THE NEW ZEALAND BUILDING CODE VERIFICATION METHOD VM2 – FOUR YEARS ON – A PRACTITIONER'S PERSPECTIVE

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INTRODUCTION

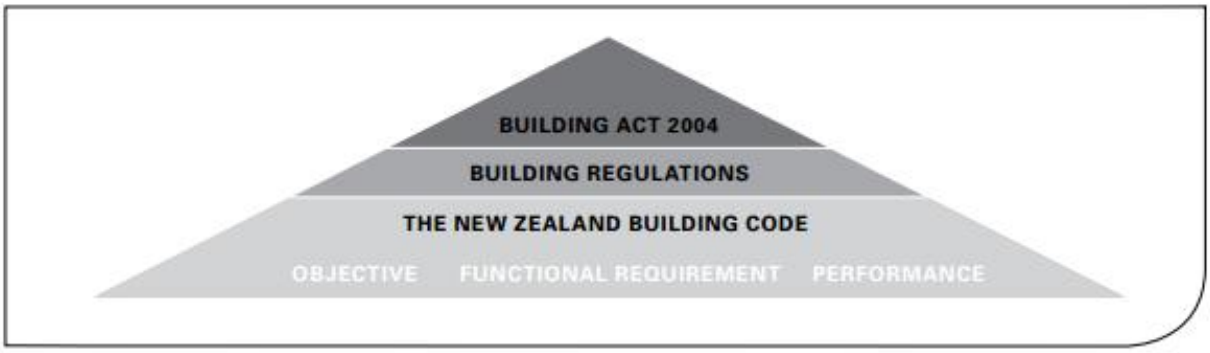
In 2012 New Zealand introduced a new set of Building Code Clauses C1 to C6 for protection from fire along with re-worked Acceptable Solutions and a brand new Verification method C/VM2 to demonstrate compliance with the New Zealand Building Code. The Verification Method C/VM2 provides a set of design scenarios to be worked through to demonstrate compliance with the Building Code clauses. Some of the scenarios require simple checks while others require ASET vs RSET analysis or radiation calculations for spread of fire. Since its introduction in 2012 the Verification Method has been revised four times as a result of practitioner and industry feedback.

They say there is no change without pain. This paper sets out from a practitioner's perspective the difficulties that were experience with the introduction of the new verification method and some of the lessons that can be learnt.

PREVIOUS REGIME

The regulatory regime prior to 2012 consisted of four main documents that impacted on fire design of buildings. These were:

- Building Act
- Building regulations (Contains the Building Code)
- Building Code (Objectives, Functional & Performance requirements)
- Acceptable Solutions (cook book approach)



The available design methods were:

- Design strictly to the Acceptable Solutions
- Use the Acceptable Solution as a framework and modify parts of it either by using engineering judgement (a reasoned argument) or calculations.
- Alternative solutions from first principles showing compliance with the Building Code.

The performance criteria in the Building Code was worded in very general terms such as do not cause injury or illness to building occupants, do not allow fire to spread to neighboring properties and assist fire fighters in conducting fire fighter operations. Written in these general terms without any measureable performance criteria did not lend itself to easily being able to demonstrate compliance with the Building Code therefore the most common method of design was to demonstrate equivalence to the Acceptable Solutions.

The perception at the time was that while it was sometimes difficult to determine the performance metrics of the Acceptable Solutions, they provided society with an acceptable level of safety by evidence of the low level of injury and deaths in buildings and no public outcry over the lack of fire safety within buildings. The track record of safety in individual residential homes is much worse but is considered acceptable for political reasons.

All new buildings and alterations to existing buildings and changes of use of existing buildings require a fire safety assessment to demonstrate compliance with the Building Code to be carried out to accompany an application for a building consent.

There are no restrictions on who can carry out a fire safety assessment so practitioners range from Architects, structural engineers, evacuation consultants and professional fire engineers. The quality of the documentation ranged from a one page summary to detailed analysis with all assumptions, design inputs and calculations clearly identified. This range of competencies tended to drive down the quality of work to the lowest common denominator as clients that needed to engage a fire engineer would often select a consultant on the basis of price rather than competency.

From a professional fire engineers perspective designing from first principle lacked any certainty of outcome due to there being no fixed performance criteria. Outcomes varied dependent on the opinions and experience of the peer reviewers meaning that just because a design was approved once it did not necessarily follow that it would be approved again in the future.

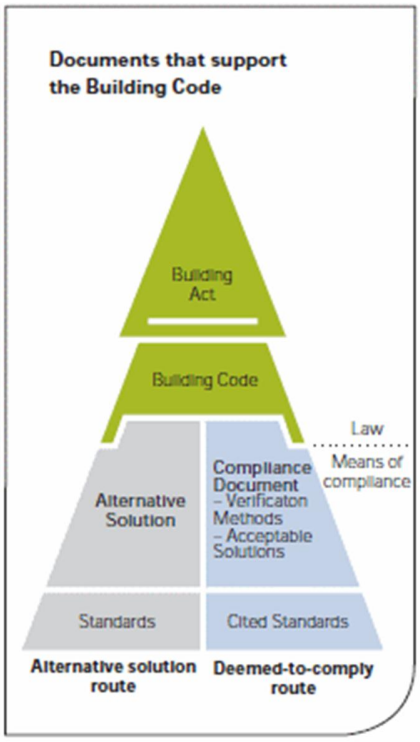
Disputes could be taken to the then Department of Building and Housing for a determination. While this worked in theory, the pressure of time in the design and construction process often meant that the

wishes of the reviewer needed to be complied with to keep the project on time rather than going for a determination.

