Out of Scope

[redacted]

-----Original Message-----
From: pjcircus [mailto:pjcircus@gmail.com]
Sent: Friday, 19 February 2016 2:00 p.m.
To: Murray Usmar
Cc: jeni@zirkacircus.com
Subject: FW: Check list and peg pull test

Hi Murry these are check sheet and photo records of set up and peg pull area and procedure that is followed at every venue and filed for reference Regards PJ

-----Original Message-----
From: Jeni Hou [mailto:jeni@zirkacircus.com]
Sent: Friday, 19 February 2016 1:12 PM
To: pjcircus
Subject: Check list

redco adding 'enginuity' to building projects

CALCULATIONS

Page A1

Client: FLAMING PHOENIX ENTERTAINMENT LTD (ZIRCA CIRCUS) 16 Nov '15

Project: MBIE - MULTI PROOF APPLICATION Project No. 15180

RECOMMENDED MINIMUM CHECKLIST FOR ASSEMBLED STRUCTURES

This list is not exhaustive and is meant as guidance only.

Inspection Date: 17 Feb 2016

Site: Upper Hutt

Inspected By: Kevin Qiao

	OK	NG
1. All aspects of the final structure are at a safe distance from power lines & other hazards	✓	
2. Ground pegs' pull-out testing results meet the minimum requirements	✓	
3. Hold down straps on walls are in place and adequately tensioned	✓	
4. All ropes, and guy wires are sound	✓	
5. Fabric is tensioned and not prone to ponding	✓	
6. Emergency exits are in place, operating correctly and are without obstruction	✓	
7. Escape routes are clear of obstruction	✓	
8. Exposed ropes and stakes adjacent to exits and entrances are marked and/or roped off	✓	
9. All locking pins and bolts are in place and secure	✓	
10. All structural supports are sound without cracks or significant dents and not overstressed	✓	
11. Eaves connection joints are securely locked home	✓	
12. No unrepaired tears in fabric are present	✓	
13. Walls are securely pegged and/or secured	✓	
14. The king posts are independently guyed where appropriate	✓	
15. Suspended weights are evenly distributed and do not overload the structure, no excessive weights suspended from roof beams etcs.	✓	
16. Wind anemometer is installed and the instructments are in good working orders	✓	
17. Final all-round visual check to satisfy that tent is erected securely	✓	

Comments:

CALCULATIONS

Page A2

Client:	FLAMING PHOENIX ENTERTAINMENT LTD (ZIRCA CIRCUS)	16 Nov '15
Project:	MBIE - MULTI PROOF APPLICATION	Project No. 15180

RECOMMENDED MINIMUM CHECKLIST FOR EQUIPMENTS

This list is not exhaustive and is meant as guidance only.

Inspection Date: 17 Feb 2016

Location: Upper Hutt

Inspected By: Kevin Qiao

Item	OK	NG
1. All ropes are checked for fraying and anything with over 20% fraying shall be discarded	✓	
2. All roof and wall covers are checked for tears and repaired in accordance with the manufacturer's recommendations.	✓	
3. All repairs to load bearing structural members are according to manufacturer's instructions or certified by a qualified structural engineer.	✓	
4. All wire rope are checked for fraying and thimble loop integrity.	✓	
5. All brackets are checked to ensure they are sound and secure.	✓	
6. All non-galvanised steel are checked for sign of corrosion.	✓	
7. All welds are checked for cracks.	✓	
8. All steel sections are checked for kinking or bowing.	✓	
9. Safety wires on all ridge poles are checked for soundness and secure fixing.	✓	

Comments:

Upper Hutt 15 to 21 Feb – Peg Pull test area

Out of Scope

From: pjcircus [mailto:pjcircus@gmail.com]
Sent: Friday, 19 February 2016 3:25 p.m.
To: Murray Usmar
Cc: jeni@zirkacircus.com
Subject: Load cell reference for files

Hi Murray,

Please find attached load cell photos as reference for the files

Cheers
PJ

From: Murray Usmar [mailto:Murray.Usmar@mbie.govt.nz]
Sent: Thursday, 18 February 2016 2:26 PM
To: pjcircus
Subject: RE: Benjamin Hemi CFEE Certificate [UNCLASSIFIED]

Thanks Paul

I assume that the letter is to come separately

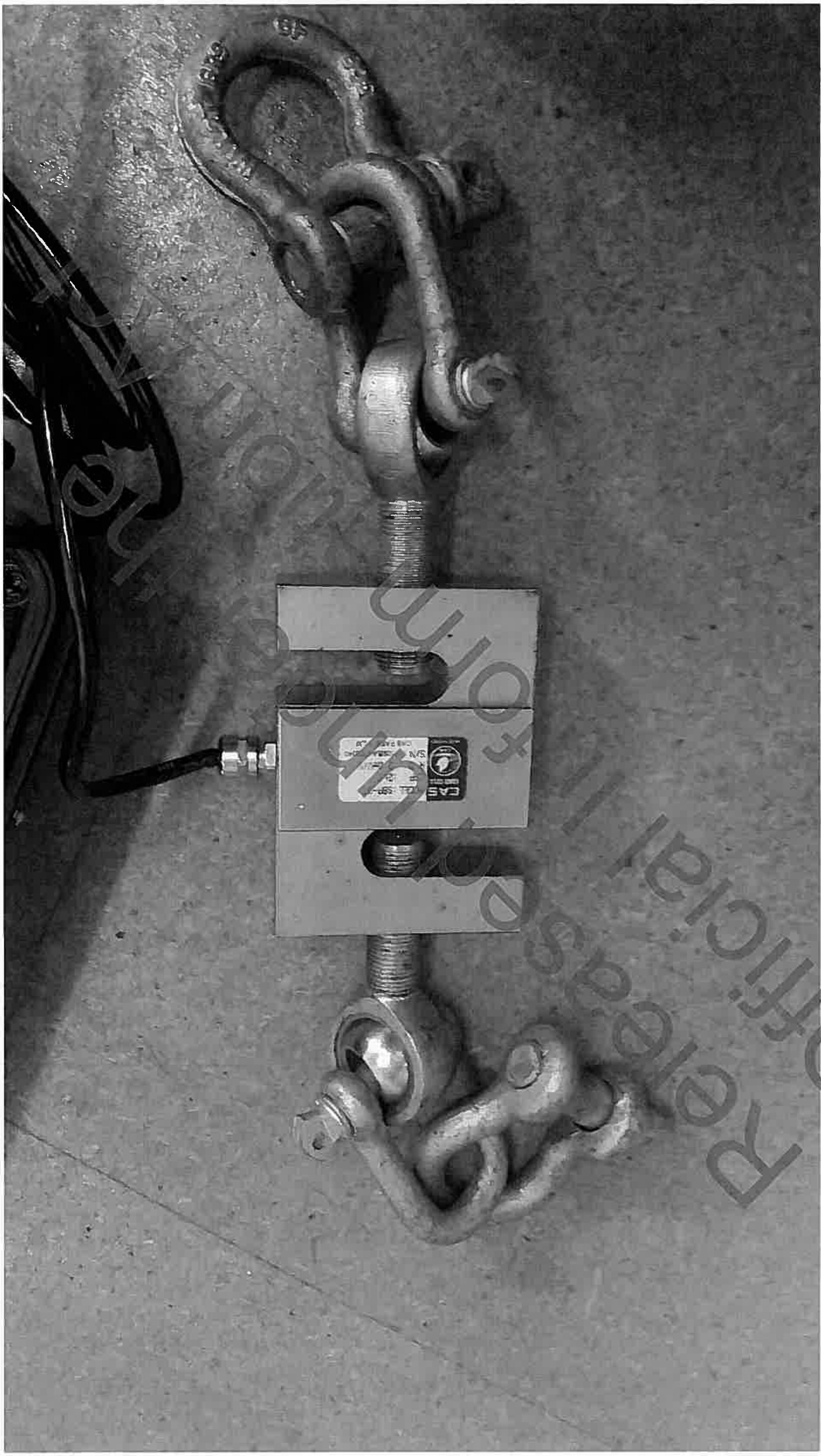
Murray Usmar
ASSESSOR NATIONAL MULTIPLE-USE APPROVALS

Determinations and Assurance Team.
Building System Performance Branch | Building, Resources and Markets Group.
Ministry of Business, Innovation & Employment

murray.usmar@mbie.govt.nz | Telephone +64 (4) 901 8365
15 Stout Street Wellington | PO Box 1473, Wellington 6140

Duplicate as per document 48


Sensortronic Scales
rinstrum
R323
GROSS / NET
PRINT
S/N:HANGING SCALE.01.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S/N

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HIKINA WHAKATUTUKI

National Multiple-Use Approval

APPLICATION ASSESSMENT CHECKLIST

Section A - Application Details / Assign Assessment

Application number:	10057	
Applicant's name:	Flaming Phoenix Entertainment Ltd (Zirka Circus)	
Application type	"Big Top" Circus Marquee	
Account manager:		Phone: Email:
Assessor (lead)	Murray Usmar	Phone: (04) 901 8365 Email: murry.usmar@mbie.govt.nz
Assessor (assigned)		Phone: Email:
Date task assigned	25/8/13 APPLICATION RECEIVED. 25/9 APPLICATION ACCEPTED.	
Date initial feedback required		
Required Completion Date		

Section B - Application Suspension (Lead Assessor only)

Suspension date:	Reason for suspension:
25/9/13	STRUCTURAL INFO REQUIRED – $2000 DEP PAID TODAY
16/10	DISCUSSION WITH REDCO HAN TONG.
2/10/2015	FURTHER CLARIFICATIONS RECEIVED FROM REDCO.

DISCUSSION ...

*REFER TO DARREL'S E-MAIL

Section C – Assessment Activity

General property details

No:	Item checked:	Comments: (illustrate design Compliance)	Reference worksheet
1.	1 Classification of exposure zones determined? Condition/s required.		
2.	Specifications suitable.		
3.	Plans – clarity/scales/details.		

Application number:	
Applicant's name:	

Foundations

No:	Item checked:	Comments:	Reference worksheet
4.	Specific engineering design.		
5.	Specific engineering design shown on plans.		
6.	Max Concrete strength specified. (refer to highest corrosion zone)		
7.	Footing dimensions detailed.		
8.	Pad & beam dimensions. (note 10kPa truss and second floor loadings)		
9.	Post footings.		
10.	Reinforcing: size, type, placement on plans.		
11.	Concrete block foundation detail.		
12.	Floor heights in relation to finished ground levels		

Slab on ground

No:	Item checked:	Comments:	Reference worksheet
13.	Max Concrete strength specified (refer to highest corrosion zone)		
14.	Floor heights shown on plans.		
15.	Hardfill detail provided.		
16.	Dam[illegible] of membra[illegible]		
17.	[illegible] Thickenin[illegible] pads.		
18.	Reinforcin[illegible] [illegible]cement on plans.		
19.	Sup[illegible] [illegible]forcing deta[illegible]		
20.	[illegible] joints detailed on plan[illegible]		
21.	[illegible] (slabs greater than 24m)		

Application number:	
Applicant's name:	

Framing

No:	Item checked:	Comments:	Reference worksheet
Wall framing			
22.	Timber grade & treatment for wall framing shown.		
23.	Max wind zone identified so fixings can be checked. (Condition / limitation required?)		
24.	Stud height & spacing detailed.		
25.	Bottom plate fixing detailed.		
26.	Lintel sizes & specifications detailed (SED beams/lintels checked by engineer)		
27.	Connections SED elements shown on plans.		
Floor framing			
28.	Timber grade and treatment for floor framing shown.		
29.	Floor loads in kPa detailed on plans.		
30.	Joist, trimmer joists, boundary joists and nogs/blocking including all sizes and spans detailed.		
31.	Support of walls parallel to floo[illegible] joists detailed.		
32.	Connections for floor fram[illegible]tailed (eg joist hangers etc).		
33.	Flooring material de[illegible] areas treatment r[illegible]		
Ceiling framing			
34.	Ceilin[illegible] siz[illegible]acing, grade (n[illegible] ctrical earthing [illegible]		
35.	[illegible] space provi[illegible] (note [illegible] a diaphragm)		
[illegible]	Ceil[illegible] linings detail[illegible]		
[illegible]			
37.	Timber gra[illegible] treatm[illegible] for roof framing sh[illegible]		
38.	Max wi[illegible] [illegible]ified so fixing[illegible] ca[illegible] [illegible]cked. ([illegible] [illegible]itation required?)		
39.	Ra[illegible] size, spacing's, [illegible]xings detailed.		
40.	[illegible] beam detailed (if SED [illegible]neer to check).		
41.	[illegible]in/batten size, spacing, span, grade and fixing detailed.		
42.	Skillion roof detail provided.		

Application number:	
Applicant's name:	

Truss roofs			
43.	Design details provided including all inputs and design criteria (note this may require a condition to the approval)		
44.	Buildable design provided from a truss manufacturer.		
45.	Point load lintels identified (SED engineer to check).		
46.	Point loads to floor (Note 10kPa requirements SED may be required engineer to check).		
47.	Connections for trusses to framing detailed.		
Deck/balcony construction			
48.	Timber grade & treatment for deck/balcony framing shown.		
49.	Joist grade, size, spacing's, span and fixings detailed. (Note 3kPa floor load required)		
50.	Saddle flashings fitted to deck/balcony joists.		
51.	Deck stringer spaced off cladding min. 12mm. Fixing details included.		
52.	Fixing of deck barrier detail (to NZS 1170).		
53.	Deck/balcony foundations (posts/ piles/ bearers) fixing, grade and size. (Note bracing requirements).		
54.	Deck/balcony drain[illegible] overflow details		
Wall bracing			
55.	Calculatio[illegible] pro[illegible] (Note where [illegible] contains SED such as a [illegible] er is required [illegible] ch[illegible]		
56.	[illegible] identified [illegible] can be checked. (Co[illegible] / limitation [illegible])		
[illegible]	[illegible] of bracing sp[illegible]		
58.	Are dragon ties [illegible]?		
59.	Spacing [illegible] and double [illegible] requirements.		
Ceiling [illegible] bracing			
[illegible]	[illegible] diaphragm required floor or [illegible]		
61.	[illegible]ular shape diaphragms (engineer to check).		
62.	Ceiling or floor framing adequate for support of diaphragm.		
63.	Openings in diaphragms.		
64.	Ceiling plane braces required (heavy roof)		

Application number:	
Applicant's name:	

Roof bracing			
64.	Timber size grade & treatment for roof bracing shown including gauge and protection if metal.		
65.	Bracing type and location detailed on plans.		
66.	Details provided for roof space braces, roof plane braces or sarking/sheet braces.		

Interior

No:	Item checked:	Comments:	Reference worksheet
67.	Insulation shown on plans.		
68.	BPI calculations provided.		
69.	Waterproofing detail showers wet area floors.		
70.	Stair, handrail & barrier details shown on plans.		
71.	Stairs, min. tread max. rise specified.		
72.	Fireplace / solid fuel heater shown on plans.		
73.	Manufacturers' specifications provided.		
74.	Flue location shown on elevations.		
75.	Light & visual awareness (incl. attic windows & skylights)		
76.	Area of glazing > 30% of wall		
77.	Ventilation (incl. all habitable spaces)		
78.	Safety glazing detail bathrooms, window seats, etc.		
79.	Air noise: design, construction detail shown on plans.		
80.	Air noise: producer statement – design received		
Food preparation & prevention of contamination			
81.	Sink & preparation surfaces		
82.	Food storage		
83.	Impervious wall linings		

Fire requirements

Application number:	
Applicant's name:	

No:	Item checked:	Comments:	Reference worksheet
84.	Fire wall specifications provided. (Note engineer to check)		
85.	Party wall details provided. (Note engineer to check)		
86.	Egress not greater than 20m to an exit.		
87.	Smoke alarms specified & shown on plans.		
88.	Outbreak from fire, gas appliances. (Non-combustible splashback's etc).		

Exterior

No:	Item checked:	Comments:	Reference worksheet
89.	E2 risk matrix assessment checked.		
90.	Exterior cladding(s) specified.		
91.	System specification provided.		
92.	Cavity system details (batten [illegible] fixing & treatment).		
93.	Control joints shown on plans (solid plaster).		
94.	Vermin proofing.		
95.	Internal & ext[redacted] [illegible] details.		
96.	Junction [illegible] dissimilar materi[redacted]		
97.	Bott[redacted] clearances to bottom edge/clear decks.		
Brick veneer			
98.	[redacted] cavity, [illegible] back proofing det[illegible] water veneer > 4m [illegible]		
99.	Brick veneer [illegible]		
[illegible]	Brick ve[redacted] [illegible]		
[illegible]2.	Bric[illegible] widths		
Flashing details			
103.	[redacted] doors, meter boxes, [illegible], etc.		
104.	[redacted] flashing detail		
105.	Chimney & flue flashing detail		
106.	Stop end apron flashing detail		
107.	Sill threshold flashing detail		
108.	Soffitt/wall junction flashing detail		
109.	Penetrations @ fixing points, pergolas, decks		

Application number:	
Applicant's name:	

110.	Penetrations of electrical cables		
111.	Parapets - caps, walls, intersections, etc.		
112.	Intersections, roof walls, dissimilar claddings.		
Roofing			
113.	Roof membrane substrate detail shown on plans.		
114.	Roof framing set out suitable for substrate.		
115.	Roof cladding specified.		
116.	Roof cladding suitable for min. roof pitches (length of sheet may effect min. pitch).		

Plumbing and drainage

No:	Item checked:	Comments:	Reference worksheet
117.	Schematic layout provided – waste/drains		
118.	Discharge length of pipes		
119.	Discharge pipes venting		
120.	Soil stack layout provided		
121.	Soil stack layout (incl. relationship to floor joists)		
122.	Soil stack venting		
123.	Schematic layout provided – waste/drains		
124.	Discharge length of pipes		
125.	Discharge pipes venting		
Water supply			
126.	Type of material		
127.	Backflow prevention		
128.	Tempered hot wa'of m		
[illegible]	Provision of laundering facilities		
[illegible]	Water main pressure for sprinklers. (Note condi'on/limitation may be re'uired)		

Stormwater drainage		
131.	Gutter & outfall sizes in relation to roof size	

Application number:	
Applicant's name:	

132.	Site stormwater/surface water collection & disposal detail (Erosion of sloping sites)		
133.	Internal gutter(s) construction detail shown on plans.		
134.	Internal gutter(s) overflow detail shown on plans.		

Application number:	
Applicant's name:	

Section D – Assessment Conditions

Conditions/limitations required to be placed on the application. (includes any additional inspections required)	
1.	
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Application number:	
Applicant's name:	

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26.	
27.	

<u>Section E</u> – Time and Costs

Timesheet Details

Date	Name	Role	Application Date	Hours Allocated
			TOTAL HOURS	

Disbursements Costs (excl. GST)

Date	Details (include full details)	Amount ($)
	TOTAL COSTS	

Application number:	
Applicant's name:	

I ……………………………………………confirm that the above time and costs are a true and accurate record of the time and costs allocated to this application.

Authorised Signature ______________________________ Date ______________

Role ________________________________

Section E – Recommendation

To: ~~Lead Assessor~~ / Manager / ~~DCE (delete non applicable)~~

I MURRAY USMAR recommend that this application be approved / ~~not approved for~~ a National Multiple-Use Approval

Authorised Signature [signature] Date 19-02-16

AS ABOVE

Authoriser (having delegated authority)

I approve / do not approve this application for a National Multiple-Use Approval and authorise the issue of a NMUA Certificate to the Applicant

Signature [signature] Date 19/2/16.

Name J. C. Gardiner

Position [signature]

BASED ON: 1) SITE SAFETY MANAGEMENT PROCEDURES BEING IN PLACE.

2) RISK MANAGEMENT + MITIGATION PROCEDURES

3) EMERGENCY EVACUATION PROCEDURES.

4) IN SERVICE HISTORY – APPROX 3 YEARS SINCE APPLICATION SUBMITTED + MARQUEE HAS BEEN USED AT VARIOUS SITES IN THAT TIME.

ALSO SUBJECT TO ~~FURTHER~~ FURTHER MONITORING WHILE ERECTED IN WELLINGTON.

Assessment for Compliance with Building Code Clauses.

Zirka Circus Application. App: No. 10057

Code Clause:	ASSESSOR	Comments
B1 Structure	Internal: Cheong	ASSESSMENT BY ENGINEERS.
B2 Durability	Internal: Usmar	FABRIC, ROPES STEEL FRAME.
C Protection from Fire	Internal: Saunders	PEER REVIEW OF FIRE REPORT/FEB.
D1 Access	Internal: Usmar	LAYOUTS (GROUND PLAN) 3.4m WIDE EXITWAYS
F6 Visibility in Escape Routes	Internal: Saunders	AS ABOVE - FIRE REPORT
F7 Warning Systems	Internal: Saunders	AS ABOVE - FIRE REPORT.
F8 Signs	Internal: Saunders	AS ABOVE - FIRE REPORT.

Ministry of Business, Innovation & Employment

MultiProof Approval Service

Compliance with Building Code Clauses - Marquees

The relevant Building Code clauses are described below. However, in each particular case the Building Code should be consulted to check that the relevant performance criteria have been met. Visit http://www.dbh.govt.nz/bcl-get-a-copy-of-building-code to find out how to get a copy of the Building Code.

B1 Structure –

Objective:
to safeguard people from injury caused by structural failure.

Functional Requirement:
it shall withstand the combination of likely loads, (including wind, earthquake, live and dead loads) it will experience during its live-span.

Compliance: *Provide details of structure frame (if part of marquee design), engineer's calculations to show that the marquee will withstand wind pressures inside & outside, data on the strength of the fabric, strength of fixings (guy ropes, marquee to guy rope, guy rope to ground), ground conditions.*

It may be easier to provide test reports to show this. The marquee manufacturer may have done this during the design process. The test reports should include wind speed & pressure and ground conditions.
The relevant standard is AS/NZS 1170.
A Design Features Statement from the designer (Engineer) would be useful.

B2 Durability –

Objective:
to ensure that the marquee will continue to satisfy the other objectives of the building code throughout its life.

Functional Requirement:
the materials & components shall be sufficiently durable to ensure that the marquee satisfies other functional requirements during its life-span.

Compliance: *Provide information on the materials used, e.g. the fabric, frames, ropes, pegs etc. For example: Are there fire resistant chemicals in the fabric? If so, how long do they last? And the type of materials used for the components.*

28/8/13

ZIRKA CIRCUS MARQUEE STRUCTURE.

- DESIGNED TO EUROPEAN STANDARDS.
- DOC'S IN GERMAN + ITALIAN.
- CALC'S NOT LOCALIZED.
- SHOP DRAWINGS.

SOLUTIONS

- IN SERVICE HISTORY
- MONITOR WIND SPEED + PRESSURE.

ZIRKA CIRCUS MARQUEE FIRE REPORT.

DATED 21 AUG 2013.

BASED ON:
C/VM2 MODIFIED. - AS AGREED ~~BY~~ TO BY NZFS + MBIE.

C/VM2 CHANGED IN JULY 2014.

DESIGNS VALID UNTIL 28 FEB 2015

- HOW DOES THE CHANGES AFFECT THE DESIGN?
- STILL COMPLIANT WITH C1-C6. (BUILDING CODE)?
- CAN WE STILL ISSUE THE ~~STATEMENT~~/CLARIFICATION THAT IT COMPLIES WITH NZBC ANAP, GIVEN THE NATURE OF THE "BUILDING"?
- COUNCIL MUST ACCEPT THE MULTIPROOF
  ↳ NOT ISSUED.
- ALTERNATIVE SOLUTION.

C DOCS PROTECTION FROM FIRE.

- OPERATIONAL INFORMATION SUPPLIED BY APPLICANT.
  - EXIT SIGNS - ILLUMINATING SIGNS: POWERED FROM ~~[illegible]~~ GENERATOR + BATTERY.
  - EMERGENCY LIGHTING - PRODUCT INFO SUPPLIED
    ↳ NIKKO TWIN LED.
    - BATTERY POWERED.
  - ALARMS - TESTED
  - EXTINGUISHERS, ~~[illegible]~~ POSITIONS NOTED.

SAFETY SYSTEMS ARE EFFECTIVELY REINSTALLED EACH TIME THE 'BUILDING' - MARQUEE IS 'RE-CONSTRUCTED' - ERECTED.

EXAMPLE ~~SAMPLE~~ TEST CERTIFICATE FOR EMERGENCY LIGHTING SUPPLIED.

ASSESSMENT OF ALAN MOLLE'S COMMENTS.

✱ 1) NOT REQUIRED - REFER TO DEBBIE SCOTT EMAIL DATED 22 MAY 2015

ZIRKA CIRCUS MARQUEE. REVIEW 13/1/16.

STRUCTURE INFO SUPPLIED

- STRUCTURAL CALC'S 28 NOV 2013, DATED FEB 20[14]
  AFTER PRE-ASSESSMENT BY ENGINEERS (DARREL + GRAEME

⇒ ENGINEERS TO COMMUNICATE DIRECTLY WITH REDCO TO RESOLVE ISSUES.

- STRUCTURAL CALC'S REV 2 DATED FEB 2014
  ↳ REVIEWED BY GRAHAM [illegible]

- STRUCTURAL CALC'S REV 3 ALSO DATED FEB 2014
  — REVIEWED BY AMIR MANSOUR

- STRUCTURAL CALC'S REV 4 MARCH 2014.

- " " REV 5 JULY 2014.

⇒ JULY 2015
REDCO TO SUBMIT FINAL SET OF INFO?

- NEW SET OF STRUCTURAL CALCULATIONS FROM REDCO DATED AUG 2015 RECEIVED 25 AUG 2015.

* FURTHER REVISION A DATED NOV 2015

ALTERNATIVE SOLUTION: OPERATIONAL SITE MANAGEMENT SYSTEMS.

POINTS TO NOTE:

- BUILDINGS (MARQUEE) CONSTRUCTED, + DEMOLISHED — REGULARLY.
- MATERIALS REUSED
- (STRUCTURAL FRAMES ETC.) → SYSTEMS INSPECTED + CHECKED BY EACH COUNCIL MORE REGULARLY.

26/2 → 6/3.

ZIRKA CIRCUS - MARQUEE   10057.
2-02-16.

REVIEW OF ASSESSMENT.

COMPLIANCE WITH BUILDING CODE.

1) B1 STRUCTURE.

BACKGROUND: • ITALIAN DESIGN - MANUFACTURE.
• P.V.C FABRIC - FERRARI 702
INSTALLED BY BAYTEX MANUFACTURING
TAURANGA
• REDCO PROFESSIONAL ENGINEERS
TAURANGA ASSESS MARQUEE DESIGN
TO RELEVANT NZ DESIGN STANDARDS
TO SHOW COMPLIANCE WITH B1.

MEANS OF COMPLIANCE.
AS/NZS 1170: 2011
NZS 3404 - STEEL STRUCTURES.

ALTERNATIVE SOLUTIONS (POINTS NOTED FROM DESIGN ~~REPORT~~ FEATURES REPORT
• NZBC PRIMARILY INTENDED FOR PERMANENT STRUCTURES
• NZBC DESIGN LOADS BASED ON PROBABILITY OF OCCURRENCE.
• MARQUEES ARE TEMPORARY DEMOUNTABLE OR RELOCATED STRUCTURES - NOT EXPECTED TO WITHSTAND MOST ADVERSE WEATHER LOADINGS
• SPECIFIC EVENTS CAN BE POSTPONED OR CANCELLED IN THE EVENT OF ADVERSE WEATHER.
• REDCO HAS 10 YEARS EXPERIENCE WORKING WITH MARQUEES + PROVIDING ERECTION/DISMANTLING RECOMMENDATIONS - BASED ON WIND SPEEDS

(2)

ASSESSMENT HISTORY.

- ~~OF~~ ORIGINAL STRUCTURAL ASSESSMENT DOCUMENT SUBMITTED 26 AUG 2013. (DATED FEB 2013)
- * THIS HAS AN ASSESSMENT OF THE ITALIAN DESIGN BY REDCO
- SEVERAL REVISIONS, DISCUSSIONS + E-MAILS BETWEEN MBIE STAFF + REDCO.
- AFTER INHOUSE DISCUSSIONS DECISION TO FOCUS ON SITE SAFETY ~~MANAGEMENT~~ AS OPPOSED TO THE DESIGN DETAILS
  - REFERENCE DARREN'S E-MAIL 10/12/15.

ITEMS REQUIRED

1/ ANCHORAGE OF THE GROUND PEGS + TEST PROCEDURES.
- PEG - PULL-OUT TEST DESCRIBED IN REDCO SUMMARY.
- SAMPLE OF PULL-OUT TESTS SUPPLIED.
- DISCUSSED WITH APPLICANT - PEG PULL TESTS ~~DONE BY~~ ALL NEW SITES
  - LOG OF RESULTS KEPT.
- DISCUSSED WITH APPLICANT: MOST SHOWS ARE TO RETURN SITES. - GROUND COMPACTED.
- INSTALLATION PROCEDURE NOTES 29/11/13.

2/ WIND MONITORING
- ~~ON-SITE MONITOR~~ • LINK TO MET OFFICE WEATHER REPORTS
- ON-SITE MONITORING.
- HIGH QUALITY WEATHER STATION - DETAILS SUPPLIED: AERCUS WS3083
  NEW ANEMOMETER ON-SITE AT ALL TIMES.
- WIND SPEED INFO BY REDCO.
- MARQUEE CAN NOT BE ERECTED IF WIND IS IN EXCESS OF 8 m/s (30km/h).
- COMPANY POLICY SHOW WON'T RUN IF WIND IS IN EXCESS OF (90 km/h) = 25 m/s.

* REDCO RECOMMENDATION 50 km/h. 13.8 m/s.

(3)

3/ EVACUATION PROCEDURES
- AS DETAILED IN FIRE REPORT.
- DETAILS OF EMERGENCY LIGHTING SUPPLIED.

4/ USE CONDITION MONITORING + UPKEEP PROCEDURES.
- DETAILS PROVIDED BY APPLICANT
↳ SUPPORTING INFO FROM QUALIFIED SUPPLIERS
↳ RIGGERS HAW [illegible] OF CAMBRIDGE FABRICATION TARRANC A.
- RELOCATION + ASSEMBLING PROCEDURES.

FRIDAY. 26 ↕ 25 THURS

- PEG PULL TEST – GROUND CONDITIONS.
- ERECTION PROCEDURE – MANUAL
- EMERGENCY SAFETY INSTALLATIONS – SUPPLIERS.
- WIND MONITORING PROCEDURES.
- ACTION PLAN WHEN WIND REACHES UPPER LIMIT.

DRAG PULL TEST PROCEDURES,

- JAMES' E-MAIL 29 NOV 2013.
  - IN SERVICE HISTORY.

- RESULTS OF NAPPER TEST.

-

- IS GROUND CHECKED.

  - ~~REL~~ IF SOFT WHAT HAPPENS.

WIND MONITORING

- JAMES' E-MAIL 28 NOV 2013.
  - MET SERVICE MONITORING
  - ANEMOMETER ON SITE - DETAILS PROVIDED.
  - MARQUEE CAN'T BE ERECTED IN WIND EXCESS OF 8m/s.

DOCUMENTS FOR REGISTER:

- FEB FIRE ENGINEERING BRIEF. DATED. 14/6/13.
- ✓ FLOOR PLAN - ON FIRE DATE 31/07/13.
- ✓ EMERGENCY LIGHT POSITIONS.
- ✓ FEB APPENDIX 1. - NZFS ACCESS, 18
  - 2 - BCA CHECK SHEET 19
  - BA SEC 46. ~~20~~
  - 3 - COMPLIANCE SCHEDULE INFORMATION, 20
  - 21.
- ✓ EVACUATION PLAN
- ZIRKA CIRCUS HEALTH + SAFETY OPERATING PROCEDURE

LISTED ON CERTIFICATE.
- DRAWINGS
- OPERATOR'S MANUAL.
- EVACUATION PLAN.
- SAFETY EQUIPMENT INSTALLATION PROCEDURE

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HIKINA WHAKATUTUKI

MultiProof Certificate

This is to certify that a National Multiple-Use Approval has been issued to:

Flaming Phoenix Entertainment Limited (Zirka Circus)

Circus Marquee — 35m diametre design

under Section 30F of the Building Act 2004 in respect of the approved plans and specifications* and subject to the conditions** specified:

Details of this National Multiple-Use Approval have been entered in the register of National Multiple-Use Approvals in accordance with Section 273 of the Building Act 2004.

John Gardiner
Manager Determinations and Assurance
Building System Performance Branch
Ministry of Business, Innovation and Employment

19 February 2016
Date Issued

A10108
Certificate Number

*The approved plans and specifications are those held by the Ministry
**See Schedule for specific drawing references, permitted variations and conditions of approval

Note: The National Multiple-Use Approval referred to in this certificate is subject to change, suspension or revocation. For the current status of this National Multiple-Use Approval, check the Ministry's website www.building.govt.nz

Schedule for certificate number A10108

Permitted Variations:

Floor Plan:
None

Cladding:
None

Certificate Holder

Flaming Phoenix Entertainment Ltd
31 Brammer Street Flagstaff
Hamilton 3210
Company number: 2155874
Certificate number: A10108

Issued by

Ministry of Business, Innovation and Employment
PO Box 1473, Wellington 6140
Website:
www.building.govt.nz/multiproof
Email: multiproof@mbie.govt.nz

Building Reference Documents

Anceschi Alberto E Paolo 35m Diametre Circus Structure:

1. Operator's and Maintenance Booklet
   Accompanying drawings:
   Drawing 1 date 15.06.2012
   Drawing 2 date 15.06.2012
   Drawing 3 date 15.06.2012
   Drawing 4 date 15.06.2012
   Drawing 5 date 15.06.2012 Total 5 sheets
2. 32m Circus Tent Translated set of drawings 15180. Numbered 20 to 34. Total 15 sheets
3. Photos. Total 3 sheets

Evacuation Plan

Emergency Safety Equipment Installation Procedures

Peg Pull Test and Wind Monitoring Procedures

Quality Assurance Checklists:
1. Equipment
2. Assembled Marquee

This National Multiple-Use Approval is subject to the following conditions:

1. Subject to all of the safety procedures, safety plans and Quality Assurance checks (as set out in Building Reference Documents) this National Multiple-Use Approval may only be used in its entirety.
2. This National Multiple-Use Approval includes the Permitted Variations set out in this Schedule. If there are changes to the approved documents (listed above) this National Multiple-Use Approval does not apply.
3. Mirror images of the floor plan are permitted.
4. This National Multiple-Use Approval can only be used where the following conditions apply:
   a. Snow Loading: Marquee is not to be erected or occupied by the Public during snow conditions.
   b. Wind Loading: Site wind speed is to be monitored using a wind anemometer on-site
   c. Ground Condition: Site to be tested using Peg Pull Test Procedures

Han Tong

From: Ian Gray
Sent: Wednesday, 10 April 2013 4:28 p.m.
To: Han Tong
Cc: Circus Aotearoa; Joe Hallam
Subject: FW: Circus Aotearoa
Attachments: 20130410_103720.jpg; 20130410_103730.jpg; 20130410_103735.jpg; 20130410_105013.jpg; 20130410_105022.jpg; img-4101304-0001.pdf

Afternoon Han

Please find below the direct pull out results from site. I trust that these are sufficient for you to work out hold down details and apply a factor of safety for Paddy's building consent.

Regards

Ian

From: Joe Hallam
Sent: Wednesday, 10 April 2013 12:13 p.m.
To: Ian Gray
Subject: Circus Aotearoa

Ian

The site is well grassed with no obvious geological features. The red circle indicates the test location.

We used a truck mounted HIAB rated to 12 tonne with a scale between the lift arm hook and the chains wrapped around the peg. The peg is steel, about 1m long and about 50mm diameter.

The pegs were loaded at an angle approximately the same as the guy ropes for the tent.

We carried out 2 tests, the first for a single peg, then for a 2 peg arrangement as per the photo.

Scale readings for the single peg arrangement were

- 498kg when the peg first began to move, and
- 625kg when the soil uplifted in front of the peg.

Scale readings for the two peg arrangement were

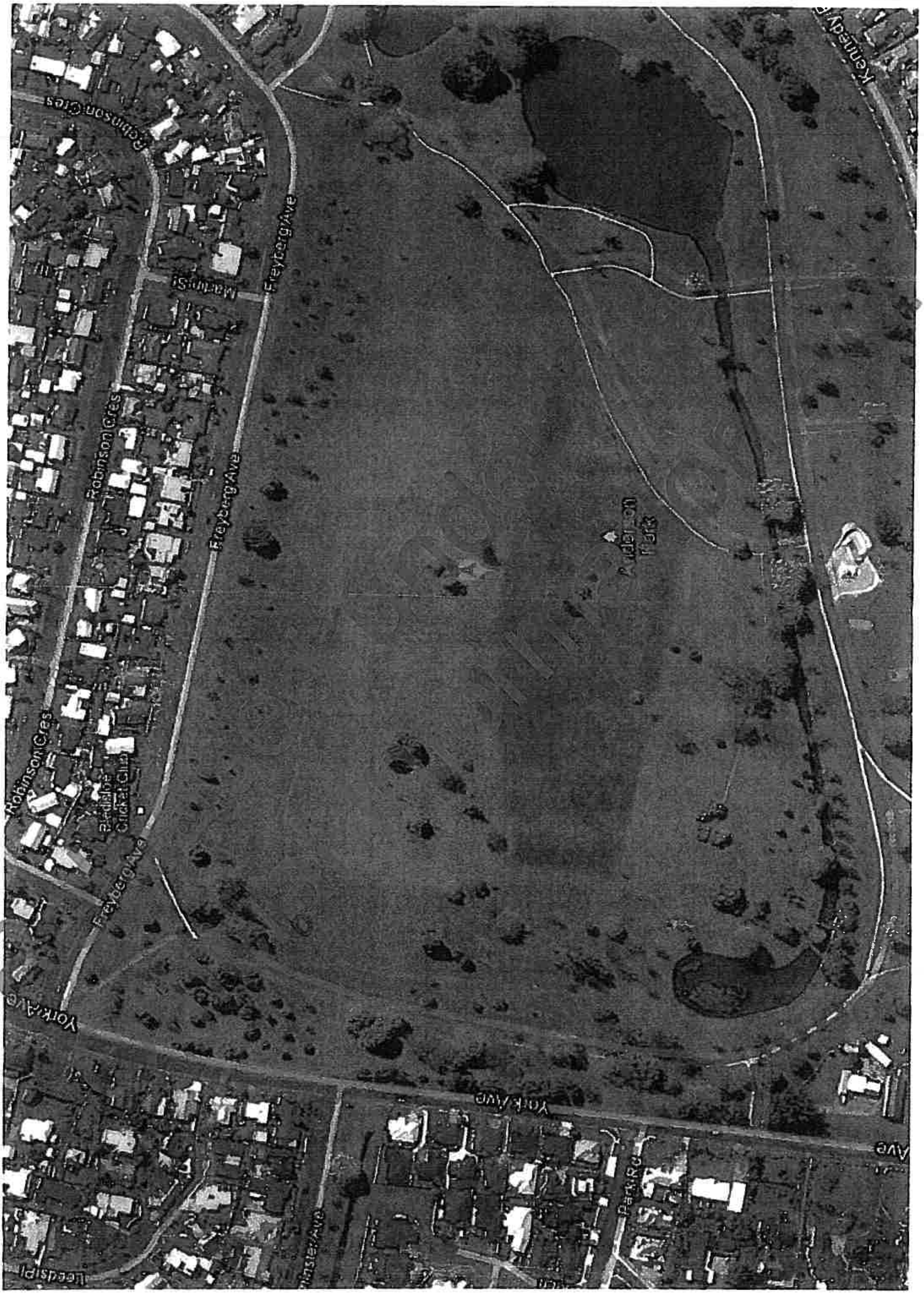
- 498kg when the peg first began to move,
- 825kg when the soil uplifted in front of the first peg (second remained stable), and
- 980kg when the soil began to uplift in front of the second peg.

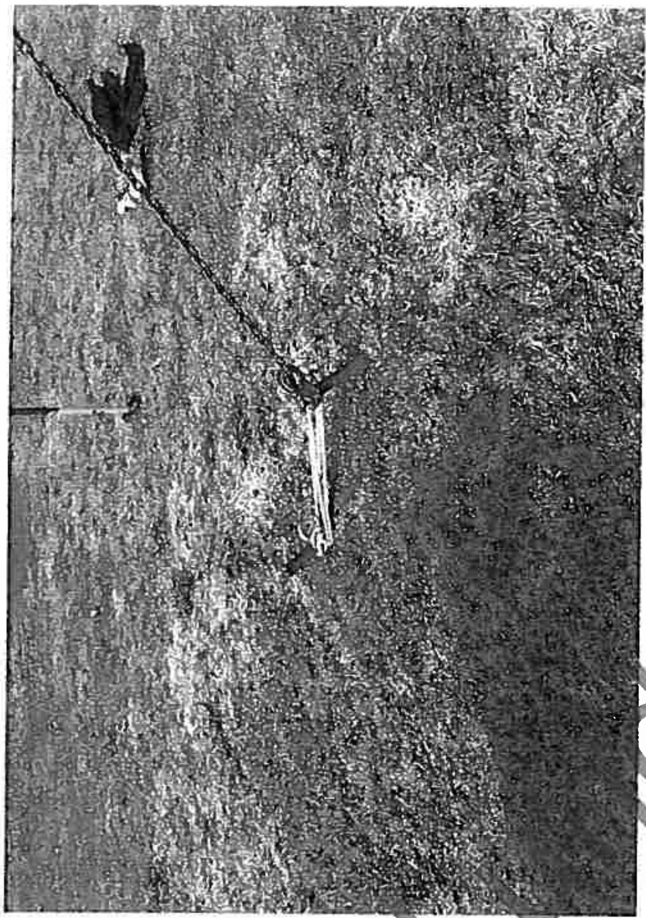
Paddy advised that after strong winds the tent boss will check the pegs and if he finds a gap behind the main peg that he can put his thumb into, then he will add another peg to that stay.

3hours of my time in the end.

Call me if you have any queries.

Joe Hallam
Design Engineer
+64 6 835 2096 | s 9(2)(a)
Suite 2, 21 Browning Street, Napier PO Box 165 TAUPO 3351


Freyberg Ave
Robinson Cres
Martin St
York Ave



Out of Scope

From: James Finlayson [mailto:james@zirkacircus.com]
Sent: Sunday, 25 August 2013 11:03 p.m.
To: Murray Usmar
Subject: Zirka Circus Multiproof Application

Dear Murray.
Please find attached my MultiProof application.
I have also attached the FEB document, as well as my own file which contains everything I normally use for Building Consent Applications.
Finally I have added a photo of our Big Top Tent so that you know what you are actually dealing with!

There were one or two items that I was a little unsure of in Section 2, but I am pretty sure that SED is the correct answer...

