



Fire Engineering Brief
for
New Platform in Existing Warehouse
At
49 Stoneleigh Drive, Rolleston

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Fire Engineering Brief for New Platform in Existing Warehouse At 49 Stoneleigh Drive, Rolleston

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1.0 Purpose of Report

The purpose of this report is to provide the information proposed for the fire design of new storage platform in the existing warehouse as required by an Alternative Solution.

2.0 Stakeholders

The stakeholders involved in this project directly relevant to the fire design and FEB are:

- Selwyn District Council – Jenny Lilley
- Peer Reviewer on behalf of Council – Jonathan Nyman, Fire Review Solutions
- NZFS – To be confirmed
- Client – Graton Holdings Warehouse

3.0 Building Act/Waivers

The project involves the construction of a new storage platform within existing warehouse, the provisions of the New Zealand Building Act S.112 apply for means of escape of fire only. There are no waivers involved as part of this building consent.

4.0 Title/Subdivisions

The Warehouse building is under the one owner.

5.0 F6 and F8 Compliance

Emergency lighting/visibility in escape routes and exit signs are provided under previously approved consent report and maintained for this warehouse building to comply with NZBC F6 and F8.

Contractors to confirm if existing emergency lighting within the warehouse needs to be extended/altered to suit the proposed new platform layout.

6.0 Compliance Schedule

The Compliance Schedule for fire requirements will be noted in the Fire Engineering Reports.

7.0 Peer Review

The peer review is being done by Council – no additional reviewer required. .

8.0 Reference Information

The following drawings and information were used in preparing this fire report.

- Drawings by Lightening Construction Ltd. titled Graton Holdings Warehouse

Dwg #	Title	Date	Rev #
07	Offices – Reference Plan	25.02.15	B2
10	Elevations	10.02.15	B1
03	Warehouse and Offices – Site Floor Plan	10.02.15	B1

9.0 Building Description

The project involves construction of new storage platform within the existing warehouse at 49 Stoneleigh Drive, Rolleston.

The platform length is 33.5m, width is 13.5m and height is 2.4m. The platform is made of 25mm MDF timber floor supported by 90 X 45 timber nogs and steel racking structure. It has two means of escape; one from each side of the platform as shown on the drawing of Appendix A. Storage less than 3.0m is provided underneath the platform. On the top of the platform, racking is provided on a long side of the platform for storage which is less than 3.0m in height.

The addition of new platform will be considered under the Building Act S.112 and achieve the compliance of means of escape from fire by using an alternative solution.

9.1 Summary of Fire Safety Systems

The existing and proposed fire safety systems throughout the warehouse are as follows:

Existing

- A Type 3 automatic fire alarm system with heat detectors and manual call points as per NZS4512. A direct connection to the Fire Service is not required where a phone is available at all times for 111 calls.
- Emergency lighting/visibility in escape routes as per NZBC F6.
- Exit signs as per NZBC F8.

Proposed

- A Type 4 automatic fire alarm system with smoke detectors and manual call points as per NZS4512. A direct connection to the Fire Service is not required where a phone is available at all times for 111 calls.
- A Type 5 fire alarm system with smoke detector as per NZS 4512 in the sleeping room. A direct connection to the Fire Service is not required where a phone is available at all times for 111 calls.
- When any smoke detection system is activated, it shall turn off all air-conditioning and mechanical ventilation '*plant*' (if any). This does not apply to individual heat pumps.
- Emergency lighting/visibility in escape routes as per NZBC F6 to be maintained or extended/altered where necessary to suit the new platform layout.

- Exit signs as per NZBC F8 to be maintained.

9.2 Occupant Load

The occupants are typical of workplaces and not open to general public. In the office/warehouse area, the occupants are considered awake, alert, familiar with the building and capable of self-evacuation.

Note: The sleeping area is in a separate firecell (i.e. 60 minutes firecell) with independent means of egress directly to outside, and therefore is not included as part of the assessment for the new platform in the warehouse area.

