National Construction Code 2019 review

Engineers Australia submission

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ENGINEERS AUSTRALIA

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Introduction

About Engineers Australia

The Institution of Engineers Australia (Engineers Australia) is the not-for-profit professional association for engineers. Established in 1919, Engineers Australia is constituted by Royal Charter to advance the science and practice of engineering for the benefit of the community.

Engineers Australia is the trusted voice of the profession. We are the global home for engineering professionals renowned as leaders in shaping a sustainable world.

Professional Engineers work closely with other experts to bring the design and construction of buildings to fruition.

The critical role of engineering in the construction sector and the importance of the Code required Engineers Australia to draw on the expertise of its members through Engineers Australia's colleges and technical societies. This submission received input from Engineers Australia's expert member groups including the National Committee on Coastal and Ocean Engineering, the National Committee on Water Engineering, the Mechanical College and the Society of Fire Safety.

The content of our submission is provided in the following sections, with a list of recommendations summarised in the conclusion to this submission.

We note the request to use the submission form for comments. – Those parts of our submission able to be placed on the submission form have been included in attachments.

Submission

1. Design for Inland and Coastal Flood Forces

Comments on the NCC related to inland and coastal flooding are provided in the sections below.

1.1 Buildings Requiring Design for Floods

Clause BP1.4 in Volume 1 covers the design of buildings in flood prone areas for the effects of flooding, but the application box indicates that this clause only applies to Class 2, 3, 4, 9a health-care or 9c structures. Why are other building types, such as office buildings, exempted from this requirement?

In Volume 2 Clause P2.1.2 appears to be the equivalent of BP1.4 in Volume 1. But there appears to be a display error - is much of this clause missing from the pdf? It is considered that largely clause P2.1.2 and BP1.4 should be identical in requiring appropriate design for floods for all buildings. Also, buildings in South Australia appear to be exempted from this clause – why?

It is recommended that all buildings subject to the effects of floods should be designed, to the degree necessary, to resist those effects.

It is noted that Council regulations will often have more detailed requirements regarding minimum floor levels for various types of development, etc. It is considered that there is no need to add the usual range of Council 'town planning' type requirements to the NCC. However, the NCC should adequately cover structural design requirements related to flooding for all building types.

1.2 Design for Safety in Floods

The design for property damage is related to the defined flood event (often 1% AEP), and is reasonably covered in Volume 1 by clause BP1.4 and the town planning type requirements typically included in Council planning schemes.

The design for human safety in floods should be related a rarer AEP level. Table B1.2b in Volume 1 has design AEPs for safety related design for Wind, Snow and Earthquake effects, with different AEPs specified depending on the Importance Level of the building.

For example, an importance level 1 building must be designed to not pose a risk to the human safety in a 1 in 200 cyclonic wind or a 1 in 250 AEP earthquake, while for Importance Level 4 the requirement is AEP 1 in 2000 cyclonic wind or 1 in 1500 earthquake.

No design AEPs are provided to guide the safe design of a building to protect the safety of people in that building during a flood (in Volume 1 or Volume 2). The NCC does not provide different levels of the safety design AEP depending on the importance level of the building.

Clause B1.2(d) and (e) mentions design for rainwater action (including ponding action), but these clauses do not explicitly state that design is required for safety related to flooding related impacts/forces (such as the water level, hydrodynamic and hydrostatic forces, etc).

Elsewhere in the code, for example in the referenced document "Standard for Construction of Buildings in Flood Hazard Areas, Version 2012.2" it appears that structural design of the building (for hydrodynamic forces, etc) is focused on the AEP 1% event, with Table 2.3.7 providing factors to roughly convert a non-1% AEP Defined Flood Event (DFE) to an approximate 1% event.

It does not appear balanced or appropriate to design a level 4 Importance Building to withstand a 1 in 2000 cyclonic wind but allow it to collapse under flood forces from a 1 in 200 (say) flood.

It is noted that the structural failure of a building in a flood has more impact that just being a safety risk for its inhabitants - the floating building material potentially adds to debris loading on downstream bridges and buildings, increasing flood levels and potentially leading to cascade failures.

It is recommended that appropriate design event AEPs for safety be defined to guide the design of buildings to resist the effects of flooding in both Volume 1 and 2.

1.3 Design of Egress in Floods

Section D of Volume 1 lists a number of requirements regarding access and egress, including evacuation requirements during a fire emergency.