NEW C/VM2 FRAMEWORK

With the perceived weaknesses in the design process identified above, the Ministry of Building Innovation and Employment (MBIE) produced a new set of documents to work from. They consisted of:

- Building Act (No change)
- Building Regulations (Updated Building Code)
- Building Code (New fire safety clauses consisting of deterministic performance criteria)
- Acceptable Solutions (New cook book approach)
- Verification Method VM2 (New. Design inputs and design scenarios given. Deterministic Performance criteria)



Similar to previous versions of the documents these are available for free download from the Ministries website.

The new Acceptable Solutions were similar to the old Acceptable Solutions except that the different building categories were given their own Acceptable Solution and some of the design options were removed from the Acceptable Solution to make it more suitable for lower skilled practitioners.

The Verification Method was intended for experience practitioners who were competent to perform fire engineering calculations, for example tenability and egress analysis and radiation analysis.

The new design options were then:

- Design strictly to the Acceptable Solutions

- Design using the verification method
- Alternative Solutions (Compliance with Building Code without reliance on the Acceptable Solutions or Verification Method)

HOW IT WORKED IN PRACTICE

The first obstacle during the implementation phase was that to use an Acceptable Solution design, the building had to comply with the Acceptable Solution fully. In New Zealand a lot of construction work consists of alterations to existing buildings. Unless a building was relatively new, then it was unlikely to comply fully with the new Acceptable Solutions purely from a perspective of the Acceptable Solutions having slowly evolved over the years. This meant that a significant number of buildings now required a verification method design and this number was well beyond the means of the fire engineering profession to deliver.

With such a shortage of fire engineers, fees went up, leads times grew considerably and clients started to form the opinion that the fire engineering framework had been specifically designed to provide more fees to fire engineers rather than the altruistic motive of providing a better system. To meet this new demand there has been a strong influx of fire engineers to New Zealand from other parts of the world which continues to this day.

This has now been somewhat alleviated by the introduction of Guidance provided by MBIE on the level of documentation required when assessing an existing building. Buildings were given a risk score and dependent on the risk score, the solution was to either consider compliance of the alterations with the existing fire safety features, carry out a gap analysis between the current fire safety features and what would be required for a new building with a discussion on what could be brought closer to compliance and finally buildings with a high risk score required full compliance with an Acceptable Solutions or analysis using the C/VM2 method.

The introduction of the VM2 method has significantly reduced the number of designs based on what might be termed “sound engineering judgement” which was the fire designer’s opinion on how the design would perform if engineering analysis was carried out on the design. In the past there had been concerns that this “sound” engineering judgement was not as sound as it was made out to be. This has largely been replaced with C/VM2 analysis.

The C/VM2 method has provided a much more consistent framework for analyzing the performance of buildings when subject to a fire. It also provides more consistency when comparing similar buildings and after analyzing many buildings a body of general knowledge is forming in the fire engineering community on how any given building would likely perform under fire conditions when subject to a verification method design check.

It has also provided a lot of certainty in the design process and had a significant reduction in the amount of time spent determining and agreeing design inputs. On the plus side this has freed up more time to spend on the design process and on the minus side some people are saying that it stifles creativity.

After 4 years the C/VM2 method has been used on many, many buildings and has undergone 4 revisions as weaknesses in its requirements have been identified. From the authors perspective it seems like we have been beta testing it for this time. However it would have been beyond the means of a small country like New Zealand to carry out this level of beta testing prior to its introduction.

From a technical perspective the C/VM2 design method can lead to over design in some areas and under design in other areas. One area where over design can occur is with a limited number of prescribed fuel

loads and design fires some spaces such as small rooms clearly can not support such large fires however there is no option to reduce the fire load or design fire size.

In other situations such as a high rise building there is not guidance within C/VM2 for analyzing vertical smoke movement within the building. Given that the document is a means of demonstrating compliance with the Building Code, if the requirements of the verification method are satisfied then the designer is under no obligation to consider any other scenarios other than what is given in the verification method.

With the introduction of the verification method the use of alternative designs has become virtually non existent due to the complexity of having to demonstrate compliance with the building code clauses and the uncertainty that that creates. Anecdotally some people have formed the view that this stifles creativity.

WHAT WE WOULD DO DIFFERENTLY

We underestimated the impact the changes had on altering existing buildings. Large numbers of buildings overnight became the subject of C/VM2 designs for even minor alterations and the resources of fire engineers was severely taxed and created a bottle neck in the construction pipeline. This was eventually overcome with guidance being provided on the level of information needing to be provided for existing buildings based on their age, fire safety information and occupant risk groups.

In addition classes of buildings that previously could be designed as Acceptable Solutions had to be designed using the verification design method. Again overnight a large number of industrial building types no longer complied as Acceptable Solutions. This was eventually resolved by modifying the Acceptable Solution design rules to include a larger number of industrial buildings that in my opinion did not represent a risk that necessitated the use of the Verification Method to design them.

At a recent forum held to discuss the effectiveness of the verification method, one of the participants stated that it was a “rough diamond” and while not perfect it is considerably better than what we had prior to 2012.

MBIE are currently undertaking a complete review of the fire safety framework and one of the thoughts is that the verification method should have been published as guidance rather than a verification document. This would have allowed more flexibility for approval authorities to deal with its strengths and weaknesses.

CONCLUSIONS

While not perfect, the verification method is considered a diamond in the rough. The change was definitely worth it and it is a breath of fresh air to be able to concentrate more on design and less on arguing over design input parameters.

There were certainly some dark days in the beginning when construction started to grind to a standstill with fire engineers being overwhelmed by the quantity of work now required to maintain the flow of construction projects.

It has raised the standard of fire engineering analysis in the country and given everyone a better benchmark for what constitutes a good design. We are now at the stage where we are able to re-look at first principle designs based on the demonstrating direct compliance with the Building Code rather than using the verification method for the more challenging or special building designs.

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