall Wetting Sprinklers

In order for advice to be provided in relation to the performance solution, a characterisation of the external wall assembly is requested. QFES request a full knowledge of the external wall assembly of the building in relation to the **performance solution proposal,** supported by the following**:**

1. An Information Pack for each external wall assembly type which contains combustible content, defined by a unique configuration of components, which should include
   - The identification and description of all the components of the external wall assembly;
   - Cross-sectional dimensional drawings of the external wall assembly with each component clearly marked.
   - Product fitness for purposes statements as applicable (for example life span limits)
2. Elevation drawings identifying the specific location(s) of each wall assembly type which contains a combustible component.

Where there is a combustible component in the external wall assembly, the assessment of combustibility of the external wall system is the responsibility of the fire engineer, however the expectation is that the fire engineering analysis is supported by verified analysis of samples, and / or fire testing applicable to the external wall system in question.

The University of Queensland has produced a testing protocol based on fire engineering science principles to repeatedly and reliably measure material properties relevant to fire spread and falling/flaming debris hazards. The protocols are found in https://claddingmaterialslibrary.com/.

The Material Library of Cladding Materials is an extensive database of material properties for a wide range of materials and specific components of products used as cladding. The data provided in the Material Library are intended to be used by fire engineers and who have completed the "External Fire Spread Risk in Tall Building Design".

The process to develop the identification of the flammability from materials sampled from a building through cross referencing to a Material Library identified material and hence using the Material Library for analysis material is outlined in Part IV of the UQ Protocols.

6 QFES requested considerations.

QFES request information to assist in provision of its referral services. Table 1 provides a summary of these information requests, supported by referenced discussion points in this document.

Table 1: Consideration of Issues in Demonstration of Key Requirements in relation to credible fire events.

Requirement	**Information to Assist QFES**
1. Involvement of the combustible cladding in fire does not compromise occupant life safety or prevent the safe evacuation of occupants from the building.	Combustibility information as per Key Requirements 3 and 4 below. Safe evacuation of occupants from the building demonstrated by ASET/RSET calculation to support deterministic assessment that occupants can evacuate without being exposed to untenable smoke concentrations, toxic / irritant gas concentrations, gas temperature or heat fluxes caused by involvement of the external wall system in the fire. Notification and detection capabilities determined by the engineering assessment in the submission may become an item to be demonstrated at inspection. See Section 7 for consideration of sprinklers. See Section 8 for consideration of Horizontal and Staged evacuation.
2. Involvement of the combustible cladding in fire does not compromise firefighter life safety or firefighting operations with respect to the notification, access, conditions and equipment required by the QFES.	Combustibility information as per Key Requirements 3 and 4 below. Fire brigade intervention demonstrated with the sequenced of activities including; evaluation of arrival to the affected building, FIP review and deployment, travel to the incident location within the site, set up equipment and initiation of suppression. Demonstrated that involvement of the external wall system in fire does not restrict access to intervention equipment or impede detection/ notification. This is to be demonstrated utilising the AFAC Fire Brigade Intervention Model (FBIM), supported by consultation with QFES to estimate the realistic time to for brigade activities to fight the fire and engage in rescue activities following arrival at site. As for Key Requirement 1, Notification and detection capabilities determined by the engineering assessment in the submission may become an item to be demonstrated at inspection. See Section 7 for consideration of sprinklers.
3. The combustible cladding does not cause or contribute to vertical fire spread beyond the storey of fire origin.	For each specific configuration of an external wall system containing a combustible component, the key fire engineering information requirements that verify the combustibility parameters for each component. Furthermore the assessments should deliver, specific determinations for the proposed installed external wall system: • assessment of the ignition potential. • Determination of vertical fire spread Contribution. • Determination of fire spread and fire damage from fire scenarios