In the checklist there is a requirement for evidence of how many times we will use the MultiProof. We have erected the tent in 66 different locations around NZ, twice, in the last 4 years (a tour takes 2 years). We are just beginning our third tour.

I have been granted building consents for each and every one of those venues. Do you require to see any Code Compliance Certs or anything?

I am always available via phone or email should you need any further information or clarification.
Regards

James

--
James Finlayson
General Manager
Flaming Phoenix Entertainment Ltd (Zirka Circus)

www.zirkacircus.com

s 9(2)(a)

Ministry of Business, Innovation & Employment

MultiProof application form

June 2013

New Zealand Government

1. The applicant

Please print clearly in black or blue pen and complete all sections.

Name of applicant (full legal name of person or entity): Flaming Phoenix Entertainment Ltd (Zirka Circus)

Name of agent acting on behalf of applicant (if applicable): James Finlayson (General Manager)

Street address: 254 Aka Aka Rd

Suburb: R.D. 3

Town or city: Pukekohe | Postcode: 2678

Postal address or registered office: As Above

Suburb:

Town or city: | Postcode:

Phone: | Fax: | Mobile:

Email: | Website:

Bank account details (for any refunds that may become due):

Account name: Flaming Phoenix Entertainment Ltd

Account number: s 9(2)(a)

Company number (if relevant): 2155874

Contact person (for all enquiries): James Finlayson

Phone: s 9(2)(a)

Email: james@zirkacircus.com

☑ I confirm (please tick) that all of the information provided in this form is correct, and that I have the authority to bind the applicant to the payment of the MultiProof processing fees and charges.

Signed for and on behalf of applicant: [signature] | Date: 25/8/2013

Name: James Finlayson

Role/position: General Manager

Application fees

You must include a pre-payment of **$2,000 (inclusive of GST)** with your application. This includes a $511.11 non-refundable component that covers the initial processing costs. The remaining $1,488.89 is pre-payment for assessment work to be undertaken on the application.

Where your application does not proceed, you will be charged for any work undertaken and refunded for any credit.

Where the value of any work undertaken exceeds $2,000, you will be invoiced for any outstanding amount owing in accordance with the rates set out in the Building (National Multiple-Use Approval) Regulations 2011.

Banking details

All payments should be lodged to the following account:

Name:	Ministry of Business, Innovation and Employment
Account Number:	03-0049-0005128-00
Reference Details:	MultiProof (insert applicant's name) [for example, MultiProof, ABC Builders Ltd]

Note: All cheques should be made payable to Ministry of Business, Innovation and Employment and crossed 'not transferable'.

Completed application

Completed applications should be sent to:

By post or courier:

National Multiple-Use Approval Service
Ministry of Business, Innovation and Employment
PO Box 10-729, Wellington 6143
Level 6, 86 Customhouse Quay, Wellington 6011

By email: multiproof@dbh.govt.nz

Contact us

Should you wish to discuss the details of your application, please contact the Advisor Client Services on 04 9018366, or by email on multiproof@dbh.govt.nz.

Further guidance on the Service can be found online, at www.dbh.govt.nz/multiproof.

Important

1. Please ensure you have completed the MultiProof application form in full and attached full plans and specifications together with all the relevant material. You will need to include $2,000 with your application or make an electronic payment before forwarding your application pack to the Ministry.

2. Please note you will be required to provide evidence of your ability to replicate the building design at least 10 times in the two years following any approval of your application.

3. You should, wherever possible, include all variations to the design in this application and attach all necessary documentation for those variations at the same time to minimise the overall assessment costs. If approved, the Ministry will include any approved variations on your MultiProof certificate.

4. Wherever possible, files should be sent by DVD/CD to avoid any unnecessary copying/scanning costs. Email file sizes may prohibit sending files via the internet and should therefore be sent on disk via courier to the address above. For ease of use, application files should be submitted in accordance with the guidelines for lodging a building consent (see the Building and Housing Group's website http://www.dbh.govt.nz/UserFiles/File/Publications/Building/Building-Act/guide-to-applying-for-a-building-consent.pdf)

5. Please note that Restricted Building Work applies to MultiProof approvals. If you are applying for approval for a house or small to medium sized apartment building, you will need to provide a Certificate of Work from each Design LBP who carried out or supervised the Restricted Building Work design. Please see http://www.dbh.govt.nz/builditright for more information about Restricted Building Work and to download the form.

6. If your application is approved, the Ministry will require full payment of all/any outstanding charges prior to the issue of the MultiProof certificate.

7. If you are paying the application pre-payment fee ($2,000) by cheque, we are unable to accept your application until the cheque has been cleared.

8. Depending on the skills required to assess your application, fees have been set by regulations at the following levels:

   - Advisor, Client Services (for account management) — $98.13 per hour
   - Assessor — $150.27 per hour
   - External Specialists — $230.00 per hour

   All rates include GST and exclude any disbursements which, if any, will be charged at cost.

Privacy notice:
Any personal information submitted in this application will be kept and maintained by the Ministry of Business, Innovation and Employment in accordance with the Privacy Act 1993. Personal information will be used for determining applications for MultiProof approvals and will also be used for the maintenance and administration of the public register of MultiProof approvals. You have the right to access, and to have corrected any information about you that is held by the Ministry.

Official Information Act notice:
All applications provided to the Ministry become official information and may be the subject of requests for information under the Official Information Act 1982. While applicants may wish to indicate grounds for withholding specific information contained in their application eg, that the information is commercially sensitive, this in no way guarantees the Ministry will withhold that information. Any decision to withhold information requested under the Act may be reviewed by the Office of the Ombudsmen.

2. The project

Describe the proposed building work with sufficient detail to enable the scope of the work to be fully understood (continue on a separate piece of paper if necessary).

This Multi Proof Application is for the Zirka Circus "Big Top" Circus Marquee.
This marquee is erected at various sites all around NZ. It is always erected and rigged in exactly the same way.

Identify the scope of the approval by ticking the appropriate boxes below. Values chosen for each category are the maximum (e.g. up to very high wind zone, up to earthquake zone 3), and the supporting documentation must show how these levels will be achieved.

Wind Zone:	☐ Low	☐ Medium	☐ High	☐ Very High	☐ Extra High	☑ SED
Earthquake Zone:	☐ 1	☐ 2	☐ 3	☐ 4		☑ SED
Subsoil Classification:	☑ A	☐ B	☐ C	☐ D	☐ E	☐ SED
Exposure Zone:	☐ B	☐ C	☐ D			☑ SED
Climate Zone:	☐ 1	☐ 2	☐ 3			
Ground Snow Loading:	☑ 1.5 kPa	☐ 2.0 kPa				☑ SED
Ground Bearing Capacity:	☑ Good Ground					☑ SED

Note: SED = specific engineering design
Note: See NZS 3604:2011 for definitions of zones and capacities (see NZS 4218:2009 for Climate zone definition)

Intended life of the building if less than 50 years (number of years):	

3. Contacts

Designer or architect		**Structural engineer**	
Business/name: Anceshi Aberta + Paolo		Business/name: Redco	
Address: Via Gugielmo Marconi 13, Rio Saliceto Reggio Emilia, Italy		Address: 470 Otumoetai Rd Tauranga 3110	
Phone (daytime): +39 0522 699949	Mobile:	Phone (daytime): 07 571 7770	Mobile:
Phone (after hours):		Phone (after hours):	
Email:		Email: redo@redco.co.nz	
Registration/qualifications:		Registration/qualifications: Chartered Professional Engineers	
Engineer		**Other**	
Business/name:		Business/name:	
Address:		Address:	
Phone (daytime):	Mobile:	Phone (daytime):	Mobile:
Phone (after hours):		Phone (after hours):	
Email:		Email:	
Registration/qualifications:		Registration/qualifications:	

Office use only:

Application received by:	
Date application received:	MultiProof application number:
Invoice receipt number	AR client number:

4. Means of compliance

Evidence of how it is proposed the building work will comply with the Building Code, as detailed within the Design Summary Checklist below:

MULTIPROOF DESIGN SUMMARY CHECKSHEET		
Note:	Select your proposed means of compliance against each of the relevant Building Code clauses by ticking the relevant box or boxes, or by specifying another means of compliance under 'Other'. Then provide details of the specific means of compliance by listing the products, systems and/or the methods used in the plans and specifications to confirm compliance. Standards used for compliance shall be the most current version at the time of application or, if cited in a compliance document (verification method or acceptable solution), should be those versions quoted with all necessary modifications	
Building data:	**Building category:** (see AS/NZS 1170.0 :2002, table 3.2.) *(Example: Importance level 2 / Domestic dwelling)*	
	Floor live loads: (see AS/NZS 1170.1 :2002, table 3.1) *(Example: 1.5 kPa)*	

BUILDING CODE CLAUSE :	COMPLIANCE USING :	MEANS OF COMPLIANCE :
Indicate which of the following Building Code clauses are involved in the work.	AS or VM, or Standards, or identify other documents used to establish compliance	Provide details of products and systems and/or the methods used in the plans and specifications to confirm compliance with the nominated approach. Identify if using: • product certification (Codemark) • specific design • producer statement (chartered professional engineer or other engineer) • licensed trade (electrical/gasfitting) • other (specify)
B1 Structure	☑ B1/AS1 ☑ B1/VM1 ☐ B1/AS2 ☐ B1/AS3	See attached PS1 documentation
B2 Durability	☐ B2/AS1 ☐ B2/VM1	
C1-C6 Protection from Fire	☐ C/AS1 ☐ C/AS2 ☐ C/AS3 ☑ C/AS4 ☐ C/AS5 ☐ C/AS6 ☐ C/AS7 ☐ C/VM1 ☑ C/VM2	C/AS4/3.3.1, 3.3.4 See attached FEB Documentation.
D1 Access Routes	☐ D1/VM1 ☑ D1/AS1	See attached FEB Documentation

BUILDING CODE CLAUSE :	COMPLIANCE USING :	MEANS OF COMPLIANCE :
D2 Mechanical installations for access	☐ D2/AS1 ☐ D2/AS2 ☐ D2/AS3	
E1 Surface Water	☐ E1/AS1 ☐ E1/VM1	
E2 External Moisture	☐ E2/VM1 ☐ E2/AS1 ☐ E2/AS2 ☐ E2/AS3	
E3 Internal Moisture	☐ E3/AS1	
F1 Hazardous Agents on Site	☐ F1/VM1	
F2 Hazardous Building Materials	☐ F2/AS1	
F3 Hazardous Substances and Processes	☐ F3/VM1	
F4 Safety from Falling	☐ F4/AS1 ☐ Fencing of Swimming Pools Act 1987	
F5 Construction and demolition hazards	☐ F5/AS1	

BUILDING CODE CLAUSE :	COMPLIANCE USING :	MEANS OF COMPLIANCE :
F6 Visibility in Escape Routes	☑ F6/AS1	Emergency Lighting System as shown in FEB F6/AS1/1.3.2 Appendix and Zicka [illegible] Emergency Lighting Plan
F7 Warning systems	☐ F7/AS1	See FEB Doc. F8/AS1/2.1.d and F8/AS1/4.5.1
F8 Signs	☑ F8/AS1	
G1 Personal Hygiene	☐ G1/AS1	
G2 Laundering	☐ G2/AS1	
G3 Food preparation and prevention of Contamination	☐ G3/AS1	
G4 Ventilation	☐ G4/AS1 ☐ G4/VM1	
G5 Interior Environment	☐ G5/AS1	
G6 Airborne and impact sound	☐ G6/AS1 ☐ G6/VM1	
G7 Natural Light	☐ G7/AS1 ☐ G7/VM1	

BUILDING CODE CLAUSE :	COMPLIANCE USING :	MEANS OF COMPLIANCE :
G8 Artificial Light	☐ G8/AS1 ☐ G8/VM1	
G9 Electricity	☐ G9/AS1	
G10 Piped Services	☐ G10/AS1 ☐ G10/VM1	
G11 Gas as an Energy Source	☐ G11/AS1	
G12 Water Supplies	☐ G12/AS1 ☐ G12/VM1 ☐ G12/AS2	
G13 Foul Water	☐ G13/AS1 ☐ G13/VM1 ☐ G13/AS2 ☐ G13/AS3 ☐ G13/VM3	
G14 Industrial liquid waste	☐ G14/AS1 ☐ G14/VM1	
G15 Solid waste	☐ G15/AS1	
H1 Energy efficiency	☐ H1/AS1 ☐ H1/VM1	

5. Materials proposed to be used

Please indicate the type of material that is proposed in this project by identifying the specification of the product or the brand names to be used, such as Insulclad®, ROCKCOTE, Monier™, Ribraft™ , Pink® Batts®:

Exterior claddings, eg, weatherboards, (specify product/system) Ferrari Precontraint 702-CH Collour Yellow/Blue.
Roof type, eg, corrugated iron, tile, (specify product/system)
Type of insulation, eg, polystyrene, (specify product/system)

6. MultiProof application checklist

Please take the time to review and complete this checklist before you send your application to us. Tick the relevant box. It is intended to make our processing of your application as smooth as possible.

Have you provided the following?	**Yes**	**N/A**
Application form completed correctly, signed and dated	✓	
Fees with the application		✓
Means of compliance with the Building Code section completed	✓	
Certificates of Work from the Design LBPs who carried out or supervised the Restricted Building Work design		
Evidence of intention and ability to replicate the design ten times in a two year period	✓	
Copy of floor plans @ 1:50 scale including:		
North point reference, if schedule method has been used for H1 compliance		✓
Overall dimensions of walls and other structural elements	✓	
Internal dimensions of rooms	✓	
Bracing layout or reference to a schedule elsewhere	✓	
Lintel sizes or reference to a schedule elsewhere		✓
Roof layout: Truss or framed		✓
Window and door locations and plan dimensions	✓	
Special wall constructions (sound, fire, moisture control)		✓
Room layouts and location of all internal fixtures and fittings	✓	
Staircase layouts		✓
Plumbing diagram and location of plumbing fixtures (including schematic storm water lay-out)		✓
Cross-section references, space numbers, door/window numbers		✓
References to detailed drawings	✓	
Outline of roof or pergola overhangs		✓
Electrical fittings needed for compliance		✓
Location of smoke alarms		✓
Openings for services		✓
Copy of exterior elevations @ 1:100 scale including:		
All exterior elevations of the building	✓	
Windows, doors and other openings, indicating size and opening type and direction		✓

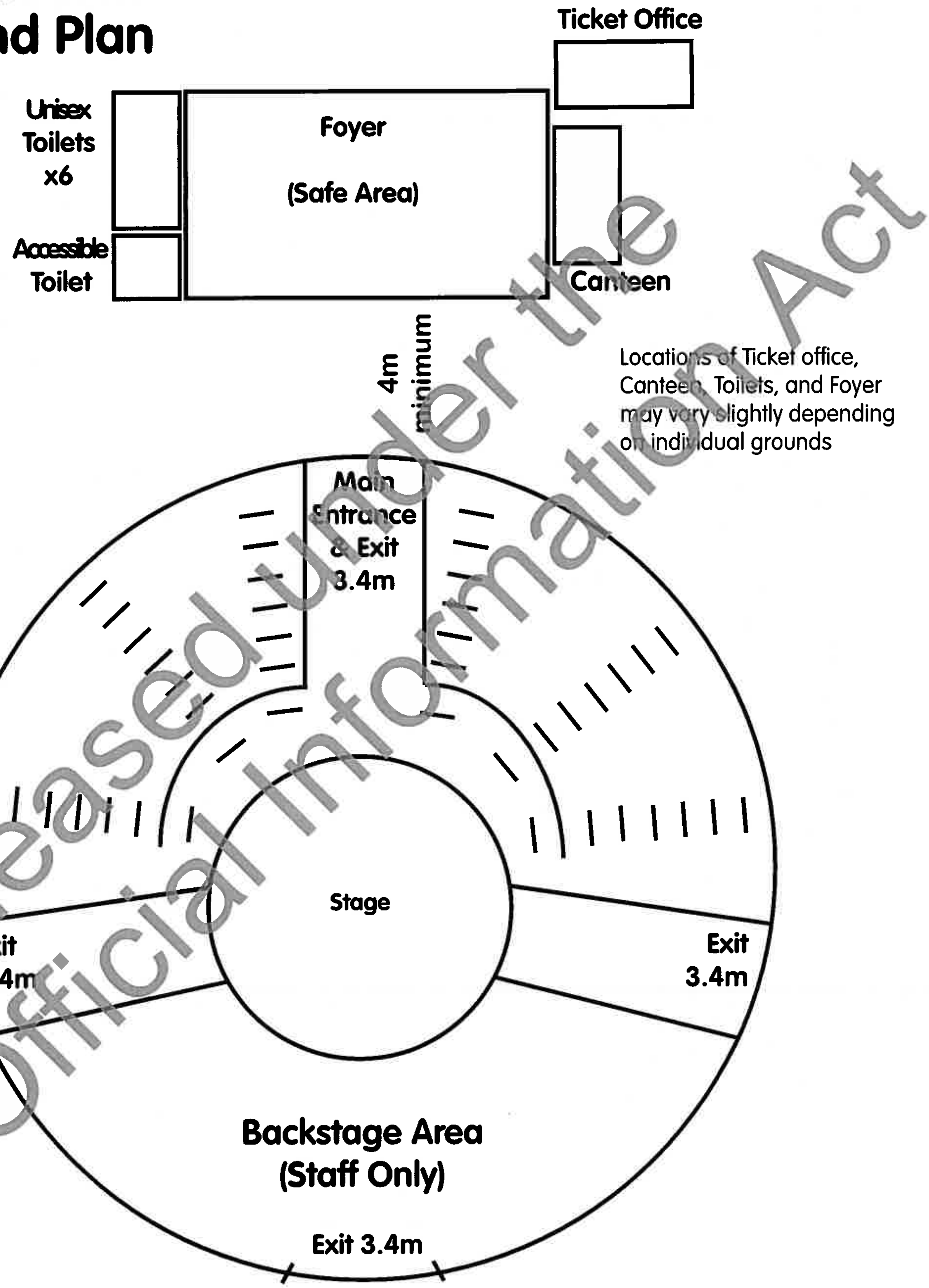
Cladding types (includes dimension between ground and base of cladding)		✓
Roofing types, roof shapes and overhangs		✓
Exterior decks, stairs and balustrades		✓
Skylights, chimneys and other openings through walls and roof		✓
Gutter, down pipe and vent locations (if located within the building)		✓
Location of construction joints in claddings		✓
References to detailed drawings		✓
Reference to risk matrix		✓
Copy of cross sections @ 1:50 scale including:	**Yes**	**N/A**
Wall heights	✓	
Window and door height dimensions		✓
Framing sizes and treatments (or in the specification)		✓
Construction details (e.g., wall and floor linings)		✓
Roof and ceiling pitches		✓
Floor slopes		✓
Cross section through stairs (providing overall stair geometry and indicating head clearances)		✓
Location of details		✓
Copy of construction details @ 1:5 scale including:		
Note: The extent and number of details will vary significantly depending on the size and complexity of the building design. However, the following constitute minimum requirements where appropriate		
Structural elements, junctions and fixings		✓
Penetrations through exterior walls and roofs		✓
Window, skylights and door head/sill/jamb details		✓
Cladding junctions (horizontal and vertical)		✓
Expansion and movement joints		✓
Wall/roof junctions		✓
Roof ridge, hip, valley, gutter and apron details		✓
Wet area (bathroom/laundry) details		✓
Bottom plate/cladding overhang		✓
Soffit and parapet details		✓
Retaining wall details		✓
Tanking and damp-proofing, cross-sections and details		✓
Deck or pergola connections to main structure		✓
Stairs showing rise/going/landings/pitch/handrails		✓
Deck balustrades and handrails, layouts and fixings		✓

	Yes	N/A
Fire separation junction and penetration details		✓
Details of services attached to the building's external envelope: water heating appliance, solar power or water heating system or the like		✓
Details of exterior wall claddings/weathertightness including:	**Yes**	**N/A**
Flashings		✓
Paint finishes		✓
Cavity details		✓
Type of exterior joinery		✓
A risk matrix – if you are using E2/AS1 as a means of compliance		
Details of bracing design		
Bracing plan clearly showing bracing lines and elements	✓	
Bracing schedule and calculations (to highest nominated wind zone or wind speed)	✓	
Copies of calculations and producer statements for specifically designed bracing systems	✓	
Heating		
Energy source ☐ electricity ☐ gas ☐ solid fuel ☐ solar ☐ other (specify)........................		✓
Has the type of heating been included in the plans /specifications?		✓
If solid fuel, gas or diesel, has the position been shown on the floor plans?		✓
Has a full copy of the manufacturers' specifications and installation instructions been shown (including flue installation detail)?		✓
Water heating		
Energy source ☐ electricity ☐ gas ☐ solid fuel ☐ solar ☐ other (specify)........................		✓
Full details of type and valving of water:heater		✓

MultiProof is the term used by the Ministry to refer to a National Multiple-Use Approval under the Building Act 2004. The use of this term is reserved for the Ministry as the copyright owner.

ZIRKA CIRCUS

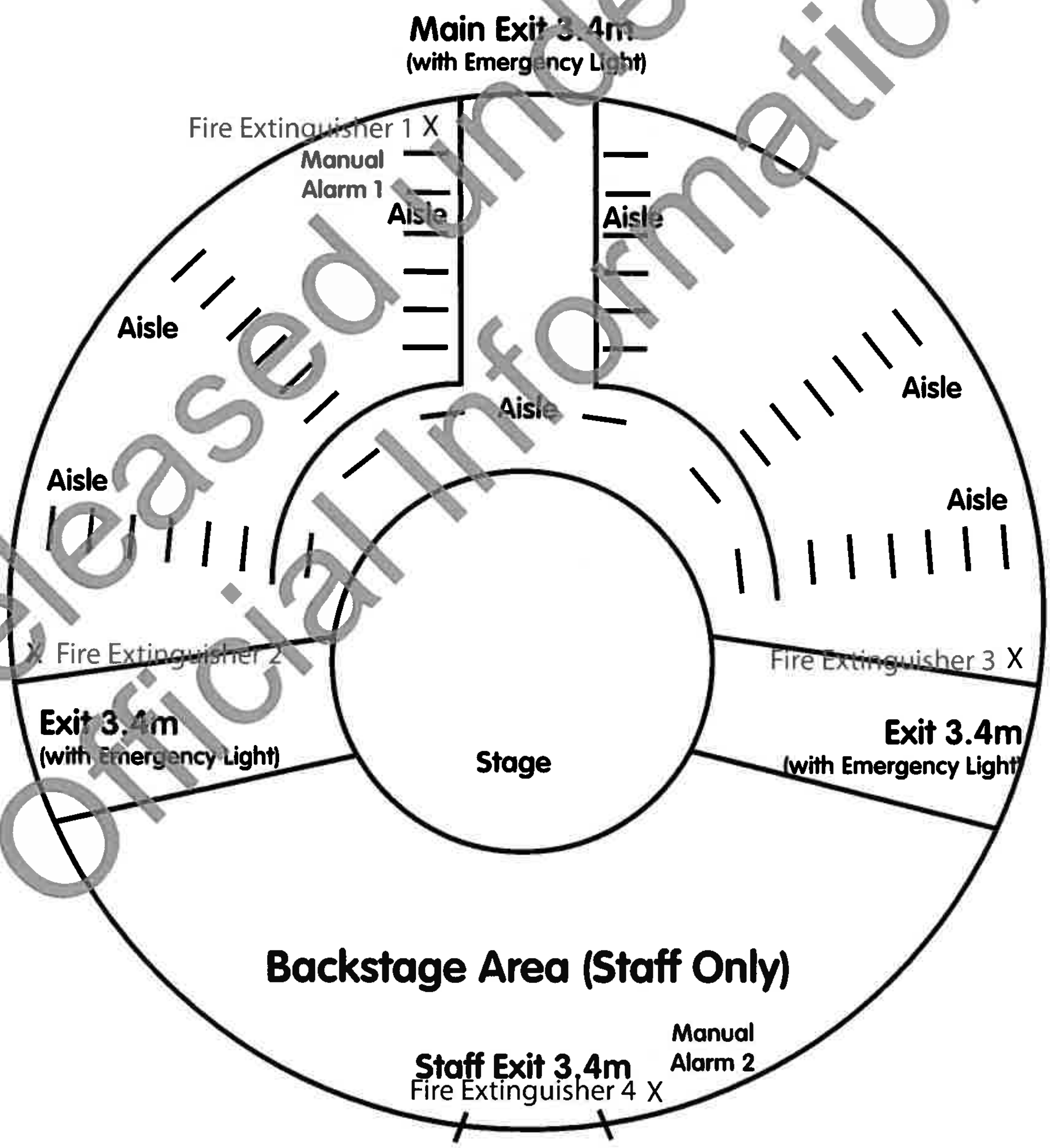
Ground Plan



Circus Tent, 35m diameter

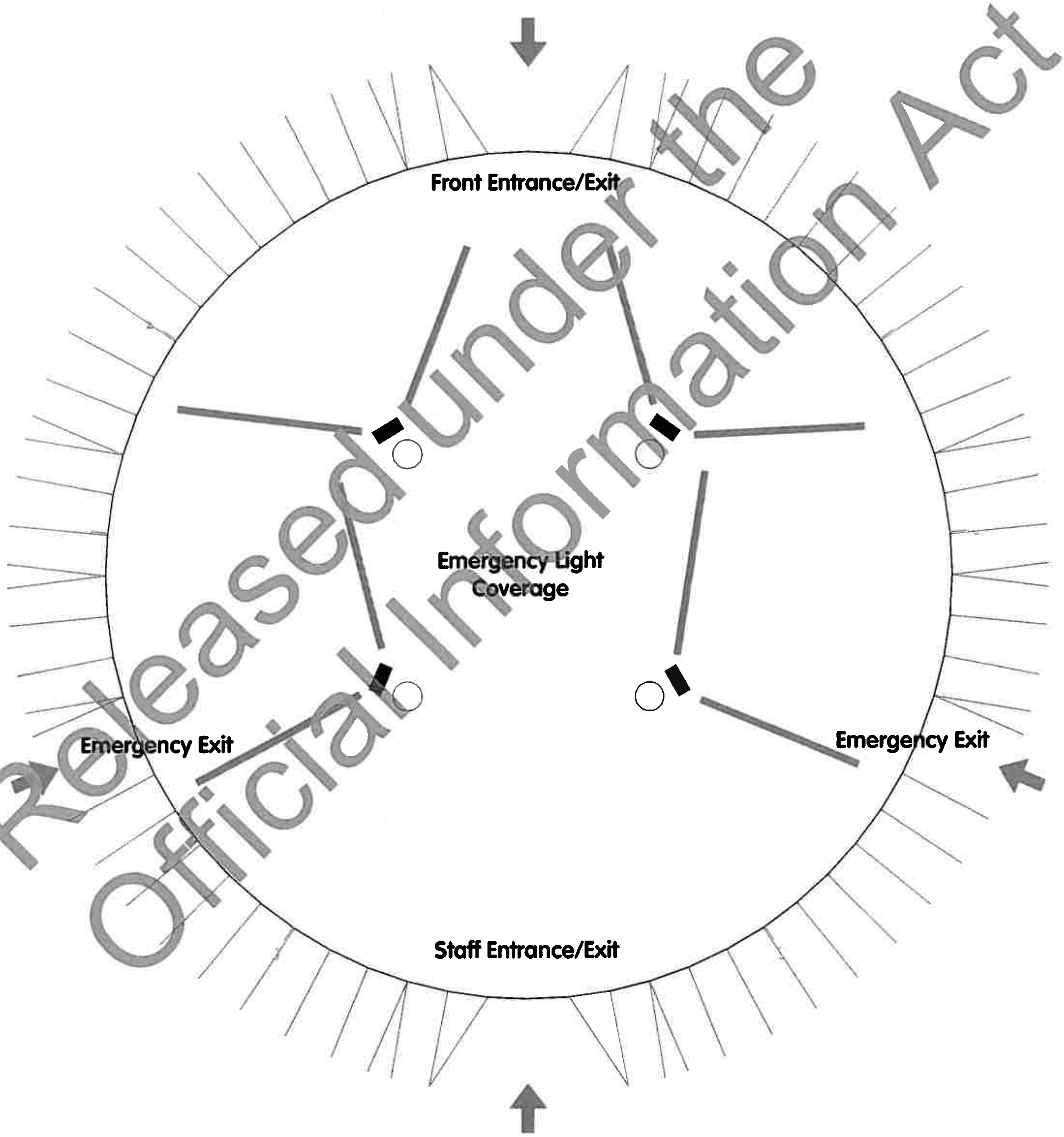
Fire Exit & Extinguisher Plan

The Zirka Circus Marquee has 4 Fire Exits, being the
Main Entrance/Exit, 2 side emergency exits, and the rear (staff) exit.
All Exits are 3.4m wide.
All have dedicated marshalls (the ushers and performers).
All Public Exits have Emergency Exit Signs, with emergency lighting (battery backup)
Zirka Circus has 2 large generators, the main show genset and the backup.
These are on standby should there be a power supply failure during the show.
Manual Alarm 1 (siren) is located at Main Exit and operated by the sound and light crew who have a view over entire Marquee. Manual Alarm 2 is located backstage.



Circus Tent, 35m diameter

Emergency Light Plan



Circus Tent, 35m diameter

Evacuation Plan for Circus Marquee

Capacity of Marquee 495 Max (including Staff)
Average capacity 250
Wardens/Ushers are responsible for the orderly evacuation of Patrons in the case of any emergency.

Four main designated exit areas –

Exit 1 Main Entrance
For the Evacuation of patrons in centre wedge of elevated seating to the immediate left and right of main Exit and VIP seating directly in front of Exit.

Exit 2 Stage Right
For evacuation of ringside and VIP seats in right hand half of Marquee, and elevated seating in the right hand third of Marquee.

Exit 3 Stage Left
For evacuation of ringside and VIP seats in left hand half of Marquee, and elevated seating in the left hand third of Marquee.

Exit 4 Backstage
Any staff not involved in evacuation process will exit via Backstage door. There is no public access to the Backstage area.

Two ushers are dedicated to each Exit to ensure the doors are held open. Wardens are dedicated to each "wedge" of seating to ensure patrons exit via closest Exit.

On exiting all patrons will be ushered to main assembly area in front of circus tent by outside staff.

Evacuation procedures coordinated by the designated team under the supervision of the tour manager, Jeni Hou.

For full details see attached Certified Fire Design.

TRAFFIC MANAGEMENT PLAN

Consideration towards the requirements of traffic management and the vehicle movements associated with the Circus event:

The Circus generates vehicle movements at and around show times. The spread of vehicle numbers is over a half hour period prior to the show and a fifteen minute period after the show.

Generally, vehicle management is required within the hour prior to the show when vehicles arrive and need to be directed to appropriate parking areas. On departure the traffic queues to exit the area around the site in an orderly fashion. Show times are at off peak traffic times (usually 7pm).

Traffic arrival over the one-hour period normally averages a maximum of 100 vehicles (including some drop off's) and a relatively low average of 2 vehicles per minute.

We allocate one warden at the entrance to the Circus car parking area to direct people to the appropriate parking location and this person is also responsible for the signage to direct cars to the area on arrival, when required. A second person is located within the parking areas to ensure orderly parking and assistance with reversing and correct alignment of vehicles. This person also acts as on site security during the period of the show.

When not using a permanent car park, signs are placed at the entrance to the Circus area and the access point into the car park area, clearly identifying the Circus event / parking area.

At other times there are minimal vehicle movements (up to six cars in the car park with people arriving at random to purchase tickets from the ticket office.

Additional lighting for the convenience of car parking and customer safety are placed at the site for the evening shows, when not already there.

The contact for Parking on site is Jeni Hou s 9(2)(a) .

Security Plan

Zirka Circus Staff undertake all security arrangements.

During non-show times, whenever onsite, staff keep watch over facilities.

During show times, Parking staff keep watch over any vehicles parked onsite.

Should security issues arise involving members of public, staff will contact Police should the need arise.

Zirka Circus Tour Health and Safety Operating Procedures:

1. Access and seating: Public access will be well lit and accessible for both able and disabled customers with the provision of ramp for access and aisle widths to cater for wheelchair access.

2. All seating is individual with access for disabled, all patrons are ushered to the area of seating appropriate to their ticket allocation, ensuring they are made aware of stairs and gangways.

3. Fire and evacuation procedures have been adopted in line with Chief Fire safety officers recommendations and approved when inspected.

4. For convenience of the patrons there is a foyer area where they can congregate prior to the Marquee being opened, this also allows for undercover protection during inclement weather conditions.

5. Customers' arrival on site is managed in peak times with parking wardens and appropriate signage - see attached Parking procedure

6. Additional lighting outside of daylight hours is provided to ensure convenience for the customers during pre and post show times.

7. Public toilets are provided and maintained by the Circus to ensure customers' convenience is met during show times.

8. Disposal of Rubbish in Wheelie bins strategically placed around the site ensures a continued "Tidy" appearance and clean and healthy environment. All rubbish generated is disposed of via approved local contractors

First Aid Plan

First Aid kits kept in management caravan and Ticket office and available for general use when required.

In the event of a first aid emergency, staff will immediately contact relevant Emergency Service, secure the site and ensure staff and patrons are removed from exposure to any further harm.

Staff will work with emergency services and injured party as instructed until service arrives.

Steps such as ensuring airway is unobstructed, checking pulse, placing in recovery position (if appropriate) will be taken

0800 2 ZIRKA (0800 294752) or 021 818488
bookings@zirkacircus.com
www.zirkacircus.com

SCHEDULE

Hamilton Branch

For All Inquires Please
Phone:Your Agent

PAGE: 01 of 01
DATE PRINTED: 27-03-2013

TAX INVOICE

NZI
1 Fanshawe St
Auckland

s 9(2)(a)

NEW CIRCUS MARQUEE
for
ZIRCA CIRCUS

STRUCTURAL CALCULATIONS

Project No. 11326

Prepared by: **Shaun Shabbot**
BEng

February 2013

Reviewed by: **Benson Zhang**
BE MEngSt

Approved by: **Graham Rundle**
BE M.IPENZ CPEng IntPE

CONTENTS:

redco

adding 'enginuity' to building projects

Providing the services of:

Chartered Professional Engineers

Redco NZ Ltd
Redco House
470 Otumoetai Road
TAURANGA 3110
Telephone: 07 571 7070
Facsimile: 07 571 7080
Email: red@redco.co.nz
www.redco.co.nz

IPENZ ENGINEERS NEW ZEALAND | NEW ZEALAND INSTITUTE OF ARCHITECTS INCORPORATED | ACENZ

Building Code Clause(s) B1

PRODUCER STATEMENT – PS1 – DESIGN

(Guidance notes on the use of this form are printed on the reverse side)*

ISSUED BY: Redco NZ Ltd
(Design Firm)

TO: Zirca Circus
(Owner/Developer)

TO BE SUPPLIED TO: All
(Building Consent Authority)

IN RESPECT OF: New Circus Marquee (Redco Project No. 11326)
(Description of Building Work)

AT: Short Term Event Site
(Address)

LOT .... **DP** .... **SO** ....

We have been engaged by the owner/developer referred to above to provide Structural Engineering
(Extent of Engagement) services in respect of the requirements of Clause(s) B1 of the Building Code for
○ All or ⦿ Part only (as specified in the attachment to this statement), of the proposed building work.

The design carried out by us has been prepared in accordance with:

☑ Compliance Documents issued by Department of Building & Housing B1/VM1 & AS1
(verification method / acceptable solution) or

☐ Alternative solution as per the attached schedule

The proposed building work covered by this producer statement is described on the drawings titled New Circus Marquee and numbered ....;
together with the specification, and other documents set out in the schedule attached to this statement.

On behalf of the Design Firm, and subject to:

(i) Site verification of the following design assumptions NZS 3604:2011 "Good ground"

(ii) All proprietary products meeting their performance specification requirements;

I **believe on reasonable grounds** the building, if constructed in accordance with the drawings, specifications, and other documents provided or listed in the attached schedule, will comply with the relevant provisions of the Building Code.

I, Claude Antony Carter Cook *(Name of Design Professional)* am: ☑ CPEng 240891 #
☐ Reg Arch .... #

I am a Member of: ☑ IPENZ ☐ NZIA and hold the following qualifications: BE, MIPENZ, CPEng, IntPE

The Design Firm issuing this statement holds a current policy of Professional Indemnity Insurance no less than $200,000*.
The Design Firm is a member of ACENZ ○ YES ⦿ NO

SIGNED BY Claude Antony Carter Cook ON BEHALF OF Redco NZ Ltd *(Design Firm)*

Date 16/01/2013 *(signature)* ....

Note: This statement shall only be relied upon by the Building Consent Authority named above. Liability under this statement accrues to the Design Firm only. The total maximum amount of damages payable arising from this statement and all other statements provided to the Building Consent Authority in relation to this building work, whether in contract, tort or otherwise (including negligence), is limited to the sum of $200,000.*

This form is to accompany **Form 2 of the Building (Forms) Regulations 2004** for the application of a Building Consent.

GUIDANCE ON USE OF PRODUCER STATEMENTS

Producer statements were first introduced with the Building Act 1992. The producer statements were developed by a combined task committee consisting of members of the New Zealand Institute of Architects, Institution of Professional Engineers New Zealand, Association of Consulting Engineers New Zealand in consultation with the Building Officials Institute of New Zealand. The original suite of producer statements has been revised at the date of this form as a result of enactment of the Building Act (2004) by these organisations to ensure standard use within the industry.

The producer statement system is intended to provide Building Consent Authorities (BCAs) with reasonable grounds for the issue of a Building Consent or a Code Compliance Certificate, without having to duplicate design or construction checking undertaken by others.

PS1 Design	Intended for use by a suitably qualified independent design professional in circumstances where the BCA accepts a producer statement for establishing reasonable grounds to issue a Building Consent;
PS2 Design Review	Intended for use by a suitably qualified independent design professional where the BCA accepts an independent design professional's review as the basis for establishing reasonable grounds to issue a Building Consent;
PS3 Construction	Forms commonly used as a certificate of completion of building work are Schedule 6 of NZS 3910:2003[1] or Schedules E1/E2 of NZIA's SCC 2007[2]
PS4 Construction Review	Intended for use by a suitably qualified independent design professional who undertakes construction monitoring of the building works where the BCA requests a producer statement prior to issuing a Code Compliance Certificate. This must be accompanied by a statement of completion of building work (Schedule 6).

The following guidelines are provided by ACENZ, IPENZ and NZIA to interpret the Producer Statement.

Competence of Design Professional

This statement is made by a Design Firm that has undertaken a contract of services for the services named, and is signed by a person authorised by that firm to verify the processes within the firm and competence of its designers.

A competent design professional will have a professional qualification and proven current competence through registration on a national competence-based register, either as a Chartered Professional Engineer (CPEng) or a Registered Architect.

Membership of a professional body, such as the Institution of Professional Engineers New Zealand (IPENZ)or the New Zealand Institute of Architects (NZIA), provides additional assurance of the designer's standing within the profession. If the design firm is a member of the Association of Consulting Engineers New Zealand (ACENZ), this provides additional assurance about the standing of the firm.

Persons or firms meeting these criteria satisfy the term "suitably qualified independent design professional".

*** Professional Indemnity Insurance**

As part of membership requirements, ACENZ requires all member firms to hold Professional Indemnity Insurance to a minimum level.

The PI insurance minimum stated on the front of this form reflects standard, small projects. If the parties deem this inappropriate for large projects the minimum may be up to $500,000.

Professional Services during Construction Phase

There are several levels of service which a Design Firm may provide during the construction phase of a project (CM1-CM5)[3] (OL1-OL4)[2]. The Building Consent Authority is encouraged to require that the service to be provided by the Design Firm is appropriate for the project concerned.

Requirement to provide Producer Statement PS4

Building Consent Authorities should ensure that the applicant is aware of any requirement for producer statements for the construction phase of building work at the time the building consent is issued as no design professional should be expected to provide a producer statement unless such a requirement forms part of the Design Firm's engagement.

Attached Particulars

Attached particulars referred to in this producer statement refer to supplementary information appended to the producer statement.

Refer Also:

1 *Conditions of Contract for Building & Civil Engineering Construction NZS 3910: 2003*

2 *NZIA Standard Conditions of Contract SCC 2007 (1st edition)*

3 *Guideline on the Briefing & Engagement for Consulting Engineering Services (ACENZ/IPENZ 2004)*

www.acenz.org.nz
www.ipenz.org.nz
www.nzia.co.nz

IPENZ ENGINEERS NEW ZEALAND — NEW ZEALAND INSTITUTE OF ARCHITECTS INCORPORATED — ACENZ

red co *adding 'enginuity' to building projects*

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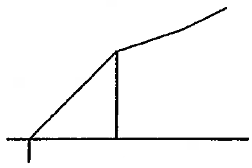
Redco House
470 Otumoetai Road
TAURANGA 3110
Telephone: 07 571 7070
Facsimile: 07 571 7080
Email: red@redco.co.nz
www.redco.co.nz

Chartered Professional Engineers

Summary and Recommendations

Project No. 11326

Configuration		**Wind speed**	**Requirements**
Guyed with pegs4		0-120 kph	2 pegs each guy rope
		>120 kph	Circus Tent to be dismantled or further hold down measures to be taken

- For wind speeds up to 120 kph the structure has to have guy ropes attached as per above table. In addition all openings in the marquee must be zipped shut for wind speeds exceeding 50 kph, except to allow patrons access to and egress from the marquee.
- For wind speeds exceeding 120 kph the marquee is not to be occupied and it is recommended that the marquee be dismantled or further hold down measures to be taken.

