ALTERNATIVE BUILDING SOLUTION

PREPARED FOR

Circus Royale.

REGARDING

Circus Royale –
Temporary Place of Public Entertainment

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REPORT REGISTER

The following report register documents the development and issue of this report and project as undertaken by this office, in accordance with the *Quality Assurance* policy of **Trevor R Howse & Associates Pty Ltd**.

Our Reference	Issue No.	Remarks	Issue Date
J28290 HH	– 1	Completed report issued to client	22.1.2009

CONTENTS PAGE

EXECUTIVE SUMMARY

This Alternative Building Solution report has been prepared at the request of Circus Royale, and relates to the and relates to the proposed temporary Place of Public Entertainment structure, the Circus Royale.

The purpose of this assessment is to review certain prescriptive non-compliance identified within the building design, and verify the attainment of compliance with the relevant performance requirements of the Building Code of Australia (BCA).

Those particular aspects of non-compliance are summarised as follows: –

ISSUE	BCA CLAUSE	BCA PERFORMANCE REQUIREMENT	REPORT REFERENCE
While an occupant load of 750 persons will be accommodate within the tent structure, only four (4) exits in lieu of five (5) shall be provided.	Clause H102.4	DP4	Part 6 pp. 14-15

The assessment of this item has been performed in accordance with the International Fire Safety Engineering Guidelines (FSEG) and Clauses A0.5 and A0.9 of the BCA.

In terms of Clause H102.4, it relies upon a qualitative analysis of the non-compliance for the purpose of demonstrating absolute compliance with performance requirement DP4.

With reference to the commentary contained within the conclusions of Part 6 of this report, and the Recommendations in Part 7, it has been concluded that: –

1. Clause H102.4 – The provision of only four (4) exits in the perimeter of the tent structure is acceptable, subject to such having an aggregate exit width of 9,000-mm

Through the implementation of the recommendations contained within this report, the impact of the prescriptive non-compliance shall be obviated, and compliance with the BCA, as an *alternative building solution*, shall be achieved.

1.0 INTRODUCTION

1.1 GENERAL

This Alternative Building Solution report has been prepared at the request of Circus Royale, and relates to the and relates to the proposed temporary Place of Public Entertainment structure, the Circus Royale.

The purpose of this assessment is to review certain prescriptive non-compliance identified within the building design, and verify the attainment of compliance with the relevant performance requirements of the Building Code of Australia (BCA).

Those particular aspects of non-compliance are summarised as follows: –

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Trevor R. Howse & Associates Pty Limited is not aware of other alternative building solutions incorporated within this project design.

1.2 FIRE SAFETY ENGINEERING BRIEF

The preparation of a separate Fire Safety Engineering Brief (FSEB) has not been considered warranted for this project.

It is acknowledged that the FSEB process is more appropriate for complex projects to define fire scenarios for evaluation, fire models, levels of analysis, and acceptance criteria.

The content of this report however, addresses each of these elements within the assessment process as are applicable to the proposed design.

1.3 REPORT BASIS

The assessment contained within this report reflects –

(a) The principles and provisions of the Building Code of Australia 2008 edition, incorporating the New South Wales Variations;

(b) The principles and provisions of the International Fire Safety Engineering Guidelines 2005;

(c) Place of Public Entertainment report numbered J28290-1, dated 15 December 2008.

1.4 SCOPE OF PROJECT

The Building Code of Australia, within Clause A0.5, provides that compliance with the applicable Performance requirements in a building design may occur through the "deemed-to-satisfy" provisions or as alternative building solutions.

It is intended that the proposed design of the subject premises in this instance incorporate a combination of prescriptive and Performance based compliance.

To this extent, this report has been prepared to identify and analysis the proposed alternative building solutions and demonstrate the acceptability of these designs to satisfy the Performance requirements of the BCA.

The parts of the building to which alternative building solutions are proposed relate to the following BCA provisions –

(a) ***Clause H102.4 – Exits to be provided***

Since the tent structure will contain an occupant load of 801-1000 persons (750 persons), a total of five (5) exit facilities with an aggregate exit width of 7500-mm are required by this prescriptive provision.

In the proposed design, a total of only four (4) exits will be provided with an aggregate exit width of 9,000-mm.

