Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

GUIDANCE NOTES FOR ACHIEVING A CODE COMPLIANCE CERTIFICATE FOR FIRE SAFETY SYSTEMS HWCP ZONE 1 ANCHOR TENANT AND CHILDCARE CENTRE, INVERCARGILL

The sprinkler system installer is to provide a fully completed certificate of completion on satisfactory completion of the installation and commissioning tests. The certificate is to be in a form meeting the requirements of the NZ building Code and associated Standard NZS 4541:2013, and to be signed by suitably qualified personnel such as FPIS Ltd, AON, or similar. The sprinkler system in conjunction with the manual call point system is to be Type 6 in accordance with the Building Consent. (*Note this work will only be fully completed when the subsequent Zone 2 is in construction and the Class A water supply and sprinkler valve set installed. Notwithstanding this, as an interim, the associated statements for the Building Consent works is required)*.

The fire alarm installer shall supply a fully completed certificate of completion on satisfactory completion of the installation and commissioning tests. The certificate is to be in a form meeting the requirements of the NZ building Code and associated Standard NZS 4512:2010, and to be signed by suitably qualified personnel such as FPIS Ltd, AON, or similar. The alarm system in conjunction with the sprinkler system is to be Type 6 with supplementary smoke detection to the extent required in accordance with the Building Consent including that all fire alarm interfaces are functioning. (*Note this work may only be completed when the subsequent Zone 2 is completed and the Fireman's control room installed*).

The installer of the Type 18 hydrant system on completion is to provide a fully completed certificate of completion on satisfactory completion of the installation and commissioning tests. The certificate is to be in a form meeting the requirements of the NZ building Code and associated Standard NZS 4510:2008 and to be signed by suitably qualified personnel such as FPIS Ltd, AON, or similar. (*Note this work may only be completed when the subsequent Zone 2 are completed and the Fire control room with subsequent inlets installed*).

The installer of the smoke extract system within the anchor tenant shall undertake a physical test confirming operation of the extract fan and make up air supply operate as per the Cosgroves consented mechanical design (Type 11), including all other required commissioning requirements of the standard. A PS3 is to be provided on completion for the system installer stating that the smoke extraction system complies with AS 1668:Part 1.

Cosgroves as the designer responsible for the smoke extraction system design is to provide a PS4 construction review stating compliance with AS 1668:Part 1.

The emergency lighting installer shall provide a producer statement (PS3) confirming that the emergency lighting meets minimum illumination levels to the required areas and the minimum duration time as required by NZBC F6/AS1 and the Building Consent. Also required is the test and commissioning certificates for the emergency lighting, including test results. (*Note this work may only be completed when the subsequent Zones 1 and 2 are completed when the subsequent Zone 2 works when the connection to the development main is achieved. Notwithstanding this, as an interim, the associated statements for the Building Consent works is required*).

Cosgroves as the owner's consultant responsible for the emergency lighting design shall provide a producer statement for construction review (PS4) to confirm that the appropriate

Environmental & Planning Services I.C.C. Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

inspections have been carried out and the building works have been completed in accordance with the consented documentation. (*Note this work may only be completed when the subsequent Zone 2 works is completed when the connection to the development main is achieved*).

Penetrations through smoke and fire separations to be sealed in accordance with AS:1530 Part 4 and AS4071:Part 1. A PS3 to C3 of the NZBC is to be provided from relevant trade that is sealing penetrations. A schedule of penetrations sealed is to be provided, noting that the treatment is to be in accordance for the solutions provided in the building consent documentation.

The applicator of the intumescent paint system shall on completion provide a PS3 stating compliance with C6 of the NZBC and the Building Consent. Also to be included is a record of the independent thickness tests.

Holmes Fire LP as the owner's consultant responsible for the fire design shall provide a producer statement for construction review (PS4) to confirm that the appropriate observations have been carried out and the building works have been completed in accordance with the consented fire strategy documentation. The level of construction monitoring is to be CM2. It is the applicant's responsibility to arrange the appropriate observations directly with the Fire Engineer or their representative.