The occupant load for the existing warehouse is calculated from occupant densities provided in C/AS5/Table 1.2. Total 15 occupants approved under existing warehouse. The occupant load is shown in the table below.

The client as noted there are no more than 5 people in the building.

Table 1: Occupant Load

Area	Occupant Density (m ² /p)	Area (m ²)	Occupant Load(p)
Existing Warehouse			
Warehouse area	100	900	9
Office	10	58	6
Total			15
Bedroom			
Bedroom	No. of bed	1 per single bed	1
New Platform			
Platform	100	452	5
Total:			5

9.3 Building Importance Level

For the purposes of C clauses, the building has an importance level of 2.

10.0 Building Code Compliance

The alternative solution provides a design methodology to demonstrate compliance with NZBC C clauses – Protection from Fire with respect to building act S.112. the Performance criteria of the building code are noted below.

10.1 C2—Prevention of fire occurring

C2.2 The maximum surface temperature of combustible building materials close to fixed appliances using controlled combustion and other fixed equipment when operating at their design level must not exceed 90°C

This clause is not applicable in this building.

C2.3 Fixed appliances using controlled combustion and other fixed equipment must be designed, constructed and installed so that there is a low probability of explosive or

hazardous conditions occurring within any spaces in or around the building that contains the appliances

This clause is not applicable in this building.

10.2 C3—Fire affecting areas beyond the fire source

C3.4 (a) materials used as internal surface linings in the following areas of buildings must meet the performance criteria specified below: (Group number Table)

This code clause is compiled for the existing warehouse wall and ceiling materials. Please refer previous fire report attached in Appendix A.

No new walls and ceiling proposed for the new platform.

C3.4 (b) floor surface materials in the following areas of buildings must meet the performance criteria specified below: (Critical Radiant Flux table)

This code clause is compiled for the existing warehouse floor surface materials. Please refer previous fire report attached in Appendix A.

The flooring for the new platform needs to comply as per the performance criteria, which will be included in the fire report.

C3.4 (c) suspended flexible fabrics and membrane structures used in the construction of buildings must have properties resulting in a low probability of injury or illness to persons not in close proximity to a fire source.

This code clause is compiled for the existing warehouse. Please refer previous fire report attached in Appendix A.

No new suspended flexible fabrics proposed for the new platform.

C3.5 Buildings must be designed and constructed so that fire does not spread more than 3.5 m vertically from the fire source over the external cladding of multi-level buildings.

This code clause is not applicable for this building.

C3.6 Buildings must be designed and constructed so that in the event of fire in the building the received radiation at the relevant boundary of the property does not exceed 30 kW/m² and at a distance of 1 m beyond the relevant boundary of the property does not exceed 16 kW/m².

This code clause is not applicable for this building under S.112.

C3.7 External walls of buildings that are located closer than 1 m to the relevant boundary of the property on which the building stands must either: (a) be constructed from materials which are not combustible building materials, or (b) for buildings in importance levels 3 and 4, be constructed from materials that, when subjected to a radiant flux of 30 kW/m², do not ignite for 30 minutes, or (c) for buildings in Importance Levels 1 and 2, be constructed from materials that, when subjected to a radiant flux of 30 kW/m², do not ignite for 15 minutes.

This code clause is not applicable for this building under S.112.

C3.8 Firecells located within 15 m of a relevant boundary that are not protected by an automatic fire sprinkler system, and that contain a fire load greater than 20 TJ or that have a floor area greater than 5,000 m² must be designed and constructed so that at the time that firefighters first apply water to the fire, the maximum radiation flux at 1.5 m above the floor is no greater than 4.5 kW/m² and the smoke layer is not less than 2 m above the floor

This code clause is not applicable for this building under S.112.

C3.9 Buildings must be designed and constructed with regard to the likelihood and consequence of failure of any fire safety system intended to control fire spread

This code clause is not applicable for this building under S.112.