1.5 STAKEHOLDERS

The relevant stakeholders to the preparation and implementation of this report are: –

(a)	BCA Consultant	–	Trevor R Howse & Associates Pty Ltd
(b)	Client	–	Circus Royale
(c)	Architect	–	Not applicable
(d)	Consent Authority	–	Armidale Council

1.6 LIMITATIONS

The content of this report relates only to the non-compliance and subject building identified.

All reasonable efforts and care have been taken in the assessment of documentation and information provided in the formulation of this alternative solution and preparation of this report.

The success of any alternative solution though, typically relies upon the implementation of recommendations provided, and maintenance of the building, fire systems, and assessment parameters nominated.

While this report assesses life safety conditions, in the event of a fire emergency, no guarantee is made that property damage shall not occur.

2.0 DEVELOPMENT DESCRIPTION

2.1 GENERAL

The subject building is a temporary tent structure, that shall be used to accommodate the Circus Royale.

In the context of this Performance Verification Assessment, the property may be described in terms of 'Building Characteristics' and 'Occupant Characteristics'.

2.2 BUILDING CHARACTERISTICS

(a) *Rise in storeys*

The building has a rise in storeys of one (1).

(b) *Classification(s)*

The building shall contain a single building classification, namely: –

(i) Class 9b – assembly

(c) *Type of Construction*

On the basis of the rise in storeys and building classifications, the entire building is required to comply with the fire rating requirements for Type C Construction.

(d) *Effective height*

The effective height of the building is less than 25-metres.

(e) *Fire compartment size limitations*

Based upon the classification and Type of Construction, Clause C2.2 of the BCA limits the floor area and volume of individual fire compartments to the following: –

(i) Type C Construction – Class 9b

- Floor area – 3,000 m^2
- Volume – 18,000 m^3

2.3 OCCUPANT CHARACTERISTICS

For buildings such as this, occupants may be grouped into two (2) primary groups.

The first group is comprised of staff, which may be either permanent or transient, but nonetheless are recognised as being more familiar with the layout of the building, fire safety systems and other characteristics.

These occupants are assumed to be: –

(a) of varying age groups

(b) alert and awake during their occupation of the building

(c) without physical or mental disabilities

(d) familiar with the building

The second group is comprised of members of the public (i.e. visitors), which are typically transient and thus have significantly less familiarity with the building and characteristics.

The building occupants are assumed to be: –

(a) of varying age groups

(b) awake and alert during their occupation of the building

(c) possibly with physical or mental disabilities

(d) unfamiliar with the building

The proposed use of the building is not considered to attract either a certain gender mix or a proportion of persons with disabilities that would differ from the general community levels.

Additionally, in the context of occupant response, coping and evacuation capabilities, the characteristics of the occupants are taken to typically reflect that experienced within assembly buildings.

3.0 OBJECTIVES & PERFORMANCE REQUIREMENTS

3.1 GENERAL

The BCA consists of Objectives, Function Statements, Performance Requirements, and Building Solutions.

While Clause A0.4 of the Code states that *"a Building Solution will comply with the BCA if it satisfies the Performance Requirements"*, figure A0.3 illustrates that compliance with the Performance Requirements is achieved through either: –

(a) Deemed-to-satisfy Building Solutions; or

(b) Alternative Building Solutions; or

(c) A combination of either Deemed-to-satisfy or Alternative Building Solutions.

It is understood that the subject building shall incorporate a combination of Deemed-to-satisfy and Alternative Building Solutions, with this report relating only to the Alternative Building Solutions listed within item 1.1 above.

3.2 DESIGN OBJECTIVES

The formulation and analysis of the proposed Alternative Building Solutions requires the establishment of Design Objectives against which the proposal can be globally measured. Design Objectives can directly influence building layout, fire safety systems, and other design characteristics employed, and are typically derived from: –

(a) The Building Code of Australia;

(b) The client / building owner;

(c) The general community.

This assessment considers BCA related objectives only – no client / owner or community objectives have been advised at the time of this report.

The principal Objective of the BCA is the life safety of the building occupants and, allied with this, the safety of any attending emergency services personnel such as the Fire Brigades.

As applicable to this assessment, Objective DO1 states as follows: –

DO1 The Objective of this Section is to: –

(a) ……..;
(b) Safeguard occupants from illness or injury while evacuating in an emergency.