Environmental & Planning Services I.C.C. Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

HWCP Invercargill Central Invercargill

HWCP Management Group

Zone 1 (Anchor) Fire Engineering Brief

Holmes Fire

Version A
24 June 2019
136249FEB03a.docx

Environmental & Planning
Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Holmes Fire
Level 2, 254 Montreal Street
Christchurch Central
PO Box 6718
Christchurch 8442
holmesfire.com

Issue Authorisation

Project: HWCP Invercargill Central, Invercargill

Project No. 136249

Version	Date	Status	Prepared	Reviewed
A	24 June 2019	For Review	ACC	DXM

Version	Extent of Revision

This report caters specifically for the requirements for this project and this client. No warranty is intended or implied for use by any third party and no responsibility is undertaken to any third party for any material contained herein. This report is produced and signed solely on behalf of Holmes Fire and no liability whatsoever accrues to the authors.

The building owner must be aware that the fire safety solutions described in this report may be alternative solutions to those given by the MBIE Acceptable Solutions or Verification Methods. Consideration of protection of the building owner's property is not included unless this has been specifically requested.

Written By:

AMY CHAO
Fire Engineer

Reviewed By:

DARIN MILLAR
Principal

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Contents

Environmental & Planning
Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City
Council
Building Consent
Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Tables

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

Building Division

Invercargill City
Council
Building Consent
Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER

2019/1381

1 PURPOSE

1.1 Purpose of this Document

The purpose of this Fire Engineering Brief (FEB) is to establish and agree the fire safety design and acceptance criteria with the relevant stakeholders of the HWCP Invercargill CBD Development **Zone 1** project. The FEB will describe the additional methodologies, input data, and acceptance criteria required to supplement those prescribed within the Verification Method C/VM2, that is used to justify compliance with the Building Code and the project design brief.

The development of the Zone 1 FEB is to address the technical aspects of design scenarios and calculation methods for this particular zone. This document is to be considered in conjunction with the Master Fire Engineering Brief.

1.2 Related Documents

This Fire Engineering Brief should be read in conjunction with the various briefing reports prepared for other consultants during this phase of the project, including any future fire reports prepared for this project by Holmes Fire. The following documents are prepared by the fire engineer for the project:

- Master Fire Engineering Brief (FEB), ref: 136249FEB01(Master)
- Zone 1 Fire Engineering Brief (FEB), ref: 136249FEB03(Anchor).
- Zone 1 Fire Engineering Strategy's (FES), ref: 136249FES01 (Anchor).
- Zone 1 Fire Engineering Sketches (FS), ref: 136249FS01 (Anchor).
- Zone 1 Fire Engineering Verification's (FEV), ref: 136249FEV01 (Anchor).

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER

2019/1381

2 DESCRIPTION OF THE PROJECT

The project covered in this C/VM2 design is the construction of the HWCP Invercargill CBD development Zone 1 (Anchor).

Zone 1 is a three-storey structure that consists of a two-storey anchor retail building with a childcare centre above and will be connected to a shopping centre (Zone 2) on the west side. Entrance into the ground floor anchor retail space is located on the north side via Esk Street with direct access to the shopping centre on the west side of building. Direct access to the first-floor anchor retail space will be available on the west side via the Level 1 carpark (Zone 3). Level 2 childcare centre can be accessed via the Level 2 carpark.

The anchor building has two exits that leads occupants directly to a safe place outside on the north side and the SE side. Occupants can also egress via the shopping centre on the west side. Level 1 has two stairwells located on the SE and NE side that leads directly to a safe place outside with a connection to the Level 1 carpark on the west side. Level 2 childcare has two means of egress via the east side stairwell that leads directly to a safe place outside or the west side walkway that leads to the carpark stairwell on the west side.

The ground floor and level 1 anchor building are interconnected via the escalator void in the centre of the building. Level 2 childcare centre if fire separated from the anchor space. Smoke extract system is proposed in the escalator ceiling void with make up air provided from the ground floor main entrance, west side opening to the shopping centre (Zone 2) and first floor opening to the Level 1 carpark on the west side.