10.3 C4—Movement to place of safety

C4.3 The evacuation time must allow occupants of a building to move to a place of safety in the event of a fire so that occupants are not exposed to any of the following: (a) a fractional effective dose of carbon monoxide greater than 0.3; (b) a fractional effective dose of thermal effects greater than 0.3; (c) conditions where, due to smoke obscuration, visibility is less than 10 m except in rooms of less than 100 m² where visibility may fall to 5 m

This code clause is applicable - refer to section 11 for the discussion on the proposed approach.

C4.4 Clause C4.3(b) and (c) do not apply where it is not possible to expose more than 1 000 occupants in a firecell protected with an automatic fire sprinkler system

This code clause is not applicable.

C4.5 Means of escape to a place of safety in buildings must be designed and constructed with regard to the likelihood and consequence of failure of any fire safety systems

This code clause is not applicable due to not having failure of any fire safety systems in the building.

10.4 C5—Access and safety for firefighting operations

C5.3 Buildings must be provided with access for fire service vehicles to a hard-standing from which there is an unobstructed path to the building within 20 m of: (a) the firefighter access into the building, and (b) the inlets to automatic fire sprinkler systems or fire hydrant systems, where these are installed

This code clause is not applicable for this building under S.112.

C5.4 Access for fire service vehicles in accordance with clause C5.3 must be provided to more than 1 side of firecells greater than 5,000 m² in floor area that are not protected by an automatic fire sprinkler system

This code clause is not applicable for this building under S.112.

C5.5 Buildings must be provided with the means to deliver water for firefighting to all parts of the building

This code clause is not applicable for this building under S.112.

C5.6 Buildings must be designed and constructed in a manner that will allow firefighters, taking into account the firefighters' personal protective equipment and standard training, to: (a) reach the floor of fire origin, (b) search the general area of fire origin, and (c) protect their means of egress

This code clause is not applicable for this building under S.112.

C5.7 Buildings must be provided with means of giving clear information to enable firefighters to: (a) establish the general location of the fire, (b) identify the fire safety systems available in the building, and (c) establish the presence of hazardous substances or process in the building

This code clause is not applicable for this building under S.112.

C5.8 Means to provide access for and safety of firefighters in buildings must be designed and constructed with regard to the likelihood and consequence of failure of any fire safety systems.

This code clause is not applicable for this building under S.112.

10.5 C6—Structural stability

C6.2 Structural systems in buildings that are necessary for structural stability in fire must be designed and constructed so that they remain stable during fire and after fire when required to protect other property taking into account: (a) the fire severity, (b) any automatic fire sprinkler systems within the buildings, (c) any other active fire safety systems that affect the fire severity and its impact on structural stability, and (d) the likelihood and consequence of failure of any fire safety systems that affect the fire severity and its impact on structural stability.

This code clause is not applicable for this building under S.112.

C6.3 Structural systems in buildings that are necessary to provide firefighters with safe access to floors for the purpose of conducting firefighting and rescue operations must be designed and constructed so that they remain stable during and after fire.

Please refer to section 11 discussion of design approach and correspondence with NZFS operation officer in Appendix A.

C6.4 Collapse of building elements that have lesser fire resistance must not cause the consequential collapse of elements that are required to have a higher fire resistance.

This code clause is not applicable for this building.

11.0 Discussion of the Proposed Design Approach

There are two aspects of means of escape from the platform that are addressed –

1. Egress from the platform by occupants on the platform.
2. Fire rating of the underside of the platform for NZFS operations.

The design approach is described below. The design approach below was confirmed with Council and reviewer via email. The reviewer's comment email is included in the Appendix.

Part 1 – Platform Egress

1. The means of escape from the platform will be discussed on an equivalency basis with the Acceptable Solutions.
2. Means of escape for people on the platform will be assessed to demonstrate that it is no worse than what would be permitted for a 35m² intermediate floor taking into account the Type 4 fire alarm system travel distances. Please refer Fire Drawing #2 attached in Appendix A.