Notes:

- All structures are considered to be temporary structures.
- The marquee erector shall determine the applicable wind speed for each specific location.
- If the marquee is to be erected on an exposed hilltop (>30m) the wind speed limitation should be reduced by 50%.
- Alternatively a wind anemometer may be used to ensure the actual site wind speeds don't exceed the limitations above.
- No big openings are allowed in the marquee. All openings must be zipped shut for wind speeds exceeding 50kph.
- The marquee is not designed to support any snow loads.
- To avoid ponding the fabric must be stretched tightly.

red co *adding 'enginuity' to building projects*

Chartered Professional Engineers

CALCULATIONS

Client: **Flaming Phoenix Entertentainment Ltd (Zirca Circus)** **20 Feb '13**

Project: **New Circus Marquee** Project No. **11326**

Building is a Circus Tent to be designed to withstand loadings
in accordance to AS/NZS 1170:2002

Dead:	Roof:	Roofing	0.01 KPa
		Framing	0.00 KPa
		Ceiling	0.00 KPa
		$q_{G\ roof}$ =	**0.01 KPa**

Singel Peg Arrangement

Wind: $V_{(des)} = V_R\ M_d\ (M_{(z,cat)}\ M_s\ M_t)$ *(Eq 2.2)*

= 40.76 m/s V_R Ultimate= 38.8 m/s

$q_{(z)} = 0.6\ V_{d(z)}^{2} \times 10^{-3}$ *(Eq 2.4)*

Ultimate $q_{(z)}$ = 1.00 kPa

$M_{(z,cat)}$ = 0.96 z = 7.500 m *Category 2*

M_s = 1.0 *Table 4.3*

M_t = 1.10 M_h = 1.10 *Table 4.4*

M_d = 1.0 M_{lee} = 1.0 *4.4.3*

Elevation = 500 m

Pressure coefficients:

C_{pi} = 0.2 -0.2

Up-wind, roof C_{pe} = -0.8

Down-wind, roof C_{pe} = -0.8

$p_W = (K_a\ K_c\ K_l\ K_p\ C_{pe} - K_c\ C_{pi})\ q_{(z)}$

Roof: $p_{W\ BC}$ = -1.00 kPa

Roof: $p_{W\ CD}$ = -1.00 kPa

Roof slope, α = 40 deg. b = 35.00 m

d/b = 1.00 d = 35.000 m

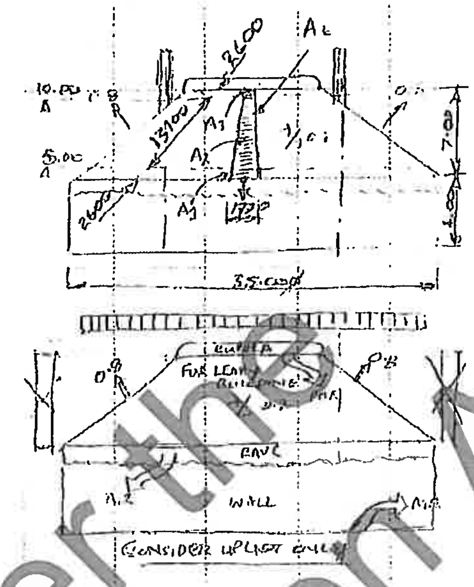
h/d = 0.21 h = 7.500 m

K_a = 1.0 *Table 5.4*

K_l = 1.0 *Table 5.6*

K_p = 1.0 *Table 5.8*

K_c = 1.0 *Table 5.5*



Wind Load Calculations

The circus tent is uniformly fixed and symmetrically plans. Therefore it is safe to assume that wind from any direction will result in a uniform load on any point. Also because of the symmetry, horizontal forces can cancel each other out therefore consider only uplift forces.

NOTE No allowances have been made for dead load of roof or cupola frame.

Calculations of Max wind speed for standard pegging arrangement

Plan area of room	962m^2
No of Guy Poles and Pegs	72
Roof Area per pegs	13.4m^2
Typical peg:	1.2m Long x
32mm Φ	
Max Holding power	
1333kN = 1360kG	
Allow Factor of safety	1.5
Therefore, working strength of Peg	8.86kN

For each segment of tent roof

Max. F	= 8.86kn
	$= \sum Pz\ Az$
Az	= 13.4m^2
Pz	= Cp Qz
Cp	= 1
Qz	$= \frac{F}{A}$ = 0.66kPa

This is the allowable Qz for a tent installation using 1 Peg per Guy Point. This assumes that the ground conditions provide adequate holding power.

NOTE: IT IS THE RESPONSIBILTY OF THE TENST INSTALLER TO CONFIRM THE HOLDING POWER OF THE GROUND PRIOR TO EACH INSTALLATION

Confirmation of Allowable Wind Speed *From NZS 4203:1992*

$Qz = 0.6v_z^2 \times 10^{-3} = 0.66$kPa

$vz = \sqrt{\frac{Qz \times 10^{-3}}{0.6}} = 33.2$m/s

Φ = 35m Az
A = 962 m^2 (249)
>5 Φ = 30.14m Az
A = 713 m^2 (686)
>10 Φ = 5.86m Az
A = 27 m^2 (27)

Multiplayer (M_z) = M_l Mz_{cat} M_s M_t M_r

Serviceability Category 2

H_t	M_l	Mz_{cat}	M_s	M_t	M_r	M_z	As
<5	0.7	0.91	1.0	1.1	1.0	0.7707	3.89
5-10	0.7	1.00	1.0	1.1	1.0	0.7700	10.72
7-10	0.7	1.05	1.0	1.1	1.0	0.8085	0.42

Factor M as Follows:

H_t	M_z	As (m^2)	$\frac{M_z \times As}{Az}$
<5	0.7707	3.89	0.203
5-10	0.7700	10.72	0616
7-10	0.8085	0.42	0.25
		$\sum M =$	0.844

For Single Peg Arrangement

$V = V_z \times M = 28.0\, m/\sec = 85\, km/hour$ < 124km/hr Allowable

To increase allowable wind speed, use larger pegs or double peg effects or double pegging is to increase holding power by 70%.

For Double Peg Arrangement

$V = V_z \times M$, $F_2 = 8.86 \times 1.7 = 15.06kM$

Allowable

AS/NZS 1170:2002

$Qz = \frac{F_z}{A} = 1.00kPa$

$V_R = 38.8m/sec$

$Vz = \sqrt{\frac{Qz \times 10^{-3}}{0.6}} = 33.2m/s$

Refer to spreadsheet

$Vz = 40.825 \times 0.8443$

$= 34.5$ m/sec = 124.2 kM/hr

$= 38.8 \times 0.8843$

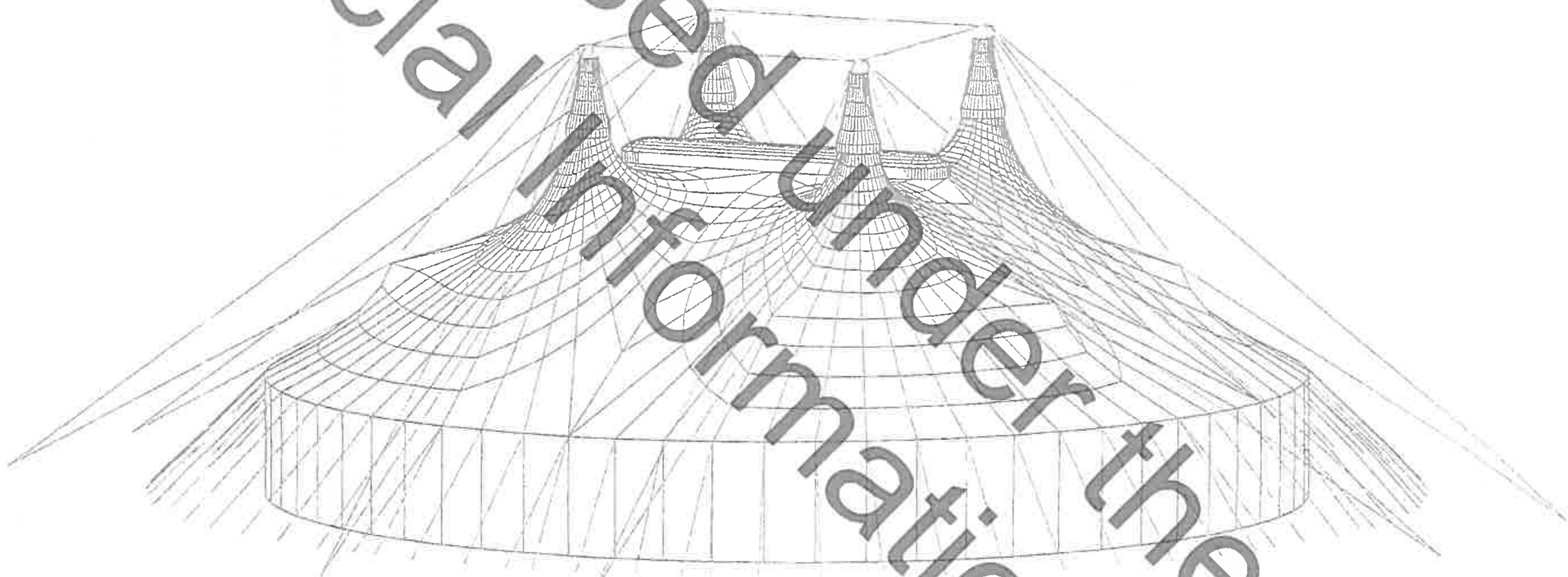
$= 34.3$ m/sec = 124 km/hr

The safe working load of each guy attachment point is approximately 15kN, *therefore OKAY.*

Effects of quarter poles on wind speed ratings.

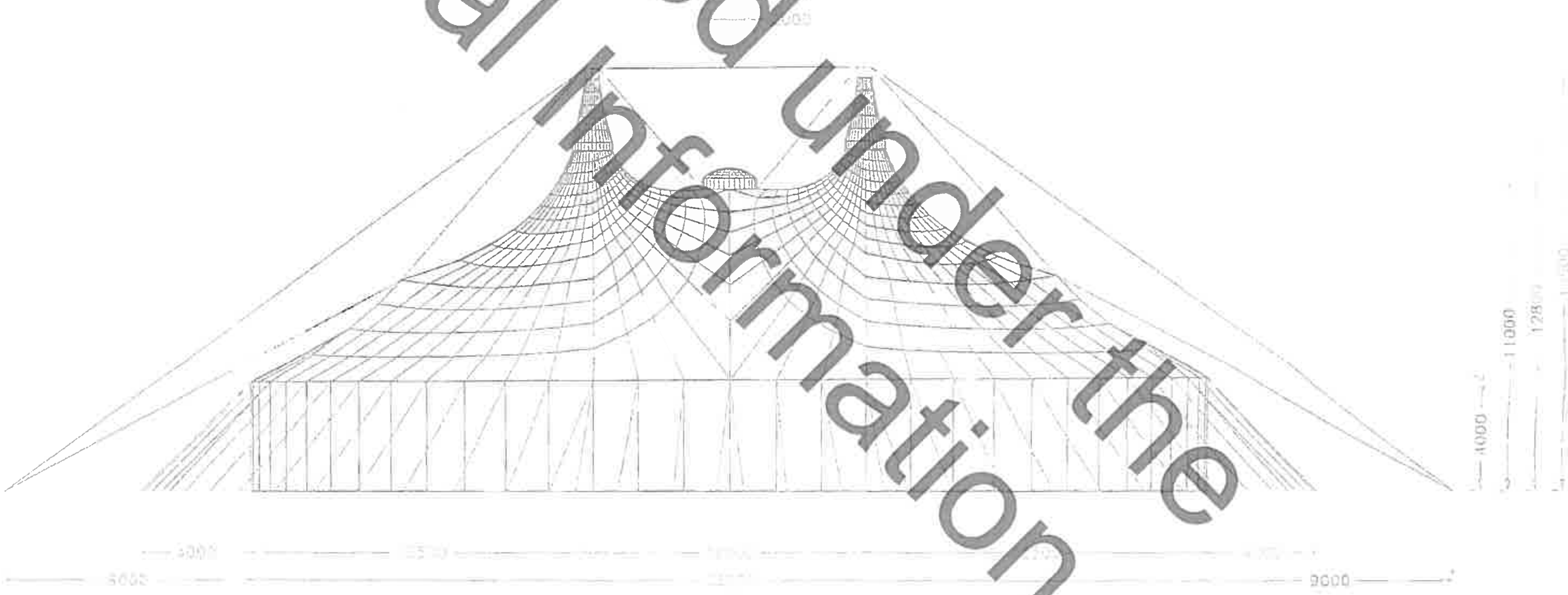
This calculation takes no account of the effect of roof shape or quarter poles or resistance to wind uplift.
Provision is made in the design of the tent for each quarter pole attachment point to be securely guyed to the ground.
This has the effect of reducing the tributary area assigned to each perimeter guy allowing the design wind speed to be further updated.

page 5



Page 5A

Tensodenda diametro mt. 35.00 - Antenne a mt. 10.00 x 10.00 - Ring diametro cm 120
Cupola mt. (1.00 + 10.00 + 1.00) x 2.00 - H. 11.00 - H. 12.80 - h. 4.00



Page 5B

Tensodenda diametro ml. 35.00 – Antenne a ml. 10.00 x 10.00 – Ring diametro cm 120
Cupola ml. (1.00 + 10.00 + 1.00) x 2.00 – H. 11.00 – H. 12.80 – h. 4.00

AWTA TEXTILE TESTING

Australian Wool Testing Authority Ltd - trading as AWTA Textile Testing
A.B.N. 43 006 014 106
1st Floor, 191 Racecourse Road, Flemington, Victoria 3031
P.O. Box 240, North Melbourne, Victoria 3051
Phone (03) 9371 2400 Fax (03) 9371 2499

TEST REPORT

CLIENT : BAYTEX MANUFACTURING LTD
52 NEWTON STREET
MT MAUNGANUI SOUTH
NEW ZEALAND

TEST NUMBER : 7-552010-BO
DATE : 30/04/2007
ORDER NUMBER : 25430702BT

SAMPLE DESCRIPTION Clients ref: "Ferrari precontraint 702 CH Big top"
PVC coated fabric
Colour: Yellow/blue
Enduse: Architectural textiles

THESE RESULTS MUST BE CONSIDERED IN CONJUNCTION WITH THE COMMENTS ON THE FOLLOWING PAGE(S)

Material Specification provided by client:
Nominal composition: PES yarn coated with PVC flame retardant on both sides and varnished
Nominal mass: 830g/m2
Nominal thickness: 064mm

AS/NZS 1530.3 - 1999 Simultaneous determination of Ignitability, Flame Propagation, Heat Release and Smoke Release

RESULTS: Face tested: Both

Date tested: 27/04/2007

	Mean		Standard Error
Ignition time	4.01	min	0.12
Flame propagation time	22.4	s	1.9
Heat release integral	105.4	kJ/m2	3.5
Smoke release, log d	0.2503		0.0139
Optical density, d	1.7839	/m	

Number of specimens ignited: 6

Number of specimens tested: 6

REGULATORY INDICES:

Ignitability Index	16	Range 0-20
Spread of Flame Index	9	Range 0-10
Heat Evolved Index	4	Range 0-10
Smoke Developed Index	8	Range 0-10

159805 2 (CONTINUED NEXT PAGE)

NATA

This Laboratory is accredited by the National Association of Testing Authorities, Australia, for:
- Chemical Testing of Textiles & Related Products : Accreditation No. 983
- Mechanical Testing of Textiles & Related Products : Accreditation No. 985
- Heat & Temperature Measurement : Accreditation No. 1356

The tests reported herein have been performed in accordance with its terms of accreditation. Samples, and their identifying descriptions have been provided by the client unless otherwise stated. AWTA Ltd makes no warranty, implied or otherwise, as to the source of the tested samples. The above test results relate only to the sample or samples tested. This document shall not be reproduced except in full and shall be rendered void if amended or altered. This document, the names AWTA Textile Testing and AWTA Ltd may be used in advertising providing the content and format of the advertisement have been approved in advance by the Managing Director of AWTA Ltd.

AWTA LIMITED

0204/5/05

APPROVED SIGNATORY

MICHAEL A. JACKSON B.Sc (Hons)
MANAGING DIRECTOR

AWTA TEXTILE TESTING

Australian Wool Testing Authority Ltd – trading as AWTA Textile Testing
A.B.N. 43 006 014 106
1st Floor, 191 Racecourse Road, Flemington, Victoria 3031
P.O. Box 240, North Melbourne, Victoria 3051
Phone (03) 9371 2400   Fax (03) 9371 2499

TEST REPORT

CLIENT : BAYTEX MANUFACTURING LTD
52 NEWTON STREET
MT MAUNGANUI SOUTH
NEW ZEALAND

TEST NUMBER : 7-552010-BO
DATE : 30/04/2007
ORDER NUMBER : 25430702BT

Comments:

These results only apply to the specimen mounted, as described in this report.

The results of this fire test may be used to directly assess fire hazard, but it should be recognized that a single test method will not provide a full assessment of fire hazard under all fire conditions.

The specimens were mounted to simulate use in an unsupported or free hanging mode. The results may be significantly different when mounted to simulate a wall cladding or upholstery application.

To allow free movement of sample during testing all corners were folded away from the clamps.

Each test specimen was sandwiched between two layers of galvanised welded square mesh made from wire of nominal diameter 0.8mm and nominal spacing of 12mm in both directions, stapled through at four points, each 100mm from the centre of the sample and the assembly clamped in four places.

APPROVED SIGNATORY

MICHAEL A. JACKSON B.Sc (Hons)
MANAGING DIRECTOR

0204/5/05

AWTA TEXTILE TESTING

Australian Wool Testing Authority Ltd – trading as AWTA Textile Testing
A.B.N. 43 006 014 106
1st Floor, 191 Racecourse Road, Flemington, Victoria 3031
P.O. Box 240, North Melbourne, Victoria 3051
Phone (03) 9371 2400 Fax (03) 9371 2499

TEST REPORT

CLIENT : BAYTEX MANUFACTURING LTD
52 NEWTON STREET
MT MAUNGANUI SOUTH
NEW ZEALAND

TEST NUMBER : 7-552010-BO
DATE : 30/04/2007
ORDER NUMBER : 25430702BT

AS 1530.2-1993 Test for Flammability of Materials

DATE TESTED: 19/04/2007

Flammability Index: 5 Range 0 - 100 for most material

		Length	Width	
Spread Factor: Range 0 - 40		4	3	
Heat Factor: Range 0 - upward		1	1	
Maximum height (d)	mean	4.6	4.3	
	cv	10.7	17.4	%
Time (t)	mean	N/A	N/A	s
	cv	N/A	N/A	%
Heat (a)	mean	2.1	2.0	degC min
	cv	9.8	0	%
No of specimens tested		6	6	

These test results relate only to the behaviour of the test specimens of the material under the particular conditions of the test, and they are not intended to be the sole criterion for assessing the potential fire hazard of the material in use

159805

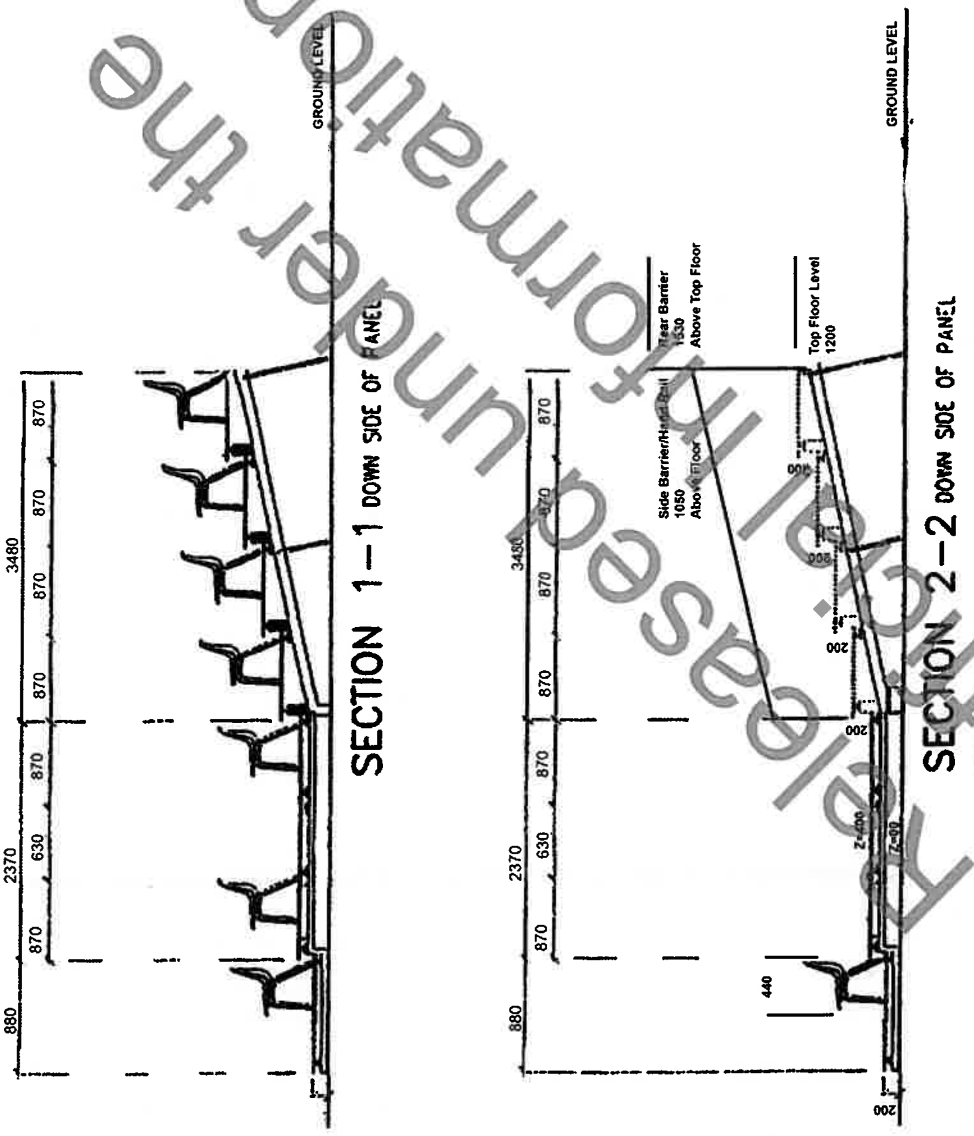
Baytex Manufacturing Co. Ltd.

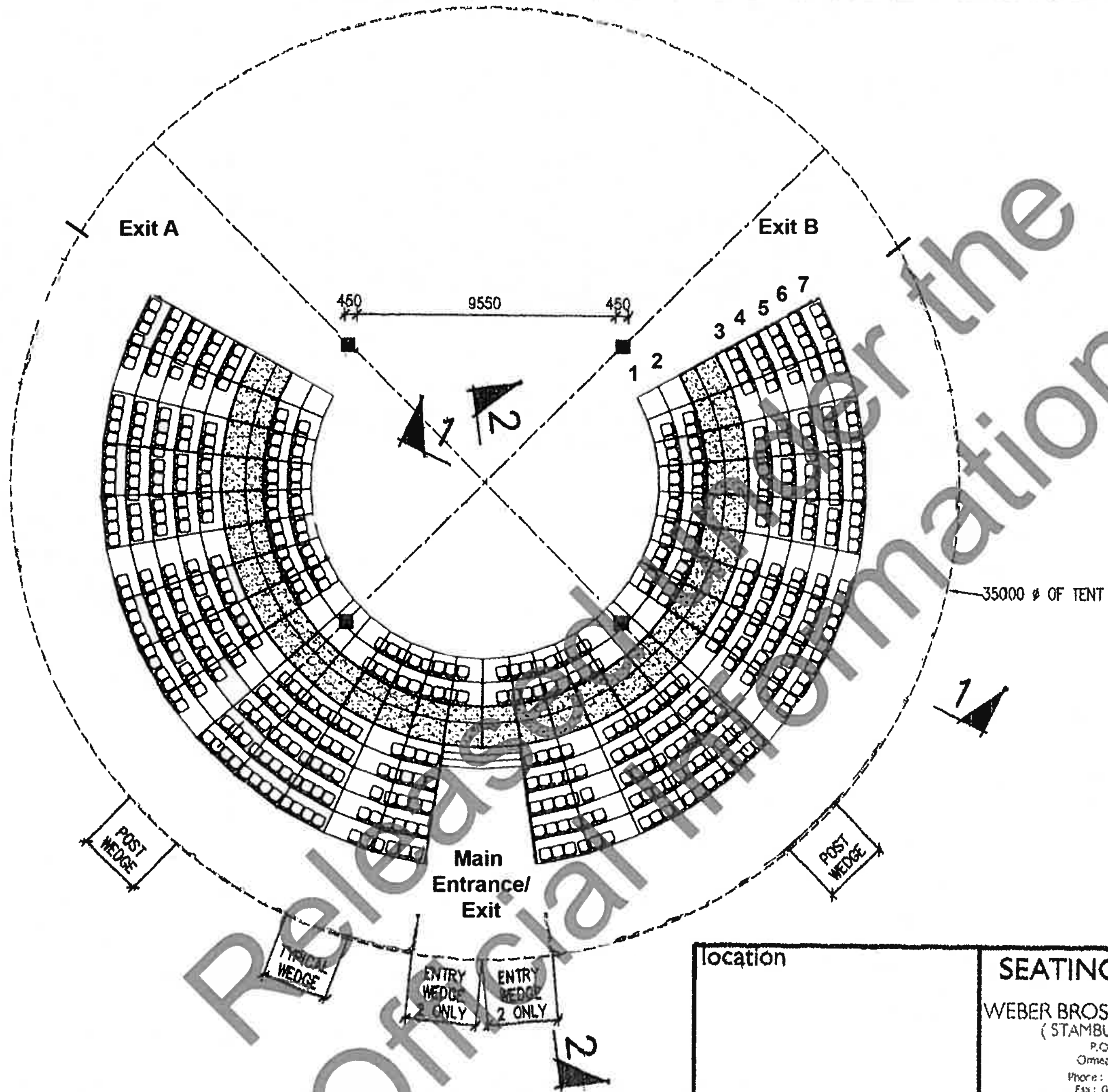
APPROVED SIGNATORY

MICHAEL A JACKSON B Sc (Hons)
MANAGING DIRECTOR

0204/5/05

5 B2. SEATING ELEVATION



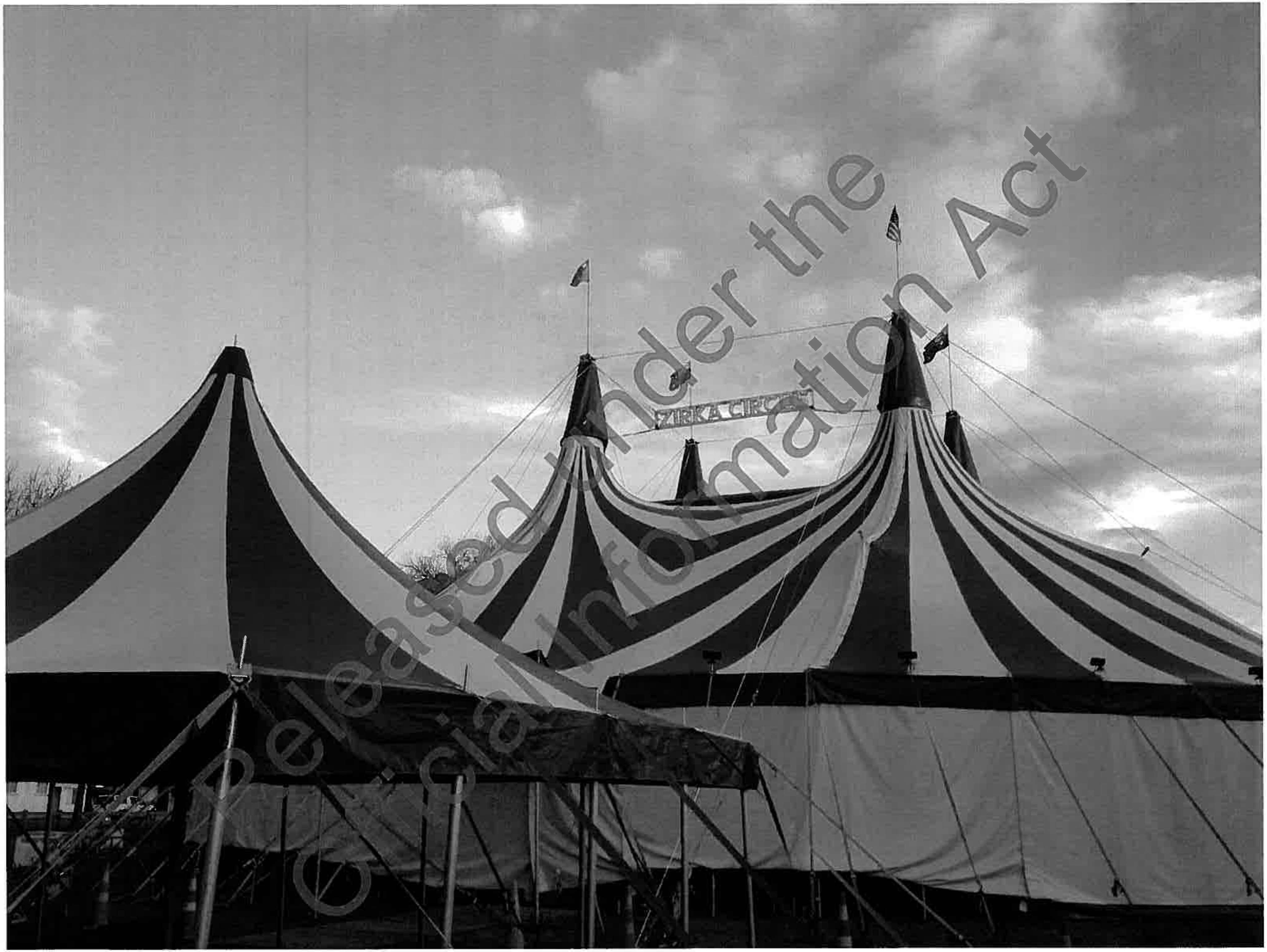


Seating Legend

Rows 1-2
VIP/Ringside 90 Seats

Rows 3-7
Elevated Up to 300 Seats

location	SEATING SYSTEMS BY WEBER BROS SHOW MAKERS (STAMBUL PTY LTD) P.O. Box 501 Ormeau Qld. 4208 Phone: 07 3807 9700 Fax: 07 3807 9600 Email: office@webershowmakers.com.au	SEATING LAYOUT PLAN DRAWN BY OSMAN DESIGNPAC (R. SMITS) SHEET 1 SCALE 1:150 DATE 07/02/2004 C:\DWG\WEBER BROS\6332 35DIA.NZ.DWG JOB NUMBER 6332


ZIRKA CIRCUS

NEW APPLICATION CHECKSHEET

Company name: ZIRKA CYRCUS App #: 10057

Date Received: 26/8/13 Date Accepted: ______

10. MU to email 30/9

Paperwork required

Application Form	✓
Pre-payment $2000.00 (cheque/direct credit)	✓
Plans/Specifications/Design detail	
RBW Certificate(s) of Design (if applicable)	

Action required ***tick***

1. Check application form is complete and signed
2. Enter Applicant details into database —
3. Enter Application details into database —
   Change status to 'Pre assessment' and Sub status to 'In process'
4. Create MAKO files ✓
5. Scan/save documentation into MAKO
6. Create codafile for hard copy documents ✓
7. Print documentation if received in soft copy
8. Date stamp all documentation when received
9. Check company number http://www.business.govt.nz/companies ✓
10. Is Applicant eligible? *(E.g. evidence [illegible])*
11. Check pre-payment has been received ($2000.00). Complete [illegible] invoice request form and send paperwork to Finance
12. Check documentation against application checklist
13. Send Applicant *Letter* [illegible] *ment (if not* [illegible] *(if not* [illegible] *working days)*
    Quick search document [illegible] (if acknowledge [illegible])
14. Enter complian[illegible] [illegible]abase
15. Receipt pre[illegible] [illegible]abase
16. Create [illegible] [illegible]ets in MAKO ✓
    Quick [illegible] 4567395
17. R[illegible] [illegible]tion with Murray

[illegible] *information* [illegible]?

[illegible]

Send further [illegible] request to Applicant
Quick search document id: 5166922
Hold onto application until all information has been received. Once information has been received and application is complete, forward to assessor for technical assessment.

No - For formally accept application, send *Application Accepted for Assessment* letter and invoice/receipt to applicant
Quick search document id: 5157152 (if acknowledge/accept at same time)
5157141 (if accept after already acknowledged)

18. Once accepted, forward application to the assessor to begin formal assessment
19. Change database status to 'Pre assessment' and sub status to 'accepted'

Once accepted the clock will start and the assessor is to begin the assessment process.

NEXT STEP: *See assessment checksheet.*
Quick search document id: 4917307

MBIE-MAKO-5259070

waiting on transacti print out

Sue Brown

From: Sue Brown
Sent: Wednesday, 2 October 2013 10:02 a.m.
To: Celerina Gieseke
Subject: RE: Transaction Print Out - Zirka Circus (Flaming Phoenix Entertainment Ltd)

Hi Celerina

Thank you. Is it possible for us to have a copy of the transaction print out too?

Thanks
Sue

From: Celerina Gieseke [mailto:Celerina.Gieseke@dol.govt.nz]
Sent: Wednesday, 2 October 2013 9:35 a.m.
To: Sue Brown
Cc: Celerina Gieseke
Subject: RE: Transaction Print Out - Zirka Circus (Flaming Phoeni[illegible] [illegible]ment Ltd)

Hi Sue,

Confirmed received $2,000 from Flaming Phoenix on 2[illegible]

Regards,
Celerina

From: Sue Brown [mailto:Sue.Brown@[illegible].govt.nz]
Sent: Monday, 30 September 2013 [illegible]
To: Celerina Gieseke
Subject: Transaction Print Out - Zirka Circus (Flaming Phoenix Entertainment Ltd)

Good Morning Celerina

A Multiproof applic[illegible] Zirka Circus (Flaming Phoenix Entertainment Ltd) has made a payment of $2,000 by electronic bank[illegible]

They have [illegible] of the tra[illegible] from their end - please see attachment

Can [illegible] provide us wi[illegible] print out to confirm payment has been received?

[illegible] know if y[illegible] [illegible]ther information

Thank you

Kind regards
Sue

Sue Brown
Administrator

Determinations and Assurance
Building System Performance Branch
Infrastructure and Resource Markets Group

Department of
Building and Housing
Te Tari Kaupapa Whare

National Multiple-Use Approval
APPLICATION INITIAL INVOICE REQUEST

To: Accounts Processing Team, Finance.

Please enter an Accounts Receivable (A/R) invoice and receipt the payment for the details shown below:

National Multiple-Use Chart Debtor Number	10057
National Multiple-Use Chart Debtor Name	Flaming Phoenix Entertainment Ltd (Zirka Circus)
NMUA Application Num (N.....)	N10057
Initial Application Prepayment Amount Received	2,000.00
Non-refundable Fee (recognised as revenue)	511.11
Bank statement date (fee credited to)	

Requested by:

Date:

<u>Notes for the NMUA Account Manager:</u>

1. If applicant is new, complete the "New Debtor Form" and send it along with this form.
2. Complete this form for each application fee credited to the NMUA bank account or attach payment cheque.
3. Accounts processing person will create an A/R invoice for the application fee and receipt the payment.
4. A/R invoice and receipt will be emailed to the requestor.
5. The requestor is responsible for sending the A/R invoice and receipt to the NMUA applicant.
6. The application fee will be recorded in Finance One General Ledger as follows:

GL Account Number	Natural Account Description	Invoice Description / Line narration	GST Excl Amt	GST Rate	GST Amt	GST Incl Amt
116.1250.NNNNNN.00000	NMUA Revenue from Application Fees	Non refundable application prepayment	444.45	15%	66.66	511.11
999.7060.NNNNNN.00000	NMUA Revenue in Advance	Refundable application prepayment	1,488.89	N/A		1,488.89
	Total Application Fee received		1,933.34		66.66	2,000.00

As at 12:40PM, Wednesday 25 September 2013

Payment Successful

A payment has been made with the following details:

To:	03-0049-0005128-00
From Account:	s 9(2)(a) (FLAMING PHOENIX)
Amount:	$2,000.00

Details to appear on their statement: Multiproof ZirkaCircus

Planning to pay this person again? Click 'Save this payee' and save them to your Payee List.

Print **Save this payee**

Notes regarding electronic payments:
If your payment is being made to a non-ASB Account, you should allow up to 2 working days from the time of this transaction for the funds to be credited to the other bank account.

ASB

FLAMING PHOENIX ENTERTAINMENT LIMITED *(2155784)* *Registered*

Last updated on 01 Aug 2013

To maintain this company log on here

Company Summary | Addresses | Directors (1) | Shareholdings (2) | Documents (16)

Company number:	2155784
Incorporation Date:	13 Aug 2008
Company Status:	Registered
Entity type:	NZ Limited Company
Constitution filed:	No
AR filing month:	August , last filed on 01 Aug 2013
Company Addresses:	**Registered Office** 254 Aka Aka Road, Rd 3, Pukekohe, 2678 , New Zealand **Address for service** 254 Aka Aka Road, Rd 3, Pukekohe, 2678 , New Zealand View all addresses
Directors	Showing 1 of 1 directors Xiujing HOU 254 Aka Aka Road, Rd 3, Pukekohe, 2678 , New Zealand

Generated on Monday, 30 September 2013 09:18:31 NZDT

Out of Scope

-----Original Message-----
From: James Finlayson [mailto:james@zirkacircus.com]
Sent: Monday, 26 August 2013 11:17 a.m.
To: Murray Usmar
Subject: Zirka Circus Multiproof Amendment

Hi again Murray

Apologies, I just received an amended copy of my FEB document from OnFire.

I asked why the photos were not in the document they sent me, and the administrator had left out part of the appendix including photos etc.

This document includes the appendices. Please replace the one I sent last night.

It is identical apart from the additional pages with photos at the end...

Sorry for the confusion!

Regards

James

--
James Finlayson
General Manager
Flaming Phoenix Entertainment Ltd (Zirka Circus)

www.zirkacircus.com

s 9(2)(a)

FIRE ENGINEERING DESIGN

ZIRKA CIRCUS

ONFIRE

Job number: 1942 | 21/08/2013 | Issue 1

Issue	Date	Author	Status	Extent of Revision
1	21 AUGUST 2013	MEA DLS	BUILDING CONSENT	

Prepared by:

Mahesh Andhe

Fire Engineer

BE Hons, PGCert (Eltrx), ME (Fire)

Reviewed by:

Debbie Scott

Principal Fire Engineer

ME Dist. (Fire), PMSFPE, FIPENZ, CPEng

ONFIRE

OnFire Consulting Limited

477 Alexandra Street, PO Box 226, Te Awamutu 3840, New Zealand

Phone: 07 870 6411 Fax: 07 870 6412

Email: info@onfire.co.nz; www.onfire.co.nz

Table of Contents

1 Purpose

The purpose of this report is to show compliance with the New Zealand Building Code (NZBC) for Protection from Fire as required by the Building Act 2004 for an existing circus tent that travels the country throughout the year and is likely to be erected 50 weeks of the year. This fire engineering design is to be used for a multiproof application.

This report addresses the requirements of the Building Act 2004 only and does not address owners or tenants property protection unless specifically referenced. This report is specific to the building and client, it is not to be used by any third party and no responsibility is taken for any third party who uses this report.

To meet the mandatory requirements of the NZBC fire safety clauses C1 to C6 Protection from Fire, this report is based on the following:

- C/VM2 Verification Method: Framework for Fire Safety Design,
- F6/AS1 Visibility in Escape Routes, Third Edition 18 October 2007,
- F7/AS1 Warning Systems, Fourth Edition, 10 April 2012,
- F8/AS1 Signs, Second Edition, 10 April 2012 (as applicable to fire safety),

This Zirka circus tent is designed in accordance with the **Verification Method C/VM2.**

Issues that may arise under the Fire Safety and Evacuation Regulations 2006 should be discussed directly with the New Zealand Fire Service (NZFS).

This report does not examine any storage, ventilation or bunding requirements for hazardous substances as defined in the Hazardous Substances and New Organisms Act 1996 (HSNO) or Building Code Clause F3-Hazardous Substances and Processes, and in particular the Hazardous Substances (classes 1 to 5 controls) Regulations 2001. It is assumed that any hazardous substance not stored as required by the Regulations is in such small quantities as to have minimal effect on the fire load of the building. Building owners should contact an EPA Test Certifier for advice on compliance.

This fire engineering design is a performance document, specifically for Zirka circus tent only. The consultants whose documentation is required to incorporate the requirements of this fire engineering design are expected to have read this report, understood the implications as it affects their scope of work and have incorporated the relevant fire safety requirements into their drawings and specifications.

The fire design in this report does not meet the criteria specified in the Gazette Notice #49 of 3 May 2012 published by the Department of Building and Housing and therefore does not require submission to the NZFS Engineering Unit (DRU).

2 FEB Acceptance

The FEB has been reviewed by all of the stakeholders. The stakeholders have no significant reservations about any of the content and have accepted the FEB. The FEB documentation is attached in Section 26.

3 Introduction

This is an existing circus tent that travels the country throughout the year and is likely to be erected 50 weeks of the year. Given the need for multiple consents throughout the year a Multi-Proof consent through the Ministry of Business, Innovation and Employment (MBIE) is to be applied for. The details in this fire engineering design relate to the Code Clauses C1-C6. Other Code Clauses are to be dealt with by the applicant with MBIE.

The circus tent is in the process of purchasing new seating and the proposed number of seats is 690 which is based on this fire engineering design.

The existing circus tent is made of a fabric called Ferrari F702 "Big Top". Testing has been undertaken by AWTA for Baytex who are NZ's leading Tent and Marquee Manufacturer and the flammability index achieved was 5. The Fabric on this circus tent is clearly stamped and hallmarked by the manufacturer, showing that this is indeed the fabric used as per FEB attached in Section 26, Appendix 6.

This fire engineering design report, along with BCA check sheet, Compliance Schedule, B-Risk inputs/outputs (for CF1 and CF2), FEB documentation, drawings, Flammability Index Test sheet for the above mentioned fabric and correspondence emails at the rear of this FER report form the fire engineering documentation.

A site visit to the tent was undertaken on the 30th April when it was erected in Hamilton, and a FEB meeting was held on 22nd of May 2013.

4 Building Importance Level and Risk Groups

4.1. Building Importance Level

In accordance with Clause A3 of the Building Code the Importance Level of the circus tent has been classified as follows:

Importance Level	Description of Building Type	Specific Structure
IL 3	Buildings of a higher level of societal benefit or importance, or with higher levels of risk-significant factors to building occupants. These buildings have increased performance requirements because they may house large numbers of people, vulnerable populations, or occupants with other risk factors, or fulfil a role of increased importance to the local community or to society in general.	Buildings where more than 300 people congregate in 1 area

4.2. Risk Groups

Although C/VM2 does not specify Risk Groups per-se, they are applicable to some sections of the Verification Method:

Location	Risk Group	Acceptable Solution	Escape Height	No.of people
Circus Tent	CA	C/AS4	0m	690

4.3. Occupant Loads

The occupant loads for the tent are based upon the proposed seating. The new seating is proposed to allow 690 occupants in the arrangement shown in Appendix 1 of Fire Engineering Brief attached as Appendix 6 in Section 26 of this Fire Engineering Report.

5 Fire Safety Precautions

5.1 Fire Safety Precautions to be installed in the building:

As discussed in the FEB, visual detection would be the main form of detection should the fire occur in the circus ring. Manual alarms would then be activated by circus staff. Type 2 fire alarm systems will be installed in the circus tent with manual call points provided in sound box and backstage as discussed in FEB. The fire alarm panel is to be provided in the sound box and is to be interfaced with audio and normal lights and emergency lighting such that when the fire alarm is sounded then the audio and lights should turn "OFF" and the emergency lighting should turn "ON".