Following the meeting on 20 June 2019 with FENZ and the peer reviewer, the design philosophy is developed as such –

- C/VM2 is silent on children having a slower travel speed. The proposed design will consider the children having slower evacuation speed of 0.7 m/s for horizontal travel and 0.5 m/s for vertical travel.

- C/VM2 requires the children to be evacuated to a "place of safety" on the same level first, which would require the sprinkler system to be fully compliant with NZS 4541 without modification. The building does not have a place of safety and the proposed design is to rely on having a buffer area (outdoor play area) on the roof top away from the childcare centre instead of a place of safety. All occupants of the building are on all out evacuation.

- Based on the departures identified above, the design may need to be considered as Alternative Solution.

Refer to Master FEV (ref:136249.FEB01) for overall principles.

Environmental & Planning
Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

3 EGRESS DESIGN PHILOSOPHY

3.1 Fire Emergency Procedures

The evacuation strategy adopted for this building forms an important part of the building design. An 'all-out' evacuation strategy applies to this building. All egress routes are assumed to be used by all occupants upon activation of the fire alarm.

There are two cases to consider regarding the evacuation of the childcare centre – which are fire inside the childcare centre, and fire in other areas. Note that only a single fire is to be considered happening in the building at any one time.

3.1.1 Fire inside Childcare Centre

In case of fire inside the childcare centre, the teachers and staff members are to either lead the children to the buffer area on the roof top, or into the carpark and then when all the children are accounted for, they are then led downstairs by the teachers and staff members.

The pre-movement time is 60 seconds for staff to respond to alarm and then 60 seconds per child per staff to the buffer area. The pre-movement times for other occupants in the other locations are not changed and not affected by the childcare centre. Due to the long pre-movement time, the egress time from the childcare centre will be isolated from the remainder of the building and RSET time will be calculated utilising hand calculation.

This concept is the same as the philosophy used in C/VM2. However, instead of having a place of safety, the area away from the childcare centre is considered as a "buffer area" as the building is unlikely to have a full NZS 4541 compliant sprinkler system. It should however be noted that if the sprinkler system is modified by appendix B of C/AS2-7, the level of safety at the open air buffer area when there is a fire inside the childcare centre is at least the same if not better as for a fire within the building.

3.1.2 Fire in Other Areas

In case of fire in other areas, the pre-movement time for the childcare centre would be 120 seconds in accordance with C/VM2 and then 60 seconds per child per staff. The pre-movement times for other occupants in the other locations are not changed and not affected by the childcare centre. Due to the long pre-movement time, the egress time from the childcare centre will be isolated from the remainder of the building and RSET time will be calculated utilising hand calculation.

C/VM2 does not distinguish the evacuation speeds between adults and children. Our proposed design will adopt the travel speed for childcare centre based on Kholshchevnikov et al.[1], with travel speed of 0.7 m/s for horizontal travel, and 0.5 m/s for vertical travel.

Once the occupants reach the safe path stairs they can travel all the out to the external safe place.

3.2 Management and Use

The staff members and teachers of the childcare centre will be the first to respond in the childcare centre

---

[1] 2 Kholshchevnikov, V.V. et al., Study of children evacuation from pre-school education institutions, Fire & Materials, Vol 36, pp. 349-366,
2012.

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

area to a fire emergency in this building. Suitable training of building staff and management is obligatory to ensure that the evacuation procedures put in place are carried out effectively.

For the purposes of meeting the requirements of the Fire Service Act, it is recommended that a Fire Safety Management Plan is prepared for the building after approval of the Fire Engineering Strategy, incorporating documentation the staff emergency response plan.

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

4 FIRE SYSTEMS OVERVIEW

4.1 Sprinkler System

A new Type 6 automatic sprinkler system is to be installed throughout the Zone 1 building in accordance with NZS4541, as an Appendix B (C/ASX) system. This may increase to being a Class A system to Appendix B but this will be established at the end of the verification.

4.2 Fire Alarm System

Supplementary smoke detection system is to be installed on Level 2 childcare centre in accordance with NZS 4512. The supplementary smoke detection system will not trigger building wide alarm and will not be connect to the FENZ. The manual call points and the sprinkler system will trigger the building wide alarm and evacuation and contact the FENZ.