Part 2 – Platform Fire Resistance

1. The platform construction is discussed in terms of fire resistance. The platform timber flooring is 25mm MDF (Medium Density Fibre) and supporting joists 90mm x 45mm and steel racking structure. A brief discussion on the inherent fire resistance rating of the provided structure will be included in the fire report, and will be used to compare the required egress time from the platform (i.e. RSET for the platform).
2. It is proposed to model a design fire under the platform using the C/VM2 methodology to obtain the smoke detector activation time (i.e. to obtain T_d for the RSET).
3. A Type 4 automatic smoke detection system is provided throughout the building including under the platform – with Type 5 in the sleeping firecell.
4. Fire rating of the underside of the platform takes into account the operational aspects of the Fire Service as supported by the email from Mike Gaskin, that the fire rating is not required.

11.1 Fire Modelling – B-RISK

A fire will be modelled underneath the platform to obtain the smoke detector activation time.

The zone model B-RISK is to be used for the analysis. It is considered suitable due to the simple geometry of the space. The zone model limits of Shape Factor and Q* will be checked and shown in the Fire Report. The challenging fire is proposed to be modelled as one room for the platform with dimensions (length 31.0m x width 13.3m at height of 2.4m) close to actual dimensions and as shown in the Figure below.

Note that the underside of the platform contains open racking, however are filled with products. It is proposed the ventilation openings are via the openings towards both ends of each aisle.

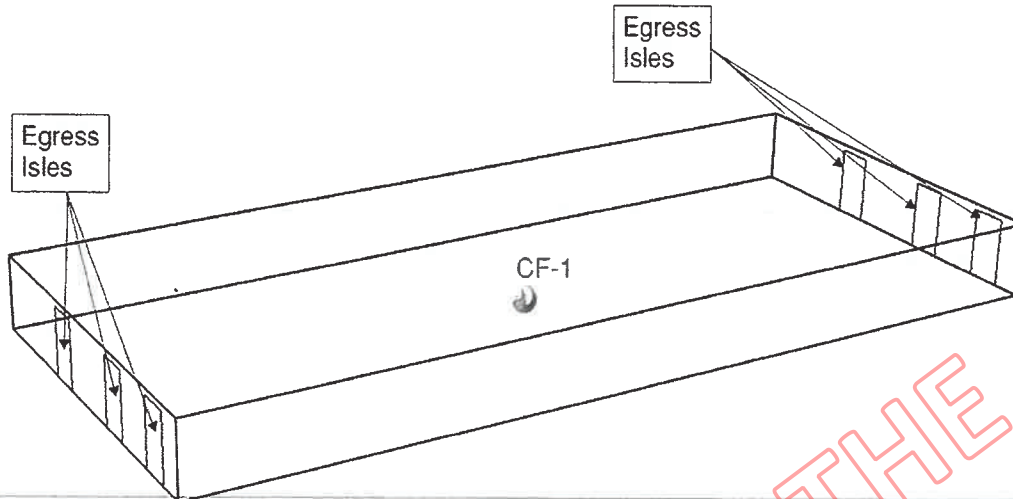


Figure: 1 Modelling Schematic of A Fire Underneath Platform

The key modelling inputs for the challenging fires to be used are summarised in the table below:

Table 2: Key Modelling Inputs

Clause / Table (C/VM2)	Criteria	Modelling Input
Design Fire Characteristics		
2.2.1n	<ul style="list-style-type: none"> Fire shall be located away from walls and corners and base of fire shall be located at a height of no more than 0.5m above floor level. 	<ul style="list-style-type: none"> Fire modelled in centre space of platform room and at a height of 0.5m.
Table 2.1	Pre-flashover design fire characteristics <ul style="list-style-type: none"> Fast t^2 fire – Peak HRR = 20MW and Fire growth rate = 0.0469 t^2 Peak HRRPUA = 250kW/m² Soot yield = 0.07 kg/kg CO yield = 0.04 kg/kg CO₂ yield = 1.5 kg/kg H₂O yield = 0.82 kg/kg Energy yield = 20MJ/kg Radiative fraction = 0.35 Fuel = CH₂O_{0.5} 	<ul style="list-style-type: none"> A Fast t^2 fire modelled in centre space with characteristics as per C/VM2.
Detection Criteria		
Table 3.2	Smoke detectors <ul style="list-style-type: none"> OD = 0.097m⁻¹ Radial distance = 7m Distance below ceiling = 25mm 	Smoke detector with detection criteria as per C/VM2.