Requirement	Information to Assist QFES
	• Determinations of projected flames from openings and damage extent • Determinations of successful FBI activities for fire scenarios. See Section 7 for consideration of sprinklers.
4. The combustible cladding does not cause or contribute to horizontal fire spread beyond the fire compartment of fire origin, or fire spread beyond other fire separating elements of construction.	For each specific configuration of an external wall system containing a combustible component, the key fire engineering information requirements to support this assessment supported by identified combustibility parameters of each combustible component, and knowledge of the configuration of the external wall system are as follows for the proposed installed external wall system: • assessment of the ignition potential. • Determination of horizontal fire spread Contribution. • Determination of fire spread and fire damage from fire scenarios • Determinations of projected flames from openings and damage extent • Determinations of successful FBI activities for fire scenarios. See Section 7 for consideration of sprinklers.
5. The combustible cladding does not contribute to fire spread between buildings on the same site or to adjoining properties.	For each unique configuration of an external wall system containing a combustible component, its closest unimpeded distance to another building located on the same site, or to the boundary of a neighbouring property is required to be known. Considering heat flux received by a building which has external wall system containing combustible material, the acceptability criteria should be determined by the ignition potential of that external wall system; the NCC CV1 and CV2 verification criteria, designed for acceptability in relation to a DtS external wall construction may not be applicable. See Section 7 for consideration of sprinklers.
6. The combustible cladding does not produce flaming or falling debris which may result in fire spread to storeys below the storey of fire origin and/or that presents a hazard for egressing building occupants, bystanders, or intervening firefighters.	For each unique configuration of an external wall system containing a combustible component, the method of fixing the external wall system to the structure of the building is required to explained. For each unique configuration of an external wall system containing a combustible component, an understanding as to how this could impact areas below as a result of involvement in a fire; impacts could include propensity to melt, form burning liquid droplets, formation of burning pools of melted polymer, falling debris. If awnings are suggested to protect occupants from the effects of falling and burning debris, the following is requested: • confirm that awnings will withstand the largest reasonably foreseeable impact from falling debris. • the egress and response strategy supporting their use. See Section 8.2 for consideration of protection at Ground Level Exits.

7 Consideration of Sprinklers

7.1 Assessment of Sprinkler Failure

Historically, a proportion of fires involving the external wall system originate internally in areas protected by an automatic extinguishing system, most of which are sprinkler systems[1]. Thus, where buildings are sprinklered, in evaluating effects on building occupants, fire brigade personnel, and impact to adjacent buildings (Key Requirements 1, 2, 5 and 6), QFES request an assessment of the sensitivity of impacts from external wall fires to sprinkler failures in the locations of fire origin.

7.2 Efficacy of Sprinklers Associated with External Wall Fires.

Sprinkler systems designed in accordance with AS2118.1 are based on the hazard classes of occupancy. Occupancy classifications for a sprinkler design are determined having regard to the expected heat release within a building compartment together with the fuel loading and burning characteristics of materials within that compartment (ref. AS2118.1 Section 2.2).

In AS2118.1 Section 3.1.1 (a), it is stated that sprinkler protection shall extend to bounding walls or other barriers designed to resist the spread of fire into the sprinkler-protected area and constructed in accordance with NCC. Sprinkler protection within the building is not specifically designed to provide protection from fire breaking through an opening from the outside, which may occur as a result of fire involving the external wall systems.

Thus, when considering lateral fire spread back into the building, the assessment should consider the efficacy of sprinkler protection elsewhere in the building taking account of knowledge of the installed sprinkler system, and the design and protection to openings on the external wall through which fire could spread to the levels above the floor of fire origin.

8 Evacuation

8.1 Staged and Horizontal Evacuation.

If there is a building requiring a long time for evacuation, the evacuation strategy must work in the event of possible external fire spread.

Vertical evacuation (using a stairway) is the preferred method to exit a building. However, vertical evacuation for very tall buildings and for some occupants within health care facilities, aged care facilities or childcare facilities is time consuming. Where this is the case, staged and/or horizontal evacuation is required. It is designed to enable occupants to move or be assisted in movement away from the area of danger to a place of safety in the building until vertical evacuation is available.

Fire spread via an external wall system has the potential to lead to fire spread to levels above the floor of fire origin prior to the designated FRL of the affected fire compartment on the level above. This may not only breach the designed vertical fire separation, but also if the fire affects two compartments above, (either side of a compartment wall abutting the perimeter of the building), the horizontal evacuation strategy in the level above may be threatened. Thus, where there is a risk of external fire spread via an external wall system, QFES seeks full details of the proposals; the demonstration of safety may include, but not be limited to, the following:

- a modified evacuation protocol endorsed by the Building Management, and an approved MIU describing how this is implemented considering fire safety systems, and staffing arrangement to manage the emergency.
- demonstration that the staffing requirements for horizontal egress are not impaired by the need to concurrently horizontally evacuate the levels above.
- where horizontal evacuation is part of the building fire safety strategy, and more than one compartment may be impaired by vertical fire spread, then there should be other compartments (smoke or fire) on that level sufficient to provide a place of safety.