A new Type 2 fire alarm system is to be installed throughout the Zone 1 building in accordance with NZS4512.

The extent of a smoke detection system on ground and level 1 will be determined as part of the detailed assessment. Certain coverage is expected to facilitate the smoke control system and any EMHOD but this does not necessarily mean a full Type 4 system in this Zone.

The use or otherwise of a double knock system for smoke detectors prior to initiating evacuation is yet to be determined and will be considered as part of a detailed assessment.

4.3 Storage Requirements

The Fire Engineering design is based on a capable storage height of no more than 3 m. It is noted that as we have not yet received a written confirmation from the Anchor tenant, that this could potentially change. Should the storage height exceed 3 m at a later stage, the design will be revisited.

4.4 Indicative Fire Separations and Means of Escape

The indicative locations of fire and smoke separations are detailed on the attached sketch FS101. Also shown on these plans are the proposed means of escape for the building. These drawings are indicative only and provided for the purpose of informing the stakeholders of the intended Fire Engineering design at this early stage of the design.

4.5 Other Proposed Key Fire Engineering Design Features

It is expected that the following Fire Engineering design features will be included in the final design:

- Mechanical smoke extract system that extracts smoke at high level of the escalator void in the centre of the anchor building.

Make up air is expected to be provided via

- powered opening of the automatic sliding doors on the ground floor, and
- powered opening of the automatic sliding doors first floor, and
- the ground floor opening that connects the anchor to the shopping centre on the west side (it is expected to be open during opening hours with meshed security roller doors afterhours that permits make up air).

The specific performance requirements of these features is currently under development and will be detailed in the Fire Engineering Strategy.

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

Building Division

Invercargill City
Council
Building Consent
Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER

2019/1381

4.6 "Do Not Exit" Exit signage

The "Do Not Exit" signage is proposed on the Childcare Centre west exit. This "Do Not Exit" signage shall be activated when the sprinkler activated on either L1 or L2 carpark. This is to prevent egress from the Childcare Centre into the carpark when there is a fire that could potentially affect occupant egress.

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

5 C/VM2 DESIGN SCENARIO APPLICABILITY

The following identifies the design scenarios that require analysis.

Table 1 – C/VM2 Design Scenario Applicability

Design Scenario	Description	Further review required	Justification
BE	Blocked Exit	No	All areas with occupant load greater than 50 people have no less than two exits available. Any space with excessive (as defined by the BE scenario) travel distances will have additional escape routes added.
UT	Unoccupied room	No	Fire suppression is provided by way of sprinkler protection throughout building
CS	Concealed Space fire	No	All areas in building provided with automatic detection.
SF	Smouldering Fire	No	Smoke detection in sleeping areas, designed and installed to a recognised national or international standard.
HS	Horizontal fire Spread	No	Clause 3.6: On the basis that the sprinkler system is provided with a Class A sprinkler system and the spaces to which this applies do not have storage in excess of 3m height. For a space to not apply with storage in excess of 3m height – it must be in a separate firecell – this is to be confirmed in the detailed design. Clause 3.7 To be achieved by compliance with Table 4.1 of C/VM2.
VS	Vertical fire Spread	No	Part A: Either by Table 4.2 of C/VM2 or use of non-combustible material. Part B & Part C: The building is provided with automatic sprinkler system.
IS	Internal Surface fire spread	No	Compliance with NZBC C3.4 is required. Proposed to comply with internal surface finish requirements in accordance with C/VM2 and appropriate C/AS4 and C/AS5.

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Design Scenario	Description	Further review required	Justification
FO	Firefighting Operations	Yes	The proposed firefighting facilities for the building, e.g. the fire alarm panel, sprinkler inlets and internal hydrant inlets and outlets, are being addressed directly with FENZ. Input from the NZFS Operational representative is requested to confirm that the proposed locations are appropriate. The agreement with FENZ will be consolidated and included in the respective FEV documentation.
CF	Challenging Fire	Yes	Refer Section 5.1
RC	Robustness Check	Yes	Refer Section 5.2

5.1 Design Scenario CF: Challenging Fire

Challenging Fire Scenarios are described in the table below and the sketches FS301 and FS302.