11.2 RSET Analysis

Based on C/VM2/3.2, the equations to determine RSET for the occupants on the platform are:

Table 3: Equations to Calculate RSET

Equation	Variables
$RSET = T_d + T_n + T_{pre} + (T_{trav} \text{ OR } T_{flow})$	T_d – detection time – smoke detection used T_n – time from detection to notification T_{pre} – time from notification to evacuation begins T_{trav} – time spent to move to a place of safety T_{flow} – time spent in congested flow
$T_{trav} = L_{trav} / S$ $S = k - a k D_{space}$	L_{trav} = travel distance (m) $k = 1.4$ for horizontal travel $a = 0.266$ D_{space} = occupant density of the space
$T_{flow} = \text{Occupant Load} / F$ $F = (1 - a D) k D_{flow} W_{eff}$	$a = 0.266$ D_{flow} = occupant density near flow constriction = 1.9 persons/m ² $k = 1.4$ for horizontal travel W_{eff} = effective width of component being traversed (m)

The RSET is to be calculated as shown in the table below:

Table 4: RSET calculation

Reference	Parameter	Time (seconds)
Smoke detector activation time	T_d	TBC
C/VM2/3.2.2	T_n	30
C/VM2/Table 3.3	T_{pre}	30 (i.e. platform is open and within the room of fire origin)
$T_{trav} = L_{trav} / S$ $S = 1.2$	T_{trav}	TBC

11.3 Discussion of Platform Fire Resistance

The platform supporting elements are timber joists 90mm x 45mm and steel racking structure.

The timber joists will be assessed using the char rates as shown in AS 1720.4.

A brief discussion on the inherent fire resistance rating of the provided structure will be included in the fire report, and will be used to compare the required egress time from the platform (i.e. RSET for the platform).