3.3 PERFORMANCE REQUIREMENTS

As contained within items 1.4 and 3.1 of this report, the subject building shall incorporate a combination of Deemed-to-satisfy and Alternative Building Solutions.

The stakeholders nominated within item 1.5 have advised of the following Deemed-to-satisfy non-compliance for which an Alternative Building Solution is proposed: –

ISSUE	BCA CLAUSE	BCA PERFORMANCE REQUIREMENT
While an occupant load of 801-1000 persons will be accommodate within the tent structure, only four (4) exits in lieu of five (5) shall be provided.	Clause H102.4	DP4

Performance Requirement DP4 states as follows: –

DP4 Exits must be provided from a building to allow occupants to evacuate safely, with their number, location and dimensions being appropriate to: –

(a) the travel distance
(b) the number, mobility and other characteristics of occupants
(c) the function or use of the building
(d) the height of the building
(e) whether the exit is from above or below ground

3.4 'DESIGN OBJECTIVES' & 'DEEMED-TO-SATISFY' PROVISIONS – COMPARISON

In accordance with Clause A0.7 of the BCA, *"a Building Solution which complies with the deemed-to-satisfy provisions is deemed to comply with the performance requirements"*.

Compliance with the performance requirements, through either a Deemed-to-satisfy or alternative building solution, is considered to meet the relevant BCA Objectives.

Historically, the Deemed-to-satisfy provisions of the BCA are founded upon a combination of research data, fire tests and, to a lesser extent, theoretical considerations or expert judgment. Consequently, the relationship between an individual provision and the performance of such within a global fire safety design is known.

It is on this basis that the Performance Requirements of the BCA have been designed, and the Deemed-to-satisfy provisions accepted as attaining compliance.

This applies notwithstanding that, in some circumstances and building designs, through scientific analysis the level of life safety provided by the Deemed-to-satisfy provisions can be questioned on the extent to which satisfaction of the applicable Performance Requirement occurs.

Where other Design Objectives are established by a client / owner or the community, compliance with the Deemed-to-satisfy or performance requirements of the BCA does not necessarily guarantee that the nominated (non-BCA) Objective is met.

4.0 HAZARDS & MITIGATING MEASURES

4.1 GENERAL

The potential fire hazard to a building and the occupants therein associated with a fire outbreak is governed by various factors. Principally, these factors can be divided into two categories, namely those contributing to a potential fire outbreak, and those mitigating the hazard.

Those factors forming part of the first category include, for example, the nature and availability of fuel and the materials of construction used in the construction and fit out of the building.

In respect of the second category, relevant factors include the nature and extent of active and passive fire safety systems, the effectiveness of management procedures, and the quality of way-finding characteristics.

It is noted that factors within these categories can overlap. This is evident with 'materials of construction', which can both contribute to the fire hazard, and mitigate such, depending upon the materials chosen and locations employed.

For the subject building, a combination of active and passive 'fire safety systems' shall exist contributing to hazard mitigation.

In the context of the performance expectations held for the global fire safety design, the individual fire safety systems and building features within can be categorised according to their function or intended purpose. These categories include: –

(a) Tenability related features

(b) Fire detection features

(c) Fire suppression features

(d) Compartmentation features

(e) Structural features

In many instances, individual fire safety systems and design characteristics can overlap multiple categories.

4.2 MATERIALS OF CONSTRUCTION & CONTENT

The materials of construction employed within the construction of the building are of importance to the fire safety design due to the potential: –

(a) contribution to a fire outbreak; and

(b) response to a fire outbreak.

Where materials of construction are of a combustible nature, the rate of fire spread and heat release (HRR) can be greatly enhanced. The enhanced heat release rate can result in a corresponding decrease in the effectiveness of active systems designed to intervene in the development of a fire (ie. sprinkler systems).

Irrespective of the combustible nature of materials however, the response of an element to the impact of fire is of critical importance in the areas of structural adequacy and thermal insulation.

Low thermal insulation qualities facilitate conductive and radiant heat transfer that can precipitate fire spread to other areas within a building. Where used in confined areas such as ceiling spaces, the time associated with the confirmation of fire may be long thus delaying the commencement of occupant evacuation and manual intervention.

