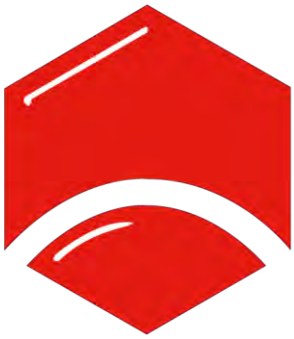

ENGINEERS
AUSTRALIA
Society of
Fire Safety

Practice Guide on the Fire Safety Verification Method

Version: PG002/001, dated 18.1.21

Prepared by

Society of Fire Safety

Engineers Australia

Introduction

The Engineers Australia Society of Fire Safety (SFS) has produced this practice guide (herein referred to as the "Guide") to assist professional fire safety engineers, project Certifiers (terminology varies state by state), design teams, approval authorities and stakeholders with the practical and appropriate use of the Fire Safety Verification Method (FSVM) as contained in Schedule 7 of the National Construction Code, Volume 1, Building Code of Australia 2019, Amendment 1 (NCC). This follows a detailed trial of the FSVM by a team of fire safety engineers from various companies on behalf of SFS. The trial is documented in 'SFS Fire Safety Verification Method Investigation', dated 9/12/2019.

Background

The FSVM is one of the optional verification methods contained within the NCC that can be used to test performance-based designs for fire safety; in this case strictly as a comparative assessment to the Deemed-to-Satisfy (DtS) provisions. The FSVM is understood to have been developed to help promote the appropriate use of performance-based design by competent fire safety practitioners.

Objective

The aim of this Guide is to share the experience and insight from the initial SFS trial of the FSVM across six case studies (as outlined in the SFS FSVM Investigation Report, 22 January 2020), in order to assist users in deciding on the appropriateness of use of the FSVM and in the transition period to industry familiarity with use of the FSVM.

As well as the FSVM described in the NCC, there is a supporting FSVM Handbook. This is not mandatory, however this Guide largely assumes that the Handbook is followed in using the FSVM, as the ABCB seminars educating users on the FSVM have promoted the use of the Handbook.

Competency

The FSVM is not a simple tool to apply and requires professional engineering judgement and expertise. The NCC requires that 'For the purposes of developing a Performance Solution, this Verification Method must only be used by fire safety engineers who are suitably qualified and experienced, and—

- have demonstrated competency in fire safety engineering; and
- are proficient in the use of fire engineering modelling methods; and
- are familiar with fire testing and validation of computational data.'

It is the expectation of the SFS that a suitably qualified and experienced fire safety engineer means a registered professional engineer in a relevant discipline who has appropriate experience and competence in fire safety engineering. Where an individual does not have qualifications that enable registration as a professional engineer in Australia, that they should have an equivalent level of education and appropriate experience and competence that would otherwise allow registration as a professional engineer.

Disclaimer

This document is published as a general guide only, not as engineering (or other professional) advice in respect of any design or building. Anyone using this guide should obtain and rely upon their own specific engineering and other professional advice.

Terminology: The language used within this guide is based upon the terminology used by the Australian fire safety industry and the NCC.

Key information to using the FSVM

The FSVM contained in the NCC is one of the optional methods used to demonstrate that a performance-based design for fire safety meets the Performance Requirements of the NCC. It does this through comparison to the DtS provisions for a similar reference building, with an equivalent, or in some cases higher, level of fire and life safety required than the DtS reference building. The FSVM is prescriptive in its methodology, but not in the data and analysis approaches. It adopts a comparative approach using a reference DtS compliant building to provide a benchmark for community expectations for fire safety.

The following key points are provided to assist in the use of the FSVM, and the decision as to whether or not the FSVM is the most appropriate approach for a project to test and demonstrate compliance. These recommendations have been developed from a team of fire safety engineers from various companies testing the FSVM with six different hypothetical case studies for SFS.

Is the FSVM suitable for the design case?

The FSVM is only one way of demonstrating performance in the NCC, and it is not mandatory. Performance Solutions developed from first principles including robust qualitative and quantitative approaches remain acceptable.

Fundamental to the FSVM is the comparison of a design to a similar DtS reference building. The reference building needs to be designed and analysed to the same extent as the subject building. The requirements for designing the reference building, as contained in the Handbook, are very strict; same location/proximity to boundary, height, floor area, number of occupants, use, etc. This means that in many cases a similar reference building cannot sensibly be created, and as such the FSVM is not appropriate for use.

This is anticipated to be the case for buildings with multiple Performance Solutions/deviations from the DtS, as well as simpler designs where there is not a straightforward DtS comparison. Refer to the SFS FSVM Investigation Report (22 January 2020) for examples of the difficulties in addressing simple common Performance Solutions using the FSVM.

Tip 1: The FSVM is only suitable when a very similar DtS building can be identified.

Tip 2: Use of the FSVM precludes some simple common performance-based designs.

Engaging stakeholders

When using the FSVM, the fire safety engineer must undertake a performance-based design brief (PBDB) that must involve all stakeholders relevant to the building design (these are mandated in the FSVM). Note that as of NCC Volume 1 2019 Amendment 1, Clause A2.2 prescribes that every Performance Solution must include a brief-report process including consultation with relevant stakeholders.

The FSVM requires engagement with the fire authorities in each state for every project where the FSVM is adopted. This may be impractical where state legislation does not mandate engagement with the fire authorities for all performance-based fire safety engineering. SFS recommends that engagement with fire authorities is attempted for all projects as a stakeholder, and that attempt be recorded, noting that in some cases the brigade may not respond.

Tip 3: The FSVM requires a PBDB, with engagement with all stakeholders.

Tip 4: The FSVM mandates the inclusion of the fire service as one of the stakeholders.