An Emergency lighting system is to be installed in the building as required by F6/AS1. The emergency lighting system is to highlight specified features such as: escape routes in excess of 20 m from the farthest point in the circus tent to the closest final exit. Also changes in direction, tripping hazards, stairs, ramps, entries into safe paths, etc. This report does not address Visibility in Escape Routes and it is therefore to be designed and detailed by an electrical engineer for compliance with clause F6 of the Building Code.

However, there is emergency lighting proposed by the client. The client wishes to have emergency lights (Flood lights) to be located on four king poles of the circus tent preferably not too high. The location and the type of these lights are as shown in the drawings attached as Appendix 7 in Section 27 of this fire engineering report.

Information in this report such as occupant load, escape routes and the location of EXIT signs will be required in order for the electrical consultant to design adequate illumination. Note also that any escape route marked on attached fire safety plans are not to be taken as 'specific escape routes' in terms of F6/AS1/1.3.2.

Engage the services of a suitably qualified person to design and install an emergency lighting system to comply with NZBC F6 Visibility in Escape Routes, Clause 1.2 and Clause 1.3. Emergency lightings shall be located in accordance with F6/AS1/1.2 and shall be located:

(a) At every change of level in the building,
(b) in any part of an escape route designed to serve more than 250 people,

Emergency lighting must be installed in the areas specified and must provide a direct illuminance of no less than (F6/AS1/1.3.1):

- Minimum 1 Lux in Escape Routes
- Minimum 1 Lux at every change of level or change of direction in an escape route
- Minimum 0.2 Lux everywhere else

Emergency lighting must be maintained for 30 minutes in the Zirka circus tent

The drawings in Section 27, Appendix 7 detail indicative locations of where emergency lighting would be required for compliance with F6/AS1.

6 Means of Escape

6.1 General

This circus tent only has open path escape routes and final exits and does not require any smoke lobbies or safe-path exitways.

The escape routes are to comply with NZBC Clause D1. Ramps, stairs, landings, handrails, doors, vision panels and openings are to comply with D1/AS1.

6.2 No. of Escape Routes

The actual numbers of escape routes provided are 4 (Main Entrance/ Exit 1, two side exits (Exit 2 and Exit 3) and a rear staff only exit (Exit 4)). Exit 4 has not been considered in the assessment as discussed in the FEB process. The open paths to Exit 1, 2 and 3 diverge at an angle no less than 90° and are separated by 27 m (≥20 m for >250 occupants) as per C/VM2 therefore complies with alternate escape route requirements of C/VM2.

6.3 Width & Height of Escape Routes

The following table details the minimum required widths of escape routes in the building.

Location	Horizontal Travel (mm)	Minimum door widths (mm)
All open paths which are not an accessible route	850	760
All open paths which are accessible routes	1200	760

The height of an escape route is to be a minimum of 2100mm; any doors are required to have a minimum clear height of 1955mm. (C/AS4/3.3.1).

The door widths in the Zirka circus tent are 3400 mm and the clear height of the doors is 1.8 m (As per FEB and the drawings attached in FEB, Section 26). The escape routes and the door widths in the Zirka circus tent comply with this requirement. (C/AS4/3.3.2).

6.4 Doors – swing and locking devices

Doors on escape routes are required to open in the direction of escape if there are more than 50 occupants using the doors. The doors in the circus tent are not traditional doors but are quickly openable tent flaps and hence comply with these requirements. The tent flap / egress doors are tied together via 'lacing'. They do have a knot in place at the bottom of the doors to ensure these doors are locked when the tent is unoccupied. The circus do have a procedure in place to ensure that the doors are unknotted (with lacing still in place) prior to the public occupying the tent. Once the knot is undone the flaps come open when pushed on the doors itself. Description regarding the opening of the tent flaps is attached in Section 28 in the correspondence emails.

6.5 Fire Escape Route Signage

6.5.1 Fire Escape Route Signage Location

Fire exit signage is to be installed throughout the building to indicate the escape routes and final exits in compliance with F8/AS1.

Escape route signs shall be located in accordance with F8/AS1/4.1. Escape routes shall be identified by exit signs which are clearly visible and shall be located:

a) At each point in the open path where a door giving access to a final exit is not visible in normal use.
b) To clearly indicate each door giving access to a final exit and
c) To clearly identify the route of travel.

6.5.2 Fire Escape Route Signage Type and Illumination

Escape route signs (and final exit signs) are to be text or a pictogram or both. (F8/AS1/2.1.d).

Exit signs in escape routes shall be illuminated as required by NZBC Clause F6. (F8/AS1/4.5.1) The Exit sign shall be internally illuminated.

Exit signage's are internally illuminated and is currently provided at all the exits. These exist signs are to be turned on prior to the starting of every performance. Additional required exit sign locations is as shown in the drawings attached as Appendix 7 in Section 27

6.6 Miscellaneous

Exit doors and escape routes are to remain clear at all times. Escape routes shall not be used for storage of goods, solid waste or solid waste containers.

Please note that the escape route widths specified in this report are the minimum required widths for fire safety only and do not specify widths that may be needed for compliance with Clause D1 (Access Routes). It is also noted that other escape route features as required by Clause D1 and Clause F4 (Safety from Falling) are not addressed by this report.

7 Design Scenario 1 Fire Blocks Exit

7.1 Escape Routes

There are three designated final exits and the escape routes to which diverge at an angle no less than 90° and are separated by 27 m (≥20 m for >250 occupants) as per C/VM2 therefore complies with alternate escape route requirements of C/VM2.

The capacity of means of escape is as detailed below as the circus tent is unsprinklered

7.2 Capacity of Means of Escape

The following table details the actual egress capacity from the building (and each area) in accordance with C/AS4/3.3.2. Although C/VM2 is used for analysis the capacity calculation shows the available egress.

Component	Door Width (mm)	Egress Capacity (# people)
Main entrance/Exit 1	3400	484
Exit 2	3400	484
Exit 3	3400	484
TOTAL		**1452**
Deduct unavailable exit		-484
Total available width		**968**

Note:

(1) In accordance with C/AS4/3.3.2e where the firecell is unsprinklered it is necessary to provide extra width to allow for the possibility that one escape route may be unusable. Also it is to be noted here that the emergency exit at the back of stage is not used in the analysis.

The egress capacity as shown on the drawings is sufficient for the design occupant load of 690 people in the building.

8 Design Scenario 2 Unknown Threat

8.1 Design Scenario 2: Fire in normally unoccupied room

This scenario is not applicable as there is no unoccupied space in the circus tent. However there is a challenging fire scenario modelled underneath the seating and is documented as design fire scenario 2 in the Challenging Fire section (Please refer to Section 15 of this fire engineering report).

9 Design Scenario 3 Concealed Space

9.1 Design Scenario 3: Fire starts in concealed space

This scenario is not applicable as there is no concealed space in the circus tent.

10 Design Scenario 4 Smouldering Fire

10.1 Design Scenario 4 Smouldering Fire

This scenario is not applicable as there are no sleeping risk group occupants in the circus tent.

11 Design Scenario 5: Horizontal Fire Spread

11.1 Boundary Exposures

For the circus tent to have 100% unprotected areas in the external walls, the tent shall be located more than 10 m away from every neighbouring boundary wherever erected as per C/VM2/A2.4 for a FLED = 800 MJ/m², Height of enclosing rectangle = 4m and Width of the firecell = >20m.

Wall Elevation	Distance to Boundary (m)	Firecell Width (m)	Unprotected Area (%)	
			Allowed	Actual
North	>10m	>20m	100%	100%
South	>10m	>20m	100%	100%
East	>10m	>20m	100%	100%
West	>10m	>20m	100%	100%

The circus tent management must ensure that the tent is located further than 10 m from every neighbouring boundary. This is to be calculated by each BCA as per their approval process.

12 Design Scenario 6: Vertical Fire Spread

As the building is <10m high to the top of the circus tent wall, vertical fire spread is not applicable

13 Design Scenario 7: Rapid Fire Spread Involving Internal Surface Linings

13.1 Interior Surface Finishes, Floor Coverings and Suspended Fabrics:

The existing circus tent is made of a fabric called Ferrari F702 "Big Top". Testing has been undertaken by AWTA for Baytex who are NZ's leading Tent and Marquee Manufacturer and the flammability index achieved was 5 (as per FEB). The Fabric on this circus tent is clearly stamped and hallmarked by the manufacturer, showing that this is indeed the fabric used, therefore satisfies the surface finish requirements of the NZBC. The testing certificate is provided in Appendix 1 of FEB attached in Section 26 as Appendix 6

There are no foamed plastics in the circus tent and the wall and the ceiling surface finish requirements do not apply to the circus tent as it is a membrane structure.

14 Design Scenario 8: Firefighting Operations

14.1 Fire Fighting Operations

The circus tent is expected to be located in public parks and other public places where NZFS shall have direct access from public streets to enable the requirements for fire service access are complied with. This is to be checked by each BCA as a part of their approval process.

15 Design Scenario 9: Challenging Fire

15.1 Capacity of Means of Escape

The following table details the actual egress widths for crowd areas in the tent which are used in the ASET/RSET calculations:

Circus Tent	Door	Door Width (mm)
Ground floor	Main entrance/exit 1	3400
	Exit 2	3400
	Exit 3	3400

15.2 Travel Distances

The worst case travel distance for the occupants in the Zirka circus tent is 36 m (18m along bleachers + 18 m horizontal travel) which is used for ASET/RSET calculations.

15.3 Modelling challenging fire scenarios using B-risk

Design Fire 1: Fire in Circus Ring

- C/VM2 mode used in B-Risk modelling.
- All the escape doors from the Circus ring are closed until evacuation begins;
- The circus ring has been modeled with an aspect ratio of 1:5 using the actual area of 6732 m^2;
- This gives a width and length of 31 m with a minimum stud height of 4 m and maximum stud height of 10 m.

- All the gaps (Kingpoles, Cupola, Seams and sidewalls) are modeled as one vent to the outside with a total area of 4 m^2; (details of gaps are provided in vent / leakage drawings attached as Appendix 2 of FEB which is in 26 of this fire report)
- The door openings (1.7 m (wide) x 1.8 m (height))and the triangular openings (1.16 m (wide) x 1.16 (height) = 1.35 m^2) above doors are modeled as half open for smoke ventilation ;
- Fast t^2 fire modelled, as per C/VM2 Table 2.1;
- FLED 800 MJ/m^2, HRRPUA 250 kW/m^2
- Doors are modeled to open at 140 seconds (110 seconds (500 kW fire size) + 30 seconds (notification time)) as per C/VM2 Table 3.3 .

  The volume of the tent modeled is 6731 m^3 which is less than the actual volume of 8013 m^3.

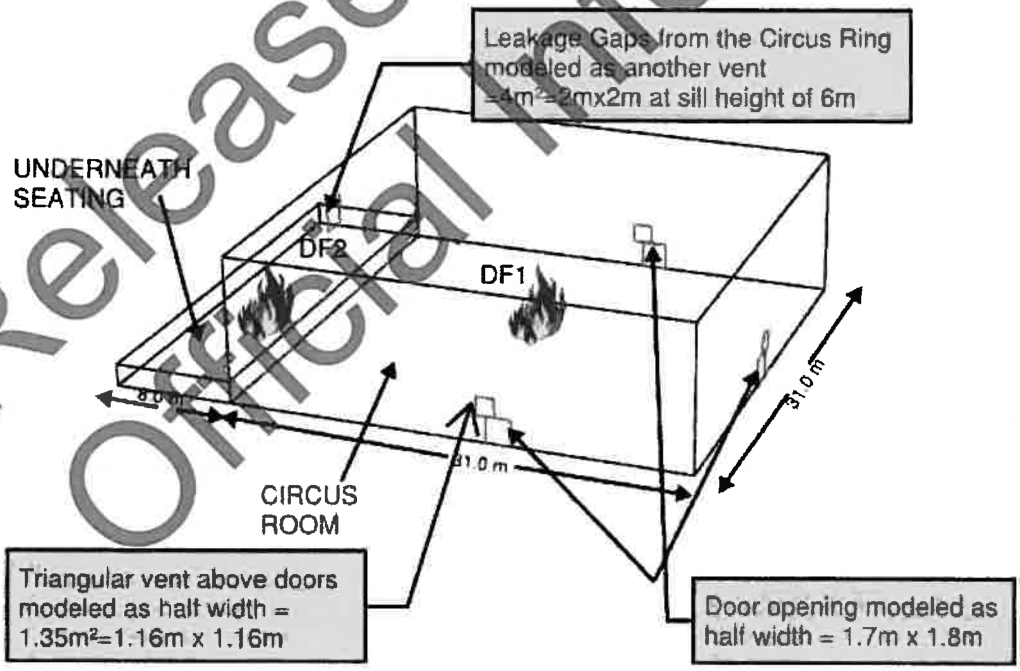
Design Fire 2: Fire underneath seating

- As per Design Fire 1 except for the location of fire origin being the space underneath the seating.

15.4 Modelling geometry to determine ASET

The model of the building was divided into two different rooms connected to each other via vent opening. Leakages were modelled as separate wall vents connecting to outside.

Below is the screenshot of the model in B-Risk. Room 1 represents the circus ring and Room 2 represents area underneath seating connecting to each other via vent. FED_{CO} $FED_{THERMAL}$ and Visibility were assessed. The height above the floor at which tenability is assessed is 2.0 m Figures below show the schematic representation of the model used for the B-Risk simulations. All doors are assumed closed until evacuation which is deemed to commence after the fire reaches 500 kW.



15.5 ASET/RSET Results Challenging Fire: Location 1

Design Fire 1: Fire within Circus Ring

The RSET is determined from the following equation:

RSET = $(T_D + T_N + T_{PRE}) + (T_{TRAV}$ OR $T_{FLOW})$

Where:

T_d = time to detection of fire = 110 seconds, (visual detection) As per C/VM2 Table 3.3 for spaces within building which have only focused activities (eg, cinemas, theatres and stadiums) occupants are assumed to start evacuation travel when fire in their space reaches 500 kw. This value is 110 seconds

T_n = Notification time applies and this value is 30 seconds as per C/VM2 3.2.2.

T_{pre} = time from notification until occupants commence evacuation=0 seconds as discussed in FEB.

The travel time is governed by either the time taken to travel to the doorway or the time taken for all the occupants to flow through the doorway (whichever is greater). .
T_{trav} = occupant travel time to move to a place of safety. Calculated knowing the travel distance and applying the travel speed as determined.

The analysis is for 50% of the occupants i.e 345 out of 690 using the main exit 1 for escape as it is likely that the occupants would like to move to the main exit where they would have originally come in from. The following tables summarises the RSET calculations for the building for this scenario.

			Enclosure of origin Circus Ring (Room 1)	
Travel Time				
Horizontal Travel				
Area			344	m^2
No. of Occupants			345 (50% using main exit 1 for escape)	people
Density of Occupants in space	D		n/a (as 690 people are expected to occupy the space as per information supplied from the client)	people/m^2
k factor	k		1.4	
a factor	A		0.266	
Travel Speed S = k-akD			1.139	m/s
Travel Speed along bleachers			0.85	
Max Travel Speed			1.2	m/s
Horizontal Travel Distance	L_{trav}		18	m
Travel Distance along bleachers	L		18	
$T_{trav} = L_{trav}/S$	**T_{trav}**	**(1)**	**16**	**seconds**

$T_{trav} = L_{trav}/S$	**T_{trav}**	**(1)**	**22**	**seconds**
Flow Time				
Occupant Density at door	D		1.9	people/m^2
Width	W		3.4	m
Boundary Layer Width			2 x 0.15	m
Effective Width	W_e		3.1	m
$F_c = (1\text{-}aD)kDW_e$			1.67 person/s VM2 (if Fc > 100, 100 persons/min max cap double leaf)	People/sec
Queuing Time	**t_q**	**(2)**	**76**	**seconds**
Evacuation time (greater of travel or flow)			76	seconds
Detection time	t_d		110	seconds
Alarm notification time	t_n		30	seconds
Occupant Pre-movement time	t_{pre}		0	seconds
RSET	**RSET**		**216**	**seconds**

ASET:

Results from B-Risk Simulation are as below:

Visibility in Circus Ring (Room 1) at 2 m above floor reduces to less than 10 m at 410 seconds.

FED (CO) in Circus Ring (Room 1) exceeded 0.3 at 775 seconds.

FED (THERMAL) in Circus Ring (Room 1) exceeded 0.3 at 490 seconds.

The following Table summarises the B-Risk modelling results for this fire scenario

	Enclosure of origin (Room 1)	
B-Risk Results		
ASET (Visibility < 10m)[1]	**<410**	**seconds**

Note:

(1) Visibility reduces to less than 10 m in Room 1 at 430 seconds.

ASET/RSET:

The following Table summarises the ASET/RSET modelling results for this fire scenario:

	Enclosure of origin (Room 1)	
ASET	**<410**	seconds
RSET	**216**	seconds

The ASET/RSET calculations show that the means of escape for the occupants of the building comply with the NZBC for a challenging fire in this location.

15.6 ASET/RSET Results Challenging Fire: Location 2

Design Fire 2: Fire underneath seating

The RSET calculation is exactly same as performed for Challenging fire location 1, since the occupants are only in Room 1 (Circus Ring). Therefore the ASET is 184 seconds.

ASET:

Results from B-Risk Simulation are as below:

Visibility in Circus Ring (Room 1) at 2 m above floor reduces to less than 10 m at 360 seconds.

FED (CO) in Circus Ring (Room 1) exceeded 0.3 at 765 seconds

FED (THERMAL) in Circus Ring (Room 1) exceeded 0.3 at 595 seconds.

The following Table summarises the B-Risk modelling results for this fire scenario:

	Remote from origin (Room 1)	
B-Risk Results		
ASET (Visibility < 10m)[1]	**<360**	**seconds**

Note:

(1) Visibility reduces to less than 10 m in Room 1 at 390 seconds with fire location underneath the seating.

ASET/RSET:

The following Table summarises the ASET/RSET modelling results for this fire scenario:

	Remote from origin (Room 1)	
ASET	**<360**	seconds
RSET	**216**	seconds

The ASET/RSET calculations show that the means of escape for the occupants of the building comply with the NZBC for a challenging fire in this location.

16 Design Scenario 10: Robustness Check

There are no key fire safety systems to fail, therefore this scenario is not applicable.

17 Structural Requirements

Structural requirements need not be assessed for Zirka circus tent provided the tent is located >10 m from the boundary as detailed in Section 11 of this Fire report .

18 D1: ACCESS ROUTES (As Applicable to Means of Escape)

Accessible routes to have signs (symbols of access ♿) complying with NZBC F8.

The clear width of an accessible route shall be no less than 1200 mm.

19 Compliance Schedule Information

There are 'Specified Systems' identified by this fire engineering design which would be required to be listed on a Compliance Schedule and is attached in Section 23 as Appendix 3.

20 Conclusion

This Verification Method analysis shows that the proposed Zirka Circus tent will achieve compliance with the NZ Building Code Clauses C1 – C6 for Protection from Fire as required by the NZ Building Act.

This is subject to the assumptions and requirements being met within this report. The main requirements of the report are summarised below however the report needs to be read in its entirety to ensure all requirements are met.

1) Emergency lighting is to be installed in the building as required by F6/AS1. However, there is emergency lighting proposed by the client. The client wishes to have emergency lights (Flood lights) to be located on four king poles of the circus tent preferably not too high. The location and the type of these lights are as shown in the drawings attached as Appendix 7 in Section 27 of this fire engineering report.
2) All exit door locking devices if any other than the openable tent flaps should be clearly visible, located where such a device would normally be expected, designed to be easily operated without a key or other security device, and allow the door to open in the normal manner.
3) Fire exit signage shall be erected throughout the building in compliance with F8/AS1. Exit signage shall be internally illuminated as part of the emergency lighting system.
4) NZFS requirements are provided in Section 21 of this report.

21 APPENDIX 1 – NZFS Access

Part 6: Firefighting

CONTENTS

6.1 Fire Service vehicular access

6.1.1 If *buildings* are located remotely from the street boundaries of a property, pavements situated on the property and likely to be used for vehicular access by *fire* appliances shall:

a) Be able to withstand a laden weight of up to 25 tonnes with an axle load of 8 tonnes or have a load-bearing capacity of no less than the public roadway serving the property, whichever is the lower, and

b) Be trafficable in all weathers, and

c) Have a minimum width of 4.0 m, and

d) Provide a clear passageway of no less than 3.5 m in width and 4.0 m in height at site entrances, internal entrances and between *buildings*, and

e) Provide access to a *hard-standing* within 20 m of:

i) An entrance to the *building*, and

ii) Any inlets to fire sprinkler or *building fire* hydrant systems.

Comment:

Access to *buildings* for *fire* appliances will be generally via public streets, but provision is needed on large, multi-*building* sites to enable appliances to reach any *building*.

6.1.2 THIS PARAGRAPH DELIBERATELY LEFT BLANK

6.2 Information for firefighters

6.2.1 If *fire* detection and alarm systems or sprinkler systems are installed, the control panel shall be located in a position close to the Fire Service attendance point and in accordance with NZS 4512, NZS 4515 and NZS 4541 as appropriate.

6.2.2 If *hazardous substances* are present in the *building* warning signage in accordance with NZBC F8 shall be displayed.

22 Appendix 2: BCA Check sheet for Building Act Section 46

The following assessment is carried out in terms of Gazette Notice #49 of 3 May 2012 published by the Department of Building and Housing to determine whether the BCA is required to forward a copy of this fire engineering to the NZFS Engineering Unit (DRU) for comment:

Clause			✓	x	Yes/No	
A	B	C	D	E	F	G
1		Evacuation Scheme in terms of Section 21A of Fire Service Act 1975				
	a	Gathering of 100 or more persons:	✓			
	b	Employment facilities for 10 or more persons:	✓			
	c	Accommodation for more than 5 persons (other than in 3 or fewer household units):		x		
	d	Hazardous substances present in quantities exceeding the prescribed minimum amounts:		x		
	e	Early childhood facilities (except in household):		x		
	f	Nursing, medical, or geriatric care(except in household):		x		
	g	Specialised care for persons with disabilities (except in household):		x		
	h	Accommodation for persons under lawful detention (except in home or community detention,		x		
		Clause 1 (Section 21A of Fire Service Act 1975) applies?			**Yes**	
2	a	Compliance with Building Code Clauses established by Compliance Document?				
		Protection from Fire: C/AS1, or C/AS2, or C/AS3 or C/AS4, or C/AS5, or C/AS6, or C/AS7, or C/VM1, or C/VM2	✓			
		Access Routes: D1/AS1	✓			
		Visibility in Escape Routes: F6/AS1	✓			
		Signs: F8	✓			
		Clause 2(a) applies?			**No**	
	b	Modification or waiver of Clauses C1-6, D1, F6 or F8 under Section 67 of the Building Act 2004?			**No**	
	c	Alteration or change of use affects fire safety system (including Specified System) except minor work?			**No**	
		Clause 2(b or c) apply?			**No**	
3		Clause 1 does not apply to: a) Single Household units, b) Household units fire cells and individual egress, c) Internal fit-out – unless fit-out is change of use, d) Outbuildings or ancillary buildings				
		Any Clause 3 triggers?			**No**	
		Are there at least 2 applicable items from column F? If yes then the BCA is obliged to forward the building consent to the DRU				**No**

The BCA is not required to forward a copy of this fire engineering to the NZFS Engineering Unit (DRU) for comment.

23 APPENDIX 3 – Compliance Schedule Information

The list of 'Specified Systems' below are for this building as identified by this fire engineering design. The Specified Systems identified below are not a comprehensive list of systems pertaining to the building. Please ensure that a comprehensive check of all possible systems is carried out when completing the Compliance Schedule.

The extent of coverage of the specified systems and where appropriate their location is identified on the attached plan. This should be included with the compliance schedule for the building.

SS	Specified System	Performance Standard	Maintenance	Inspections	New	Modify	List on CS
2	Automatic or Manual emergency warning systems for fire or other dangers Type 2 Manual call point system	NZBC: F7 Modified as discussed in FEB		By IQP: **Every time whenever the circus tent is erected in a new place** **Monthly:** In accordance with NZS 4512 Paragraph 602 **Yearly:** In accordance with NZS 4512 Paragraph 603			
4	Emergency lighting systems Including illuminated signs	NZBC: F6, F8 AS 2293.3: 2005 *(Emergency escape lighting and exit signs for buildings - Emergency escape luminaries and exit signs)* (Existing NZS 6742)	In accordance with: AS/NZS 2293.2:1995 Section 3	By IQP **Six monthly:** In accordance with Paragraph 3.2 and Appendix B AS/NZS 2293.2 **Yearly** : In accordance with Paragraph 3.3 AS/NZS 2293.2			✓
15	Any or all of the following systems and features, so long as they form part of a building's means of escape from fire, and so long as those means also contain any or all of the systems or features specified in clauses 1 to 6, 9, and 13: Performance standard = NZBC:C1 – C6, F7, F8 as appropriate						
15 (2)	Final exits Details: Designated final exit doors	NZBC:C1 – C6 Fire Safety and Evacuation of Building Regulations 1992 Compliance Schedule Handbook 2007 All final exit doors to be free of obstructions both sides of the door and not to be locked or barred. Any panic furniture or simple fastenings should operate freely to release door. Full opening of door width is required.	Fire Safety and Evacuation of Building Regulations 1992 Compliance Schedule Handbook 2007 Maintained in a safe condition: free from obstructions, locking, blocking, barring, storage of combustibles and ease of opening at the final exit.	Daily inspections by owner for crowd type occupancies Monthly inspections for all other occupancies with annual inspection and maintenance by IQP By owner/Occupier **Daily**: Check doors are not locked blocked or barred. **Weekly:** As daily plus ensure routes to final exits do not contain combustibles and any fastenings open easily and door swings to full width of opening. By IQP **Yearly:** As above, complete report to owner and complete required forms.			✓

15 (4)	Signs for communicating information intended to facilitate evacuation	NZBC:F8 Signs will be visible under all foreseeable conditions including interruption of mains power.	Immediate replacement or refurbishment of signs if missing, incorrect or illegible.	Daily inspections by owner for crowd type occupancies Monthly inspections for all other occupancies with annual inspection and maintenance by IQP By owner/occupier **Monthly:** Ensure signs in place where required, they are legible and clean and are illuminated. Record in log book. By IQP. **Yearly:** As per monthly and complete report and required forms.			✓

24 APPENDIX 4 – B-Risk RESULTS – CF1

17.1. B-Risk Results – CF1

Design Fire 1: Fire in Circus ring

```
Tuesday,August 20,2013,04:16 PM
B-RISK Fire Simulator and Design Fire Tool (Ver 2013.12)

Input Filename : input1.xml
Base File : C:\Users\Owner\Documents\B-
RISK\riskdata\basemodel_Zirka_Circus\basemodel_Zirka_Circus.xml

User Mode : C/VM2

Zirka Circus

====================================================================
Description of Rooms
====================================================================
Room 1 : Circus Room
         Room Length (m) =                               31.00
         Room Width (m) =                                31.00
         Maximum Room Height (m) =                       10.00
         Minimum Room Height (m) =                       4.00
         Floor Elevation (m) =                           0.000
         Absolute X Position (m) =                       0.000
         Absolute Y Position (m) =                       0.000
         Room 1 has a sloping ceiling.
         Shape Factor (Af/H^2) =                         9.6

         Wall Surface is steel (mild)
         Wall Density (kg/m3) =                          7850.0
         Wall Conductivity (W/m.K) =                     45.800
         Wall Specific Heat (J/kg.K) =                   460
         Wall Emissivity =                               0.90
         Wall Thickness (mm) =                           3.0

         Ceiling Surface is steel (mild)
         Ceiling Density (kg/m3) =                       7850.0
         Ceiling Conductivity (W/m.K) =                  45.800
         Ceiling Specific Heat (J/kg.K) =                460
         Ceiling Emissivity =                            0.90
         Ceiling Thickness (mm) =                        3.0

         Floor Surface is concrete
         Floor Density (kg/m3) =                         2300.0
         Floor Conductivity (W/m.K) =                    1.200
         Floor Specific Heat (J/kg.K) =                  880
         Floor Emissivity =                              0.50
         Floor Thickness = (mm)                          100.0

Room 2 : Bleachers
         Room Length (m) =                               31.00
         Room Width (m) =                                8.00
         Maximum Room Height (m) =                       1.50
         Minimum Room Height (m) =                       1.50
         Floor Elevation (m) =                           0.000
         Absolute X Position (m) =                       0.000
         Absolute Y Position (m) =                       31.000
         Room 2 has a flat ceiling.
         Shape Factor (Af/H^2) =                         110.2

         Wall Surface is steel (mild)
         Wall Density (kg/m3) =                          7850.0
         Wall Conductivity (W/m.K) =                     45.800
         Wall Specific Heat (J/kg.K) =                   460
         Wall Emissivity =                               0.90
         Wall Thickness (mm) =                           3.0
```

```
        Ceiling Surface is steel (mild)
        Ceiling Density (kg/m3) =                       7850.0
        Ceiling Conductivity (W/m.K) =                  45.800
        Ceiling Specific Heat (J/kg.K) =                460
        Ceiling Emissivity =                            0.90
        Ceiling Thickness (mm) =                        3.0

        Floor Surface is concrete
        Floor Density (kg/m3) =                         2300.0
        Floor Conductivity (W/m.K) =                    1.200
        Floor Specific Heat (J/kg.K) =                  880
        Floor Emissivity =                              0.50
        Floor Thickness = (mm)                          100.0

====================================================================
Wall Vents
====================================================================
Vent  1 : Vent above front entran
                   From room 1 to 3
                   Front face of room 1
                   Offset (m) =                         14.870
                   Vent Width (m) =                     1.160
                   Vent Height (m) =                    1.160
                   Vent Sill Height (m) =               1.800
                   Vent Soffit Height (m) =             2.960
                   Opening Time (sec) =                 110
                   Closing Time (sec) =                 0
                   Flow Coefficient (sec) =             0.680

Vent  2 : Vent above right door
                   From room 1 to 3
                   Right  face of room 1
                   Offset (m) =                         12.900
                   Vent Width (m) =                     1.160
                   Vent Height (m) =                    1.160
                   Vent Sill Height (m) =               1.800
                   Vent Soffit Height (m) =             2.960
                   Opening Time (sec) =                 110
                   Closing Time (sec) =                 0
                   Flow Coefficient (sec) =             0.680

Vent  3 : Vent above left door
                   From room 1 to 3
                   Left  face of room 1
                   Offset (m) =                         12.900
                   Vent Width (m) =                     1.160
                   Vent Height (m) =                    1.160
                   Vent Sill Height (m) =               1.800
                   Vent Soffit Height (m) =             2.960
                   Opening Time (sec) =                 110
                   Closing Time (sec) =                 0
                   Flow Coefficient (sec) =             0.680

Vent  4 : Door opening fron entra
                   From room 1 to 3
                   Front face of room 1
                   Offset (m) =                         13.800
                   Vent Width (m) =                     1.700
                   Vent Height (m) =                    1.800
                   Vent Sill Height (m) =               0.000
                   Vent Soffit Height (m) =             1.800
                   Opening Time (sec) =                 110
                   Closing Time (sec) =                 0
                   Flow Coefficient (sec) =             0.680

Vent  5 : Door opening Right face
                   From room 1 to 3
                   Right  face of room 1
                   Offset (m) =                         11.800
                   Vent Width (m) =                     1.700
                   Vent Height (m) =                    1.800
```

```
                    Vent Sill Height (m) =                  0.000
                    Vent Soffit Height (m) =                1.800
                    Opening Time (sec) =                    110
                    Closing Time (sec) =                    0
                    Flow Coefficient (sec) =                0.680

Vent  6 : Door Opening left face
                    From room 1 to 3
                    Left  face of room 1
                    Offset (m) =                            11.800
                    Vent Width (m) =                        1.700
                    Vent Height (m) =                       1.800
                    Vent Sill Height (m) =                  0.000
                    Vent Soffit Height (m) =                1.800
                    Opening Time (sec) =                    110
                    Closing Time (sec) =                    0
                    Flow Coefficient (sec) =                0.680

Vent  7 : Bleachers height
                    From room 1 to 2
                    Rear  face of room 1
                    Offset (m) =                            0.000
                    Vent Width (m) =                        31.000
                    Vent Height (m) =                       1.500
                    Vent Sill Height (m) =                  0.000
                    Vent Soffit Height (m) =                1.500
                    Opening Time (sec) =                    0
                    Closing Time (sec) =                    0
                    Flow Coefficient (sec) =                0.680
                    Vent Type is 3D adhered spill plume
                    Balcony Width (m) =                     0.000
                    Downstand Depth (m) =                   8.500

Vent  8 : ceiling vent
                    From room 1 to 3
                    Rear  face of room 1
                    Offset (m) =                            15.500
                    Vent Width (m) =                        2.000
                    Vent Height (m) =                       2.000
                    Vent Sill Height (m) =                  6.000
                    Vent Soffit Height (m) =                8.000
                    Opening Time (sec) =                    0
                    Closing Time (sec) =                    0
                    Flow Coefficient (sec) =                0.680

====================================================================
Ceiling/Floor Vents
====================================================================
====================================================================
Ambient Conditions
====================================================================
Interior Temp (C) =                                         21.0
Exterior Temp (C) =                                         18.0
Relative Humidity (%) =                                     50

====================================================================
Tenability Parameters
====================================================================
Monitoring Height for Visibility and FED (m) =              2.00
Asphyxiant gas model =                                      FED(CO) C/VM2
Visibility calculations assume:                             reflective signs
Egress path segments for FED calculations
1. Start Time (sec)                                         0
1. End Time (sec)                                           600
1. Room                                                     1
2. Start Time (sec)                                         600
2. End Time (sec)                                           900
2. Room                                                     1
3. Start Time (sec)                                         900
3. End Time (sec)                                           1200
3. Room                                                     1
```

```
================================================================
Sprinkler / Detector Parameters
================================================================
         Ceiling Jet model used is NIST JET.
         Sprinkler System Reliability                   1.000
         Sprinkler Probability of Suppression           1.000
         Sprinkler Cooling Coefficient                  1.000

================================================================
Smoke Detector Parameters
================================================================
         Smoke Detection System Reliability             1.000


================================================================
Mechanical Ventilation (to/from outside)
================================================================
Mechanical Ventilation not installed.
         Mech ventilation system reliability            1.000


================================================================
Description of the Fire
================================================================
CO Yield pre-flashover(g/g) =                           0.040
CO Yield post-flashover(g/g) =                          0.400
Soot Yield pre-flashover(g/g) =                         0.070
Soot Yield post-flashover(g/g) =                        0.140
Flame Emission Coefficient (1/m) =                      1.00
Fuel - Carbon Moles                                     1.00
Fuel - Hydrogen Moles                                   2.00
Fuel - Oxygen Moles                                     0.50
Fuel - Nitrogen Moles                                   0.00

Burning objects are manually positioned in room.

Burning Object No 1
Fire
              Located in Room                           1
              Energy Yield (kJ/g) =                     20.0
              CO2 Yield (kg/kg fuel) =                  1.500
              HCN Yield (kg/kg fuel) =                  0.000
              H2O Yield (kg/kg fuel) =                  0.818
              Heat Release Rate Per Unit Area (kW/m2) = 250.0
              Radiant Loss Fraction =                   0.35
              Fire Elevation (m) =                      0.300
              Fire Object Length (m) =                  0.300
              Fire Object Width (m) =                   0.300
              Fire Object Height (m) =                  0.000
              Location, X-coordinate (m) =              15.500
              Location, Y-coordinate (m) =              15.500
              Fire Location (for entrainment) =         centre
              Plume behaviour is undisturbed

              Alpha T2 growth coefficient =             0.0469
              Peak HRR (kW) =                           20000

================================================================
Postflashover Inputs
================================================================
Postflashover model is OFF.


================================================================
Results from Fire Simulation
================================================================

0 min    00 sec
         (0 sec)                        Room 1    Room 2    Outside

         Layer (m)                      9.908     1.500
         Upper Temp (C)                 21.0      21.0
```

```
        Lower Temp (C)                21.0      21.0
        HRR (kW)                      0.0       0.0
        Visibility (m) at 2m          20+       20+

        FED gases on egress path = 0.000
        FED thermal on egress path = 0.000

0 min   10 sec
        (10 sec)                      Room 1    Room 2    Outside

        Layer (m)                     9.468     1.500
        Upper Temp (C)                21.3      20.9
        Lower Temp (C)                21.0      20.9
        HRR (kW)                      4.7       0.0
        Visibility (m) at 2m          20+       20+

        FED gases on egress path = 0.000
        FED thermal on egress path = 0.000

0 min   20 sec
        (20 sec)                      Room 1    Room 2    Outside

        Layer (m)                     9.081     1.500
        Upper Temp (C)                21.9      20.9
        Lower Temp (C)                21.0      20.9
        HRR (kW)                      18.8      0.0
        Visibility (m) at 2m          20+       20+

        FED gases on egress path = 0.000
        FED thermal on egress path = 0.000

0 min   30 sec
        (30 sec)                      Room 1    Room 2    Outside

        Layer (m)                     8.735     1.500
        Upper Temp (C)                22.5      20.8
        Lower Temp (C)                21.0      20.8
        HRR (kW)                      42.2      0.0
        Visibility (m) at 2m          20+       20+

        FED gases on egress path = 0.000
        FED thermal on egress path = 0.000

0 min   40 sec
        (40 sec)                      Room 1    Room 2    Outside

        Layer (m)                     8.418     1.500
        Upper Temp (C)                23.3      20.8
        Lower Temp (C)                21.0      20.8
        HRR (kW)                      75.0      0.0
        Visibility (m) at 2m          20+       20+

        FED gases on egress path = 0.000
        FED thermal on egress path = 0.000

0 min   50 sec
        (50 sec)                      Room 1    Room 2    Outside

        Layer (m)                     8.121     1.500
        Upper Temp (C)                24.2      20.8
        Lower Temp (C)                21.0      20.8
        HRR (kW)                      117.3     0.0
        Visibility (m) at 2m          20+       20+

        FED gases on egress path = 0.000
        FED thermal on egress path = 0.001

1 min   00 sec
        (60 sec)                      Room 1    Room 2    Outside

        Layer (m)                     7.841     1.500
        Upper Temp (C)                25.1      20.8
```

	Lower Temp (C)	21.0	20.8	
	HRR (kW)	168.8	0.0	
	Visibility (m) at 2m	20+	20+	

FED gases on egress path = 0.000
FED thermal on egress path = 0.001

1 min	10 sec (70 sec)	Room 1	Room 2	Outside
	Layer (m)	7.578	1.500	
	Upper Temp (C)	26.1	20.8	
	Lower Temp (C)	21.0	20.8	
	HRR (kW)	229.8	0.0	
	Visibility (m) at 2m	20+	20+	

FED gases on egress path = 0.000
FED thermal on egress path = 0.001

1 min	20 sec (80 sec)	Room 1	Room 2	Outside
	Layer (m)	7.329	1.500	
	Upper Temp (C)	27.2	20.7	
	Lower Temp (C)	21.0	20.7	
	HRR (kW)	300.2	0.0	
	Visibility (m) at 2m	20+	20+	

FED gases on egress path = 0.000
FED thermal on egress path = 0.001

1 min	30 sec (90 sec)	Room 1	Room 2	Outside
	Layer (m)	7.092	1.500	
	Upper Temp (C)	28.3	20.7	
	Lower Temp (C)	21.0	20.7	
	HRR (kW)	379.9	0.0	
	Visibility (m) at 2m	20+	20+	

FED gases on egress path = 0.000
FED thermal on egress path = 0.001

1 min	40 sec (100 sec)	Room 1	Room 2	Outside
	Layer (m)	6.866	1.500	
	Upper Temp (C)	29.5	20.7	
	Lower Temp (C)	21.0	20.7	
	HRR (kW)	469.0	0.0	
	Visibility (m) at 2m	20+	20+	

FED gases on egress path = 0.000
FED thermal on egress path = 0.001

1 min	50 sec (110 sec)	Room 1	Room 2	Outside
	Layer (m)	6.650	1.500	
	Upper Temp (C)	30.6	20.7	
	Lower Temp (C)	21.0	20.7	
	HRR (kW)	567.5	0.0	
	Visibility (m) at 2m	20+	20+	

FED gases on egress path = 0.000
FED thermal on egress path = 0.001

2 min	00 sec (120 sec)	Room 1	Room 2	Outside
	Layer (m)	6.444	1.500	
	Upper Temp (C)	31.8	20.7	

```
        Lower Temp (C)               21.0      20.7
        HRR (kW)                     675.4     0.0
        Visibility (m) at 2m         20+       20+

        FED gases on egress path = 0.000
        FED thermal on egress path = 0.001

2 min   10 sec
        (130 sec)                    Room 1    Room 2    Outside

        Layer (m)                    6.260     1.500
        Upper Temp (C)               33.1      20.6
        Lower Temp (C)               21.0      20.6
        HRR (kW)                     792.6     0.0
        Visibility (m) at 2m         20+       20+

        FED gases on egress path = 0.000
        FED thermal on egress path = 0.001

2 min   20 sec
        (140 sec)                    Room 1    Room 2    Outside

        Layer (m)                    6.084     1.500
        Upper Temp (C)               34.5      20.6
        Lower Temp (C)               21.0      20.6
        HRR (kW)                     919.2     0.0
        Visibility (m) at 2m         20+       20+

        FED gases on egress path = 0.000
        FED thermal on egress path = 0.001

2 min   30 sec
        (150 sec)                    Room 1    Room 2    Outside

        Layer (m)                    5.913     1.500
        Upper Temp (C)               35.9      20.6
        Lower Temp (C)               21.0      20.6
        HRR (kW)                     1055.3    0.0
        Visibility (m) at 2m         20+       20+

        FED gases on egress path = 0.000
        FED thermal on egress path = 0.002

2 min   40 sec
        (160 sec)                    Room 1    Room 2    Outside

        Layer (m)                    5.744     1.500
        Upper Temp (C)               37.3      20.6
        Lower Temp (C)               21.0      20.6
        HRR (kW)                     1200.6    0.0
        Visibility (m) at 2m         20+       20+

        FED gases on egress path = 0.000
        FED thermal on egress path = 0.002

2 min   50 sec
        (170 sec)                    Room 1    Room 2    Outside

        Layer (m)                    5.577     1.500
        Upper Temp (C)               38.9      20.6
        Lower Temp (C)               21.1      20.6
        HRR (kW)                     1355.4    0.0
        Visibility (m) at 2m         20+       20+

        FED gases on egress path = 0.000
        FED thermal on egress path = 0.002

3 min   00 sec
        (180 sec)                    Room 1    Room 2    Outside

        Layer (m)                    5.411     1.500
        Upper Temp (C)               40.5      20.5
```

```
        Lower Temp (C)               21.1      20.5
        HRR (kW)                     1519.6    0.0
        Visibility (m) at 2m         20+       20+

        FED gases on egress path = 0.000
        FED thermal on egress path = 0.002

3 min   10 sec
        (190 sec)                    Room 1    Room 2    Outside

        Layer (m)                    5.247     1.500
        Upper Temp (C)               42.2      20.5
        Lower Temp (C)               21.1      20.5
        HRR (kW)                     1693.1    0.0
        Visibility (m) at 2m         20+       20+

        FED gases on egress path = 0.000
        FED thermal on egress path = 0.002

3 min   20 sec
        (200 sec)                    Room 1    Room 2    Outside

        Layer (m)                    5.084     1.500
        Upper Temp (C)               44.0      20.5
        Lower Temp (C)               21.2      20.5
        HRR (kW)                     1876.0    0.0
        Visibility (m) at 2m         20+       20+

        FED gases on egress path = 0.000
        FED thermal on egress path = 0.002

3 min   30 sec
        (210 sec)                    Room 1    Room 2    Outside

        Layer (m)                    4.923     1.500
        Upper Temp (C)               45.8      20.5
        Lower Temp (C)               21.2      20.5
        HRR (kW)                     2068.3    0.0
        Visibility (m) at 2m         20+       20+

        FED gases on egress path = 0.000
        FED thermal on egress path = 0.002

3 min   40 sec
        (220 sec)                    Room 1    Room 2    Outside

        Layer (m)                    4.764     1.500
        Upper Temp (C)               47.7      20.5
        Lower Temp (C)               21.3      20.5
        HRR (kW)                     2270.0    0.0
        Visibility (m) at 2m         20+       20+

        FED gases on egress path = 0.000
        FED thermal on egress path = 0.002

3 min   50 sec
        (230 sec)                    Room 1    Room 2    Outside

        Layer (m)                    4.605     1.500
        Upper Temp (C)               49.7      20.4
        Lower Temp (C)               21.3      20.4
        HRR (kW)                     2481.0    0.0
        Visibility (m) at 2m         20+       20+

        FED gases on egress path = 0.000
        FED thermal on egress path = 0.002

4 min   00 sec
        (240 sec)                    Room 1    Room 2    Outside

        Layer (m)                    4.448     1.500
        Upper Temp (C)               51.7      20.4
```