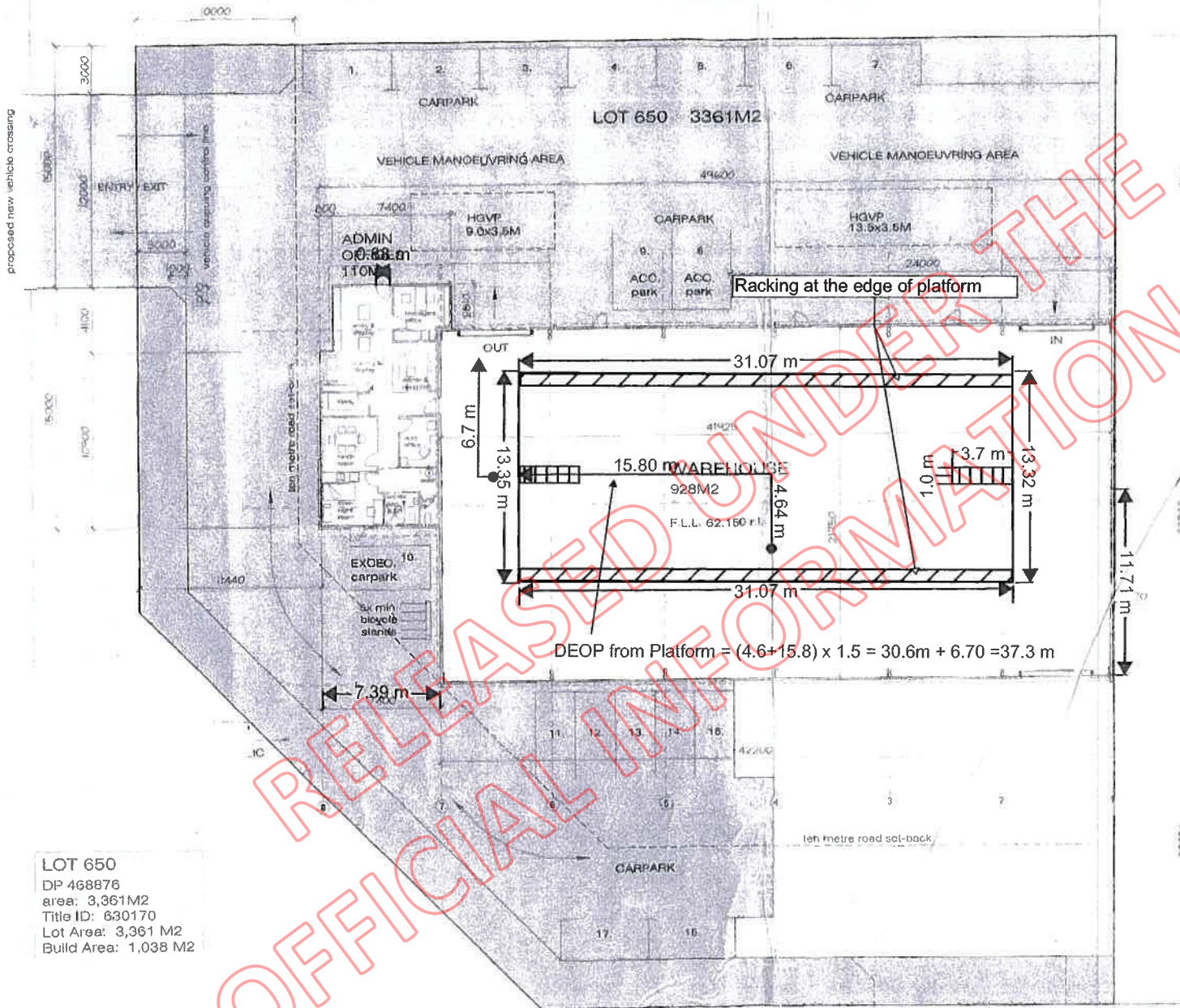
12.0 References

- Extract from the New Zealand Building Code: Clauses C1 – C6 Protection from Fire
- C/VM2 *Verification Method: Framework for Fire Safety Design*, Amendment 4, 1 July 2014. Department of Building & Housing, Wellington, NZ.
- AS 1720.4 – 2006 Timber Structures Part 4: Fire resistance for structural adequacy of timber members.

Appendix A – Drawings

Dwg #	Rev #	Date	Description
Fire #1	Rev 0	7 October 2016	Platform MOE Plan
Fire #2	Rev 0	7 October 2016	MOE plan from 35m2 Platform
Fire #3	Rev 0	7 October 2016	Warehouse MOE Plan
-	Issue A	26 Jan 2015	TM Consultants – Fire Design Report
Email	-	15 August 2016	NZFS Correspondence
Email	-	5 September 2016	Peer reviewer Correspondence
Email	-	5 September 2016	Council Correspondence

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- notes:
1. READ IN CONJUNCTION WITH TMCO CIVIL & HYDRAULIC DOCUMENTS RE STORMWATER & SITE PAVING LEVELS ETC
 2. PARKING PROVIDED
 - 17x Carpark Incl. 2x Mobility/Accessible parks
 - 1x 13.5x3.5M HGVP
 - 1x 9.0x3.5M HGVP
 - 5x Bicycle stands

Project # 162030 Drawing # Fire#1 Date : 7 October 2016 Revision # Rev0	Enlightened SOLUTIONS
Sketch Title : Platform Means of Escape	
s 9(2)(a)	
<p>Note:</p> <ol style="list-style-type: none"> 1. These drawings are intended to support the fire report. They do not show all of the required fire safety features specified in our fire report. 2. This drawing must not be considered as a detailed construction drawing. 3. Unless instructed otherwise by the fire engineer, all fire separations must extend to the underside of the slab or floor/roof cladding above with all gaps at the junction appropriately fire and smoke stopped. 4. Penetrations in Fire/Smoke barriers are to be appropriately sealed in accordance with manufacturers specifications. 	
<p>Legend:</p> <p>← 2.4 m ● Travel Distance</p>	