It is recommended that a clause be added to require consideration of evacuation requirements in a flood emergency.

Such consideration should consider the external environment outside the exit. It is undesirable for evacuees to be required to enter deep or fast flowing water, and the exit should allow evacuees to climb to higher ground.

The likely flood warning time may also be a consideration in the design of flood evacuation, that is, notice allowing evacuation before the bulk of the flood arrives may reduce the criticality of designing an up-hill evacuation path.

1.4 Design for Coastal Flooding

Previous versions of the National Construction Code have had very little information that refers to the coast. This is still the case in the most recent version. It would be good to have explained why there is a lack of information related to coastal flooding, erosion and hydrodynamic (eg waves, currents, overtopping) forcing within the code. Is there an intention to include information relevant to areas subject to coastal flooding, including storm surge and coastal wave action in future versions of the code?

It is noted that there are two sections of volume 2 that are used in coastal areas, that are roof sheeting durability in relation to corrosion (Section 3.5.1.2) and fall prevention requirements for the design of balustrades (used on jetties) (Section 3.9.2.3).

The commentary in Sections 2.1 to 2.3 above for flooding in Volume 1 should also include some commentary on coastal flooding, including storm surge and coastal wave action in all areas subject to these hazards. It is noted it is unclear as to why there are variations in design ARI/AEP for various hazards/loads. Would ARI/AEP for coastal hazards be included in future versions of the code?

There is concern that there is potential for misapplication of this document in areas subject to coastal hazards. A focus on selecting a flood level, say a 100 year ARI, (with freeboard) does not consider coastal hazards such as wave forcing acting on structures and overtopping.

In Volume 1 there are definitions on p.393 (p.229 in Volume 3) for breaking surf with no other reference in the document. There are also descriptions of freeboard as a level above the defined flood level to compensate for wave action and localised hydraulic behaviour on p.404 (p. 241 in Volume 3) with no explanation of how to identify that wave action of localised hydraulic behaviour.

It is noted there is no information on considerations for drainage in buildings subject to coastal flooding or overtopping in Volume 3.

1.5 Ancillary NCC Flood Design Documents

It is noted Volumes 1 to 3 refer to the Standard for Construction of Buildings in Flood Hazard Areas, which refers to the ABCB Information Handbook Construction of Buildings in Flood Hazard Areas.

Consideration to updating these ancillary documents is recommended, particularly to reflect the changes recommended in this submission.

If these documents are to be updated Engineers Australia would be pleased to provide further input on the proposed changes.

2. Fire Safety Verification Method

There are many goals behind the development of the Fire Safety Verification Method (FSVM). These include, but are not limited to ABCB's desire to increase the use of Performance Based design, provide designs that are consistent and when done in accordance with the FSVM to meet the performance requirements of the NCC, and in essence elevate the quality of fire safety engineering practice in Australia. The FSVM as proposed is not fulfilling its goals in all of these propositions and has the potential to cause less than optimal outcomes in its current form.

In addition, there is serious concern, that the FSVM in its current form will likely result in buildings which present an unacceptable level of fire safety (unsafe buildings); much more than current practice.

2.1 Increase the use of performance based design

The proposed FSVM requires an assessment of twelve fire scenarios, many of them repeated location to location and scenario to scenario, yet ignores the reality that not all of these scenarios are necessary to evaluate a design. The result of this is that the FSVM will be limited in use to very large complex buildings which have a design budget capable of absorbing the increased analysis costs that a proper application of the proposed FSVM will require. Advantageously for fire safety engineers, the proposed

FSVM will increase their workload and because it will be limited in most part to large projects, it will increase their profit margins. Therefore, the design cost will increase for no added benefit.

Likewise, the proposed FSVM will decrease the routine use of performance design for small projects due to the increased design costs and the time to complete an analysis. This will have some of its greatest impact on builders who try to re-engineer projects during their application of value management strategies. Thus increasing not just design cost, but the cost of construction. This does not increase the economic benefits as originally anticipated by the Board.

2.3 Provide consistent designs

In 2017 an ABCB calibration research team consisting of some of the leading fire engineers in Australia evaluated the FSVM. They found that unless highly competent engineers applied the FSVM, it could be used to develop unsafe designs inconsistent with the Performance Objectives of the NCC; and as a Verification Method, there will be no recourse to prevent such misuse. Unfortunately, only the calibration group’s summary report has been made available to the public, so that others not privy to the complete reports, are unaware of the many serious flaws in the FSVM.