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        Lower Temp (C)                21.4      20.4
        HRR (kW)                      2701.4    0.0
        Visibility (m) at 2m          20+       20+

        FED gases on egress path = 0.000
        FED thermal on egress path = 0.003

4 min   10 sec
        (250 sec)                     Room 1    Room 2    Outside

        Layer (m)                     4.292     1.500
        Upper Temp (C)                53.8      20.4
        Lower Temp (C)                21.5      20.4
        HRR (kW)                      2931.3    0.0
        Visibility (m) at 2m          20+       20+

        FED gases on egress path = 0.000
        FED thermal on egress path = 0.003

4 min   20 sec
        (260 sec)                     Room 1    Room 2    Outside

        Layer (m)                     4.136     1.500
        Upper Temp (C)                55.9      20.4
        Lower Temp (C)                21.6      20.4
        HRR (kW)                      3170.4    0.0
        Visibility (m) at 2m          20+       20+

        FED gases on egress path = 0.000
        FED thermal on egress path = 0.003

4 min   30 sec
        (270 sec)                     Room 1    Room 2    Outside

        Layer (m)                     3.982     1.500
        Upper Temp (C)                58.1      20.4
        Lower Temp (C)                21.7      20.4
        HRR (kW)                      3419.0    0.0
        Visibility (m) at 2m          20+       20+

        FED gases on egress path = 0.000
        FED thermal on egress path = 0.003

4 min   40 sec
        (280 sec)                     Room 1    Room 2    Outside

        Layer (m)                     3.825     1.500
        Upper Temp (C)                60.3      20.3
        Lower Temp (C)                21.8      20.3
        HRR (kW)                      3677.0    0.0
        Visibility (m) at 2m          20+       20+

        FED gases on egress path = 0.000
        FED thermal on egress path = 0.003

4 min   50 sec
        (290 sec)                     Room 1    Room 2    Outside

        Layer (m)                     3.666     1.500
        Upper Temp (C)                62.6      20.3
        Lower Temp (C)                22.0      20.3
        HRR (kW)                      3944.3    0.0
        Visibility (m) at 2m          20+       20+

        FED gases on egress path = 0.000
        FED thermal on egress path = 0.003

5 min   00 sec
        (300 sec)                     Room 1    Room 2    Outside

        Layer (m)                     3.504     1.500
        Upper Temp (C)                64.9      20.3
```

Lower Temp (C)	22.1	20.3
HRR (kW)	4221.0	0.0
Visibility (m) at 2m	20+	20+

FED gases on egress path = 0.000
FED thermal on egress path = 0.003

5 min 10 sec
(310 sec)

	Room 1	Room 2	Outside
Layer (m)	3.339	1.500	
Upper Temp (C)	67.3	20.3	
Lower Temp (C)	22.3	20.3	
HRR (kW)	4507.1	0.0	
Visibility (m) at 2m	20+	20+	

FED gases on egress path = 0.000
FED thermal on egress path = 0.003

5 min 20 sec
(320 sec)

	Room 1	Room 2	Outside
Layer (m)	3.171	1.500	
Upper Temp (C)	69.8	20.3	
Lower Temp (C)	22.4	20.3	
HRR (kW)	4802.6	0.0	
Visibility (m) at 2m	20+	20+	

FED gases on egress path = 0.000
FED thermal on egress path = 0.003

5 min 30 sec
(330 sec)

	Room 1	Room 2	Outside
Layer (m)	3.001	1.500	
Upper Temp (C)	72.2	20.2	
Lower Temp (C)	22.5	20.2	
HRR (kW)	5107.4	0.0	
Visibility (m) at 2m	20+	20+	

FED gases on egress path = 0.000
FED thermal on egress path = 0.004

5 min 40 sec
(340 sec)

	Room 1	Room 2	Outside
Layer (m)	2.829	1.500	
Upper Temp (C)	74.8	20.2	
Lower Temp (C)	22.7	20.2	
HRR (kW)	5421.6	0.0	
Visibility (m) at 2m	20+	20+	

FED gases on egress path = 0.000
FED thermal on egress path = 0.004

5 min 50 sec
(350 sec)

	Room 1	Room 2	Outside
Layer (m)	2.657	1.500	
Upper Temp (C)	77.4	20.2	
Lower Temp (C)	22.8	20.2	
HRR (kW)	5745.3	0.0	
Visibility (m) at 2m	20+	20+	

FED gases on egress path = 0.000
FED thermal on egress path = 0.004

6 min 00 sec
(360 sec)

	Room 1	Room 2	Outside
Layer (m)	2.487	1.500	
Upper Temp (C)	80.5	20.2	

	Room 1	Room 2	Outside
Lower Temp (C)	23.0	20.2	
HRR (kW)	6078.2	0.0	
Visibility (m) at 2m	20+	20+	

FED gases on egress path = 0.000
FED thermal on egress path = 0.004

6 min 10 sec (370 sec)

	Room 1	Room 2	Outside
Layer (m)	2.320	1.500	
Upper Temp (C)	83.5	20.2	
Lower Temp (C)	23.2	20.2	
HRR (kW)	6420.6	0.0	
Visibility (m) at 2m	20+	20+	

FED gases on egress path = 0.000
FED thermal on egress path = 0.004

6 min 20 sec (380 sec)

	Room 1	Room 2	Outside
Layer (m)	2.157	1.500	
Upper Temp (C)	86.5	20.2	
Lower Temp (C)	23.5	20.2	
HRR (kW)	6772.4	0.0	
Visibility (m) at 2m	20+	20+	

FED gases on egress path = 0.000
FED thermal on egress path = 0.004

6 min 30 sec (390 sec)

	Room 1	Room 2	Outside
Layer (m)	2.087	1.500	
Upper Temp (C)	91.0	20.1	
Lower Temp (C)	23.7	20.1	
HRR (kW)	7133.5	0.0	
Visibility (m) at 2m	20+	20+	

FED gases on egress path = 0.000
FED thermal on egress path = 0.004

6 min 40 sec (400 sec)

	Room 1	Room 2	Outside
Layer (m)	2.029	1.500	
Upper Temp (C)	95.5	20.1	
Lower Temp (C)	24.1	20.1	
HRR (kW)	7504.0	0.0	
Visibility (m) at 2m	20+	20+	

FED gases on egress path = 0.000
FED thermal on egress path = 0.005

6 min 50 sec (410 sec)

	Room 1	Room 2	Outside
Layer (m)	1.973	1.500	
Upper Temp (C)	100.0	20.1	
Lower Temp (C)	24.5	20.1	
HRR (kW)	7883.9	0.0	
Visibility (m) at 2m	0.57	20+	

FED gases on egress path = 0.001
FED thermal on egress path = 0.015

7 min 00 sec (420 sec)

	Room 1	Room 2	Outside
Layer (m)	1.922	1.500	
Upper Temp (C)	104.3	20.1	

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         Lower Temp (C)                 25.0      20.1
         HRR (kW)                       8273.2    0.0
         Visibility (m) at 2m           0.54      20+

         FED gases on egress path = 0.003
         FED thermal on egress path = 0.037

7 min    10 sec
         (430 sec)                      Room 1    Room 2    Outside

         Layer (m)                      1.872     1.500
         Upper Temp (C)                 108.6     20.1
         Lower Temp (C)                 25.6      20.1
         HRR (kW)                       8671.8    0.0
         Visibility (m) at 2m           0.52      20+

         FED gases on egress path = 0.006
         FED thermal on egress path = 0.064

7 min    20 sec
         (440 sec)                      Room 1    Room 2    Outside

         Layer (m)                      1.823     1.500
         Upper Temp (C)                 112.9     20.1
         Lower Temp (C)                 26.3      20.1
         HRR (kW)                       9079.8    0.0
         Visibility (m) at 2m           0.50      20+

         FED gases on egress path = 0.008
         FED thermal on egress path = 0.093

7 min    30 sec
         (450 sec)                      Room 1    Room 2    Outside

         Layer (m)                      1.777     1.500
         Upper Temp (C)                 117.3     20.0
         Lower Temp (C)                 27.1      20.0
         HRR (kW)                       9497.3    0.0
         Visibility (m) at 2m           0.47      20+

         FED gases on egress path = 0.011
         FED thermal on egress path = 0.127

7 min    40 sec
         (460 sec)                      Room 1    Room 2    Outside

         Layer (m)                      1.731     1.500
         Upper Temp (C)                 121.6     20.0
         Lower Temp (C)                 28.1      20.0
         HRR (kW)                       9924.0    0.0
         Visibility (m) at 2m           0.45      20+

         FED gases on egress path = 0.014
         FED thermal on egress path = 0.166

7 min    50 sec
         (470 sec)                      Room 1    Room 2    Outside

         Layer (m)                      1.685     1.500
         Upper Temp (C)                 126.0     20.0
         Lower Temp (C)                 29.1      20.0
         HRR (kW)                       10360.2   0.0
         Visibility (m) at 2m           0.44      20+

         FED gases on egress path = 0.017
         FED thermal on egress path = 0.209

8 min    00 sec
         (480 sec)                      Room 1    Room 2    Outside

         Layer (m)                      1.639     1.500
         Upper Temp (C)                 130.4     20.0
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        Lower Temp (C)                 30.2       20.0
        HRR (kW)                       10805.8    0.0
        Visibility (m) at 2m           0.42       20+

        FED gases on egress path = 0.020
        FED thermal on egress path = 0.258

8 min   10 sec
        (490 sec)                      Room 1     Room 2     Outside

        Layer (m)                      1.593      1.500
        Upper Temp (C)                 134.9      20.0
        Lower Temp (C)                 31.2       20.0
        HRR (kW)                       11260.7    0.0
        Visibility (m) at 2m           0.40       20+

        FED gases on egress path = 0.024
        FED thermal on egress path = 0.313

8 min   20 sec
        (500 sec)                      Room 1     Room 2     Outside

        Layer (m)                      1.548      1.500
        Upper Temp (C)                 139.4      20.0
        Lower Temp (C)                 32.3       20.0
        HRR (kW)                       11725.0    0.0
        Visibility (m) at 2m           0.39       20+

        FED gases on egress path = 0.028
        FED thermal on egress path = 0.375

8 min   30 sec
        (510 sec)                      Room 1     Room 2     Outside

        Layer (m)                      1.503      1.500
        Upper Temp (C)                 144.0      20.0
        Lower Temp (C)                 33.2       20.0
        HRR (kW)                       12198.7    0.0
        Visibility (m) at 2m           0.37       20+

        FED gases on egress path = 0.032
        FED thermal on egress path = 0.444

8 min   40 sec
        (520 sec)                      Room 1     Room 2     Outside

        Layer (m)                      1.463      1.485
        Upper Temp (C)                 148.7      47.5
        Lower Temp (C)                 34.1       22.5
        HRR (kW)                       12681.8    0.0
        Visibility (m) at 2m           0.36       0.35

        FED gases on egress path = 0.036
        FED thermal on egress path = 0.520

8 min   50 sec
        (530 sec)                      Room 1     Room 2     Outside

        Layer (m)                      1.457      1.455
        Upper Temp (C)                 153.4      45.3
        Lower Temp (C)                 36.7       24.7
        HRR (kW)                       13174.2    0.0
        Visibility (m) at 2m           0.35       0.30

        FED gases on egress path = 0.041
        FED thermal on egress path = 0.606

9 min   00 sec
        (540 sec)                      Room 1     Room 2     Outside

        Layer (m)                      1.461      1.429
        Upper Temp (C)                 158.0      42.2
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         Lower Temp (C)               41.3      27.3
         HRR (kW)                     13676.0   0.0
         Visibility (m) at 2m         0.33      0.28

         FED gases on egress path = 0.046
         FED thermal on egress path = 0.701

9 min    10 sec
         (550 sec)                    Room 1    Room 2    Outside

         Layer (m)                    1.461     1.403
         Upper Temp (C)               162.5     42.0
         Lower Temp (C)               47.9      30.7
         HRR (kW)                     14187.3   0.0
         Visibility (m) at 2m         0.32      0.27

         FED gases on egress path = 0.051
         FED thermal on egress path = 0.805

9 min    20 sec
         (560 sec)                    Room 1    Room 2    Outside

         Layer (m)                    1.455     1.372
         Upper Temp (C)               167.1     44.2
         Lower Temp (C)               54.6      34.9
         HRR (kW)                     14707.8   0.0
         Visibility (m) at 2m         0.31      0.26

         FED gases on egress path = 0.057
         FED thermal on egress path = 0.920

9 min    30 sec
         (570 sec)                    Room 1    Room 2    Outside

         Layer (m)                    1.446     1.333
         Upper Temp (C)               172.0     47.9
         Lower Temp (C)               61.0      39.5
         HRR (kW)                     15237.8   0.0
         Visibility (m) at 2m         0.30      0.25

         FED gases on egress path = 0.063
         FED thermal on egress path = 1.000

9 min    40 sec
         (580 sec)                    Room 1    Room 2    Outside

         Layer (m)                    1.435     1.284
         Upper Temp (C)               177.0     52.2
         Lower Temp (C)               67.2      44.3
         HRR (kW)                     15777.2   0.0
         Visibility (m) at 2m         0.29      0.25

         FED gases on egress path = 0.070
         FED thermal on egress path = 1.000

9 min    50 sec
         (590 sec)                    Room 1    Room 2    Outside

         Layer (m)                    1.424     1.224
         Upper Temp (C)               182.1     56.6
         Lower Temp (C)               73.0      49.1
         HRR (kW)                     16325.9   0.0
         Visibility (m) at 2m         0.29      0.24

         FED gases on egress path = 0.076
         FED thermal on egress path = 1.000

10 min   00 sec
         (600 sec)                    Room 1    Room 2    Outside

         Layer (m)                    1.414     1.154
         Upper Temp (C)               187.3     60.9
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        Lower Temp (C)                78.9       53.6
        HRR (kW)                      16884.0    0.0
        Visibility (m) at 2m          0.28       0.24

        FED gases on egress path = 0.084
        FED thermal on egress path = 1.000

10 min  10 sec
        (610 sec)                     Room 1     Room 2     Outside

        Layer (m)                     1.404      1.075
        Upper Temp (C)                192.5      65.0
        Lower Temp (C)                84.9       57.6
        HRR (kW)                      17451.5    0.0
        Visibility (m) at 2m          0.27       0.23

        FED gases on egress path = 0.092
        FED thermal on egress path = 1.000

10 min  20 sec
        (620 sec)                     Room 1     Room 2     Outside

        Layer (m)                     1.393      0.986
        Upper Temp (C)                197.7      68.9
        Lower Temp (C)                90.5       61.9
        HRR (kW)                      18028.4    0.0
        Visibility (m) at 2m          0.26       0.23

        FED gases on egress path = 0.100
        FED thermal on egress path = 1.000

10 min  30 sec
        (630 sec)                     Room 1     Room 2     Outside

        Layer (m)                     1.383      0.882
        Upper Temp (C)                203.1      72.8
        Lower Temp (C)                95.9       66.0
        HRR (kW)                      18614.6    0.0
        Visibility (m) at 2m          0.26       0.22

        FED gases on egress path = 0.109
        FED thermal on egress path = 1.000

10 min  40 sec
        (640 sec)                     Room 1     Room 2     Outside

        Layer (m)                     1.372      0.772
        Upper Temp (C)                208.5      76.5
        Lower Temp (C)                101.0      70.6
        HRR (kW)                      19210.2    0.0
        Visibility (m) at 2m          0.25       0.22

        FED gases on egress path = 0.118
        FED thermal on egress path = 1.000

10 min  50 sec
        (650 sec)                     Room 1     Room 2     Outside

        Layer (m)                     1.356      0.664
        Upper Temp (C)                214.0      82.1
        Lower Temp (C)                105.3      75.9
        HRR (kW)                      19815.3    0.0
        Visibility (m) at 2m          0.25       0.22

        FED gases on egress path = 0.128
        FED thermal on egress path = 1.000

11 min  00 sec
        (660 sec)                     Room 1     Room 2     Outside

        Layer (m)                     1.333      0.586
        Upper Temp (C)                218.8      87.2
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        Lower Temp (C)                109.9     81.4
        HRR (kW)                      20000.0   0.0
        Visibility (m) at 2m          0.24      0.21

        FED gases on egress path = 0.139
        FED thermal on egress path = 1.000

11 min  10 sec
        (670 sec)                     Room 1    Room 2    Outside

        Layer (m)                     1.329     0.519
        Upper Temp (C)                222.9     92.1
        Lower Temp (C)                114.6     85.7
        HRR (kW)                      20000.0   0.0
        Visibility (m) at 2m          0.23      0.21

        FED gases on egress path = 0.150
        FED thermal on egress path = 1.000

11 min  20 sec
        (680 sec)                     Room 1    Room 2    Outside

        Layer (m)                     1.329     0.474
        Upper Temp (C)                226.3     95.5
        Lower Temp (C)                118.8     89.8
        HRR (kW)                      20000.0   0.0
        Visibility (m) at 2m          0.23      0.21

        FED gases on egress path = 0.162
        FED thermal on egress path = 1.000

11 min  30 sec
        (690 sec)                     Room 1    Room 2    Outside

        Layer (m)                     1.332     0.450
        Upper Temp (C)                229.1     98.4
        Lower Temp (C)                122.5     93.1
        HRR (kW)                      20000.0   0.0
        Visibility (m) at 2m          0.22      0.20

        FED gases on egress path = 0.174
        FED thermal on egress path = 1.000

11 min  40 sec
        (700 sec)                     Room 1    Room 2    Outside

        Layer (m)                     1.333     0.455
        Upper Temp (C)                231.5     100.2
        Lower Temp (C)                125.6     96.4
        HRR (kW)                      20000.0   0.0
        Visibility (m) at 2m          0.22      0.20

        FED gases on egress path = 0.188
        FED thermal on egress path = 1.000

11 min  50 sec
        (710 sec)                     Room 1    Room 2    Outside

        Layer (m)                     1.336     0.448
        Upper Temp (C)                233.7     101.3
        Lower Temp (C)                127.8     98.5
        HRR (kW)                      20000.0   0.0
        Visibility (m) at 2m          0.21      0.19

        FED gases on egress path = 0.202
        FED thermal on egress path = 1.000

12 min  00 sec
        (720 sec)                     Room 1    Room 2    Outside

        Layer (m)                     1.341     0.448
        Upper Temp (C)                235.6     102.3
```

		Room 1	Room 2	Outside
	Lower Temp (C)	129.6	99.9	
	HRR (kW)	20000.0	0.0	
	Visibility (m) at 2m	0.21	0.19	

FED gases on egress path = 0.216
FED thermal on egress path = 1.000

12 min	10 sec (730 sec)	Room 1	Room 2	Outside
	Layer (m)	1.294	0.422	
	Upper Temp (C)	237.3	105.1	
	Lower Temp (C)	127.5	98.5	
	HRR (kW)	20000.0	0.0	
	Visibility (m) at 2m	0.21	0.18	

FED gases on egress path = 0.232
FED thermal on egress path = 1.000

12 min	20 sec (740 sec)	Room 1	Room 2	Outside
	Layer (m)	1.248	0.375	
	Upper Temp (C)	238.4	109.5	
	Lower Temp (C)	126.3	95.9	
	HRR (kW)	20000.0	0.0	
	Visibility (m) at 2m	0.20	0.18	

FED gases on egress path = 0.247
FED thermal on egress path = 1.000

12 min	30 sec (750 sec)	Room 1	Room 2	Outside
	Layer (m)	1.215	0.369	
	Upper Temp (C)	239.1	113.0	
	Lower Temp (C)	126.9	97.6	
	HRR (kW)	20000.0	0.0	
	Visibility (m) at 2m	0.20	0.18	

FED gases on egress path = 0.263
FED thermal on egress path = 1.000

12 min	40 sec (760 sec)	Room 1	Room 2	Outside
	Layer (m)	1.199	0.308	
	Upper Temp (C)	240.2	116.6	
	Lower Temp (C)	127.1	94.5	
	HRR (kW)	20000.0	0.0	
	Visibility (m) at 2m	0.20	0.17	

FED gases on egress path = 0.279
FED thermal on egress path = 1.000

12 min	50 sec (770 sec)	Room 1	Room 2	Outside
	Layer (m)	1.173	0.274	
	Upper Temp (C)	241.0	119.6	
	Lower Temp (C)	127.3	93.6	
	HRR (kW)	20000.0	0.0	
	Visibility (m) at 2m	0.19	0.17	

FED gases on egress path = 0.295
FED thermal on egress path = 1.000

13 min	00 sec (780 sec)	Room 1	Room 2	Outside
	Layer (m)	1.152	0.239	
	Upper Temp (C)	241.8	122.1	

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        Lower Temp (C)                127.4     92.2
        HRR (kW)                      20000.0   0.0
        Visibility (m) at 2m          0.19      0.17

        FED gases on egress path = 0.311
        FED thermal on egress path = 1.000

13 min  10 sec
        (790 sec)                     Room 1    Room 2    Outside

        Layer (m)                     1.130     0.222
        Upper Temp (C)                242.5     124.3
        Lower Temp (C)                127.1     91.6
        HRR (kW)                      20000.0   0.0
        Visibility (m) at 2m          0.19      0.16

        FED gases on egress path = 0.328
        FED thermal on egress path = 1.000

13 min  20 sec
        (800 sec)                     Room 1    Room 2    Outside

        Layer (m)                     1.111     0.218
        Upper Temp (C)                243.2     126.1
        Lower Temp (C)                126.4     90.5
        HRR (kW)                      20000.0   0.0
        Visibility (m) at 2m          0.19      0.16

        FED gases on egress path = 0.345
        FED thermal on egress path = 1.000

13 min  30 sec
        (810 sec)                     Room 1    Room 2    Outside

        Layer (m)                     1.104     0.164
        Upper Temp (C)                244.1     127.4
        Lower Temp (C)                124.9     82.2
        HRR (kW)                      20000.0   0.0
        Visibility (m) at 2m          0.18      0.16

        FED gases on egress path = 0.362
        FED thermal on egress path = 1.000

13 min  40 sec
        (820 sec)                     Room 1    Room 2    Outside

        Layer (m)                     1.094     0.122
        Upper Temp (C)                244.9     127.7
        Lower Temp (C)                123.4     75.4
        HRR (kW)                      20000.0   0.0
        Visibility (m) at 2m          0.18      0.15

        FED gases on egress path = 0.379
        FED thermal on egress path = 1.000

13 min  50 sec
        (830 sec)                     Room 1    Room 2    Outside

        Layer (m)                     1.087     0.102
        Upper Temp (C)                245.6     127.9
        Lower Temp (C)                121.4     72.3
        HRR (kW)                      20000.0   0.0
        Visibility (m) at 2m          0.18      0.15

        FED gases on egress path = 0.397
        FED thermal on egress path = 1.000

14 min  00 sec
        (840 sec)                     Room 1    Room 2    Outside

        Layer (m)                     1.075     0.102
        Upper Temp (C)                246.2     128.0
```

```
        Lower Temp (C)               118.9     73.8
        HRR (kW)                     20000.0   0.0
        Visibility (m) at 2m         0.18      0.15

        FED gases on egress path = 0.415
        FED thermal on egress path = 1.000

14 min  10 sec
        (850 sec)                    Room 1    Room 2    Outside

        Layer (m)                    1.059     0.123
        Upper Temp (C)               246.6     128.2
        Lower Temp (C)               116.1     76.9
        HRR (kW)                     20000.0   0.0
        Visibility (m) at 2m         0.18      0.15

        FED gases on egress path = 0.433
        FED thermal on egress path = 1.000

14 min  20 sec
        (860 sec)                    Room 1    Room 2    Outside

        Layer (m)                    1.035     0.183
        Upper Temp (C)               246.9     128.4
        Lower Temp (C)               113.0     82.7
        HRR (kW)                     20000.0   0.0
        Visibility (m) at 2m         0.18      0.15

        FED gases on egress path = 0.451
        FED thermal on egress path = 1.000

14 min  30 sec
        (870 sec)                    Room 1    Room 2    Outside

        Layer (m)                    1.022     0.225
        Upper Temp (C)               247.4     129.3
        Lower Temp (C)               110.0     82.0
        HRR (kW)                     20000.0   0.0
        Visibility (m) at 2m         0.17      0.14

        FED gases on egress path = 0.470
        FED thermal on egress path = 1.000

14 min  40 sec
        (880 sec)                    Room 1    Room 2    Outside

        Layer (m)                    1.008     0.309
        Upper Temp (C)               247.6     131.1
        Lower Temp (C)               107.2     84.6
        HRR (kW)                     20000.0   0.0
        Visibility (m) at 2m         0.17      0.14

        FED gases on egress path = 0.489
        FED thermal on egress path = 1.000

14 min  50 sec
        (890 sec)                    Room 1    Room 2    Outside

        Layer (m)                    0.987     0.387
        Upper Temp (C)               248.0     130.6
        Lower Temp (C)               104.8     87.5
        HRR (kW)                     20000.0   0.0
        Visibility (m) at 2m         0.17      0.14

        FED gases on egress path = 0.508
        FED thermal on egress path = 1.000

15 min  00 sec
        (900 sec)                    Room 1    Room 2    Outside

        Layer (m)                    0.989     0.419
        Upper Temp (C)               248.6     132.5
```

```
        Lower Temp (C)                103.4      86.6
        HRR (kW)                      20000.0    0.0
        Visibility (m) at 2m          0.17       0.14

        FED gases on egress path = 0.528
        FED thermal on egress path = 1.000

15 min  10 sec
        (910 sec)                     Room 1     Room 2     Outside

        Layer (m)                     0.995      0.433
        Upper Temp (C)                249.3      133.1
        Lower Temp (C)                102.2      85.3
        HRR (kW)                      20000.0    0.0
        Visibility (m) at 2m          0.17       0.14

        FED gases on egress path = 0.548
        FED thermal on egress path = 1.000

15 min  20 sec
        (920 sec)                     Room 1     Room 2     Outside

        Layer (m)                     0.996      0.452
        Upper Temp (C)                249.8      133.4
        Lower Temp (C)                101.5      84.7
        HRR (kW)                      20000.0    0.0
        Visibility (m) at 2m          0.17       0.14

        FED gases on egress path = 0.569
        FED thermal on egress path = 1.000

15 min  30 sec
        (930 sec)                     Room 1     Room 2     Outside

        Layer (m)                     0.998      0.468
        Upper Temp (C)                250.4      133.7
        Lower Temp (C)                100.9      84.4
        HRR (kW)                      20000.0    0.0
        Visibility (m) at 2m          0.17       0.13

        FED gases on egress path = 0.589
        FED thermal on egress path = 1.000

15 min  40 sec
        (940 sec)                     Room 1     Room 2     Outside

        Layer (m)                     1.001      0.483
        Upper Temp (C)                251.0      133.9
        Lower Temp (C)                100.1      84.2
        HRR (kW)                      20000.0    0.0
        Visibility (m) at 2m          0.16       0.13

        FED gases on egress path = 0.610
        FED thermal on egress path = 1.000

15 min  50 sec
        (950 sec)                     Room 1     Room 2     Outside

        Layer (m)                     1.005      0.496
        Upper Temp (C)                251.4      134.2
        Lower Temp (C)                100.0      83.3
        HRR (kW)                      20000.0    0.0
        Visibility (m) at 2m          0.16       0.13

        FED gases on egress path = 0.631
        FED thermal on egress path = 1.000

16 min  00 sec
        (960 sec)                     Room 1     Room 2     Outside

        Layer (m)                     1.009      0.503
        Upper Temp (C)                251.9      134.2
```

Lower Temp (C)	99.8	82.6
HRR (kW)	20000.0	0.0
Visibility (m) at 2m	0.16	0.13

FED gases on egress path = 0.653
FED thermal on egress path = 1.000

16 min 10 sec (970 sec)

	Room 1	Room 2	Outside
Layer (m)	1.013	0.510	
Upper Temp (C)	252.4	134.2	
Lower Temp (C)	99.3	82.1	
HRR (kW)	20000.0	0.0	
Visibility (m) at 2m	0.16	0.13	

FED gases on egress path = 0.675
FED thermal on egress path = 1.000

16 min 20 sec (980 sec)

	Room 1	Room 2	Outside
Layer (m)	1.015	0.518	
Upper Temp (C)	252.9	134.3	
Lower Temp (C)	98.7	81.8	
HRR (kW)	20000.0	0.0	
Visibility (m) at 2m	0.16	0.13	

FED gases on egress path = 0.697
FED thermal on egress path = 1.000

16 min 30 sec (990 sec)

	Room 1	Room 2	Outside
Layer (m)	1.016	0.527	
Upper Temp (C)	253.4	134.3	
Lower Temp (C)	98.1	81.5	
HRR (kW)	20000.0	0.0	
Visibility (m) at 2m	0.16	0.13	

FED gases on egress path = 0.719
FED thermal on egress path = 1.000

16 min 40 sec (1000 sec)

	Room 1	Room 2	Outside
Layer (m)	1.018	0.536	
Upper Temp (C)	253.9	134.5	
Lower Temp (C)	97.6	81.3	
HRR (kW)	20000.0	0.0	
Visibility (m) at 2m	0.16	0.13	

FED gases on egress path = 0.741
FED thermal on egress path = 1.000

16 min 50 sec (1010 sec)

	Room 1	Room 2	Outside
Layer (m)	1.019	0.544	
Upper Temp (C)	254.4	134.6	
Lower Temp (C)	97.2	81.1	
HRR (kW)	20000.0	0.0	
Visibility (m) at 2m	0.16	0.13	

FED gases on egress path = 0.764
FED thermal on egress path = 1.000

17 min 00 sec (1020 sec)

	Room 1	Room 2	Outside
Layer (m)	1.021	0.551	
Upper Temp (C)	254.9	134.9	

```
        Lower Temp (C)                96.8      80.9
        HRR (kW)                      20000.0   0.0
        Visibility (m) at 2m          0.16      0.13

        FED gases on egress path = 0.787
        FED thermal on egress path = 1.000

17 min  10 sec
        (1030 sec)                    Room 1    Room 2    Outside

        Layer (m)                     1.022     0.559
        Upper Temp (C)                255.3     135.1
        Lower Temp (C)                96.5      80.8
        HRR (kW)                      20000.0   0.0
        Visibility (m) at 2m          0.16      0.12

        FED gases on egress path = 0.810
        FED thermal on egress path = 1.000

17 min  20 sec
        (1040 sec)                    Room 1    Room 2    Outside

        Layer (m)                     1.023     0.566
        Upper Temp (C)                255.8     135.4
        Lower Temp (C)                96.2      80.7
        HRR (kW)                      20000.0   0.0
        Visibility (m) at 2m          0.16      0.12

        FED gases on egress path = 0.833
        FED thermal on egress path = 1.000

17 min  30 sec
        (1050 sec)                    Room 1    Room 2    Outside

        Layer (m)                     1.025     0.573
        Upper Temp (C)                256.3     135.6
        Lower Temp (C)                95.9      80.6
        HRR (kW)                      20000.0   0.0
        Visibility (m) at 2m          0.16      0.12

        FED gases on egress path = 0.856
        FED thermal on egress path = 1.000

17 min  40 sec
        (1060 sec)                    Room 1    Room 2    Outside

        Layer (m)                     1.026     0.579
        Upper Temp (C)                256.8     135.8
        Lower Temp (C)                95.7      80.6
        HRR (kW)                      20000.0   0.0
        Visibility (m) at 2m          0.16      0.12

        FED gases on egress path = 0.879
        FED thermal on egress path = 1.000

17 min  50 sec
        (1070 sec)                    Room 1    Room 2    Outside

        Layer (m)                     1.027     0.585
        Upper Temp (C)                257.3     136.1
        Lower Temp (C)                95.5      80.5
        HRR (kW)                      20000.0   0.0
        Visibility (m) at 2m          0.16      0.12

        FED gases on egress path = 0.903
        FED thermal on egress path = 1.000

18 min  00 sec
        (1080 sec)                    Room 1    Room 2    Outside

        Layer (m)                     1.029     0.590
        Upper Temp (C)                257.8     136.3
```

```
         Lower Temp (C)                95.4      80.5
         HRR (kW)                      20000.0   0.0
         Visibility (m) at 2m          0.16      0.12

         FED gases on egress path = 0.927
         FED thermal on egress path = 1.000

18 min   10 sec
         (1090 sec)                    Room 1    Room 2    Outside

         Layer (m)                     1.030     0.595
         Upper Temp (C)                258.2     136.5
         Lower Temp (C)                95.3      80.5
         HRR (kW)                      20000.0   0.0
         Visibility (m) at 2m          0.16      0.12

         FED gases on egress path = 0.950
         FED thermal on egress path = 1.000

18 min   20 sec
         (1100 sec)                    Room 1    Room 2    Outside

         Layer (m)                     1.031     0.599
         Upper Temp (C)                258.7     136.8
         Lower Temp (C)                95.3      80.5
         HRR (kW)                      20000.0   0.0
         Visibility (m) at 2m          0.16      0.12

         FED gases on egress path = 0.974
         FED thermal on egress path = 1.000

18 min   30 sec
         (1110 sec)                    Room 1    Room 2    Outside

         Layer (m)                     1.033     0.603
         Upper Temp (C)                259.1     137.0
         Lower Temp (C)                95.3      80.5
         HRR (kW)                      20000.0   0.0
         Visibility (m) at 2m          0.16      0.12

         FED gases on egress path = 0.998
         FED thermal on egress path = 1.000

18 min   40 sec
         (1120 sec)                    Room 1    Room 2    Outside

         Layer (m)                     1.034     0.606
         Upper Temp (C)                259.6     137.2
         Lower Temp (C)                95.3      80.6
         HRR (kW)                      20000.0   0.0
         Visibility (m) at 2m          0.16      0.12

         FED gases on egress path = 1.000
         FED thermal on egress path = 1.000

18 min   50 sec
         (1130 sec)                    Room 1    Room 2    Outside

         Layer (m)                     1.035     0.610
         Upper Temp (C)                260.0     137.4
         Lower Temp (C)                95.3      80.7
         HRR (kW)                      20000.0   0.0
         Visibility (m) at 2m          0.15      0.12

         FED gases on egress path = 1.000
         FED thermal on egress path = 1.000

19 min   00 sec
         (1140 sec)                    Room 1    Room 2    Outside

         Layer (m)                     1.037     0.613
         Upper Temp (C)                260.5     137.7
```

```
         Lower Temp (C)                95.4      80.8
         HRR (kW)                      20000.0   0.0
         Visibility (m) at 2m          0.15      0.12

         FED gases on egress path = 1.000
         FED thermal on egress path = 1.000

19 min   10 sec
         (1150 sec)                    Room 1    Room 2    Outside

         Layer (m)                     1.038     0.615
         Upper Temp (C)                260.9     137.9
         Lower Temp (C)                95.4      80.9
         HRR (kW)                      20000.0   0.0
         Visibility (m) at 2m          0.15      0.12

         FED gases on egress path = 1.000
         FED thermal on egress path = 1.000

19 min   20 sec
         (1160 sec)                    Room 1    Room 2    Outside

         Layer (m)                     1.039     0.618
         Upper Temp (C)                261.3     138.1
         Lower Temp (C)                95.5      81.0
         HRR (kW)                      20000.0   0.0
         Visibility (m) at 2m          0.15      0.12

         FED gases on egress path = 1.000
         FED thermal on egress path = 1.000

19 min   30 sec
         (1170 sec)                    Room 1    Room 2    Outside

         Layer (m)                     1.040     0.620
         Upper Temp (C)                261.7     138.4
         Lower Temp (C)                95.6      81.1
         HRR (kW)                      20000.0   0.0
         Visibility (m) at 2m          0.15      0.12

         FED gases on egress path = 1.000
         FED thermal on egress path = 1.000

19 min   40 sec
         (1180 sec)                    Room 1    Room 2    Outside

         Layer (m)                     1.041     0.623
         Upper Temp (C)                262.1     138.6
         Lower Temp (C)                95.8      81.2
         HRR (kW)                      20000.0   0.0
         Visibility (m) at 2m          0.15      0.12

         FED gases on egress path = 1.000
         FED thermal on egress path = 1.000

19 min   50 sec
         (1190 sec)                    Room 1    Room 2    Outside

         Layer (m)                     1.042     0.625
         Upper Temp (C)                262.5     138.8
         Lower Temp (C)                95.9      81.4
         HRR (kW)                      20000.0   0.0
         Visibility (m) at 2m          0.15      0.12

         FED gases on egress path = 1.000
         FED thermal on egress path = 1.000

20 min   00 sec
         (1200 sec)                    Room 1    Room 2    Outside

         Layer (m)                     1.043     0.626
         Upper Temp (C)                262.9     139.0
```

```
Lower Temp (C)                96.0      81.5
HRR (kW)                      20000.0   0.0
Visibility (m) at 2m          0.15      0.12

FED gases on egress path = 1.000
FED thermal on egress path = 1.000


====================================================================
Event Log
====================================================================
Simulation Finished.
FED(thermal) Exceeded 0.3 at 490.0 Seconds.
FED(CO) Exceeded 0.3 at 775.0 Seconds.
410 sec. Visibility at 2m above floor reduced to 10 m in room 1
0 sec. Item 1 Fire ignited.
Iteration 1


====================================================================
Initial Time-Step = 5.00 seconds.
Computer Run-Time = 13.2 seconds.
====================================================================
```

Visibility in Circus Ring (Room 1) at 2 m above floor reduces to less than 10 m at 410 seconds.

FED (CO) in Circus Ring (Room 1) exceeded 0.3 at 775 seconds

FED (THERMAL) in Circus Ring (Room 1) exceeded 0.3 at 490 seconds.

25 APPENDIX 5 – B-Risk RESULTS – CF2

18.1. Branzfire Results – CF2

Design Fire 2: Fire underneath seating

```
Tuesday,August 20,2013,04:18 PM
B-RISK Fire Simulator and Design Fire Tool (Ver 2013.12)

Input Filename : input1.xml
Base File : C:\Users\Owner\Documents\B-
RISK\riskdata\basemodel_Zirka_Circus\basemodel_Zirka_Circus.xml

User Mode : C/VM2

Zirka Circus

==================================================================
Description of Rooms
==================================================================
Room 1 : Circus Room
         Room Length (m) =                                 31.00
         Room Width (m) =                                  31.00
         Maximum Room Height (m) =                         10.00
         Minimum Room Height (m) =                         4.00
         Floor Elevation (m) =                             0.000
         Absolute X Position (m) =                         0.000
         Absolute Y Position (m) =                         0.000
         Room 1 has a sloping ceiling.
         Shape Factor (Af/H^2) =                           9.6

         Wall Surface is steel (mild)
         Wall Density (kg/m3) =                            7850.0
         Wall Conductivity (W/m.K) =                       45.800
         Wall Specific Heat (J/kg.K) =                     460
         Wall Emissivity =                                 0.90
         Wall Thickness (mm) =                             3.0

         Ceiling Surface is steel (mild)
         Ceiling Density (kg/m3) =                         7850.0
         Ceiling Conductivity (W/m.K) =                    45.800
         Ceiling Specific Heat (J/kg.K) =                  460
         Ceiling Emissivity =                              0.90
         Ceiling Thickness (mm) =                          3.0

         Floor Surface is concrete
         Floor Density (kg/m3) =                           2300.0
         Floor Conductivity (W/m.K) =                      1.200
         Floor Specific Heat (J/kg.K) =                    880
         Floor Emissivity =                                0.50
         Floor Thickness = (mm)                            100.0

Room 2 : Bleachers
         Room Length (m) =                                 31.00
         Room Width (m) =                                  8.00
         Maximum Room Height (m) =                         1.50
         Minimum Room Height (m) =                         1.50
         Floor Elevation (m) =                             0.000
         Absolute X Position (m) =                         0.000
         Absolute Y Position (m) =                         31.000
         Room 2 has a flat ceiling.
         Shape Factor (Af/H^2) =                           110.2

         Wall Surface is steel (mild)
         Wall Density (kg/m3) =                            7850.0
         Wall Conductivity (W/m.K) =                       45.800
         Wall Specific Heat (J/kg.K) =                     460
```

```
        Wall Emissivity =                                   0.90
        Wall Thickness (mm) =                               3.0

        Ceiling Surface is steel (mild)
        Ceiling Density (kg/m3) =                           7850.0
        Ceiling Conductivity (W/m.K) =                      45.800
        Ceiling Specific Heat (J/kg.K) =                    460
        Ceiling Emissivity =                                0.90
        Ceiling Thickness (mm) =                            3.0

        Floor Surface is concrete
        Floor Density (kg/m3) =                             2300.0
        Floor Conductivity (W/m.K) =                        1.200
        Floor Specific Heat (J/kg.K) =                      880
        Floor Emissivity =                                  0.50
        Floor Thickness = (mm)                              100.0

=====================================================================
Wall Vents
=====================================================================
Vent  1 : Vent above front entran
                   From room 1 to 3
                   Front face of room 1
                   Offset (m) =                             14.870
                   Vent Width (m) =                         1.160
                   Vent Height (m) =                        1.160
                   Vent Sill Height (m) =                   1.800
                   Vent Soffit Height (m) =                 2.960
                   Opening Time (sec) =                     110
                   Closing Time (sec) =                     0
                   Flow Coefficient (sec) =                 0.680

Vent  2 : Vent above right door
                   From room 1 to 3
                   Right  face of room 1
                   Offset (m) =                             12.900
                   Vent Width (m) =                         1.160
                   Vent Height (m) =                        1.160
                   Vent Sill Height (m) =                   1.800
                   Vent Soffit Height (m) =                 2.960
                   Opening Time (sec) =                     110
                   Closing Time (sec) =                     0
                   Flow Coefficient (sec) =                 0.680

Vent  3 : Vent above left door
                   From room 1 to 3
                   Left  face of room 1
                   Offset (m) =                             12.900
                   Vent Width (m) =                         1.160
                   Vent Height (m) =                        1.160
                   Vent Sill Height (m) =                   1.800
                   Vent Soffit Height (m) =                 2.960
                   Opening Time (sec) =                     110
                   Closing Time (sec) =                     0
                   Flow Coefficient (sec) =                 0.680

Vent  4 : Door opening from entra
                   From room 1 to 3
                   Front face of room 1
                   Offset (m) =                             13.800
                   Vent Width (m) =                         1.700
                   Vent Height (m) =                        1.800
                   Vent Sill Height (m) =                   0.000
                   Vent Soffit Height (m) =                 1.800
                   Opening Time (sec) =                     110
                   Closing Time (sec) =                     0
                   Flow Coefficient (sec) =                 0.680

Vent  5 : Door opening Right face
                   From room 1 to 3
                   Right  face of room 1
                   Offset (m) =                             11.800
```

```
                   Vent Width (m) =                        1.700
                   Vent Height (m) =                       1.800
                   Vent Sill Height (m) =                  0.000
                   Vent Soffit Height (m) =                1.800
                   Opening Time (sec) =                    110
                   Closing Time (sec) =                    0
                   Flow Coefficient (sec) =                0.680

Vent  6 : Door Opening left face
                   From room 1 to 3
                   Left  face of room 1
                   Offset (m) =                            11.800
                   Vent Width (m) =                        1.700
                   Vent Height (m) =                       1.800
                   Vent Sill Height (m) =                  0.000
                   Vent Soffit Height (m) =                1.800
                   Opening Time (sec) =                    110
                   Closing Time (sec) =                    0
                   Flow Coefficient (sec) =                0.680

Vent  7 : Bleachers height
                   From room 1 to 2
                   Rear  face of room 1
                   Offset (m) =                            0.000
                   Vent Width (m) =                        31.000
                   Vent Height (m) =                       1.500
                   Vent Sill Height (m) =                  0.000
                   Vent Soffit Height (m) =                1.500
                   Opening Time (sec) =                    0
                   Closing Time (sec) =                    0
                   Flow Coefficient (sec) =                0.680
                   Vent Type is 3D adhered spill plume
                   Balcony Width (m) =                     0.000
                   Downstand Depth (m) =                   8.500

Vent  8 : ceiling vent
                   From room 1 to 3
                   Rear  face of room 1
                   Offset (m) =                            15.500
                   Vent Width (m) =                        2.000
                   Vent Height (m) =                       2.000
                   Vent Sill Height (m) =                  6.000
                   Vent Soffit Height (m) =                8.000
                   Opening Time (sec) =                    0
                   Closing Time (sec) =                    0
                   Flow Coefficient (sec) =                0.680

====================================================================
Ceiling/Floor Vents
====================================================================
====================================================================
Ambient Conditions
====================================================================
Interior Temp (C) =                                        21.0
Exterior Temp (C) =                                        18.0
Relative Humidity (%) =                                    50

====================================================================
Tenability Parameters
====================================================================
Monitoring Height for Visibility and FED (m) =             2.00
Asphyxiant gas model =                                     FED(CO) C/VM2
Visibility calculations assume:                            reflective signs
Egress path segments for FED calculations
1. Start Time (sec)                                        0
1. End Time (sec)                                          600
1. Room                                                    1
2. Start Time (sec)                                        600
2. End Time (sec)                                          900
2. Room                                                    1
3. Start Time (sec)                                        900
3. End Time (sec)                                          1200
```

```
3. Room                                                   1

==================================================================
Sprinkler / Detector Parameters
==================================================================
        Ceiling Jet model used is NIST JET.
        Sprinkler System Reliability                      1.000
        Sprinkler Probability of Suppression              1.000
        Sprinkler Cooling Coefficient                     1.000

==================================================================
Smoke Detector Parameters
==================================================================
        Smoke Detection System Reliability                1.000


==================================================================
Mechanical Ventilation (to/from outside)
==================================================================
Mechanical Ventilation not installed.
        Mech ventilation system reliability               1.000


==================================================================
Description of the Fire
==================================================================
CO Yield pre-flashover(g/g) =                             0.040
CO Yield post-flashover(g/g) =                            0.400
Soot Yield pre-flashover(g/g) =                           0.070
Soot Yield post-flashover(g/g) =                          0.140
Flame Emission Coefficient (1/m) =                        1.00
Fuel - Carbon Moles                                       1.00
Fuel - Hydrogen Moles                                     2.00
Fuel - Oxygen Moles                                       0.50
Fuel - Nitrogen Moles                                     0.00

Burning objects are manually positioned in room.