Structural elements with low fire resistance may collapse prior to the complete evacuation of the building occupants or during Fire Brigade activities due to the attainment of a low 'critical failure temperature' in the material.

This report assumes that any furnishings, equipment or the like to be provided within the premises over the building life shall be typical with that associated with a 'asssembly building' use and that no unique or exceptional circumstances shall exist.

4.3 FIRE SAFETY SYSTEMS

4.3.1 Fire safety schedule

Tables 4.3.1.1 and 4.3.1.2 below provide a copy of the Fire Safety Schedule associated with the 'existing' building, and that which shall apply subsequent to the implementation of the parameters / recommendations contained within this report.

Figure 4.1.3.1 – Existing fire safety schedule

Fire Safety Measure	Installed	Standard of Performance
Fire rated access panels & doors	N/A	
Automatic fail safe devices	N/A	
Automatic fire detection & alarm	N/A	
Automatic fire suppression systems	N/A	
Emergency lifts	N/A	
Emergency lighting	Yes	AS 2293.1

Fire Safety Measure	Installed	Standard of Performance
EWIS	N/A	
Exit signs	Yes	AS 2293.1
Fire control centres & rooms	N/A	
Fire dampers	N/A	
Fire doors	N/A	
Fire hydrant systems	N/A	
Fire seals	N/A	
Fire shutters	N/A	
Fire windows	N/A	
Hose reel systems	N/A	
Lightweight construction	N/A	
Mechanical air handling systems.	N/A	
Perimeter emergency vehicle access	N/A	
Portable fire extinguishers	Yes	AS 2444
Safety curtain in proscenium opening	N/A	
Smoke & heat vents	N/A	
Smoke dampers	N/A	
Smoke detectors & heat detectors	N/A	
Smoke doors	N/A	
Solid core doors	N/A	
Standby power systems	N/A	
Wall-wetting sprinkler / drenchers	N/A	
Warning & operational signs	Yes	EP&A Reg, Clause 98C

Figure 4.1.3.2 – Proposed fire safety schedule

Fire Safety Measure	Installed	Standard of Performance
Fire rated access panels & doors		
Automatic fail safe devices		
Automatic fire detection & alarm		
Automatic fire suppression systems		
Emergency lifts		
Emergency lighting	Yes	Unchanged
EWIS		
Exit signs	Yes	Unchanged
Fire control centres & rooms		
Fire dampers		
Fire doors		
Fire hydrant systems		
Fire seals		
Fire shutters		
Fire windows		
Hose reel systems		
Lightweight construction		
Mechanical air handling systems.		
Perimeter emergency vehicle access		
Portable fire extinguishers	Yes	Unchanged
Safety curtain in proscenium opening		
Smoke & heat vents		
Smoke dampers		
Smoke detectors & heat detectors		
Smoke doors		
Solid core doors		
Standby power systems		
Wall-wetting sprinkler / drenchers		
Warning & operational signs	Yes	Unchanged

5.0 ACCEPTANCE CRITERIA

5.1 GENERAL

For the fire & life safety 'Design Objectives' for the project, Acceptance Criteria derived from traditional sources such as the Fire Engineering Guidelines are employed.

For each Alternative Building Solution proposed within this assessment, the Acceptance Criteria represent benchmarks for measuring compliance.

The Acceptance Criteria must relate directly to each 'Design Objective' to ensure that the attainment of the benchmarks is truly representative of compliance with the 'Design Objective' and Building Code of Australia.

5.2 METHOD OF ANALYSIS

In terms of Clause H102.4, it relies upon a qualitative analysis of the non-compliance for the purpose of demonstrating absolute compliance with performance requirement DP4.

5.3 'CIRCUS ROYALE' ACCEPTANCE CRITERIA

For the Alternative Building Solution proposed within the subject premises, with recognition of the nature and location of prescriptive non-compliance, the following Acceptance Criteria is established: –

(a) **Clause H102.4 – Exits to be provided**

The prescriptive requirement to provide five (5) exits from the building is designed purely to ensure the smooth dispersal of occupants without overloading any one particular exit with an excessive number of persons.

The flow of occupants evacuating from the building though, is not solely a function of the number of exits provided but is influenced by a wide variety of factors.