There is a risk that the current FSVM can be so inadequately applied, that it would allow the design of an unlimited height high rise building, without an automatic sprinkler system, and with only a corridor pressurization system; that a building with large occupancy loads can be designed to collapse inwards trapping occupants and first responders.

Fire safety engineers consider these appropriate design practices. In other words, the FSVM as written, can result in unsafe buildings. This is consistent with the experience in New Zealand with a similar FSVM, where a fifty story building was designed as a single stair high rise with a fifteen-minute fire resistance level (FRL). This lack of safe design and lack of application consistency is one of the many reasons that the use of the FSVM has been sharply curtailed in New Zealand.

This safety issue is further complicated by the expected implementation of the FSVM. One key stakeholder, the fire brigade, will only be able to effectively comment on the FSVM building during the fire engineering brief stage. This will require extensive resources that do not currently exist. This is consistent with the New Zealand experience, which could contribute to a similar outcome in Australia.

2.4 Enhance the quality of fire safety engineering in Australia

The use of a simplified approach to design, such as that in the FSVM, requires more knowledge and skill than other approaches. This has been made abundantly clear by world renown fire safety engineering educators such as Prof Jose Torero, formerly from the University of Queensland and others such as Dr Jonathan Barnett formerly from WPI.

Additionally, the FSVM is based on the NZFSVM which is based on old and outdated knowledge and research. As the ABCB’s sponsored calibration group clearly pointed out, use of outdated research creates the potential for unsafe designs as new and better information becomes available. As a minimum, the FSVM should be current the date it is published. The proposed FSVM was in part, outdated ten years ago. To create a current, up to date FSVM requires a proper assessment of the state of the art of fire safety engineering which is yet to be started.

In December 2017 a proposal by members of the Society of Fire Safety to develop a proper FSVM Users’ Guide which would provide users with current sources of information, was rejected by the ABCB due to the cost and time required. Instead, the Board funded the current overview which contains numerous errors, outdated information, and as is shown in our detailed analysis, has examples which are inconsistent with the FSVM. It lacks an understanding of the current state of fire safety engineering, and is misleading and simply incorrect. One might argue that these defects are due to the poorly written FSVM, or the incorrect FSVM, or the lack in skill by the author of the examples. Whichever the case may be, it demonstrates the fatal flaw of including the FSVM in NCC 2019.

3. Energy Performance

Consistency not only in language and meaning but consistency in developing certainty should be an ongoing process within the Code's lifecycles.

Currently there is a lack of regulatory certainty in regards to energy requirements within the built environment. This regulatory inconsistency only helps to undermine policy objectives such as improving energy productivity.

While households and businesses are under increasing pressure due to rising energy costs, there has never been a better time to improve building energy efficiency.

This can be done by setting strong mandatory minimum standards – including Section J of the Code – so that current market failures in energy and thermal comfort can be addressed.

Engineers Australia commends the work being undertaken by the Australian Sustainable Built Environment Council (ASBEC) in the areas of setting mandatory standards; and Engineers Australia encourages the Australian Building Codes Board to continue to work co-operatively with ASBEC to achieve these standards.

Conclusion

Engineers Australia considered that implementation of the following recommendations will improve the ability of the National Construction Code to guide the safe and efficient design of our built infrastructure for the benefit of the Australian community.

Industry and government working more closely together to achieve a modern and responsive code will be the first step in developing a set of instruments that provide that benefit.

Governments need to work collectively to provide industry with the tools so that the construction sector can continue to help deliver jobs, drive economies and to provide a built environment that is capable and resilient now and into the future.

Recommendations

Engineers Australia recommends:

- All buildings should be designed for the impacts of flooding.
- The design of buildings should consider two levels of design, design for property damage and design for human safety.
- The design of egress from a building should consider flooding.
- Information on design for storm surge and coastal wave action should be included in future versions of the NCC for areas subject to coastal flooding.
- The complete reports should have been made available to the public to insure a transparent process.
- That the Fire Safety Verification Method in its current form not be implemented until a review of the method is undertaken using a sample of warehouses to test the veracity of the method.
- That the ABCB and the BMF move to develop mandatory minimum standards for energy efficiency in buildings.
- That the ABCB and the BMF create targeted incentives and programs for energy efficiency in the built environment in concert with ASBEC.
- That the ABCB and the BMF work with governments to develop comprehensive and defined energy market reforms.

Contact details

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