LOT 650
DP 468876
area: 3,361M2
Title ID: 630170
Lot Area: 3,361 M2
Build Area: 1,038 M2

WAREHOUSE AND OFFICES - SITE FLOOR PLAN
1:250 (on A3 paper)

Graton Holdings Warehouse
49 STONELEIGH DR. ROLLESTON
6 / 16 Newtown Street, BROMLEY, CHCH
s 9(2)(a) E. kevin@lightning.co.nz

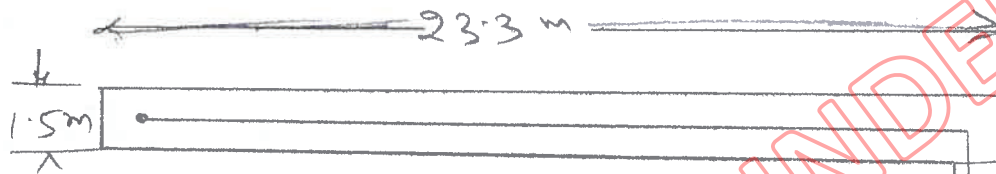
lightning CONSTRUCTION LTD

Scale: 1:250	Issue: B1	SHT. of 00	03
Date: 10-02-15			

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Equivalent to 35 m^2 (C/AS 5).

$$\text{Floor area} = 1.5 \text{ m} \times 23.3 \text{ m} = 35 \text{ m}^2.$$



Project # 162030
Drawing # Fire#2
Date : 7 October 2016
Revision # Rev0
Sketch Title : Platform Notes

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s 9(2)(a) www.enlightenedsolutions.co.nz

Worst case DEOP = $(22.3 + 3.7) \times 1.5 = 39.0 \text{ m} < 50.0 \text{ m}$.
(single means of escape)

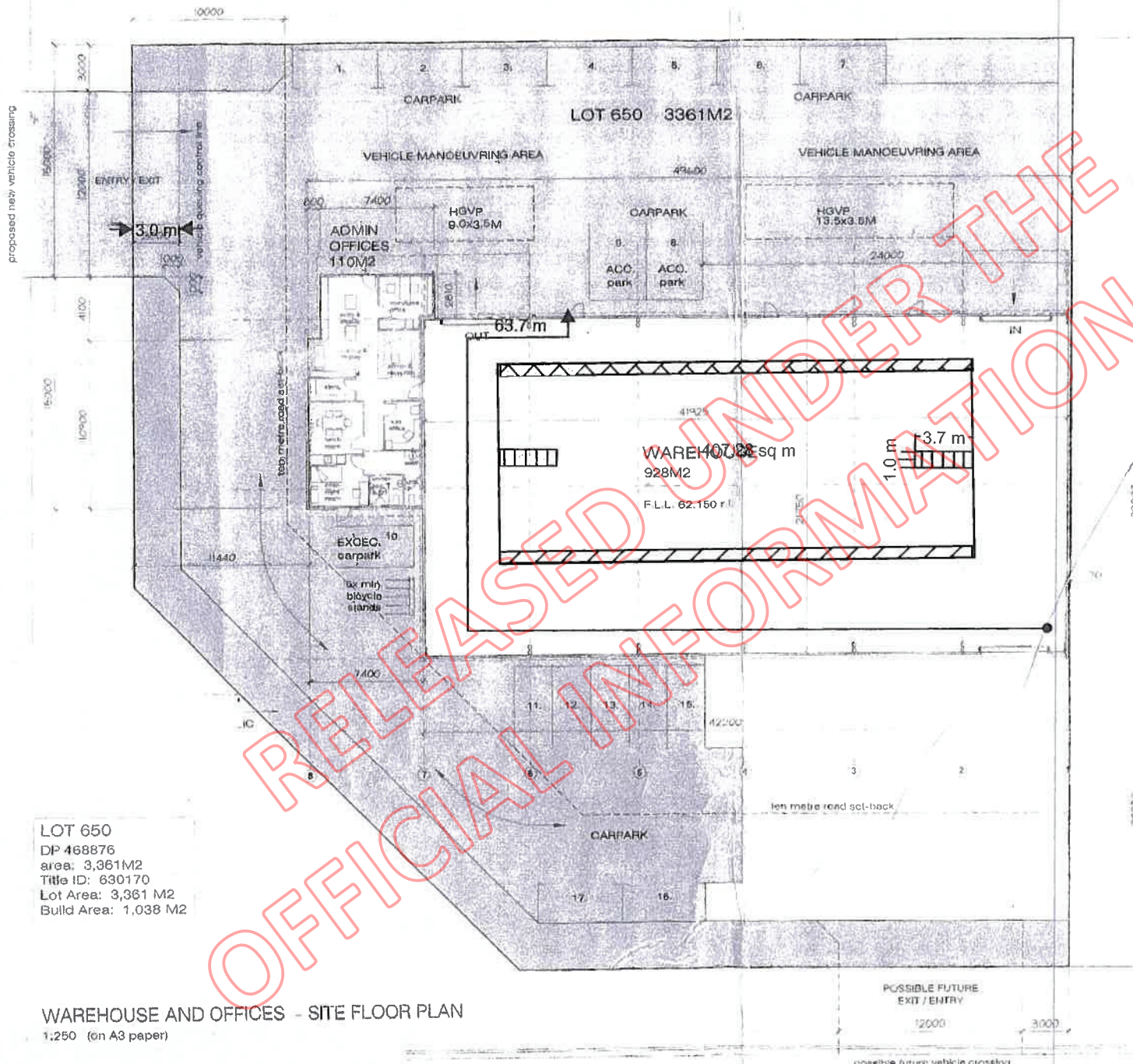
In Existing warehouse - platform has two means of escape. (Refer FIRE #1)

