ALTERNATIVE SOLUTIONS - *Past, Present and Future.* By Dr Weng Poh

TWO VIEWS - *Alternative Solutions that built No. 1 Bligh Street*

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PROFESSIONAL ACCREDITATION - *Education, experience and dedication*
Alternative Solutions are still a relatively new approach in Australia, but the benefits they are providing have already been proven to be quite significant. In this article, Dr Weng Poh, Associate Director and Principal Fire Engineer with Umow Lai Pty Ltd, takes a look at the history of Alternative Solutions in Australia – the advantages they bring, the criticisms they have attracted, and where the reforms that began over two decades ago may lead us in the future.

The Alternative Solution approach is still relatively young. It was born in mid 1990, and was infant in the 2000's and grew rapidly to its adolescence in the 2010's. It has provided significant benefits to the building industry but it still exhibits some adolescent characteristics in that its development and internal coordination are still largely incomplete. It will need to further evolve and grow to reach full maturity.

Alternative Solutions - a brief history

Arguably, the refurbishment of the forty-one story building at 140 William Street, Melbourne in 1992 was the first major project that an engineering solution was applied as an alternative to the prescribed requirements of the Building Code of Australia (BCA). The assessment was undertaken by BHP Research with a comprehensive program of full-scale fire testing, structural and risk analyses to determine whether the fire protection of the floors could be omitted after the removal of the existing asbestos-based fire protection material. The assessment involved a holistic review, taking into account an improved fire safety system incorporated in the refurbished building; and it showed that the building was at least as safe as the BCA prescribed solution. The solution was subsequently accepted by the approval authorities.

1989

Warren Centre Study on Fire Safety and Engineering proposed that design for fire safety be treated as an engineering responsibility rather than a matter for detailed regulatory control.

1991

The Building Regulation Review Task Force was set up to review and codify the concepts of an alternative approach to achieve cost-effectiveness in fire protection of buildings.

1993

Fire Code Reform Centre (FCRC) was established to introduce a fully engineered approach to fire safety regulations.

1996

FCRC released the Fire Engineering Guide lines outlining a methodology for the design and assessment of fire safety in buildings.

1996

The Australian Building Code Board (ABCB) introduced a performance approach as Alternative Solutions into BCA96 [8]. The prescriptive requirements were largely unchanged and retained as Deemed-to-Satisfy (DTS) solutions.

Alternative solutions - a brief outline

The BCA96 introduced a regulatory hierarchy of Objectives, Functional Statements and Performance Requirements. In terms of fire safety, the BCA objectives may be broadly summarised as shown in Figure 2.

Figure 2

BCA Fire Safety Objectives

Objectives and Functional Statements were provided as guidance for the designers. The assessment criteria are the Performance Requirements that must be satisfied to for a solution to be acceptable. They are the vehicles for the Alternative Solutions to achieve compliance. The prescriptive requirements are deemed to satisfy the Performance Requirements, hence allowing them to be accepted within the same framework as their alternative counterparts.
In a DTS solution, the fire safety systems are fully prescribed. These include the fire resistance of the building elements, egress provisions, fire protection systems and smoke hazard management systems. (see Figure 3).

**Figure 3 DTS Solution**

The DTS Provisions were formulated empirically over the history of regulatory requirements. Nevertheless, they have been effective, as reflected by good fire safety records in Australia. However, the approach is rigid, and some of the requirements are very onerous due to the fact that they were formulated for the worst-case scenarios for each building class.

In contrast, the performance approach is flexible. The fire safety systems may be engineered and tailored to suit the physical and occupant characteristics in the individual building (see Figure 5).

**Figure 4 Alternative Solution**

The solution is acceptable when it is demonstrated to satisfy the Performance Requirements through one of the following methods:

1. Verification methods
2. Comparison with the DTS Provisions
3. Expert Judgement

In method (i), the designers and approving authorities must make some professional judgements in a responsible manner to ensure the evaluation and outcomes satisfy the Performance Requirements. This judgement is necessary due to the fact that the Performance Requirements are qualitative and do not contain measurable criteria.

Method (iii) on the other hand is based solely on judgement. This method is often avoided by the designers due to the difficulty in establishing the level of expertise necessary and appropriate for the judgement.

This leaves method (ii) where the DTS solution provides a tangible benchmark where the solution can be objectively evaluated and compared against. A corollary of this to the general principle for performance approach is that an Alternative Solution must at least be as safe as the corresponding DTS Solution.