Burning Object No 1
Fire
             Located in Room                              2
             Energy Yield (kJ/g) =                        20.0
             CO2 Yield (kg/kg fuel) =                     1.500
             HCN Yield (kg/kg fuel) =                     0.000
             H2O Yield (kg/kg fuel) =                     0.818
             Heat Release Rate Per Unit Area (kW/m2) =    250.0
             Radiant Loss Fraction =                      0.35
             Fire Elevation (m) =                         0.300
             Fire Object Length (m) =                     0.300
             Fire Object Width (m) =                      0.300
             Fire Object Height (m) =                     0.000
             Location, X-coordinate (m) =                 15.500
             Location, Y-coordinate (m) =                 4.000
             Fire Location (for entrainment) =            centre
             Plume behaviour is undisturbed

             Alpha T2 growth coefficient =                0.0469
             Peak HRR (kW) =                              20000

==================================================================
Postflashover Inputs
==================================================================
Postflashover model is OFF.


==================================================================
Results from Fire Simulation
==================================================================

0 min    00 sec
         (0 sec)                      Room 1    Room 2    Outside
```

```
        Layer (m)                    9.908     1.500
        Upper Temp (C)               21.0      21.0
        Lower Temp (C)               21.0      21.0
        HRR (kW)                     0.0       0.0
        Visibility (m) at 2m         20+       20+

        FED gases on egress path = 0.000
        FED thermal on egress path = 0.000

0 min   10 sec
        (10 sec)                     Room 1    Room 2    Outside

        Layer (m)                    9.907     1.497
        Upper Temp (C)               21.0      23.7
        Lower Temp (C)               21.0      21.0
        HRR (kW)                     0.0       4.7
        Visibility (m) at 2m         20+       4.74

        FED gases on egress path = 0.000
        FED thermal on egress path = 0.000

0 min   20 sec
        (20 sec)                     Room 1    Room 2    Outside

        Layer (m)                    9.571     1.490
        Upper Temp (C)               20.9      28.4
        Lower Temp (C)               20.9      21.0
        HRR (kW)                     0.0       18.8
        Visibility (m) at 2m         20+       1.94

        FED gases on egress path = 0.000
        FED thermal on egress path = 0.000

0 min   30 sec
        (30 sec)                     Room 1    Room 2    Outside

        Layer (m)                    9.219     1.480
        Upper Temp (C)               21.0      33.9
        Lower Temp (C)               20.9      21.0
        HRR (kW)                     0.0       42.2
        Visibility (m) at 2m         20+       1.21

        FED gases on egress path = 0.000
        FED thermal on egress path = 0.000

0 min   40 sec
        (40 sec)                     Room 1    Room 2    Outside

        Layer (m)                    8.839     1.466
        Upper Temp (C)               21.0      39.3
        Lower Temp (C)               20.9      21.0
        HRR (kW)                     0.0       75.0
        Visibility (m) at 2m         20+       0.88

        FED gases on egress path = 0.000
        FED thermal on egress path = 0.000

0 min   50 sec
        (50 sec)                     Room 1    Room 2    Outside

        Layer (m)                    8.482     1.452
        Upper Temp (C)               21.1      44.0
        Lower Temp (C)               20.9      21.0
        HRR (kW)                     0.0       117.3
        Visibility (m) at 2m         20+       0.69

        FED gases on egress path = 0.000
        FED thermal on egress path = 0.001

1 min   00 sec
        (60 sec)                     Room 1    Room 2    Outside
```

Layer (m)	8.147	1.436	
Upper Temp (C)	21.3	49.1	
Lower Temp (C)	20.9	21.1	
HRR (kW)	0.0	168.8	
Visibility (m) at 2m	20+	0.57	

FED gases on egress path = 0.000
FED thermal on egress path = 0.001

1 min 10 sec
(70 sec)

	Room 1	Room 2	Outside
Layer (m)	7.816	1.420	
Upper Temp (C)	21.5	54.2	
Lower Temp (C)	20.9	21.2	
HRR (kW)	0.0	229.8	
Visibility (m) at 2m	20+	0.49	

FED gases on egress path = 0.000
FED thermal on egress path = 0.001

1 min 20 sec
(80 sec)

	Room 1	Room 2	Outside
Layer (m)	7.504	1.405	
Upper Temp (C)	21.7	59.8	
Lower Temp (C)	20.9	21.4	
HRR (kW)	0.0	300.2	
Visibility (m) at 2m	20+	0.43	

FED gases on egress path = 0.000
FED thermal on egress path = 0.001

1 min 30 sec
(90 sec)

	Room 1	Room 2	Outside
Layer (m)	7.202	1.392	
Upper Temp (C)	22.0	65.8	
Lower Temp (C)	20.9	21.6	
HRR (kW)	0.0	379.9	
Visibility (m) at 2m	20+	0.39	

FED gases on egress path = 0.000
FED thermal on egress path = 0.001

1 min 40 sec
(100 sec)

	Room 1	Room 2	Outside
Layer (m)	6.913	1.380	
Upper Temp (C)	22.4	72.3	
Lower Temp (C)	20.9	21.8	
HRR (kW)	0.0	469.0	
Visibility (m) at 2m	20+	0.36	

FED gases on egress path = 0.000
FED thermal on egress path = 0.001

1 min 50 sec
(110 sec)

	Room 1	Room 2	Outside
Layer (m)	6.638	1.370	
Upper Temp (C)	22.7	80.5	
Lower Temp (C)	20.9	22.1	
HRR (kW)	0.0	567.5	
Visibility (m) at 2m	20+	0.33	

FED gases on egress path = 0.000
FED thermal on egress path = 0.001

2 min 00 sec
(120 sec)

	Room 1	Room 2	Outside

Layer (m)	6.391	1.363	
Upper Temp (C)	23.0	89.0	
Lower Temp (C)	20.9	22.5	
HRR (kW)	0.0	675.4	
Visibility (m) at 2m	20+	0.31	

FED gases on egress path = 0.000
FED thermal on egress path = 0.001

2 min 10 sec (130 sec)

	Room 1	Room 2	Outside
Layer (m)	6.161	1.355	
Upper Temp (C)	23.4	96.6	
Lower Temp (C)	20.8	22.9	
HRR (kW)	0.0	792.6	
Visibility (m) at 2m	20+	0.29	

FED gases on egress path = 0.000
FED thermal on egress path = 0.001

2 min 20 sec (140 sec)

	Room 1	Room 2	Outside
Layer (m)	5.943	1.347	
Upper Temp (C)	23.9	103.2	
Lower Temp (C)	20.8	23.3	
HRR (kW)	0.0	919.2	
Visibility (m) at 2m	20+	0.28	

FED gases on egress path = 0.000
FED thermal on egress path = 0.001

2 min 30 sec (150 sec)

	Room 1	Room 2	Outside
Layer (m)	5.731	1.338	
Upper Temp (C)	24.4	110.6	
Lower Temp (C)	20.8	23.8	
HRR (kW)	0.0	1055.3	
Visibility (m) at 2m	20+	0.27	

FED gases on egress path = 0.000
FED thermal on egress path = 0.002

2 min 40 sec (160 sec)

	Room 1	Room 2	Outside
Layer (m)	5.525	1.329	
Upper Temp (C)	25.0	118.3	
Lower Temp (C)	20.9	24.2	
HRR (kW)	0.0	1200.6	
Visibility (m) at 2m	20+	0.26	

FED gases on egress path = 0.000
FED thermal on egress path = 0.002

2 min 50 sec (170 sec)

	Room 1	Room 2	Outside
Layer (m)	5.324	1.320	
Upper Temp (C)	25.6	126.1	
Lower Temp (C)	20.9	24.7	
HRR (kW)	0.0	1355.4	
Visibility (m) at 2m	20+	0.26	

FED gases on egress path = 0.000
FED thermal on egress path = 0.002

3 min 00 sec (180 sec) Room 1 Room 2 Outside

```
         Layer (m)                    5.127     1.312
         Upper Temp (C)               26.3      133.9
         Lower Temp (C)               20.9      25.1
         HRR (kW)                     0.0       1519.6
         Visibility (m) at 2m         20+       0.25

         FED gases on egress path = 0.000
         FED thermal on egress path = 0.002

3 min    10 sec
         (190 sec)                    Room 1    Room 2    Outside

         Layer (m)                    4.936     1.303
         Upper Temp (C)               27.0      141.7
         Lower Temp (C)               20.9      25.6
         HRR (kW)                     0.0       1693.1
         Visibility (m) at 2m         20+       0.25

         FED gases on egress path = 0.000
         FED thermal on egress path = 0.002

3 min    20 sec
         (200 sec)                    Room 1    Room 2    Outside

         Layer (m)                    4.749     1.293
         Upper Temp (C)               27.8      149.4
         Lower Temp (C)               20.9      26.1
         HRR (kW)                     0.0       1876.0
         Visibility (m) at 2m         20+       0.25

         FED gases on egress path = 0.000
         FED thermal on egress path = 0.002

3 min    30 sec
         (210 sec)                    Room 1    Room 2    Outside

         Layer (m)                    4.567     1.284
         Upper Temp (C)               28.6      157.2
         Lower Temp (C)               21.0      26.5
         HRR (kW)                     0.0       2068.3
         Visibility (m) at 2m         20+       0.24

         FED gases on egress path = 0.000
         FED thermal on egress path = 0.002

3 min    40 sec
         (220 sec)                    Room 1    Room 2    Outside

         Layer (m)                    4.389     1.275
         Upper Temp (C)               29.5      164.9
         Lower Temp (C)               21.0      27.0
         HRR (kW)                     0.0       2270.0
         Visibility (m) at 2m         20+       0.24

         FED gases on egress path = 0.000
         FED thermal on egress path = 0.002

3 min    50 sec
         (230 sec)                    Room 1    Room 2    Outside

         Layer (m)                    4.216     1.266
         Upper Temp (C)               30.5      172.5
         Lower Temp (C)               21.1      27.5
         HRR (kW)                     0.0       2481.0
         Visibility (m) at 2m         20+       0.24

         FED gases on egress path = 0.000
         FED thermal on egress path = 0.002

4 min    00 sec
         (240 sec)                    Room 1    Room 2    Outside
```

```
         Layer (m)                      4.047     1.256
         Upper Temp (C)                 31.5      180.2
         Lower Temp (C)                 21.1      28.0
         HRR (kW)                       0.0       2701.4
         Visibility (m) at 2m           20+       0.24

         FED gases on egress path = 0.000
         FED thermal on egress path = 0.002

4 min    10 sec
         (250 sec)                      Room 1    Room 2    Outside

         Layer (m)                      3.880     1.247
         Upper Temp (C)                 32.6      187.4
         Lower Temp (C)                 21.2      28.5
         HRR (kW)                       0.0       2931.3
         Visibility (m) at 2m           20+       0.23

         FED gases on egress path = 0.000
         FED thermal on egress path = 0.003

4 min    20 sec
         (260 sec)                      Room 1    Room 2    Outside

         Layer (m)                      3.712     1.238
         Upper Temp (C)                 33.7      193.1
         Lower Temp (C)                 21.2      28.9
         HRR (kW)                       0.0       3170.4
         Visibility (m) at 2m           20+       0.23

         FED gases on egress path = 0.000
         FED thermal on egress path = 0.003

4 min    30 sec
         (270 sec)                      Room 1    Room 2    Outside

         Layer (m)                      3.541     1.228
         Upper Temp (C)                 34.8      200.0
         Lower Temp (C)                 21.3      29.3
         HRR (kW)                       0.0       3419.0
         Visibility (m) at 2m           20+       0.23

         FED gases on egress path = 0.000
         FED thermal on egress path = 0.003

4 min    40 sec
         (280 sec)                      Room 1    Room 2    Outside

         Layer (m)                      3.367     1.218
         Upper Temp (C)                 36.0      207.3
         Lower Temp (C)                 21.4      29.7
         HRR (kW)                       0.0       3677.0
         Visibility (m) at 2m           20+       0.23

         FED gases on egress path = 0.000
         FED thermal on egress path = 0.003

4 min    50 sec
         (290 sec)                      Room 1    Room 2    Outside

         Layer (m)                      3.194     1.208
         Upper Temp (C)                 37.2      214.6
         Lower Temp (C)                 21.5      30.2
         HRR (kW)                       0.0       3944.3
         Visibility (m) at 2m           20+       0.22

         FED gases on egress path = 0.000
         FED thermal on egress path = 0.003

5 min    00 sec
         (300 sec)                      Room 1    Room 2    Outside
```

	Room 1	Room 2	Outside
Layer (m)	3.024	1.199	
Upper Temp (C)	38.5	221.7	
Lower Temp (C)	21.6	30.8	
HRR (kW)	0.0	4221.0	
Visibility (m) at 2m	20+	0.22	

FED gases on egress path = 0.000
FED thermal on egress path = 0.003

5 min 10 sec (310 sec)

	Room 1	Room 2	Outside
Layer (m)	2.859	1.189	
Upper Temp (C)	39.9	228.9	
Lower Temp (C)	21.7	31.3	
HRR (kW)	0.0	4507.1	
Visibility (m) at 2m	20+	0.22	

FED gases on egress path = 0.000
FED thermal on egress path = 0.003

5 min 20 sec (320 sec)

	Room 1	Room 2	Outside
Layer (m)	2.699	1.180	
Upper Temp (C)	41.4	236.0	
Lower Temp (C)	21.8	31.9	
HRR (kW)	0.0	4802.6	
Visibility (m) at 2m	20+	0.22	

FED gases on egress path = 0.000
FED thermal on egress path = 0.003

5 min 30 sec (330 sec)

	Room 1	Room 2	Outside
Layer (m)	2.546	1.171	
Upper Temp (C)	42.9	243.0	
Lower Temp (C)	21.9	32.5	
HRR (kW)	0.0	5107.4	
Visibility (m) at 2m	20+	0.22	

FED gases on egress path = 0.000
FED thermal on egress path = 0.003

5 min 40 sec (340 sec)

	Room 1	Room 2	Outside
Layer (m)	2.399	1.161	
Upper Temp (C)	44.6	250.0	
Lower Temp (C)	22.0	33.1	
HRR (kW)	0.0	5421.6	
Visibility (m) at 2m	20+	0.22	

FED gases on egress path = 0.000
FED thermal on egress path = 0.004

5 min 50 sec (350 sec)

	Room 1	Room 2	Outside
Layer (m)	2.259	1.152	
Upper Temp (C)	46.2	256.9	
Lower Temp (C)	22.2	33.8	
HRR (kW)	0.0	5745.3	
Visibility (m) at 2m	20+	0.22	

FED gases on egress path = 0.000
FED thermal on egress path = 0.004

6 min 00 sec (360 sec) Room 1 Room 2 Outside

Layer (m)	2.124	1.142
Upper Temp (C)	48.0	263.9
Lower Temp (C)	22.3	34.4
HRR (kW)	0.0	6078.2
Visibility (m) at 2m	20+	0.21

FED gases on egress path = 0.000
FED thermal on egress path = 0.004

6 min 10 sec
(370 sec)

	Room 1	Room 2	Outside
Layer (m)	1.989	1.133	
Upper Temp (C)	49.8	270.8	
Lower Temp (C)	22.5	35.2	
HRR (kW)	0.0	6420.6	
Visibility (m) at 2m	0.72	0.21	

FED gases on egress path = 0.001
FED thermal on egress path = 0.005

6 min 20 sec
(380 sec)

	Room 1	Room 2	Outside
Layer (m)	1.855	1.124	
Upper Temp (C)	51.6	277.0	
Lower Temp (C)	22.7	35.9	
HRR (kW)	0.0	6772.4	
Visibility (m) at 2m	0.69	0.21	

FED gases on egress path = 0.002
FED thermal on egress path = 0.007

6 min 30 sec
(390 sec)

	Room 1	Room 2	Outside
Layer (m)	1.720	1.115	
Upper Temp (C)	53.6	280.2	
Lower Temp (C)	23.0	36.7	
HRR (kW)	0.0	7133.5	
Visibility (m) at 2m	0.66	0.21	

FED gases on egress path = 0.004
FED thermal on egress path = 0.009

6 min 40 sec
(400 sec)

	Room 1	Room 2	Outside
Layer (m)	1.584	1.105	
Upper Temp (C)	55.7	286.8	
Lower Temp (C)	23.2	37.6	
HRR (kW)	0.0	7504.0	
Visibility (m) at 2m	0.63	0.21	

FED gases on egress path = 0.005
FED thermal on egress path = 0.012

6 min 50 sec
(410 sec)

	Room 1	Room 2	Outside
Layer (m)	1.450	1.096	
Upper Temp (C)	57.7	293.5	
Lower Temp (C)	23.6	38.8	
HRR (kW)	0.0	7883.9	
Visibility (m) at 2m	0.60	0.21	

FED gases on egress path = 0.007
FED thermal on egress path = 0.015

7 min 00 sec
(420 sec)

	Room 1	Room 2	Outside

```
         Layer (m)                     1.345     1.084
         Upper Temp (C)                59.8      300.3
         Lower Temp (C)                24.6      40.3
         HRR (kW)                      0.0       8273.2
         Visibility (m) at 2m          0.58      0.21

         FED gases on egress path = 0.009
         FED thermal on egress path = 0.019

7 min    10 sec
         (430 sec)                     Room 1    Room 2    Outside

         Layer (m)                     1.247     1.071
         Upper Temp (C)                61.9      307.1
         Lower Temp (C)                26.0      43.2
         HRR (kW)                      0.0       8671.8
         Visibility (m) at 2m          0.55      0.20

         FED gases on egress path = 0.011
         FED thermal on egress path = 0.022

7 min    20 sec
         (440 sec)                     Room 1    Room 2    Outside

         Layer (m)                     1.155     1.059
         Upper Temp (C)                64.1      314.0
         Lower Temp (C)                28.0      49.4
         HRR (kW)                      0.0       9079.8
         Visibility (m) at 2m          0.53      0.20

         FED gases on egress path = 0.013
         FED thermal on egress path = 0.027

7 min    30 sec
         (450 sec)                     Room 1    Room 2    Outside

         Layer (m)                     1.066     1.049
         Upper Temp (C)                66.3      321.4
         Lower Temp (C)                30.7      59.7
         HRR (kW)                      0.0       9497.3
         Visibility (m) at 2m          0.51      0.20

         FED gases on egress path = 0.015
         FED thermal on egress path = 0.032

7 min    40 sec
         (460 sec)                     Room 1    Room 2    Outside

         Layer (m)                     1.044     1.045
         Upper Temp (C)                69.2      329.4
         Lower Temp (C)                33.9      73.5
         HRR (kW)                      0.0       9924.0
         Visibility (m) at 2m          0.49      0.20

         FED gases on egress path = 0.018
         FED thermal on egress path = 0.037

7 min    50 sec
         (470 sec)                     Room 1    Room 2    Outside

         Layer (m)                     1.046     1.046
         Upper Temp (C)                72.5      337.3
         Lower Temp (C)                37.6      90.2
         HRR (kW)                      0.0       10360.2
         Visibility (m) at 2m          0.46      0.20

         FED gases on egress path = 0.020
         FED thermal on egress path = 0.044

8 min    00 sec
         (480 sec)                     Room 1    Room 2    Outside
```

```
         Layer (m)                      1.044     1.044
         Upper Temp (C)                 75.9      347.7
         Lower Temp (C)                 41.7      105.7
         HRR (kW)                       0.0       10805.8
         Visibility (m) at 2m           0.44      0.20

         FED gases on egress path = 0.023
         FED thermal on egress path = 0.051

8 min    10 sec
         (490 sec)                      Room 1    Room 2    Outside

         Layer (m)                      1.039     1.039
         Upper Temp (C)                 79.6      356.6
         Lower Temp (C)                 45.7      119.8
         HRR (kW)                       0.0       11260.7
         Visibility (m) at 2m           0.42      0.20

         FED gases on egress path = 0.026
         FED thermal on egress path = 0.060

8 min    20 sec
         (500 sec)                      Room 1    Room 2    Outside

         Layer (m)                      1.031     1.033
         Upper Temp (C)                 83.7      365.5
         Lower Temp (C)                 49.7      133.2
         HRR (kW)                       0.0       11725.0
         Visibility (m) at 2m           0.40      0.20

         FED gases on egress path = 0.030
         FED thermal on egress path = 0.071

8 min    30 sec
         (510 sec)                      Room 1    Room 2    Outside

         Layer (m)                      1.007     1.023
         Upper Temp (C)                 87.7      374.3
         Lower Temp (C)                 53.5      145.5
         HRR (kW)                       0.0       12198.7
         Visibility (m) at 2m           0.39      0.19

         FED gases on egress path = 0.034
         FED thermal on egress path = 0.083

8 min    40 sec
         (520 sec)                      Room 1    Room 2    Outside

         Layer (m)                      0.999     1.011
         Upper Temp (C)                 91.9      381.9
         Lower Temp (C)                 57.1      155.9
         HRR (kW)                       0.0       12681.8
         Visibility (m) at 2m           0.37      0.19

         FED gases on egress path = 0.038
         FED thermal on egress path = 0.098

8 min    50 sec
         (530 sec)                      Room 1    Room 2    Outside

         Layer (m)                      0.985     1.000
         Upper Temp (C)                 96.4      385.8
         Lower Temp (C)                 60.5      165.1
         HRR (kW)                       0.0       13174.2
         Visibility (m) at 2m           0.36      0.19

         FED gases on egress path = 0.042
         FED thermal on egress path = 0.115

9 min    00 sec
         (540 sec)                      Room 1    Room 2    Outside
```

Layer (m)	0.989	0.990
Upper Temp (C)	100.9	394.1
Lower Temp (C)	63.6	174.8
HRR (kW)	0.0	13676.0
Visibility (m) at 2m	0.34	0.19

FED gases on egress path = 0.047
FED thermal on egress path = 0.135

9 min 10 sec (550 sec)

	Room 1	Room 2	Outside
Layer (m)	0.977	0.977	
Upper Temp (C)	105.1	402.3	
Lower Temp (C)	66.8	184.6	
HRR (kW)	0.0	14187.3	
Visibility (m) at 2m	0.33	0.19	

FED gases on egress path = 0.052
FED thermal on egress path = 0.158

9 min 20 sec (560 sec)

	Room 1	Room 2	Outside
Layer (m)	0.965	0.965	
Upper Temp (C)	109.3	410.5	
Lower Temp (C)	69.8	194.2	
HRR (kW)	0.0	14707.8	
Visibility (m) at 2m	0.32	0.18	

FED gases on egress path = 0.058
FED thermal on egress path = 0.185

9 min 30 sec (570 sec)

	Room 1	Room 2	Outside
Layer (m)	0.950	0.953	
Upper Temp (C)	113.4	418.6	
Lower Temp (C)	72.5	203.6	
HRR (kW)	0.0	15237.8	
Visibility (m) at 2m	0.30	0.18	

FED gases on egress path = 0.064
FED thermal on egress path = 0.215

9 min 40 sec (580 sec)

	Room 1	Room 2	Outside
Layer (m)	0.938	0.941	
Upper Temp (C)	117.6	426.7	
Lower Temp (C)	75.0	212.7	
HRR (kW)	0.0	15777.2	
Visibility (m) at 2m	0.29	0.18	

FED gases on egress path = 0.070
FED thermal on egress path = 0.250

9 min 50 sec (590 sec)

	Room 1	Room 2	Outside
Layer (m)	0.915	0.927	
Upper Temp (C)	121.6	434.5	
Lower Temp (C)	78.0	221.2	
HRR (kW)	0.0	16325.9	
Visibility (m) at 2m	0.28	0.18	

FED gases on egress path = 0.077
FED thermal on egress path = 0.288

10 min 00 sec (600 sec)

	Room 1	Room 2	Outside

Layer (m)	0.908	0.912
Upper Temp (C)	125.6	441.7
Lower Temp (C)	81.1	228.1
HRR (kW)	0.0	16884.0
Visibility (m) at 2m	0.27	0.17

FED gases on egress path = 0.085
FED thermal on egress path = 0.332

10 min 10 sec (610 sec)

	Room 1	Room 2	Outside
Layer (m)	0.894	0.902	
Upper Temp (C)	129.5	449.8	
Lower Temp (C)	84.0	236.7	
HRR (kW)	0.0	17451.5	
Visibility (m) at 2m	0.26	0.17	

FED gases on egress path = 0.093
FED thermal on egress path = 0.380

10 min 20 sec (620 sec)

	Room 1	Room 2	Outside
Layer (m)	0.888	0.887	
Upper Temp (C)	133.5	457.8	
Lower Temp (C)	86.5	245.5	
HRR (kW)	0.0	18028.4	
Visibility (m) at 2m	0.26	0.17	

FED gases on egress path = 0.101
FED thermal on egress path = 0.433

10 min 30 sec (630 sec)

	Room 1	Room 2	Outside
Layer (m)	0.876	0.875	
Upper Temp (C)	137.3	465.5	
Lower Temp (C)	88.8	253.9	
HRR (kW)	0.0	18614.6	
Visibility (m) at 2m	0.25	0.17	

FED gases on egress path = 0.111
FED thermal on egress path = 0.492

10 min 40 sec (640 sec)

	Room 1	Room 2	Outside
Layer (m)	0.863	0.862	
Upper Temp (C)	141.2	473.4	
Lower Temp (C)	91.1	262.6	
HRR (kW)	0.0	19210.2	
Visibility (m) at 2m	0.24	0.16	

FED gases on egress path = 0.120
FED thermal on egress path = 0.557

10 min 50 sec (650 sec)

	Room 1	Room 2	Outside
Layer (m)	0.868	0.848	
Upper Temp (C)	145.3	479.8	
Lower Temp (C)	93.0	267.9	
HRR (kW)	0.0	19815.3	
Visibility (m) at 2m	0.23	0.16	

FED gases on egress path = 0.131
FED thermal on egress path = 0.629

11 min 00 sec (660 sec)

	Room 1	Room 2	Outside

	Room 1	Room 2	Outside
Layer (m)	0.846	0.841	
Upper Temp (C)	149.3	479.9	
Lower Temp (C)	95.3	273.1	
HRR (kW)	0.0	20000.0	
Visibility (m) at 2m	0.22	0.16	

FED gases on egress path = 0.142
FED thermal on egress path = 0.707

11 min 10 sec (670 sec)

	Room 1	Room 2	Outside
Layer (m)	0.849	0.835	
Upper Temp (C)	152.9	483.5	
Lower Temp (C)	97.4	274.8	
HRR (kW)	0.0	20000.0	
Visibility (m) at 2m	0.22	0.16	

FED gases on egress path = 0.155
FED thermal on egress path = 0.793

11 min 20 sec (680 sec)

	Room 1	Room 2	Outside
Layer (m)	0.844	0.832	
Upper Temp (C)	156.1	485.5	
Lower Temp (C)	99.9	278.3	
HRR (kW)	0.0	20000.0	
Visibility (m) at 2m	0.21	0.15	

FED gases on egress path = 0.168
FED thermal on egress path = 0.885

11 min 30 sec (690 sec)

	Room 1	Room 2	Outside
Layer (m)	0.858	0.831	
Upper Temp (C)	158.9	487.1	
Lower Temp (C)	100.2	281.3	
HRR (kW)	0.0	20000.0	
Visibility (m) at 2m	0.21	0.15	

FED gases on egress path = 0.181
FED thermal on egress path = 0.983

11 min 40 sec (700 sec)

	Room 1	Room 2	Outside
Layer (m)	0.830	0.832	
Upper Temp (C)	161.3	488.3	
Lower Temp (C)	99.8	284.1	
HRR (kW)	0.0	20000.0	
Visibility (m) at 2m	0.20	0.15	

FED gases on egress path = 0.196
FED thermal on egress path = 1.000

11 min 50 sec (710 sec)

	Room 1	Room 2	Outside
Layer (m)	0.864	0.830	
Upper Temp (C)	163.5	489.2	
Lower Temp (C)	101.9	285.3	
HRR (kW)	0.0	20000.0	
Visibility (m) at 2m	0.20	0.15	

FED gases on egress path = 0.211
FED thermal on egress path = 1.000

12 min 00 sec (720 sec) Room 1 Room 2 Outside

```
        Layer (m)                      0.818     0.826
        Upper Temp (C)                 166.1     488.8
        Lower Temp (C)                 96.7      282.7
        HRR (kW)                       0.0       20000.0
        Visibility (m) at 2m           0.19      0.15

        FED gases on egress path = 0.227
        FED thermal on egress path = 1.000

12 min  10 sec
        (730 sec)                      Room 1    Room 2    Outside

        Layer (m)                      0.825     0.826
        Upper Temp (C)                 168.9     488.5
        Lower Temp (C)                 95.2      281.0
        HRR (kW)                       0.0       20000.0
        Visibility (m) at 2m           0.18      0.15

        FED gases on egress path = 0.243
        FED thermal on egress path = 1.000

12 min  20 sec
        (740 sec)                      Room 1    Room 2    Outside

        Layer (m)                      0.821     0.825
        Upper Temp (C)                 170.8     489.2
        Lower Temp (C)                 95.8      281.9
        HRR (kW)                       0.0       20000.0
        Visibility (m) at 2m           0.18      0.16

        FED gases on egress path = 0.259
        FED thermal on egress path = 1.000

12 min  30 sec
        (750 sec)                      Room 1    Room 2    Outside

        Layer (m)                      0.818     0.823
        Upper Temp (C)                 172.7     489.9
        Lower Temp (C)                 95.2      282.1
        HRR (kW)                       0.0       20000.0
        Visibility (m) at 2m           0.17      0.16

        FED gases on egress path = 0.275
        FED thermal on egress path = 1.000

12 min  40 sec
        (760 sec)                      Room 1    Room 2    Outside

        Layer (m)                      0.821     0.823
        Upper Temp (C)                 174.3     490.5
        Lower Temp (C)                 95.0      281.9
        HRR (kW)                       0.0       20000.0
        Visibility (m) at 2m           0.17      0.16

        FED gases on egress path = 0.292
        FED thermal on egress path = 1.000

12 min  50 sec
        (770 sec)                      Room 1    Room 2    Outside

        Layer (m)                      0.805     0.817
        Upper Temp (C)                 175.2     491.5
        Lower Temp (C)                 95.5      281.9
        HRR (kW)                       0.0       20000.0
        Visibility (m) at 2m           0.17      0.16

        FED gases on egress path = 0.308
        FED thermal on egress path = 1.000

13 min  00 sec
        (780 sec)                      Room 1    Room 2    Outside
```

```
         Layer (m)                     0.806     0.816
         Upper Temp (C)                176.4     491.5
         Lower Temp (C)                95.8      278.6
         HRR (kW)                      0.0       20000.0
         Visibility (m) at 2m          0.16      0.17

         FED gases on egress path = 0.326
         FED thermal on egress path = 1.000

13 min   10 sec
         (790 sec)                     Room 1    Room 2    Outside

         Layer (m)                     0.812     0.817
         Upper Temp (C)                177.5     490.9
         Lower Temp (C)                95.6      277.1
         HRR (kW)                      0.0       20000.0
         Visibility (m) at 2m          0.16      0.17

         FED gases on egress path = 0.343
         FED thermal on egress path = 1.000

13 min   20 sec
         (800 sec)                     Room 1    Room 2    Outside

         Layer (m)                     0.793     0.812
         Upper Temp (C)                178.0     490.4
         Lower Temp (C)                94.4      275.4
         HRR (kW)                      0.0       20000.0
         Visibility (m) at 2m          0.16      0.17

         FED gases on egress path = 0.361
         FED thermal on egress path = 1.000

13 min   30 sec
         (810 sec)                     Room 1    Room 2    Outside

         Layer (m)                     0.822     0.812
         Upper Temp (C)                179.3     489.7
         Lower Temp (C)                93.0      268.9
         HRR (kW)                      0.0       20000.0
         Visibility (m) at 2m          0.16      0.17

         FED gases on egress path = 0.379
         FED thermal on egress path = 1.000

13 min   40 sec
         (820 sec)                     Room 1    Room 2    Outside

         Layer (m)                     0.778     0.809
         Upper Temp (C)                179.2     489.0
         Lower Temp (C)                91.7      262.0
         HRR (kW)                      0.0       20000.0
         Visibility (m) at 2m          0.16      0.17

         FED gases on egress path = 0.397
         FED thermal on egress path = 1.000

13 min   50 sec
         (830 sec)                     Room 1    Room 2    Outside

         Layer (m)                     0.810     0.809
         Upper Temp (C)                180.3     488.2
         Lower Temp (C)                89.6      252.4
         HRR (kW)                      0.0       20000.0
         Visibility (m) at 2m          0.15      0.17

         FED gases on egress path = 0.416
         FED thermal on egress path = 1.000

14 min   00 sec
         (840 sec)                     Room 1    Room 2    Outside
```

```
        Layer (m)                       0.774     0.802
        Upper Temp (C)                  179.9     487.5
        Lower Temp (C)                  87.7      244.5
        HRR (kW)                        0.0       20000.0
        Visibility (m) at 2m            0.15      0.17

        FED gases on egress path = 0.435
        FED thermal on egress path = 1.000

14 min  10 sec
        (850 sec)                       Room 1    Room 2    Outside

        Layer (m)                       0.805     0.802
        Upper Temp (C)                  181.1     486.8
        Lower Temp (C)                  85.7      235.0
        HRR (kW)                        0.0       20000.0
        Visibility (m) at 2m            0.15      0.17

        FED gases on egress path = 0.454
        FED thermal on egress path = 1.000

14 min  20 sec
        (860 sec)                       Room 1    Room 2    Outside

        Layer (m)                       0.771     0.797
        Upper Temp (C)                  180.7     486.2
        Lower Temp (C)                  83.9      227.6
        HRR (kW)                        0.0       20000.0
        Visibility (m) at 2m            0.15      0.17

        FED gases on egress path = 0.473
        FED thermal on egress path = 1.000

14 min  30 sec
        (870 sec)                       Room 1    Room 2    Outside

        Layer (m)                       0.800     0.799
        Upper Temp (C)                  181.5     485.8
        Lower Temp (C)                  81.9      219.7
        HRR (kW)                        0.0       20000.0
        Visibility (m) at 2m            0.15      0.17

        FED gases on egress path = 0.493
        FED thermal on egress path = 1.000

14 min  40 sec
        (880 sec)                       Room 1    Room 2    Outside

        Layer (m)                       0.770     0.799
        Upper Temp (C)                  181.3     485.6
        Lower Temp (C)                  80.9      215.0
        HRR (kW)                        0.0       20000.0
        Visibility (m) at 2m            0.15      0.17

        FED gases on egress path = 0.513
        FED thermal on egress path = 1.000

14 min  50 sec
        (890 sec)                       Room 1    Room 2    Outside

        Layer (m)                       0.764     0.788
        Upper Temp (C)                  181.2     485.8
        Lower Temp (C)                  79.4      213.3
        HRR (kW)                        0.0       20000.0
        Visibility (m) at 2m            0.15      0.17

        FED gases on egress path = 0.534
        FED thermal on egress path = 1.000

15 min  00 sec
        (900 sec)                       Room 1    Room 2    Outside
```

	Room 1	Room 2	Outside
Layer (m)	0.795	0.796	
Upper Temp (C)	182.5	486.0	
Lower Temp (C)	78.3	207.8	
HRR (kW)	0.0	20000.0	
Visibility (m) at 2m	0.14	0.17	

FED gases on egress path = 0.555
FED thermal on egress path = 1.000

15 min 10 sec (910 sec)

	Room 1	Room 2	Outside
Layer (m)	0.782	0.789	
Upper Temp (C)	182.3	486.7	
Lower Temp (C)	77.2	204.5	
HRR (kW)	0.0	20000.0	
Visibility (m) at 2m	0.14	0.17	

FED gases on egress path = 0.575
FED thermal on egress path = 1.000

15 min 20 sec (920 sec)

	Room 1	Room 2	Outside
Layer (m)	0.782	0.793	
Upper Temp (C)	182.9	486.8	
Lower Temp (C)	76.6	204.2	
HRR (kW)	0.0	20000.0	
Visibility (m) at 2m	0.14	0.17	

FED gases on egress path = 0.597
FED thermal on egress path = 1.000

15 min 30 sec (930 sec)

	Room 1	Room 2	Outside
Layer (m)	0.795	0.795	
Upper Temp (C)	183.5	487.3	
Lower Temp (C)	76.2	203.9	
HRR (kW)	0.0	20000.0	
Visibility (m) at 2m	0.14	0.17	

FED gases on egress path = 0.618
FED thermal on egress path = 1.000

15 min 40 sec (940 sec)

	Room 1	Room 2	Outside
Layer (m)	0.782	0.794	
Upper Temp (C)	183.8	488.0	
Lower Temp (C)	75.3	202.8	
HRR (kW)	0.0	20000.0	
Visibility (m) at 2m	0.14	0.17	

FED gases on egress path = 0.640
FED thermal on egress path = 1.000

15 min 50 sec (950 sec)

	Room 1	Room 2	Outside
Layer (m)	0.767	0.788	
Upper Temp (C)	183.6	488.2	
Lower Temp (C)	74.7	201.4	
HRR (kW)	0.0	20000.0	
Visibility (m) at 2m	0.14	0.17	

FED gases on egress path = 0.662
FED thermal on egress path = 1.000

16 min 00 sec (960 sec)

	Room 1	Room 2	Outside

```
        Layer (m)                      0.769     0.795
        Upper Temp (C)                 184.3     488.3
        Lower Temp (C)                 74.4      198.3
        HRR (kW)                       0.0       20000.0
        Visibility (m) at 2m           0.14      0.17