Design of the reference building

Design of the reference building is key to the FSVM and needs to be done with care. There are several options in any DtS design, and all aspects of compliance need to be considered in creating a feasible and compliant reference building. As such, the reference building should be agreed upon by all stakeholders in the PBDB before undertaking detailed analysis. The design team will need to be clear at the start of the project with whom lies the responsibility of designing a fully DtS compliant reference building; this may need to be reflected in client briefs and contracts.

The fire safety engineer needs to use expert judgement to determine if the DtS reference building is in fact suitable to meet the Performance Requirements of the NCC. Whilst this is an inherent assumption of the NCC, it is the advice of the SFS that fire safety engineers should not knowingly compare a design against a DtS design that would not, if analysed appropriately, be shown to have an acceptable level of performance.

An example would be where the required safe egress time is greater than the available safe egress time in both the proposed design and the DtS design, even if the margin is better for the proposed design than for the DtS design (Section 1.5 of NCC schedule 7 implies that this would be acceptable, but SFS does not recommend demonstrating a negative margin of safety, unless addressed in a broader risk based assessment where some low likelihood events may have a negative margin of safety). There are such cases where a deterministic approach would show unsatisfactory outcomes in a comparison, but when paired with a risk-based approach the outcomes may be acceptable.

Tip 5: Design/selection of the reference building is key to the FSVM and can be complex.

Tip 6: The reference building needs to be agreed by all stakeholders in the PBDB.

Tip 7: It is the SFS view that a negative margin of safety is not appropriate, even if less negative than the reference building unless addressed in a broader risk based assessment where some low likelihood events may have a negative margin of safety.

Analysis

The approach to the analysis and assessment needs to be agreed in the PBDB. The FSVM does not in itself give data or methodologies for analysis. There is far greater information in the associated Handbook, but this has no standing in legislation and the SFS view is that, as such, it should be used with caution. As stated in the Handbook, 'This Handbook is not mandatory or regulatory in nature and compliance with it will not necessarily discharge a user's legal obligation'.

Qualified fire engineers should use their own professional judgement, education, experience and peer reviewed literature/data sources as per professional practice; as stated in the Handbook, 'This Handbook is not a comprehensive guide to fire safety. Reference should be made to appropriate technical documentation such as the International Fire Engineering Guidelines (IFEG) or ISO 23932-1:2018 Fire safety engineering – General Principles and related standards for more detailed information.'

Use of the FSVM without the Handbook, i.e. as documented in the NCC only, would give greater flexibility and allow use of professional experience and judgement, and peer reviewed publications. As the NCC is the only regulated document, use of the FSVM as written in the NCC along with appropriate professional judgement and references may be a preferable option. However, as identified further in this Guide, there are benefits to the general framework provided in the FSVM and Handbook.

There are additional FSVM Data Sheets which are also in guidance form but provide more specific quantitative data. Peer review of the Data Sheets is unclear.

There is no stated restriction on using the FSVM for part of the building or for certain solutions, and different approaches to demonstrating performance for other areas or Performance Solutions. This needs to be agreed in the PBDB.

Selection of design fires has a rigorous approach in the FSVM, with twelve scenarios to consider (and more if deemed appropriate); not all are applicable to every design. This approach of thinking through all the scenarios that can impact on a building design is encouraged for all performance-based engineering, no matter if the FSVM is used or not. In the Handbook, fire scenarios need to be agreed with stakeholders as part of the PBDB process, with further advice in Section 9 of the Handbook and associated data sheets. Judgement will need to be applied, and fire characteristics and pass/fail criteria explicitly documented in the PBDB where modelling or calculations will be undertaken (as is best practice currently for design from first principles). General advice on derivation of fire scenarios is provided in Section 9 of the FSVM Handbook and associated Data Sheets.

Tip 8: The approaches to analysis, pass/fail criteria, data sources need to be agreed in the PBDB.

Tip 9: Qualified professional fire engineers should use their own professional judgement as to selection of data, analysis methodologies etc. as per professional practice. The FSVM Handbook has no regulatory status and does not discharge user's legal obligations.

Tip 10: The framework for selection of fire scenarios is rigorous and should be adopted in all performance-based designs.

Practical considerations and implementation

Use of the FSVM requires approximately two to three times the amount of time of comprehensive current fire engineering approaches, as identified by the cases studies undertaken by the working group. The working group could identify no obvious benefits in fire safety. Simplistically it requires analysis of both the subject building and a reference building that must also be designed and analysed. This needs to be considered in programming a project, and when practically a detailed PDBD can be undertaken, particularly for larger or more design focussed projects.

The reliance of the FSVM on a DtS design for comparison may also have implications on trying to do fire engineering design in a detailed design stage, or for design changes after the concept design stage (both of these are relatively common in a design and construct contract), as retrospectively creating a reference building may not be possible. This is untested, and an approach to late design changes should be discussed with stakeholders during the PBDB process. The process identified, particularly with the requirement for a detailed reference building, is an academic approach and may not work for the reality of a whole of building design process, where the fire safety engineer is involved as a designer rather than simply analysing simple solutions. In these cases, the FSVM may not be the most appropriate approach.

Tip 11: The FSVM requires two to three times the work of a good first principles approach. It may not be appropriate for later stage design changes, for design focussed projects or for D&C procurement.

It is recommended that projects undertaken using the FSVM have a peer reviewer, particularly in the first few years of its implementation, to help the industry achieve a consistent view on some of the ambiguities in the FSVM and Handbook. This will assist in achieving a professional and defensible view of how it is used and consistency for approvals.

Tip 12: A peer reviewer is recommended when FSVM is used, until industry is familiar with it.