**Alternative Solutions to date**

Since the BCA introduction of alternative solutions in 1996, there has been an exponential increase in the number of buildings in Australia designed using a performance approach.

The Fire Engineering Guidelines were revised in 2001 and later adopted for use overseas as International Fire Engineering Guidelines in 2005. A number of design guides have also been developed for design of specific types of buildings, including carparks, sports stands, shopping centres, office buildings, and general design of buildings.

Examples of buildings that were successfully completed using performance approach are shown below.

- Melbourne GPO Redevelopment – performance approach was used to overcome design issues arising from various heritage constraints.

**Figure 5**

Melbourne GPO

- Melbourne Sports and Aquatic Centre – performance approach was used to address the unique nature of a sports facility that cannot be designed using the BCA prescriptive approach.

**Figure 6**

Melbourne Sports and Aquatic Centre
- The John Curtin School of Medical Research – a performance approach was used to derive solutions to suit the unique architectural and scientific set up of the research facility.
Figure 7
The John Curtin School of Medical Research – Australian National University
- International Centre and Business Building, Deakin University – a performance approach was used to overcome issues arising from Environmentally Sustainable Development (ESD) design

Figure 8
International Centre and Business Building
- Deakin University
Despite the huge success of the performance approach, some Alternative Solutions have also attracted staunch criticisms. These include:
- Some designers lack the necessary knowledge to achieve an acceptable standard of practice
- Some Alternative Solutions are geared towards cost-cutting rather than fire safety
- Some Alternative Solutions are used to 'justify' designs which are in certain circumstances unsafe [19]
- Some Alternative Solutions are impractical, illogical, complex and poorly documented

In 2002, Kip conducted a review of achievements and criticisms of performance approach in Australia.
It is observed that the fundamental issue behind the criticisms is associated with the lack of consistencies in the quality of the Alternative Solutions delivered to date. This may be attributed to:
- a) Lack of a definitive minimum acceptable level for fire safety
- b) Lack of specific guidance on the evaluation of building solutions
- c) Variation in competencies of the designers and approvers

Factor (a) has long been recognised as an issue, since the beginning of building code reform in the late 1990s. The ABCB is currently undertaking a project to develop measurable Performance Requirements, which will greatly assist in establishing the acceptable level for fire safety.

Factor (b) is perhaps the failure of the International Fire Engineering Guidelines which only outline the general design and evaluation process but not the specific guidance and criteria for the evaluations. This shortcoming has led the fire authorities in various states to further develop their own guidelines to impose some uniformity within their own states.

In order to tackle factor (c), registrations are now required in various States for the practitioners involved in design, evaluation or approval of Alternative Solutions.

Alternative Solutions…
the future
There has been much emphasis on the changes required for the performance approach to reach maturity. However, it must not be forgotten that the performance approach is an integral part of a solution framework which includes the prescriptive approach. There is no compelling reason why the two approaches should be polarised at two ends of the design spectrum. On the contrary, if logic prevails, they should both change and evolve together with the changes in Performance Requirements as follows:
- Performance Requirements to be fully quantifiable to allow D1S and Alternative Solutions to be objectively evaluated.
- Common Alternative Solutions that have been proven acceptable should be incorporated into the BCA as D1S solutions
- D1S Solutions that have been shown to be inadequate or too onerous should be modified to closer align with the Performance Requirements.

The evolution may be depicted as shown in Figure 9 on the following page.
Figure 9 Evolution of Fire Safety Design

The above changes will lead to reduced variability and increased transparency of building design processes. This will greatly benefit the industry and building practitioners, including fire engineers and building surveyors. However, the changes will require collective action and support from the building industry, parishioners and regulators.

When it evolves and reaches maturity, the term ‘Alternative Solution’ may become irrelevant for there may be only one unified way of designing a building for fire safety – an engineered approach, as envisaged in the building code reform that began over 20 years ago.

BIOGRAPHY

Dr Weng Poh FIEAust CIP Eng, BE (Hons), M Eng Sc, PhD.

Dr Weng Poh is an Associate Director and the head of the Fire Engineering group at Uwos Lai Pty Ltd. Weng started his fire engineering career as a researcher at BHP Research where he was involved in the landmark 140 William Street fire-safety assessment and later a key member of Fire Code Reform Program.

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