        FED gases on egress path = 0.685
        FED thermal on egress path = 1.000

16 min  10 sec
        (970 sec)                      Room 1    Room 2    Outside

        Layer (m)                      0.764     0.785
        Upper Temp (C)                 184.4     489.0
        Lower Temp (C)                 73.7      198.0
        HRR (kW)                       0.0       20000.0
        Visibility (m) at 2m           0.14      0.17

        FED gases on egress path = 0.707
        FED thermal on egress path = 1.000

16 min  20 sec
        (980 sec)                      Room 1    Room 2    Outside

        Layer (m)                      0.764     0.793
        Upper Temp (C)                 185.1     489.1
        Lower Temp (C)                 73.4      195.1
        HRR (kW)                       0.0       20000.0
        Visibility (m) at 2m           0.14      0.17

        FED gases on egress path = 0.730
        FED thermal on egress path = 1.000

16 min  30 sec
        (990 sec)                      Room 1    Room 2    Outside

        Layer (m)                      0.761     0.781
        Upper Temp (C)                 185.1     488.7
        Lower Temp (C)                 72.8      195.8
        HRR (kW)                       0.0       20000.0
        Visibility (m) at 2m           0.14      0.17

        FED gases on egress path = 0.753
        FED thermal on egress path = 1.000

16 min  40 sec
        (1000 sec)                     Room 1    Room 2    Outside

        Layer (m)                      0.786     0.790
        Upper Temp (C)                 186.5     490.0
        Lower Temp (C)                 72.4      192.9
        HRR (kW)                       0.0       20000.0
        Visibility (m) at 2m           0.14      0.17

        FED gases on egress path = 0.776
        FED thermal on egress path = 1.000

16 min  50 sec
        (1010 sec)                     Room 1    Room 2    Outside

        Layer (m)                      0.778     0.785
        Upper Temp (C)                 186.7     490.8
        Lower Temp (C)                 72.4      192.4
        HRR (kW)                       0.0       20000.0
        Visibility (m) at 2m           0.14      0.17

        FED gases on egress path = 0.799
        FED thermal on egress path = 1.000

17 min  00 sec
        (1020 sec)                     Room 1    Room 2    Outside
```

```
        Layer (m)                      0.786     0.790
        Upper Temp (C)                 187.3     490.8
        Lower Temp (C)                 72.3      192.4
        HRR (kW)                       0.0       20000.0
        Visibility (m) at 2m           0.14      0.17

        FED gases on egress path = 0.823
        FED thermal on egress path = 1.000

17 min  10 sec
        (1030 sec)                     Room 1    Room 2    Outside

        Layer (m)                      0.764     0.784
        Upper Temp (C)                 187.1     491.3
        Lower Temp (C)                 72.4      192.9
        HRR (kW)                       0.0       20000.0
        Visibility (m) at 2m           0.14      0.17

        FED gases on egress path = 0.847
        FED thermal on egress path = 1.000

17 min  20 sec
        (1040 sec)                     Room 1    Room 2    Outside

        Layer (m)                      0.768     0.791
        Upper Temp (C)                 187.9     491.5
        Lower Temp (C)                 72.3      190.7
        HRR (kW)                       0.0       20000.0
        Visibility (m) at 2m           0.14      0.17

        FED gases on egress path = 0.870
        FED thermal on egress path = 1.000

17 min  30 sec
        (1050 sec)                     Room 1    Room 2    Outside

        Layer (m)                      0.761     0.779
        Upper Temp (C)                 187.8     491.7
        Lower Temp (C)                 71.7      190.[illegible]
        HRR (kW)                       0.0       20000.0
        Visibility (m) at 2m           0.14      0.17

        FED gases on egress path = 0.895
        FED thermal on egress path = 1.000

17 min  40 sec
        (1060 sec)                     Room 1    Room 2    Outside

        Layer (m)                      0.787     0.788
        Upper Temp (C)                 189.1     492.2
        Lower Temp (C)                 71.3      188.0
        HRR (kW)                       0.0       20000.0
        Visibility (m) at 2m           0.13      0.17

        FED gases on egress path = 0.919
        FED thermal on egress path = 1.000

17 min  50 sec
        (1070 sec)                     Room 1    Room 2    Outside

        Layer (m)                      0.778     0.783
        Upper Temp (C)                 189.1     493.0
        Lower Temp (C)                 71.3      188.0
        HRR (kW)                       0.0       20000.0
        Visibility (m) at 2m           0.13      0.17

        FED gases on egress path = 0.943
        FED thermal on egress path = 1.000

18 min  00 sec
        (1080 sec)                     Room 1    Room 2    Outside
```

```
         Layer (m)                      0.791     0.782
         Upper Temp (C)                 189.6     492.6
         Lower Temp (C)                 71.6      189.0
         HRR (kW)                       0.0       20000.0
         Visibility (m) at 2m           0.13      0.17

         FED gases on egress path = 0.968
         FED thermal on egress path = 1.000

18 min   10 sec
         (1090 sec)                     Room 1    Room 2    Outside

         Layer (m)                      0.761     0.783
         Upper Temp (C)                 189.3     493.6
         Lower Temp (C)                 72.3      192.6
         HRR (kW)                       0.0       20000.0
         Visibility (m) at 2m           0.13      0.17

         FED gases on egress path = 0.992
         FED thermal on egress path = 1.000

18 min   20 sec
         (1100 sec)                     Room 1    Room 2    Outside

         Layer (m)                      0.782     0.783
         Upper Temp (C)                 190.3     494.3
         Lower Temp (C)                 73.3      193.5
         HRR (kW)                       0.0       20000.0
         Visibility (m) at 2m           0.13      0.17

         FED gases on egress path = 1.000
         FED thermal on egress path = 1.000

18 min   30 sec
         (1110 sec)                     Room 1    Room 2    Outside

         Layer (m)                      0.772     0.781
         Upper Temp (C)                 190.5     495.5
         Lower Temp (C)                 73.3      194.3
         HRR (kW)                       0.0       20000.0
         Visibility (m) at 2m           0.13      0.17

         FED gases on egress path = 1.000
         FED thermal on egress path = 1.000

18 min   40 sec
         (1120 sec)                     Room 1    Room 2    Outside

         Layer (m)                      0.755     0.789
         Upper Temp (C)                 190.8     495.2
         Lower Temp (C)                 73.1      192.7
         HRR (kW)                       0.0       20000.0
         Visibility (m) at 2m           0.13      0.17

         FED gases on egress path = 1.000
         FED thermal on egress path = 1.000

18 min   50 sec
         (1130 sec)                     Room 1    Room 2    Outside

         Layer (m)                      0.788     0.784
         Upper Temp (C)                 191.8     495.2
         Lower Temp (C)                 73.0      191.5
         HRR (kW)                       0.0       20000.0
         Visibility (m) at 2m           0.13      0.17

         FED gases on egress path = 1.000
         FED thermal on egress path = 1.000

19 min   00 sec
         (1140 sec)                     Room 1    Room 2    Outside
```

```
         Layer (m)                      0.755     0.779
         Upper Temp (C)                 191.3     495.5
         Lower Temp (C)                 72.6      190.7
         HRR (kW)                       0.0       20000.0
         Visibility (m) at 2m           0.13      0.17

         FED gases on egress path = 1.000
         FED thermal on egress path = 1.000

19 min   10 sec
         (1150 sec)                     Room 1    Room 2    Outside

         Layer (m)                      0.788     0.786
         Upper Temp (C)                 192.6     495.5
         Lower Temp (C)                 72.6      190.5
         HRR (kW)                       0.0       20000.0
         Visibility (m) at 2m           0.13      0.17

         FED gases on egress path = 1.000
         FED thermal on egress path = 1.000

19 min   20 sec
         (1160 sec)                     Room 1    Room 2    Outside

         Layer (m)                      0.783     0.780
         Upper Temp (C)                 192.7     495.8
         Lower Temp (C)                 73.6      192.9
         HRR (kW)                       0.0       20000.0
         Visibility (m) at 2m           0.13      0.17

         FED gases on egress path = 1.000
         FED thermal on egress path = 1.000

19 min   30 sec
         (1170 sec)                     Room 1    Room 2    Outside

         Layer (m)                      0.760     0.775
         Upper Temp (C)                 192.2     495.4
         Lower Temp (C)                 73.3      195.9
         HRR (kW)                       0.0       20000.0
         Visibility (m) at 2m           0.13      0.17

         FED gases on egress path = 1.000
         FED thermal on egress path = 1.000

19 min   40 sec
         (1180 sec)                     Room 1    Room 2    Outside

         Layer (m)                      0.788     0.786
         Upper Temp (C)                 193.6     496.8
         Lower Temp (C)                 73.5      193.8
         HRR (kW)                       0.0       20000.0
         Visibility (m) at 2m           0.13      0.17

         FED gases on egress path = 1.000
         FED thermal on egress path = 1.000

19 min   50 sec
         (1190 sec)                     Room 1    Room 2    Outside

         Layer (m)                      0.785     0.776
         Upper Temp (C)                 193.6     496.6
         Lower Temp (C)                 73.9      194.8
         HRR (kW)                       0.0       20000.0
         Visibility (m) at 2m           0.13      0.17

         FED gases on egress path = 1.000
         FED thermal on egress path = 1.000

20 min   00 sec
         (1200 sec)                     Room 1    Room 2    Outside
```

```
        Layer (m)                      0.759     0.780
        Upper Temp (C)                 193.4     497.5
        Lower Temp (C)                 74.1      196.5
        HRR (kW)                       0.0       20000.0
        Visibility (m) at 2m           0.13      0.17

        FED gases on egress path = 1.000
        FED thermal on egress path = 1.000


=====================================================================
Event Log
=====================================================================
Simulation Finished.
FED(thermal) Exceeded 0.3 at 595.0 Seconds.
FED(CO) Exceeded 0.3 at 765.0 Seconds.
10 sec. Visibility at 2m above floor reduced to 10 m in room 2
0 sec. Item 1 Fire ignited.
Iteration 1