$$\text{DEOP} = (4.6 + 15.8) \times 1.5 = 30.6 \text{ m} + 6.7 = 37.3 \text{ m} < 39.0 \text{ m (C/AS 5)}$$

provided platform travel distance is not worse than the 35 m^2 mezzanine floor as per C/AS 5.

Note:

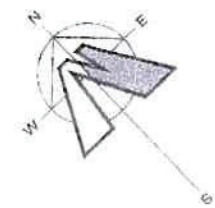
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4. Penetrations in Fire/Smoke barriers are to be appropriately sealed in accordance with manufacturers specifications.



proposed new vehicle crossing

LOT 650
 DP 468876
 area: 3,361M2
 Title ID: 630170
 Lot Area: 3,361 M2
 Build Area: 1,038 M2

WAREHOUSE AND OFFICES - SITE FLOOR PLAN
 1:250 (on A3 paper)



- notes:
1. READ IN CONJUNCTION WITH TMCO CIVIL & HYDRAULIC DOCUMENTS RE STORMWATER & SITE PAVING LEVELS ETC
 2. PARKING PROVIDED
 17x Carparks Incl 2x Mobility/Accessible parks
 1x 13.5x3.5M HGVP
 1x 9.0x3.5M HGVP
 5x Bicycle stands

Project # 162030	Enlightened SOLUTIONS
Drawing # Fire#3	
Date : 7 October 2016	
Revision # Rev0	
Sketch Title : Warehouse Means of Escape	
s 9(2)(a)	
<p>Note:</p> <ol style="list-style-type: none"> 1. These drawings are intended to support the fire report. They do not show all of the required fire safety features specified in our fire report. 2. This drawing must not be considered as a detailed construction drawing. 3. Unless instructed otherwise by the fire engineer, all fire separations must extend to the underside of the slab or floor/roof cladding above with all gaps at the junction appropriately fire and smoke stopped. 4. Penetrations in Fire/Smoke barriers are to be appropriately sealed in accordance with manufacturers specifications. 	
<p>Legend:</p> <p>2.4 m Travel Distance</p>	

Graton Holdings Warehouse	
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6 / 16 Newtown Street. BROMLEY, CHCH	
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