For instance, the aggregate exit width *of* the exits provided is of paramount importance to the resultant flow.

With recognition of this, the proposed Alternative Building Solution satisfies performance requirement DP4 where it is illustrated that the absence of a fifth exit from the perimeter of the building does not impede any evacuation.

6.0 PERFORMANCE VERIFICATION ASSESSMENT

6.1 PRESCRIPTIVE NON-COMPLIANCE – CLAUSE H102. 4

6.1.1 Preamble

The prescriptive non-compliance with BCA Clause H102.4 shall be assessed using qualitative analysis techniques.

The purpose of such analysis is to demonstrate that the absence of a fifth exit from the building does not impede the evacuation of occupants from the building.

The assessment considers a single fire source / outbreak only and, like the prescriptive provisions of the BCA, does not consider deliberate acts of vandalism or arson.

6.1.2 Analysis

As contained within Part 1 of this report above, the tent shall be provided with only four (4) exits in lieu of five (5), albeit that the aggregate exit width will exceed the prescriptive requirement.

In terms of this non-compliance, the following is also extended as the basis for which the non-compliance impact is obviated: –

(a) The aggregate exit width provided by the four (4) proposed exits totals 9,000-mm.

This aggregate exit width exceeds the prescriptive requirements of Clause H102.4 (7,500-mm) by an entire 1,500-mm; extra width facilitates an increase in the occupant flow from the building, and thereby a reduction in evacuation time.

Whilst an increase in the occupant travel time would normally be associated with a reduction in the number of exits provided from a building, the provision of extra width in this instance enables *any time increase* to be offset.

(b) Under a prescriptively compliant design of five (5) exits and 7,500-mm of aggregate exit width, an average exit size of 1,500-mm is provided.

Within the proposed design, an average exit width of 2,250-mm exists.

In the event that one (1) of the exits is blocked by fire, the consequence to both a deemed-to-satisfy and the proposed design is evident as follows: –

- Deemed-to-satisfy design –

  (i) Only four (4) exits
  (ii) Aggregate exit width of 6,000-mm

- Proposed design –

  (i) Only three (3) exits
  (ii) Aggregate exit width of 6,750-mm.

As illustrated, under fire conditions where an exit is blocked by fire, the aggregate exit width available in the proposed design exceeds the prescriptively compliant circumstance.

(c) The structure, when occupied, is under a constantly implemented and managed "Emergency Evacuation & Management Procedures" manual.

The presence of this manual, as includes for the constant presence of trained personnel, ensures that, in the event of any emergency, immediate actions in the form of both hazard management (ie. direct intervention to fire and the like) and managed evacuation, shall occur.

In recognizing that a prescriptively compliant design does not require the provision of such emergency procedures, and therefore relies upon the public to "respond" to an emergency, the direct management of the building serves to eliminate the extensive "response" time delay, as a component of the overall evacuation time (cue + response + travel), providing a further reduction that obviates increase associated with the reduction in exit numbers.

6.1.3 Conclusion

On the basis of the above, that –

(a) the subject building is of a temporary nature;

(b) compliance with the intent and objective is achieved; and

(c) the proposed design provides an aggregate exit width *in excess* of a prescriptively compliant design,

it is considered that compliance with performance requirement DP4 is achieved.

7.0 CONCLUSION & RECOMMENDATIONS

7.1 GENERAL

The foregoing assessment has addressed the non-compliance identified within item 1.4 of this report, and has verified that compliance with the nominated performance requirement is achieved.

The effectiveness and compliance of the Alternative Building Solution is contingent upon the implementation of the recommendations nominated below and the maintenance of the building and systems therein.

7.2 RECOMMENDATIONS

The following recommendations are derived through the assessment performed, and are made to ensure that the effectiveness of the Alternative Building Solution.

General

(a) Maintain ongoing house keeping during occupation to eliminate the accumulation of combustible materials throughout the building.

(b) Maintain the usage and building, occupant, and assessment characteristics as contained within / relied upon in the preparation of this report.

(c) Formulate and implement an AS 3745 compliant Emergency Evacuation & Management Procedures manual, documenting the results and limitations associated with this assessment.

Clause H102.4

Implement the other recommendations of this report.

Author

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Trevor R Howse & Associates Pty Limited