=====================================================================
Initial Time-Step = 5.00 seconds.
Computer Run-Time = 8.3 seconds.
=====================================================================
```

Visibility in Circus Ring (Room 1) at 2 m above floor reduces to less than 10 m at 360 seconds.

FED (CO) in Circus Ring (Room 1) exceeded 0.3 at 765 seconds

FED (THERMAL) in Circus Ring (Room 1) exceeded 0.3 at 595 seconds.

26 Appendix 6 - Fire Engineering Brief (FEB)

FIRE ENGINEERING DESIGN

ZIRKA CIRCUS

FEB

ONFIRE

Job number: 1942 | 14 June 2013 | Issue 2

Issue	Date	Author		Status	Extent of Revision
FEB	20 May 2013	DLS	PJR	DRAFT for discussion	Fire Engineering Brief
FEB	14 June 2013	DLS		For Approval	Fire Engineering Brief

Prepared by:

Debbie Scott

Principal Fire Engineer

ME Dist (Fire), PMSFPE, FIPENZ, CPEng

Reviewed by:

Peter Reddin

Senior Fire Engineer

ME (Fire), PMSFPE, MIPENZ, CPEng

ONFIRE

OnFire Consulting Limited

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Email: info@onfire.co.nz; www.onfire.co.nz

Table of Contents

1 Purpose

The purpose of this Fire Engineering Brief is to obtain agreement from the peer-reviewer and other relevant parties on the design methodology and input parameters for acceptance of the FEB and thereafter implementing the fire engineering design (and any necessary changes to the building design) leading to multi-proof building consent to show compliance with the New Zealand Building Code (NZBC) for Protection from Fire as required by the Building Act 2004 for the building.

2 Introduction

This is an existing circus tent that travels the country throughout the year and is likely to be erected 50 weeks of the year. Given the need for multiple consents throughout the year a Multi-Proof consent through the Ministry of Business, Innovation and Employment (MBIE) is to be applied for. The details in this fire engineering brief relate to the Code Clauses C1-C6. Other Code Clauses are to be dealt with by the applicant with MBIE.

The circus tent is in the process of purchasing new seating and the proposed number of seats is 690 however this is dependent upon the results of this fire engineering design. The seating arrangement may need to be changed on the basis of this review.

The existing circus tent is made of a fabric called Ferrari F702 "Big Top". Testing has been undertaken by AWTA for Baytex who are NZ's leading Tent and Marquee Manufacturer and the flammability index achieved was 5. The Fabric on this circus tent is clearly stamped and hallmarked by the manufacturer, showing that this is indeed the fabric used.

This FEB report, drawings and photos at the rear of this FEB report in Appendix 1 and the dimensions, B-Risk Setup and vent arrangement in Appendix 2 form the fire engineering documentation. A site visit to the tent was also undertaken on the 30th April when it was erected in Hamilton.

3 Building Importance Level and Risk Groups

In accordance with Clause A3 of the Building Code the building Importance Level has been classified as follows:

Importance Level	Description of Building Type	Specific Structure
IL 3	Buildings of a higher level of societal benefit or importance, or with higher levels of risk-significant factors to building occupants. These buildings have increased performance requirements because they may house large numbers of people, vulnerable populations, or occupants with other risk factors, or fulfil a role of increased importance to the local community or to society in general.	Buildings where more than 300 people congregate in 1 area

Although C/VM2 does not specify Risk Groups per-se, they are applicable to some sections of the Verification Method:

Location	Risk Group	Acceptable Solution	Escape Height
Circus Tent	CA	C/AS4	<4.0m

4 Fire Engineering Brief (FEB)

The FEB process for this building includes the following people and organisations as interested and affected parties:

Peer Reviewer	Nick Saunders - MBIE	email:	Nick.saunders@mbie.govt.nz
BCA	Nick Saunders - MBIE	email:	Nick.saunders@mbie.govt.nz
Tent Owner	James Finlayson	email:	james@zirkacircus.com
NZFS	NZFS Engineering Unit	email:	engineers@fire.org.nz
Design Fire Engineer	Debbie Scott	email	Debbie@onfire.co.nz

4.1 Compliance Methodology

The circus tent is not compliant with the relevant Acceptable Solution C/AS4 for the following reasons:

- It does not have traditional 'doorways' and instead has quickly opened tent flaps
- The seating structure is not fire rated
- A compliant smoke detection system to NZS4512 is not able to be installed
- The tent uses stage smoke causing issues with smoke detection

Therefore the relevant design scenarios of the Verification Method must be used to show compliance with the NZBC Protection from Fire clauses C1-C6.

4.2 Proposed improvements to the means of escape for the tent

There is no 'alteration' being proposed to the circus tent and the reason for needing a Consent is due to the tent being moved to a new site every few weeks.

For this tent the following possible improvements from the current situation are proposed in order to improve the means of escape:

- Emergency lighting on battery backup to be provided,
- Additional exit signage to be provided to show people the route to the three main egress tent doors

4.3 Relevant design fire scenarios in accordance with C/VM2

The following design fire scenarios are applicable to the fire modelling for the ASET/RSET calculations for pre- and post-alteration.

DFS	Description	Methods available	Reqd? What method
1:BE Blocked Exit	Escape routes serving >50p, Separation ≥8m <250p; ≥20m >250p	>1 escape route required (3 provided)	Yes
2: UT Unknown Threat	Rooms with >50p	a) ASET/RSET, or b) Separation: i. Burnout if no AFD ii. If AFD: A. -/60/60 FRR or Demonstrate effectiveness	N/A in large open circus tent
3:CS Concealed Space	Rooms with >50p, concealed space >0.8m in 2 dimensions	a) Separation, or b) Automatic fire detection (AFD)	N/A– no concealed spaces
4:SF Smouldering Fire	Slow smouldering fire threatens sleeping occupants.	Provide smoke detection throughout	N/A – no sleeping
5:HS Horizontal Spread	Exposure to other property, sleeping occupancy or exitway	a) Calculate radiation, or b) Use tabulated values from C/AS2 to C/AS6 as applicable	Table values to be used and tent to be located far from boundaries
6:VS Vertical Spread	Upper floors with sleeping, or other property, and All buildings >10m. A) Spread over façade materials B) Fire plumes via openings & UPA's	A) a) Large scale tests b) Small scale tests c) Use non-combustible materials	N/A
7:IS Internal Surfaces	Criteria for lining materials, some exceptions	Achieve requirements in Building Code	Tent fabric tested to flammability index
8:FO Firefighting Ops.	a) FSO at 1200 sec (no AFA) b) FSO at 1000 sec with AFA c) FBIM	For unsprinklered firecells <15m to boundary with: i) FLED >20TJ, or ii) Floor area >5000m2	FLED<20TJ
	Access within 20m of:	a) Building entry, and b) Inlets to sprinklers, hydrants	Access available
	Water supply	a) Fire Appliance <75m, or	Yes 75m metre
9:CF Challenging Fire	I. Design fires in various locations.	ASET/RSET analysis for all building occupants from design fires in various locations (except a ,b, c). Also assess internal & external escape routes. Assess FED & visibility.	Design fires required • Underneath seating • Centre of circus ring

		Assume active & passive systems will perform as intended.	
10:RC Robustness Check	Failure of key system exposes: a) >150 people, or b) >50 people sleeping in firecell c) Detention, Treatment or Care	ASET/RSET with each system failed in turn, except i. Sprinklers & Detection systems,	N/A as no systems to fail

4.4 Challenging fire

Fast t^2 fires will be modelled using B Risk and the ASET/RSET for the tent occupants will be determined. This includes assessment of the escape routes, FED (CO and thermal) and visibility. It assumes that passive and active systems will perform as intended.

Challenging fires are proposed to be located as follows:
- In the circus ring
- Underneath Seating

The proposed design fire locations are shown on the Drawing in Appendix 2.

4.5 C/VM2 Design Fire Scenario Life Safety Rules and Parameters

The following table summarises the Design Fire Scenario modelling rules as applicable to this building:

Rule	Description	Verification Requirement	Proposal
a)	Warning System:	A smoke detection system is not to be installed as agreed by the stakeholders at the FEB meeting for the following reasons: • The circus tent is all one large space with focused activity and occupants will be able to see a fire • There is a high level of staff management in the tent • Smoke detection would provide false alarm issues due to the theatrical smoke • Installation of a smoke detection system is difficult for a tent and not able to comply with a standard • There are durability issues of constantly erecting and dismantling a detection system weekly	Manual call points are to be provided at the sound box and at back of stage. These are to set off sounders in the circus tent. The sound box staff are to turn off the music upon activation of the manual call point system
b)	Fire & Smoke doors:	Assumed closed, unless used for escape: i) Low load: open 3 sec/person for egress.	N/A
		ii) High load: open for duration of queuing.	N/A

c)	Other doors:	Assumed open	N/A
d)	Egress doors:	Assume half-width for smoke flow calculations	Circus tent doors (3 of) assumed open during evacuation
e)	Zone model leakage:	Non-rated walls: model as tall narrow slot. Use a single unit for all wall leakage (B-Risk modelling used)	Leakage greater in a tent than a normal building. It is proposed to model this additional leakage at high level In particular there are leakage paths at the top of the tent in the locations detailed on the drawings in Appendix 2. Venting in the zone model will be used to model this leakage as well as the vents provided by the circus construction eg. Vents that are part of the circus tent doors.
f)	CFD model leakage:	As per Zone model, or 1 vent at floor level & 1 vent at ceiling	N/A (Zone model used)
g)	Leakage areas:	Assumed closed, unless used for escape: i) Smoke doors/separations: zero, except 10mm gap under door	N/A
		ii) Fire doors (not Sm) 10mm gap over height of door.	N/A
		iii) Fire rated construction: zero leakage.	N/A
		iv) Non rated walls: a. Internal: 0.001m^2/m^2 b. External: 0.005 m^2/m^2	As per e) above, further leakage proposed
h)	Compliant Smoke separations:	In situ until: Rated temperature or flashover (soonest governs)	N/A
i)	Non-compliant Smoke separations:	In situ until: Upper layer temperature reaches 200°C	N/A
j)	Windows:	Non-rated open at: i) Upper layer temperature reaches 500°C, or ii) Fire becomes ventilation limited.	N/A
		Rated windows: in-situ until rated time	N/A
k)	Fire Location:	≤0.5m FFL	Yes – See Appendix 2 for design fire locations and section 4.4
l)	FED	FED_{CO}: CO, CO_2 & O_2	<0.3
		$FED_{Thermal}$: Radiative & Convective	<0.3
m)	Visibility	Visibility to	>10m

4.6 C/VM2 Design Fire Characteristics: Pre-flashover fires

The following table summarises the Design Fire Characteristics rules as applicable to this building:

Building Use	Fire Growth Rate (kW)	Species	Radiative Fraction	Peak HRR
All buildings (including Storage <3.0m)	Fast αt^2 $0.0469t^2$	i) Y_{SOOT} = 0.07kg/kg	0.35	20MW
		ii) Y_{CO} = 0.04kg/kg		
		iii) ΔH_C = 20MJ/kg		
		iv) Y_{CO2} = 1.5kg/kg		
		v) Y_{H2O} = 1.0kg/kg		

4.7 B Risk Setup

B Risk is to be used for the challenging fire modelling to provide the Available Safe Egress Time (ASET).

The circus tent is circular however B Risk does not allow for this type of room to be modelled, therefore an equivalent sized square room is to be modelled.

The circus tent has four very high peaks where the four main poles are located, these provide four narrow high volumes for smoke to fill. There is also a high point in the centre above the lighting rig. A sloping roof will be modelled in B Risk to a similar volume to that provided in the actual circus tent. Appendix 2 details further the actual situation compared to the proposed B Risk set-up.

There are a variety of vents provided in the tent which are further detailed in Appendix 2. These will be modelled in B-Risk as ceiling vents and leakage.

5 Movement of People

5.1 Occupant Loads

The occupant loads for the tent are based upon the proposed seating. The new seating is proposed to allow 690 occupants. If however this design shows that this occupancy is not possible the seating will be adjusted to suit. The order to purchase the seating from Ulrich Aluminium is currently on hold awaiting the outcome of this design.

5.2 Detector Criteria

As discussed at the FEB meeting, visual detection as allowed by C/VM2 would be the main form of detection if a fire should the fire occur in the circus ring. Manual alarms would then be activated by circus staff.

5.3 Notification time

As per C/VM2, an alarm notification time of 30 seconds applies to the ASET/RSET calculations.

5.4 Pre-travel activity times

The pre-travel activity times used for the ASET/RSET calculations are as follows:

Description of Building Use	Pre Travel Time
Spaces within buildings which have only focused activities (eg, cinemas, theatres and stadiums) Space of origin (occupants assumed to start evacuation travel immediately after detection and notification time or when fire in their space reaches 500 kW, whichever occurs first)	0s

5.5 Travel times

The travel time assessment will be based on the greater of the travel time or the flow time as determined from the appropriate calculations as per C/VM2. It is expected that flow time will govern.

The owner advised that the tent flap doors have a clear width of 3.4m to a 1.8m head height. Avobe that the tent flap joins at the centre at a height of 3.4m. The effective width will be calculated using the standard boundary layer conditions in C/VM2.

50% of the occupants will be assessed to be travelling through the primary exit. The rest of the occupants will be distributed between the other two public exits. The back stage exit will not be used by the public.

6 Miscellaneous

The circus tent doors are not typical doors. They are 3.4m wide tent flaps which are made up of two flap openings. The openings are secured for bad weather using 'lacing'. This is a special knotting system that once pushed on, it releases easily and access is available through the tent flap. Photos of the system are shown in the Appendix.

The power system in the building can be made up of a combination of mains power and a generator. The main circus tent lighting can be provided by a combination of the generator and the mains power. The owner intends to also provide emergency lighting in the building using stand alone battery back up fittings.

Exit signage is currently provided at all of the exits, these are illuminated exit signs. These signs are turned on (illuminated) prior to each performance starting. Where necessary further exit signage is to be provided for F8 compliance.

The seating is located on the tiered chquer plate flooring which is proposed to extend to a 2m height as per the 3D drawings in Appendix 1. Given this flooring is unrated no storage is to occur beneth it. This includes the staff BBQ, diesel heater etc..

The seating layout and design is required to comply with the requirements for seating size, aisles etc. in C/AS4. The seating is joined together with four in a row. As discussed at the FEB meeting the owner is investigating the ability to fix the seats which are located at the ends of the aisles to the flooring. The order to purchase the seating from Ulrich Aluminium is currently on hold awaiting the outcome of this design.

7 APPENDIX 1 – Drawings and Photos and other relevant info

ZIRKA CIRCUS
Ground Plan

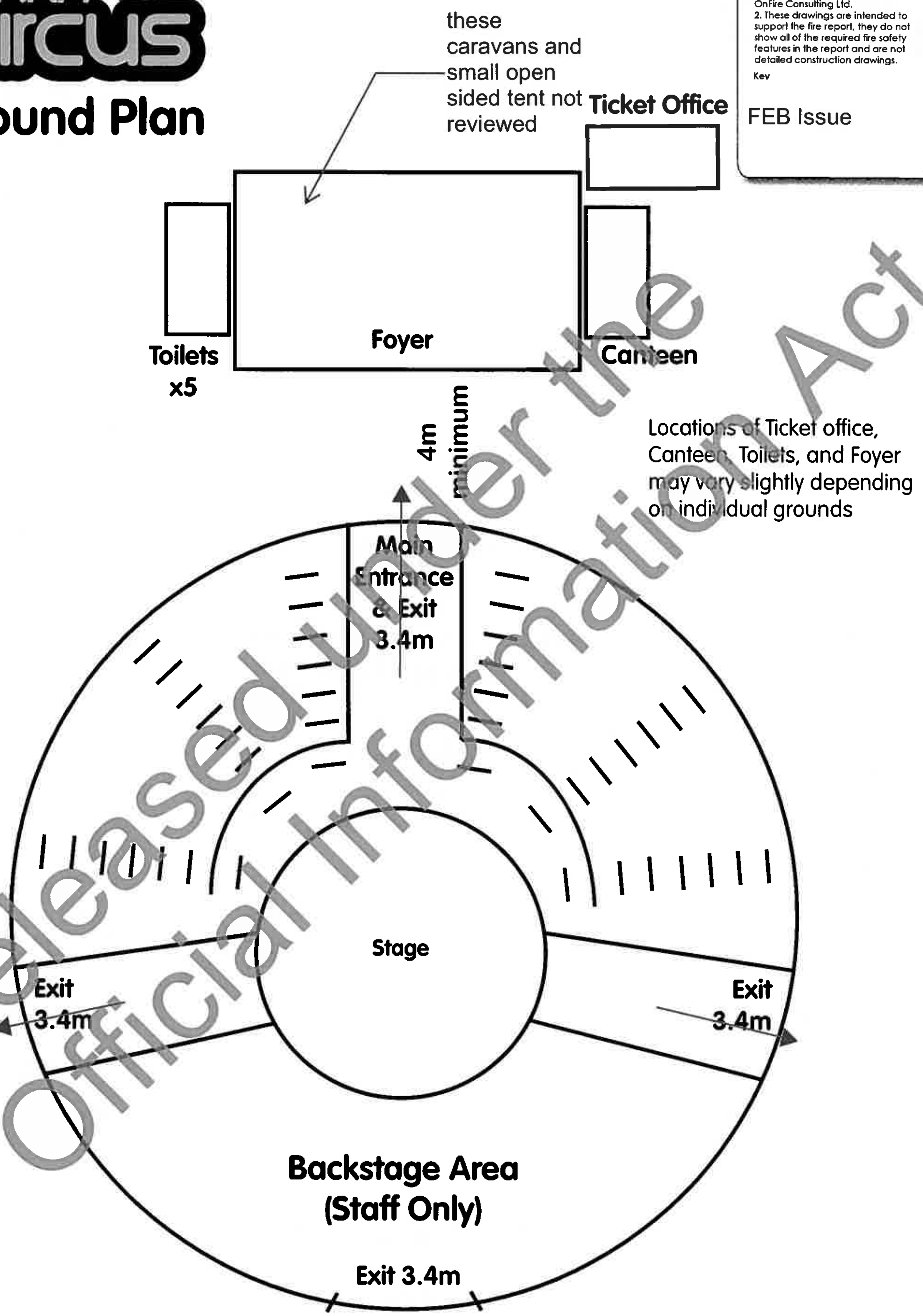
ONFIRE

Job Number: 1942
Date: 14 June 2013

1. These drawings are to be read in conjunction with the Design Advice by OnFire Consulting Ltd.
2. These drawings are intended to support the fire report, they do not show all of the required fire safety features in the report and are not detailed construction drawings.

Kev

FEB Issue



Circus Tent, 35m diameter

ZIRKA CIRCUS

Ground Plan

ONFIRE

Job Number: 1942
Date: 14 June 2013

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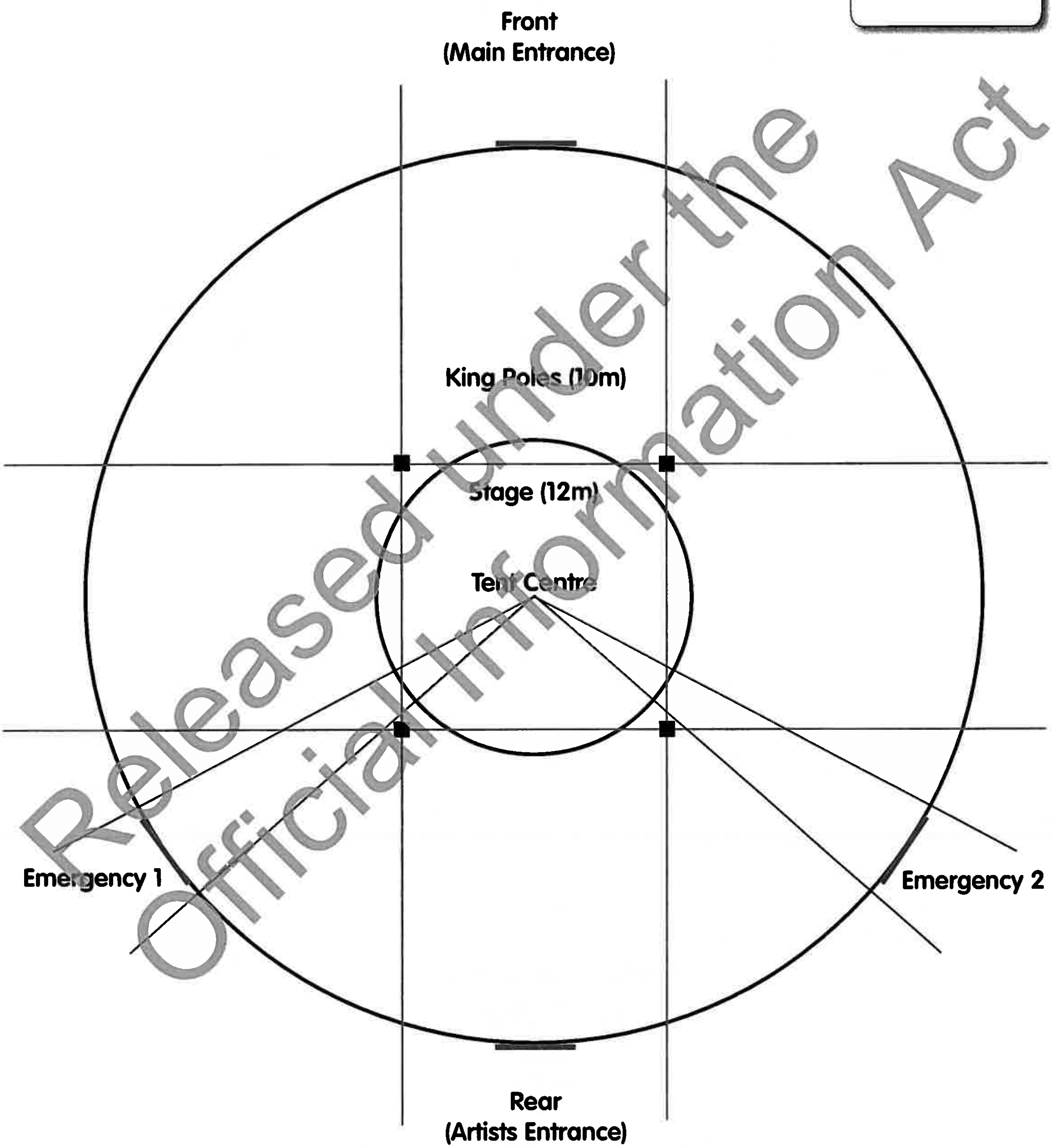
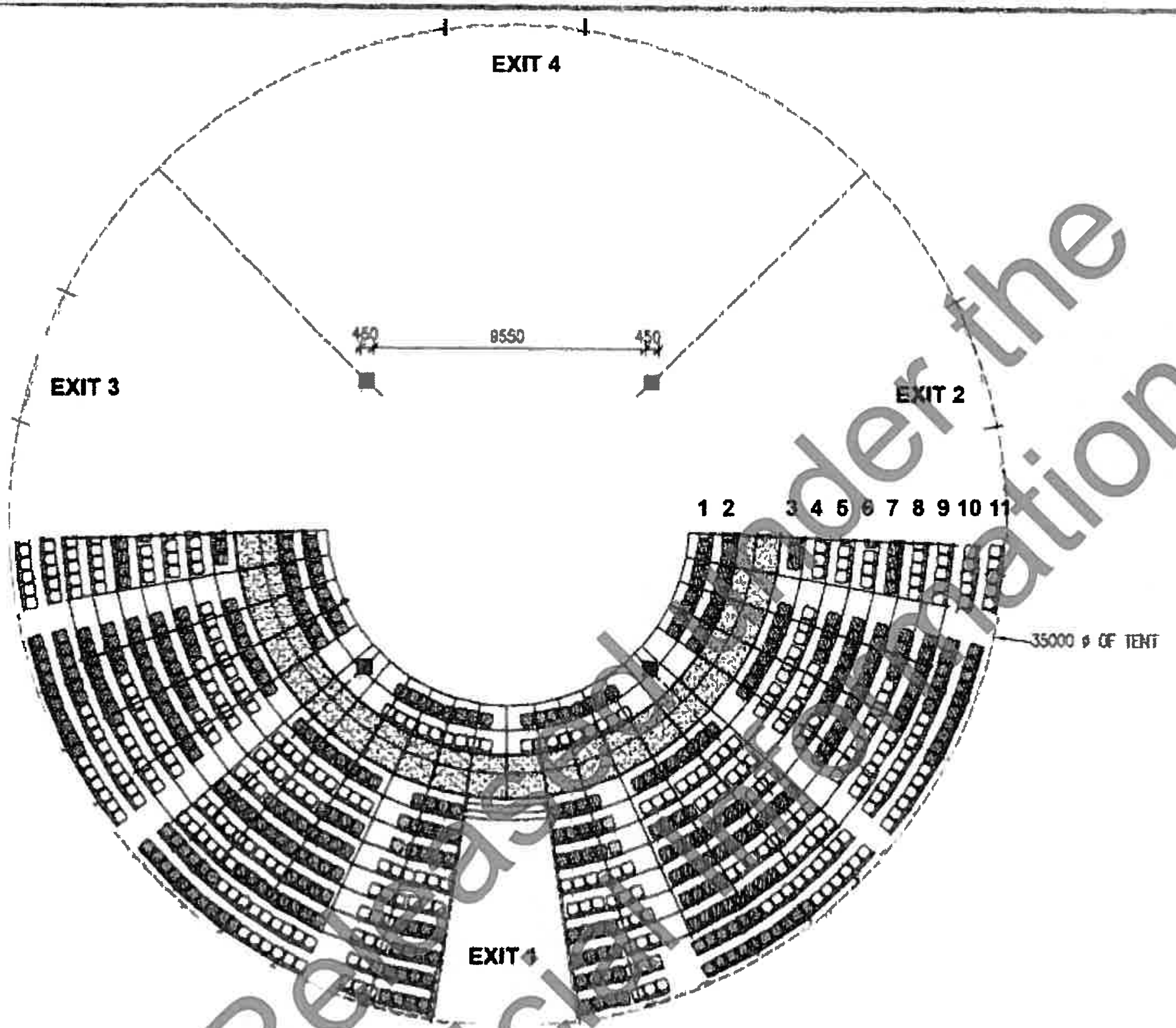
Key

FEB Issue





ONFIRE

Job Number: 1942
Date: 14 June 2013

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Key

FEB Issue

Bespoke Seating layout as designed for Zirka Circus by Ullrich Aluminium

Rows 1 and 2 VIP/ Ringside up to 90 seats

Rows 3 -11 Elevated up to 600 seats

ZIRKA CIRCUS 24 SECTION STADIUM DESIGN

ONFIRE

Job Number: 1942
Date: 14 June 2013

1. These drawings are to be read in conjunction with the Design Advice by OnFire Consulting Ltd.
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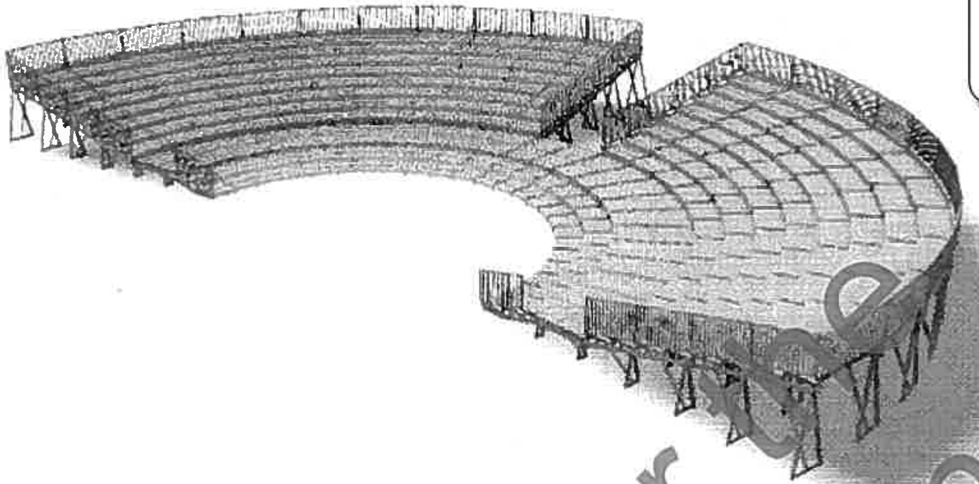
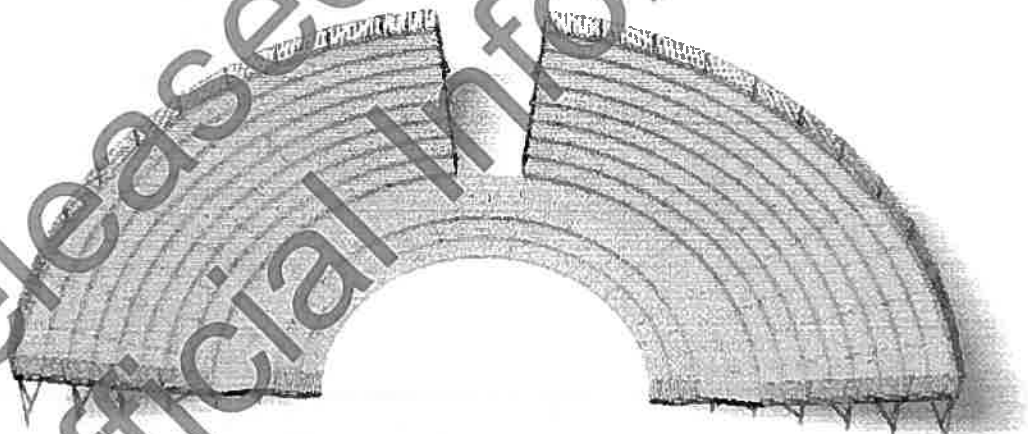
Key

FEB Issue





ZIRKA CIRCUS 24 SECTION STADIUM DESIGN

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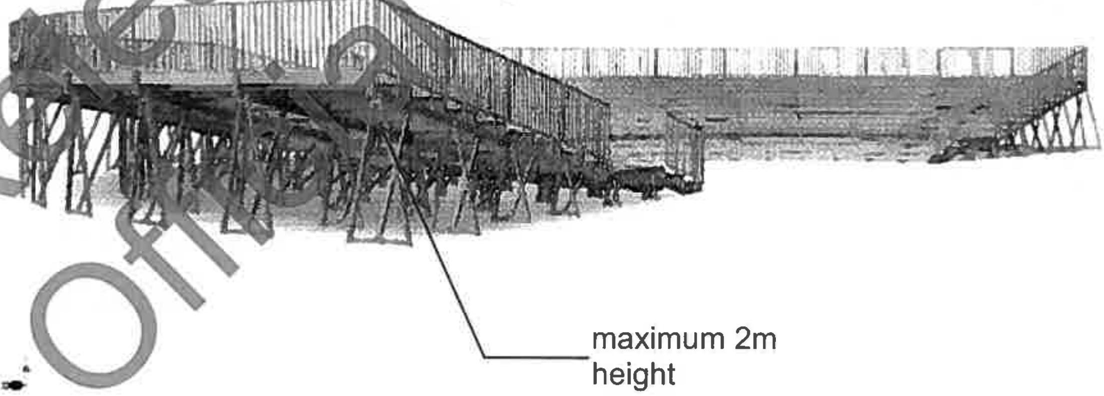

ZIRKA CIRCUS 24 SECTION STADIUM DESIGN

ONFIRE

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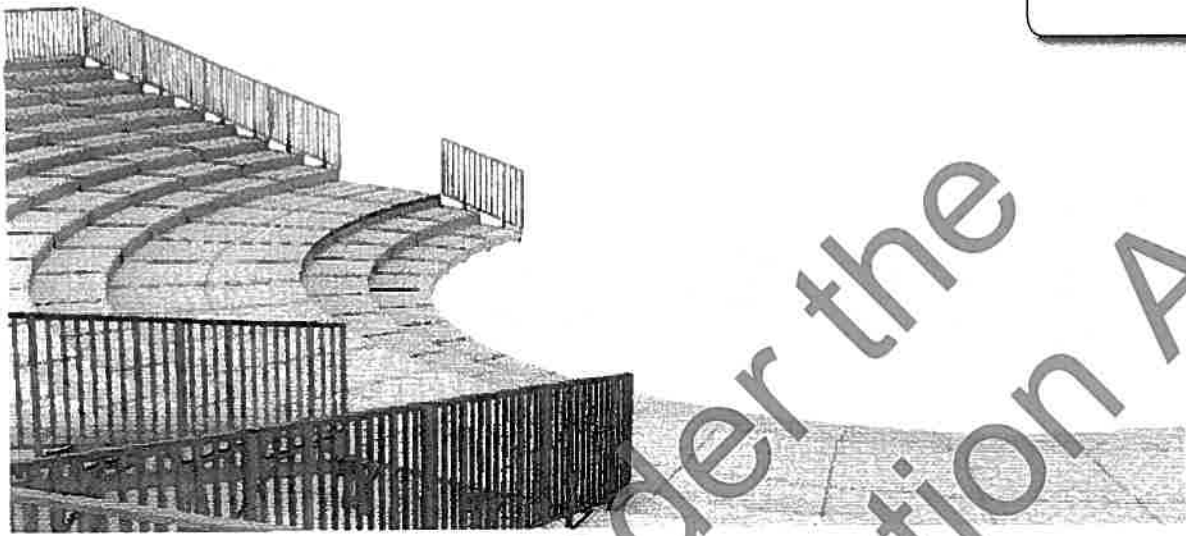

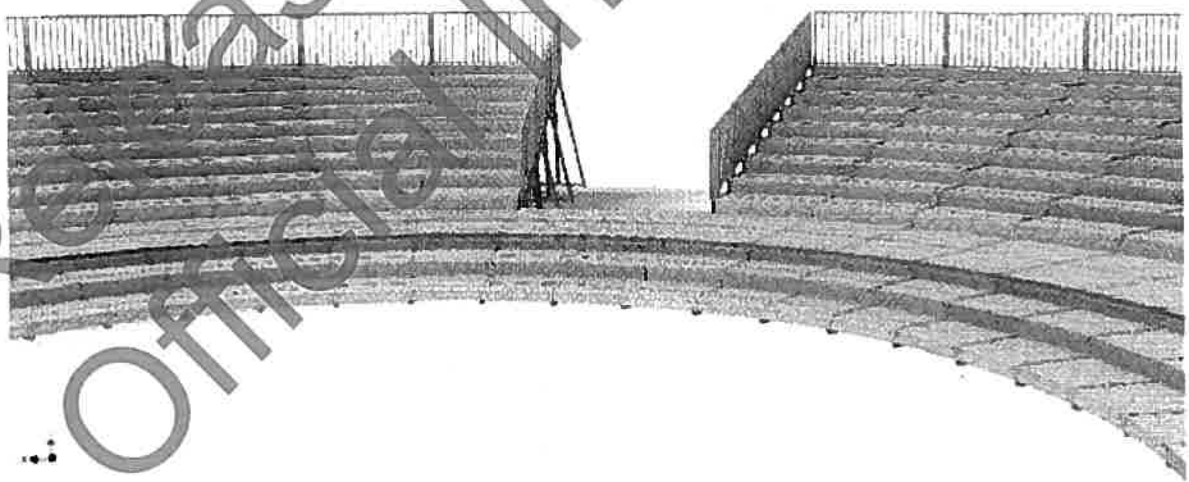

Ullrich Hamilton Fabrication

ONFIRE

Job Number: 1942
Date: 14 June 2013

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2. These drawings are intended to support the fire report, they do not show all of the required fire safety features in the report and are not detailed construction drawings.

Key

FEB Issue

ZIRKA CIRCUS

increasing to 690 with proposed new seating

Evacuation Plan for Circus Marquee

Capacity of Marquee 495 Max (including Staff)
Average capacity 250
Wardens/Ushers are responsible for the orderly evacuation of Patrons in the case of any emergency.

Four main designated exit areas –

Exit 1 Main Entrance
For the Evacuation of patrons in centre wedge of elevated seating to the immediate left and right of main Exit and VIP seating directly in front of Exit.

Exit 2 Stage Right
For evacuation of ringside and VIP seats in right hand half of Marquee, and elevated seating in the right hand third of Marquee.

Exit 3 Stage Left
For evacuation of ringside and VIP seats in left hand half of Marquee, and elevated seating in the left hand third of Marquee.

Exit 4 Backstage
Any staff not involved in evacuation process will exit via Backstage door. There is no public access to the Backstage area.

Two ushers are dedicated to each Exit to ensure the doors are held open. Wardens are dedicated to each "wedge" of seating to ensure patrons exit via closest Exit.

On exiting all patrons will be ushered to main assembly area in front of circus tent by outside staff.

Evacuation procedures coordinated by the designated team under the supervision of the tour manager, Jeni Hou.

For full details see attached Certified Fire Design.

ONFIRE
Job Number: 1942
Date: 14 June 2013
1. These drawings are to be read in conjunction with the Design Advice by OnFire Consulting Ltd.
2. These drawings are intended to support the fire report, they do not show all of the required fire safety features in the report and are not detailed construction drawings.
Key

FEB Issue

ZIRKA CIRCUS

Zirka Circus Health and Safety Operating Procedures:

During Set up and Pull Down

1. All workplace safety and OSH safety regulations will be observed.
2. Only Zirka Circus staff are permitted within perimeter of set up.
3. Public are welcome to watch (set up is usually on Public Parks or Reserves) but will be kept at least 10m outside Marquee perimeter by staff.

Once Set Up

4. Access areas within Zirka Circus set up will be well lit and accessible for all staff members and public. If sufficient lighting is unavailable portable lighting will be provided.
5. Trip hazards will be indentified, isolated, and affected parties will be made aware when appropriate.
6. Fire and evacuation procedures have been adopted in line with Approved Fire Design recommendations and approved when inspected pre show time.
7. Fire extinguishers are located at main points within Zirka Circus set up.
8. Kitchen facilities are set up in accordance to safety/health regulations.
9. Toilets/showers are provided and maintained by Zirka Circus to ensure convenience is met when needed.
10. All grey water/sewage is held in containment tanks until disposal in appropriately certified dump stations.
11. Disposal of Rubbish in Wheelie bins strategically placed around the site ensures a continued "Tidy" appearance and clean and healthy environment. Bins are decanted into a Skip on site.
12. All rubbish generated is disposed of via approved local contractors or at appropriately certified dump stations.

Security Plan

1. Zirka Circus staff undertake all security arrangements.
2. During non-show times, whenever onsite, staff keep watch over facilities.
3. Should security issues arise involving members of public, staff will contact Police should the need arise.

First Aid Plan

1. First Aid kits kept in management caravan and Ticket office and available for general use when required.
2. If located with a locked premises, a relevant gate key will be requested to provide emergency vehicle access.
3. A qualified first aider is always on site.
4. In the event of a first aid emergency, staff will immediately contact relevant Emergency Service, secure the site and ensure staff and patrons are removed from exposure to any further harm.
5. Staff will work with emergency services and injured party as instructed until service arrives.
6. Steps such as ensuring airway is unobstructed, checking pulse, placing in recovery position (if appropriate) will be taken.

Contacts

General Manager:	James Finlayson s 9(2)(a)
Managing Director:	Jeni Hou s 9(2)(a)
Bookings and other enquiries	0800 2 ZIRKA (0800 294752)

AWTA TEXTILE TESTING

Australian Wool Testing Authority Ltd – trading as AWTA Textile Testing
A.B.N. 43 006 014 106
1st Floor, 191 Racecourse Road, Flemington, Victoria 3031
P.O. Box 240, North Melbourne, Victoria 3051
Phone (03) 9371 2400 Fax (03) 9371 2499

TEST REPORT

CLIENT : BAYTEX MANUFACTURING LTD
52 NEWTON STREET
MT MAUNGANUI SOUTH
NEW ZEALAND

TEST NUMBER : 7-552010-BO
DATE : 30/04/2007
ORDER NUMBER : 25430702BT

SAMPLE DESCRIPTION Clients ref: "Ferrari precontraint 702 CH Big top"
PVC coated fabric
Colour: Yellow/blue
Enduse: Architectural textiles

THESE RESULTS MUST BE CONSIDERED IN CONJUNCTION WITH THE COMMENTS ON THE FOLLOWING PAGE(S)

Material Specification provided by client:
Nominal composition: PES yarn coated with PVC flame retardant on both sides and varnished
Nominal mass: 830g/m2
Nominal thickness: 064mm

AS/NZS 1530.3 - 1999 Simultaneous determination of Ignitability, Flame Propagation, Heat Release and Smoke Release

RESULTS: Face tested: Both

Date tested: 27/04/2007

	Mean		Standard Error
Ignition time	4.01	min	0.12
Flame propagation time	22.4	s	1.9
Heat release integral	105.4	kJ/m2	3.5
Smoke release, log d	0.2503		0.0139
Optical density, d	1.7839	/m	

Number of specimens ignited: 6

Number of specimens tested: 6

REGULATORY INDICES:

Ignitability Index	16	Range 0-20
Spread of Flame Index	9	Range 0-10
Heat Evolved Index	4	Range 0-10
Smoke Developed Index	8	Range 0-10

159805 2 (CONTINUED NEXT PAGE)

APPROVED SIGNATORY

MICHAEL A. JACKSON B.Sc.(Hons)
MANAGING DIRECTOR

0204/5/05

AWTA TEXTILE TESTING

Australian Wool Testing Authority Ltd – trading as AWTA Textile Testing
A.B.N. 43 006 014 106
1st Floor, 191 Racecourse Road, Flemington, Victoria 3031
P.O. Box 240, North Melbourne, Victoria 3051
Phone (03) 9371 2400 Fax (03) 9371 2499

TEST REPORT

CLIENT : BAYTEX MANUFACTURING LTD
52 NEWTON STREET
MT MAUNGANUI SOUTH
NEW ZEALAND

TEST NUMBER : 7-552010-BQ
DATE : 30/04/2007
ORDER NUMBER : 25430702BT

Comments:

These results only apply to the specimen mounted, as described in this report.

The results of this fire test may be used to directly assess fire hazard, but it should be recognized that a single test method will not provide a full assessment of fire hazard under all fire conditions.

The specimens were mounted to simulate use in an unsupported or free hanging mode. The results may be significantly different when mounted to simulate a wall cladding or upholstery application.

To allow free movement of sample during testing all corners were folded away from the clamps.

Each test specimen was sandwiched between two layers of galvanised welded square mesh made from wire of nominal diameter 0.8mm and nominal spacing of 12mm in both directions, stapled through at four points, each 100mm from the centre of the sample and the assembly clamped in four places.

APPROVED SIGNATORY

MICHAEL A. JACKSON B.Sc (Hons)
MANAGING DIRECTOR

AWTA TEXTILE TESTING

Australian Wool Testing Authority Ltd - trading as AWTA Textile Testing
A.B.N. 43 006 014 106
1st Floor, 191 Racecourse Road, Flemington, Victoria 3031
P.O. Box 240, North Melbourne, Victoria 3051
Phone (03) 9371 2400 Fax (03) 9371 2499

TEST REPORT

CLIENT : BAYTEX MANUFACTURING LTD
52 NEWTON STREET
MT MAUNGANUI SOUTH
NEW ZEALAND

TEST NUMBER : 7-552010-BO
DATE : 30/04/2007
ORDER NUMBER : 25430702BT

AS 1530.2-1993 — Test for Flammability of Materials

DATE TESTED: 19/04/2007

Flammability Index: 5 Range 0 - 100 for most material

		Length	Width	
Spread Factor: Range 0 - 40		4	3	
Heat Factor: Range 0 - upward		1	1	
Maximum height (d)	mean	4.6	4.3	
	cv	10.7	17.4	%
Time (t)	mean	N/A	N/A	s
	cv	N/A	N/A	%
Heat (a)	mean	2.1	2.0	degC min
	cv	9.8	0	%
No of specimens tested		6	6	

These test results relate only to the behaviour of the test specimens of the material under the particular conditions of the test, and they are not intended to be the sole criterion for assessing the potential fire hazard of the material in use

This Laboratory is accredited by the National Association of Testing Authorities, Australia, for:

Chemical Testing of Textiles & Related Products	Accreditation No. 983
Mechanical Testing of Textiles & Related Products	Accreditation No. 985
Heat & Temperature Measurement	Accreditation No. 1356

AWTA LIMITED

Baytex Manufacturing Co. Ltd.

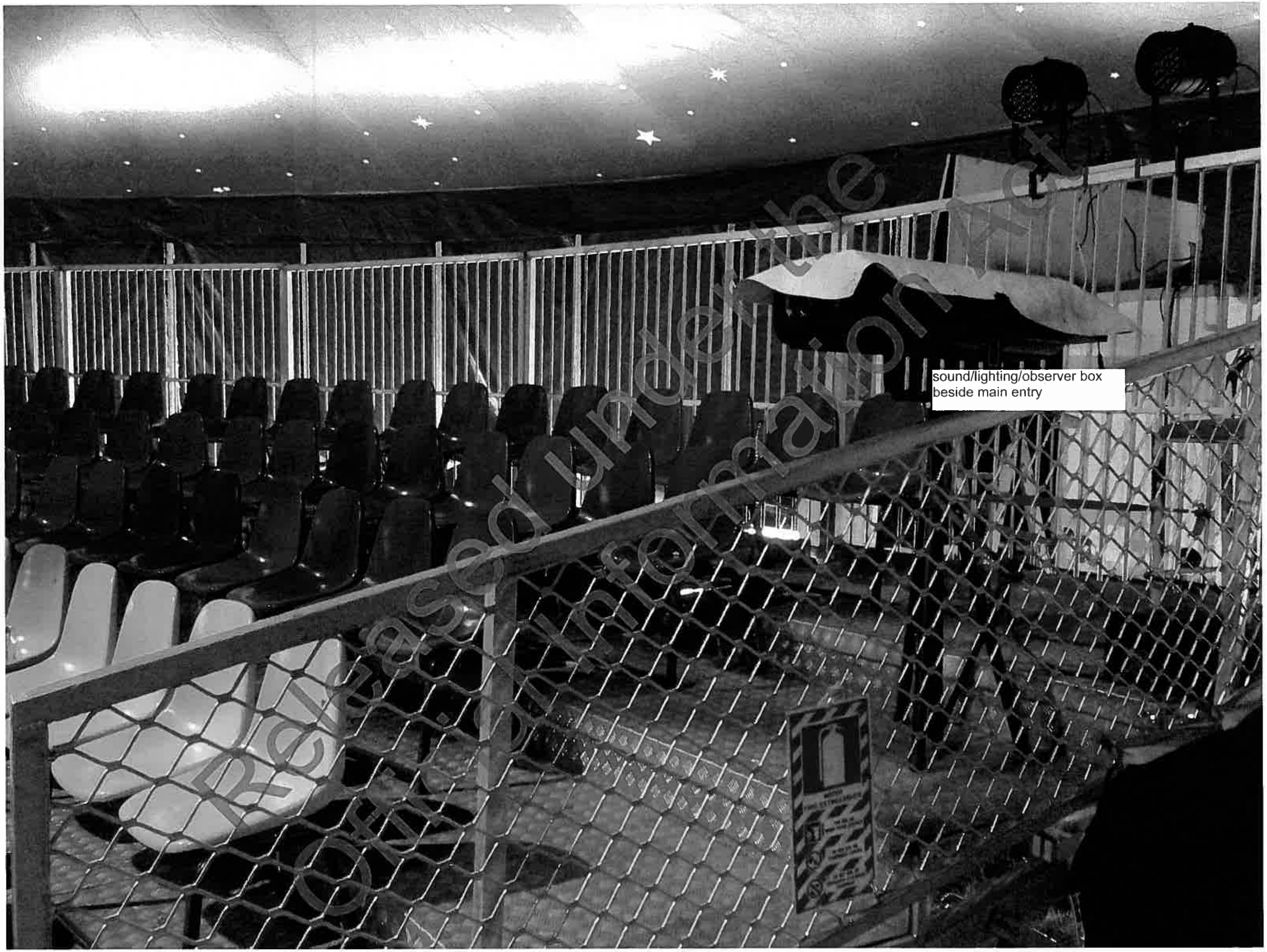
0204/5/05

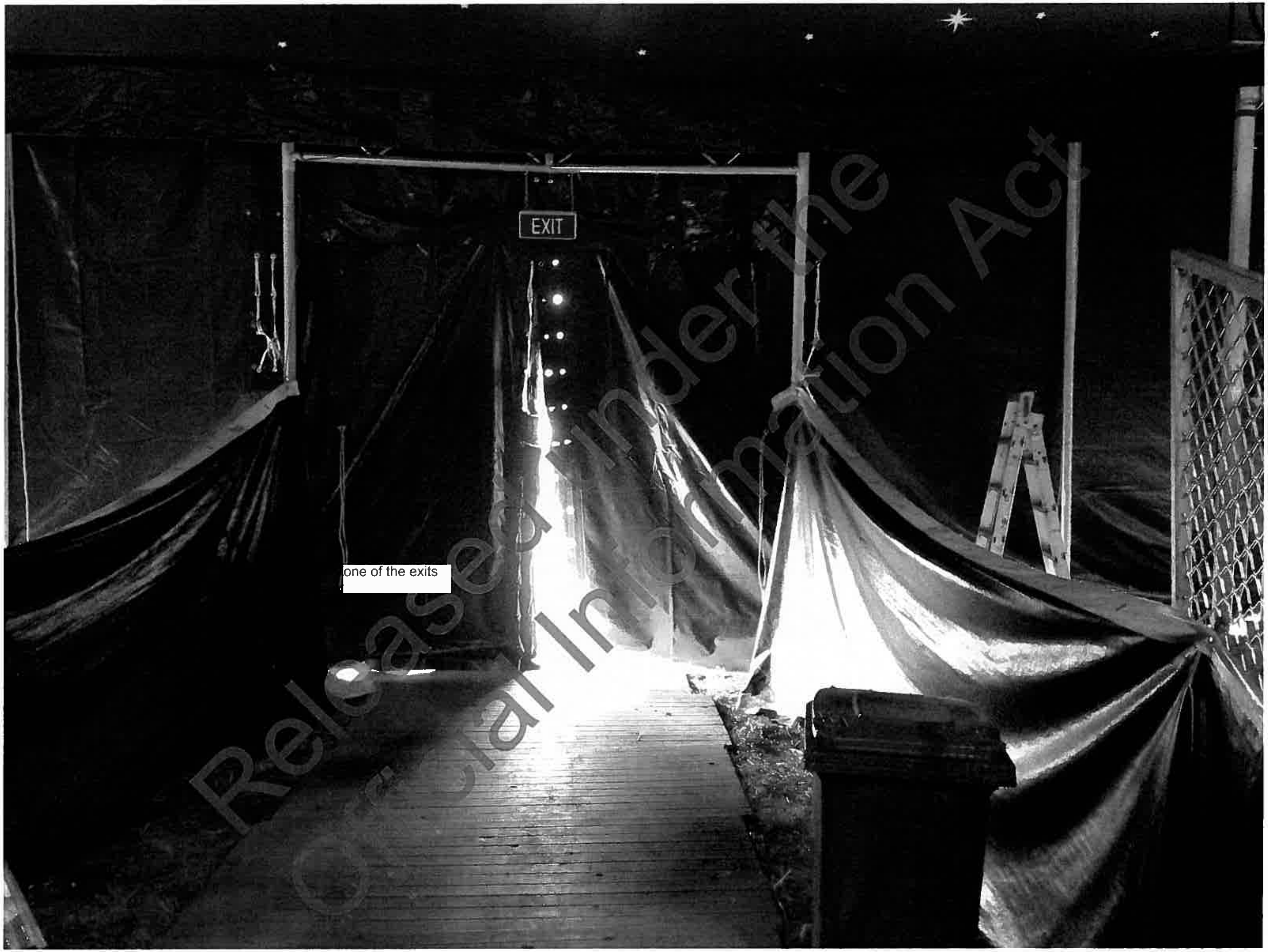
APPROVED SIGNATORY

MICHAEL A. JACKSON B Sc.(Hons)
MANAGING DIRECTOR


looking from main entry into circus ring and then towards back of stage


old seating
arrangement


sound/lighting/observer box
beside main entry


EXIT
one of the exits

typical tent flap door showing lacing
and exit signage

close up showing 'lacing' of tent doors
to enable quick pushing open and exit

looking up to the roof of the tent

note two of the four main 'kingpoles' from which the lighting and prop structure is supported


back stage area

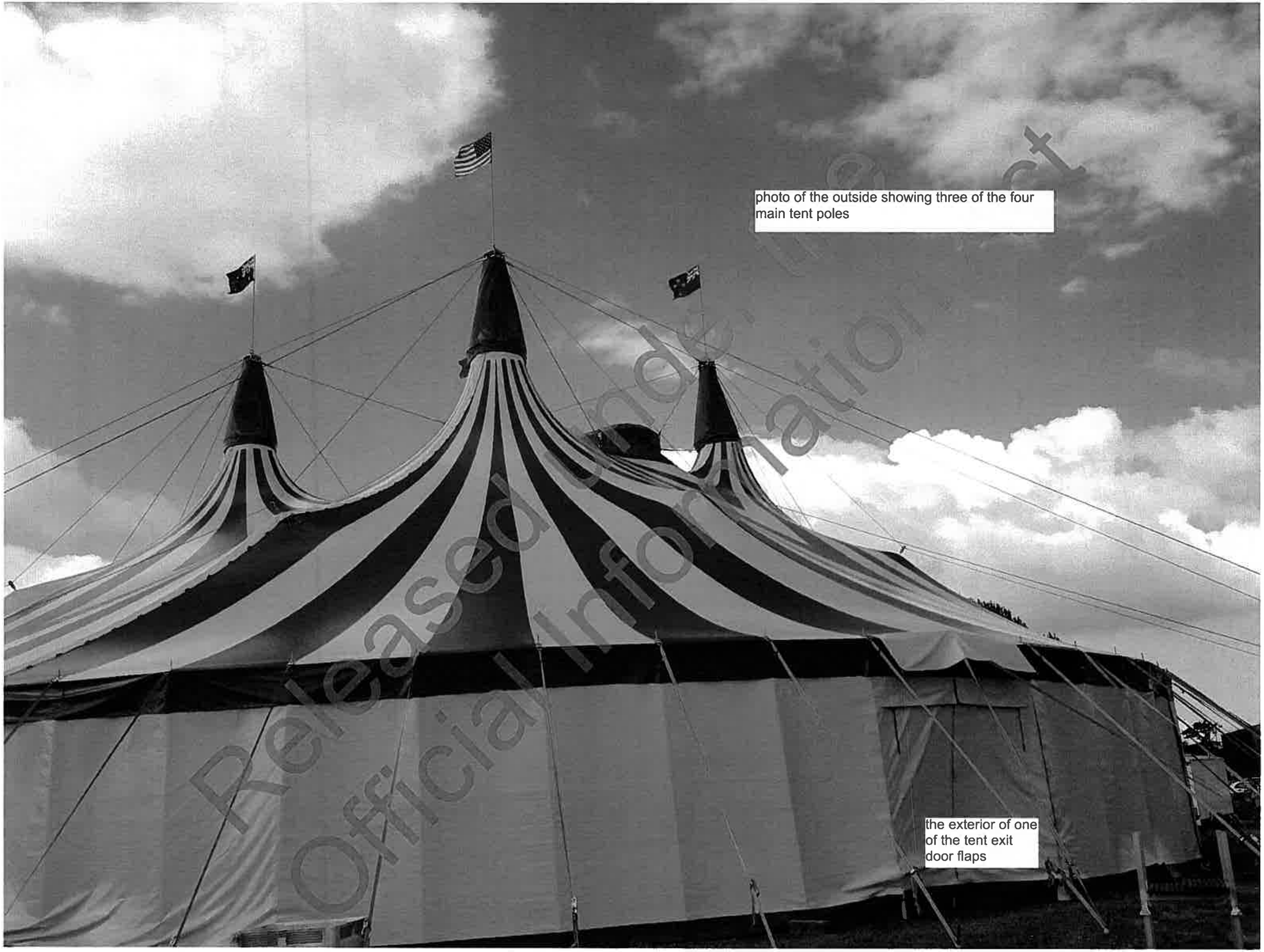


photo of the outside showing three of the four main tent poles
the exterior of one of the tent exit door flaps


underneath the existing seating - heater only used before performances and not during

8 APPENDIX 2 – Dimensions, B-Risk Setup and Vents

TENT FLOOR AREA

35m diameter
Area = 962m2

Equivalent Square Size = 31m x 31m

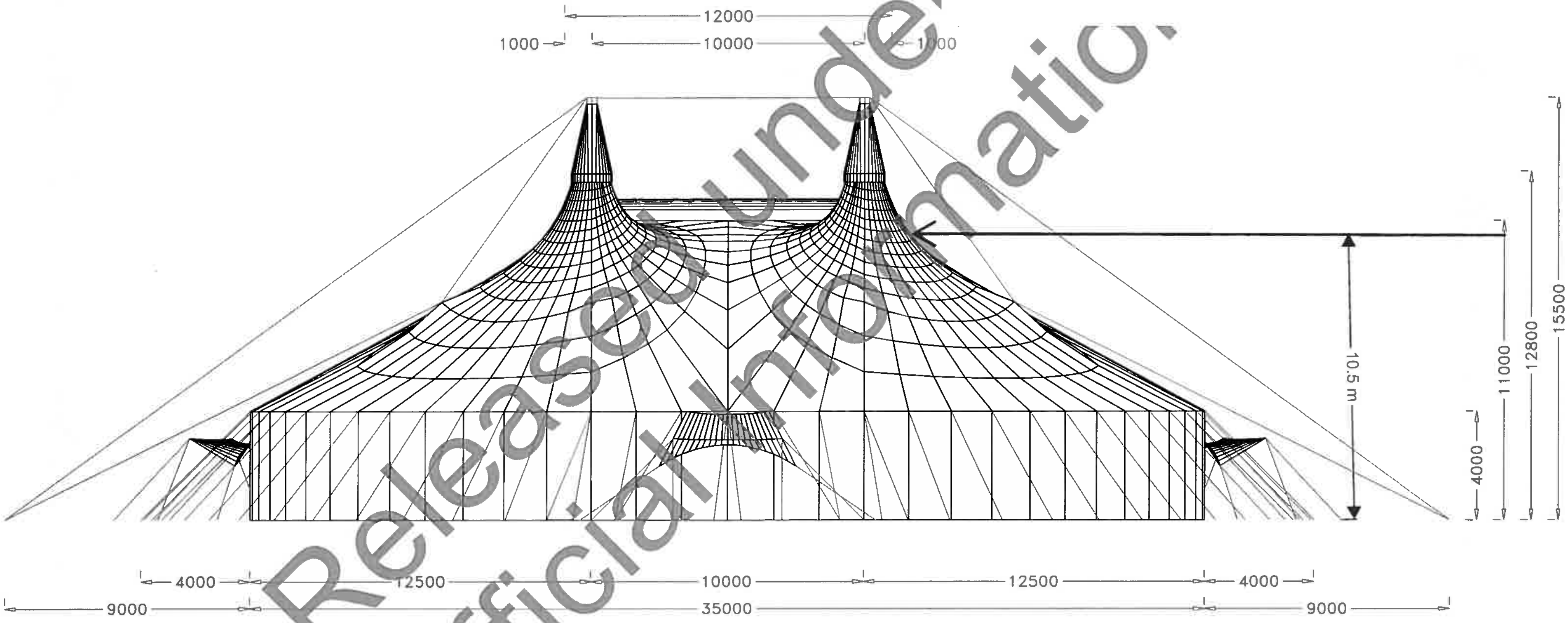
TENT HEIGHT

Knee height = 4m
Height to bottom of kingpoles = 10.5m
Kingpole height to be ignored

B-Risk Room to be modelled using a sloping roof between 4m and 10.5m

VENTS

1. Each kingpole (4 of) has natural venting
2. Each doorway has a triangular vent above it (3 of) once evacuation has started
3. Vent around the cupola (central structural piece at the top/centre of the tent)
4. Tent seams (2 of) 33m long, conservatively 15mm wide
5. Gap at top of side walls around the entire perimeter - conservatively 20mm wide



27 APPENDIX 7 – Drawings

1) These drawings are to be read in conjunction with the Design Advice by OnFire Consulting Ltd.

2) These drawings are intended to support the fire report, they do not show all of the required fire safety features in the report and are not detailed construction drawings

Key

EXIT Required illuminated exit sign, indicative locations to F8/AS1

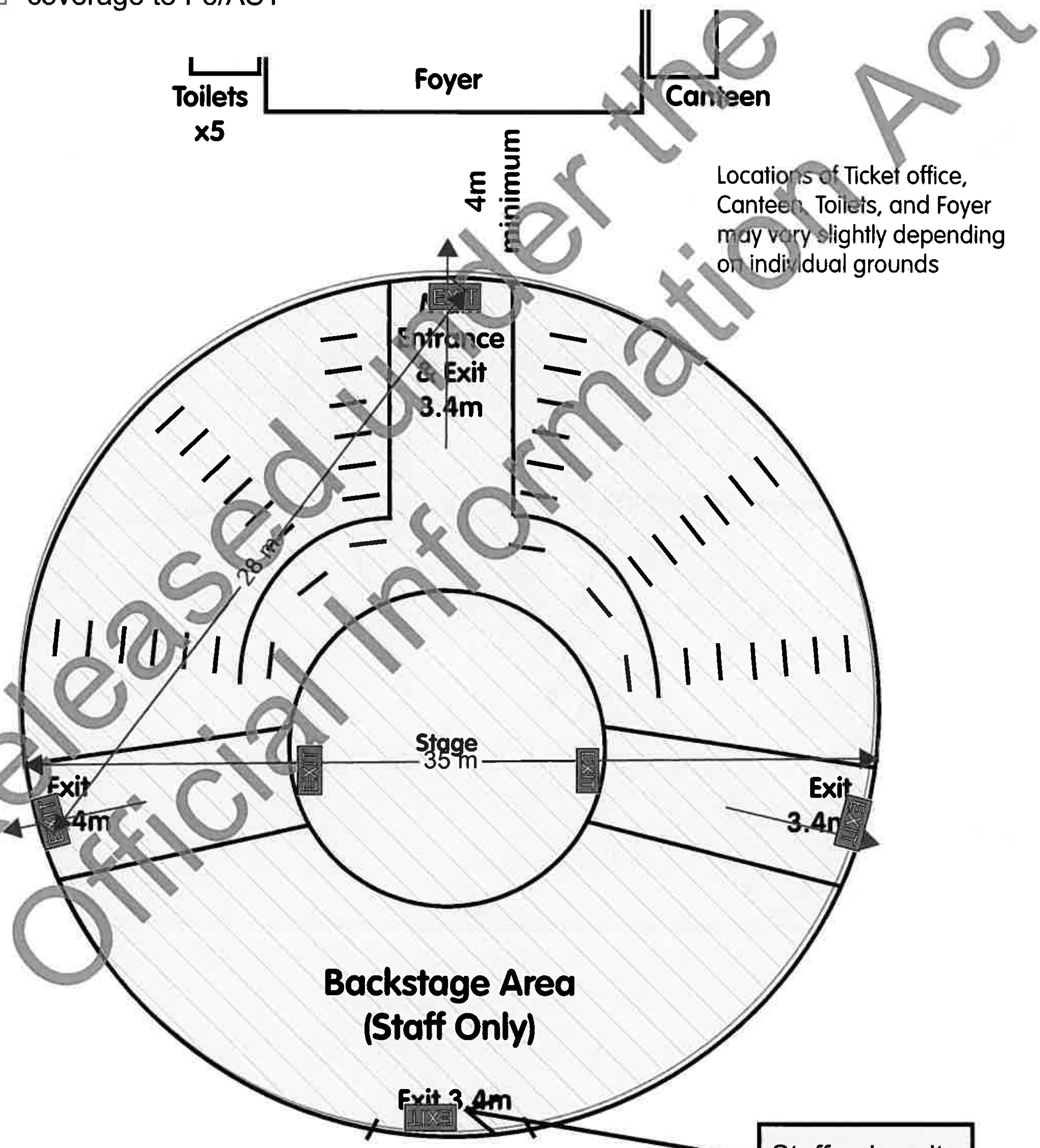
Required new emergency lighting coverage to F6/AS1

ONFIRE

Drawn: M. Andhe Date: 31/07/13
Sheet: Floor Plans
Issue: Fire Safety Design

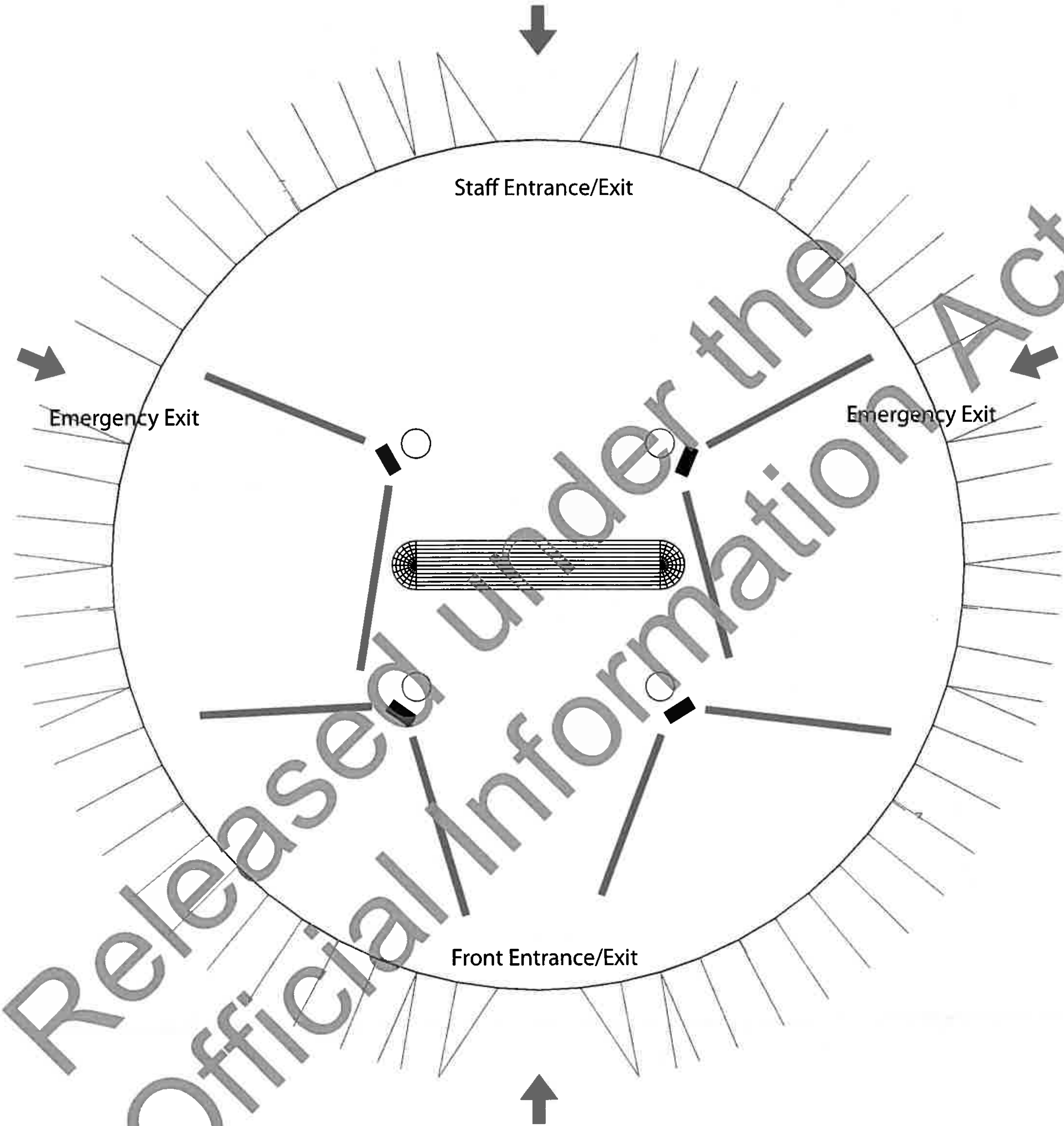
Project Title
Zirka Circus
Fire Safety Design

Job No.	Issue
1942	1



Circus Tent, 35m diameter

Emergency Light Positions



NZ $299.00
incl GST

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Zoom Image

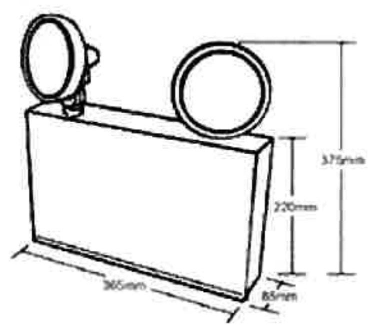
Product query

01707

10 Watt Emergency Flood

The M+HBardic Twin Halogen Floodlight emergency luminaire is designed to provide emergency lighting to large high ceiling areas, such as factories and warehouses.

The unit uses 2 x 10 Watt halogen spotlights



Features include

- Designed and tested to comply with AS/NZS 2293
- Automatic battery low cut out to prevent over discharge of the battery
- Available with Sealed Lead Acid of NiCad Batteries
- 8 minutes "off" delay – the luminaire remains illuminated for 8 minutes following restoration of the AC mains supply to allow High Bay lights to strike
- High temperature components for extended life
- Red LED indicates a healthy AC mains supply and functioning charger
- Test switch to test the emergency operation while AC mains supply is healthy

28 APPENDIX 8 - CORRESPONDENCE EMAILS

ONFIRE

Mell Quigley <admin@onfire.co.nz>

Re: Exemption for Kawerau

2 messages

Debbie Scott <debbie@onfire.co.nz> Wed, Jun 12, 2013 at 5:54 PM
To: James Finlayson <james@zirkacircus.com>
Cc: shayh@whakatane.co.nz, Mell Quigley <admin@onfire.co.nz>

Hi Shay

I understand that you've been talking to Zirka Circus about a Consent application.

I am in the process of working with Zirka to design the circus tent to the new Code C1-C6. I am doing this through MBIE as the peer reviewer as Zirka intend on applying for the Multi-proof application through them to enable their Consents to be easier in the future.

As I'm sure you'll understand this will take some time and we are only at the FEB part of the process. I visited the tent a month or so ago when it was at The Base in Hamilton and did an inspection and spoke to James Finlayson. We have also held a FEB meeting with the NZFS and MBIE in Auckland and I'm in process of updating the FEB report for their acceptance.

Other Council people in the past have been concerned with the tent flap/egress doors being tied together. I admit I was also concerned with this and didn't like the idea. However after visiting the tent I was very impressed with the way these doors open. The way they are tied together is called 'lacing' and its very clever and as soon as you push on it they open once the first knot is undone. The biggest issue with them is that this lacing is first knot whilst the tent is unoccupied for security reasons. Similar to what you might do if it was velcroed, you would need some locking device to stop anybody opening them at night time. Security locks are allowed by the compliance docs when buildings are unoccupied. The circus need, and have, a procedure in place to ensure that these doors are un-knotted (with lacing still in place) prior to the public occupying the tent. I've asked James to take a video of how the lacing works as its not until you actually see it you see how effective it is. I think it would be easier to open than velcro as it would be some industrial strength velcro that would be required to hold them heavy tent fabric I suspect.

I hope this explains where I'm at with it, as I said above its still early days with doing the new Code design but Zirka are aware they have to do it and we are working on it as fast as possible.

Please call if you have any queries.

Debbie Scott
Principal Fire Engineer
BE Hons, ME Dist. (Fire), FIPENZ, CPEng, PMSFPE

ONFIRE
OnFire Consulting Limited
477 Alexandra Street
PO Box 226
Te Awamutu 3840
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F. 07 870 6412
M. s 9(2)(a)
www.onfire.co.nz

On Tue, Jun 11, 2013 at 1:34 PM, James Finlayson <james@zirkacircus.com> wrote:

> Hi Debbie
> Our application for Kawerau is currently being processed.
> I wonder if it is possible for you to forward the same email you sent to the people in Tokoroa, to Shay in Whakatane?
>
> His email is shayh@whakatane.co.nz
>
> Thanks very much
> Regards
> James
>
> --
> James Finlayson
> General Manager
> Flaming Phoenix Entertainment Ltd (Zirka Circus)
>
> www.zirkacircus.com
>
> s 9(2)(a)

Debbie Scott <debbie@onfire.co.nz> Thu, Jun 13, 2013 at 10:02 AM
To: Mell Quigley <admin@onfire.co.nz>

Debbie Scott
Principal Fire Engineer
BE Hons, ME Dist. (Fire), FIPENZ, CPEng, PMSFPE

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---------- Forwarded message ----------
From: **Debbie Scott** <debbie@onfire.co.nz>
Date: Thu, Jun 13, 2013 at 9:32 AM
Subject: Re: Exemption for Kawerau
To: Shay Harrop <Shay.Harrop@whakatane.govt.nz>
Cc: "james@zirkacircus.com" <james@zirkacircus.com>, "dean@zirkacircus.com" <dean@zirkacircus.com>, "Meagan Edhouse (Meagan.Edhouse@kaweraudc.govt.nz)" <Meagan.Edhouse@kaweraudc.govt.nz>, Geoff Winship <Geoff.Winship@whakatane.govt.nz>

Hi Shay
Please see my comments inserted in red below.
Kind Regards
Debbie

Debbie Scott
Principal Fire Engineer
BE Hons, ME Dist. (Fire), FIPENZ, CPEng, PMSFPE

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On Thu, Jun 13, 2013 at 9:24 AM, Shay Harrop <Shay.Harrop@whakatane.govt.nz> wrote:

Hi Debbie

Thanks for your email I have a good understanding on how the hitch works for the door and can show how to tie it if you like.

As I am sure you understand my problem is accepting the fire compliance as a whole, the fire report provided under the old code even looks like it should have gone to the DRU. yes I can understand your difficulty, I believe other Councils have given exemptions for Consent on the basis they can't give Consent as we don't yet have the approval from MBIE for the multiproof acceptance as we aren't far enough down the process. So I guess what I am looking for is enough information to approve on reasonable grounds. Understand :-) To do this I think I need a better understanding on what the final requirements are likely to be e.g. will the numbers be limited? Numbers are likely to be more than what is currently expected at Kawerau, the circus is waiting to order new seating which will provide for more people (up to 690 depending on how my modelling works out). What type of warning system will be relied upon? Given the large open space and focussed activity both MBIE and NZFS have provisionally agreed in the FEB meeting to having only manual alarm systems. Similar to what the circus currently have. We will need to provide emergency lighting as part of this new design to meet F6 and James Finlayson is busy designing/organising this. Etc.

A copy of the notes from the initial FEB and any correspondence with MIBE and the NZFS may assist in giving the ability to head forward on this one. At this stage I only have an old FEB, its not quite right but I'll stamp DRAFT on it and send to you shortly.

I understand the circus is proposed to open tomorrow and at this stage I do not have enough information to allow me to issue the building consent and subsequently open for business. I will respond to any response as soon as it received please copy Geoff Winship Geoff.Winship@whakatane.govt.nz into any correspondence encase I get called out of the office.

I hope this helps, feel free to give me a call if you have any queries. Debbie

Kind regards

Shay Harrop | **Building Control Officer**

WHAKATĀNE DISTRICT COUNCIL | Private Bag 1002 | Whakatāne 3158
Phone 07 306 0500 **Ext** 7552 | **ddi** | **Mobile** s 9(2)(a) | **Fax** 07 307 0718
Email Shay.Harrop@whakatane.govt.nz | **Web** www.whakatane.govt.nz

From: Debbie Scott [mailto:debbie@onfire.co.nz]
Sent: Wednesday, 12 June 2013 5:59 p.m.
To: Shay Harrop; James Finlayson
Subject: Fwd: Exemption for Kawerau

[Quoted text hidden]