[1] Fire Hazards of Exterior Wall Assemblies Containing Combustible Components, White and Delichatsios, ed Milke, Springer Briefs in Fire, Fire Protection Research Foundation, Springer 2015

- the FRL for the compartmentation (including the FRL for smoke compartment, if reliance is placed on these)
- the capability of the smoke zone pressurisation system to perform in relation to the number of compartments affect by fire for the duration of evacuation, taking account of the risk from external fire spread.
- modification to fire safety systems which may include changes to EWIS logic or zone pressurisation to be endorsed as achievable by an engineer accredited to approve such systems. An “in principle” endorsement should be submitted with the FER.

8.2 Protection at Ground Level Exits

Conditions at an external building exit should not impacted by fire, smoke and falling debris effects from an external wall fire.

Where combustible cladding surrounds the exit opening or is in locations above a ground level exit, the installation of an awning above the exit is often suggested as a solution to protecting people from the effects of falling cladding debris.

The following should be considered when designing awnings:

- the largest force from falling debris, taking account of the cladding size components and height of the cladding above the awning.
- the number of people potentially exposed to falling debris in proximity to the exit.
- use of non-combustible construction.

The awning design should be supported by a description of the fire safety philosophy relating to its use.

For example, if exits are available only at one side of a building or if there is a fire isolated stair extending the height of a tall building leading to an exit, and there is a risk of falling debris at the exit location, awnings would need to be designed to protect all persons envisioned to use those exits.

Alternatively, if exits are distributed at a number of locations around the building, and the occupants have the opportunity within the building to re-route from one exit location to another, then an awning may be designed to protect a smaller number of people, for example a warden to undertake a pre-egress surveillance to confirm the absence of a risk of falling debris.

Thus the fire engineering solution should include a demonstration of the robustness of the awning to withstand impact of falling debris and a philosophy of its use describing how occupants are protected from falling debris at a particular exit, supported by agreed procedures included in a Management in Use (MIU) document.

Other solutions to enable egress to a safe exit may be considered such as fully fire rated and structural rated passageways or spaces leading to a safe external location.

9 Relevant Information for QFES from a Comparative Assessment

QFES acknowledge the certifier’s prerogative to determine a nominated Assessment Method in accordance with NCC Section A2.2 (2) which includes a comparative assessment methodology to demonstrate suitability of the proposed performance solution.

QFES does not consider a comparison between the capacity of a DtS design to contain fire spread and that of an external wall system containing combustible material to provide information relevant to QFES operational considerations.

QFES evaluation of the submission proposals will be based on the determinations and outcomes of the calculated fire performance of the proposed performance solution to impact on Fire Brigade Intervention capacity.

Thus, where a performance solution proposal intends to pursue a comparative assessment, QFES will provide advice on the assessed deterministic outcomes of fire performance outputs associated with combustible cladding relating to the subject building, and not a hypothetical DtS building.

10 Pre-existing Performance Solutions

If there are previously approved performance solutions in relation to the subject building, these are unlikely to have considered the impact of wall assemblies which contain combustible content. The Performance Based Design Brief shall identify all the previously approved performance solutions and confirm the proposed approach against which these will be reviewed in accordance with Section A2.2 (2) of the NCC. The methodology should include a review of the validity and completeness of the previously approved performance solutions in accordance with the specified approach.

11 Format of Submission

The expectation is that the submission for assessment takes the form of a Performance-Based Design Brief (PBDB), as described in NCC A2.2(4), and Schedule 7, Section 1.3, and considers the issues requested in the QFES position statements.

It should be noted that the PBDB must cover the fire safety strategy for the building. Reference to the Building Fire Safety Risk Assessment, or inclusion of this as an Appendix, in lieu of a full description of the fire safety strategy applicable to the performance solution to use combustible components in the external wall system, is not the preferred approach.