Table 2 - Challenging Fire Descriptions

Challenging Fire Scenario	Location	Description
CF1	GF Anchor	Fire in middle of atrium (escalator void). "Fast" t-squared fire growth rate, i.e. $Q=0.0469t^2$. Maximum fire size = 20 MW or fire size at which sprinklers activate.
CF2	GF Anchor	Fire on the ground floor retail space under L1 (intermediate floor). We will adopt the ceiling height as being the highest expected for the tenancy for the sprinkler activation time, "Fast" t-squared fire growth rate, i.e. $Q=0.0469t^2$. Maximum fire size = 20 MW or fire size at which sprinklers activate.
CF3	2L Childcare Centre	"Fast" t-squared fire growth rate, i.e. $Q=0.0469t^2$. Maximum fire size = 20 MW or fire size at which sprinklers activate.

Input and acceptance criteria specified by the Verification Method C/VM2 are used for the fire design as detailed below, including consideration of the additional design parameters previously discussed, and other relevant data and assumptions as referenced.

5.1.1 Challenging Fire 1

Challenging Fire 1 is located to simulate a plume scenario at the bottom of the high-ceiling space. This reflects the anticipated worst case for largest fire and affect the tenability on the Level 1 retail space resulting in less available safe egress time for occupants from the Level 1 retail space.

The internal, non-fire rated partition between Zone 1 (Anchor) and Zone 2 (Mall) is expected to remain in place for the duration of egress, as the upper layer temperature is not expected to exceed 200°C. The above expectations will be confirmed in the analysis to be undertaken.

Environmental & Planning Services I.C.C. Document Received 17 Dec 2019 Building Division

Invercargill City Council Building Consent Authority Approved Site Copy

Approved For Issue 27/02/2020

BUILDING CONSENT NUMBER 2019/1381

Both the GF and L1 of the Zone 1 (Anchor) will be included as part of the assessment with automatic sliding doors open upon fire alarm activation. A delay of 15 s will be applied after the operation of the fire alarm system before the doors are taken as open. The connection between GF Zone 1 (Anchor) and Zone 2 (Mall) will be considered as constantly open. The smoke exhaust system will start at the activation of the fire alarm system with a 30 s ramp up time.

This fire represents the worst-case scenario for Level 1 retail space, therefore no challenging fire is proposed on Level 1 as a separate scenario.

5.1.2 Challenging Fire 2

Challenging Fire 2 is located to simulate a balcony spill plume fire which reflect the worst case for smoke production and affect tenability on Level 1 retail space resulting in less available safe egress time for occupants.

The internal, non-fire rated partition between Zone 1 (Anchor) and Zone 2 (Mall) is expected to remain in place for the duration of egress, as the upper layer temperature is not expected to exceed 200°C. The above expectations will be confirmed in the analysis to be undertaken.

Both the GF and L1 of the Zone 1 (Anchor) will be included as part of the assessment with automatic sliding doors open upon fire alarm activation. A delay of 15s will be applied after the operation of the fire alarm system before the doors are taken as open. The connection between GF Zone 1 (Anchor) and Zone 2 (Mall) will be considered as constantly open. The smoke exhaust system will start at the activation of the fire alarm system with a 30 s ramp up time.

As the ceiling height is not the same throughout the ground floor, it is proposed that for this challenging fire, B-Risk model will be used to find the sprinkler activation time for the higher ceiling (GF) and this number will be used as the sprinkler activation time in the FDS model. The FDS model for smoke movement will use the lower ceiling height (GF).

5.1.3 Challenging Fire 3

Challenging Fire 3 threatens the occupants within the childcare centre area, for whom tenability will be assessed. The fire within the childcare centre is not expected to threaten the occupants in the remainder of the building due to the inherent separations expected. Note that the building is still under an “all out” evacuation.

CF3 will be modelled in B-RISK with a room for fire origin in the kitchen and a supplementary room to be equivalent to 50% of the floor area (given the partitions will be non rated).

5.2 Design Scenario RC: Robustness Check

5.2.1 Smoke exhaust

Robustness Check Scenario (RC1) will utiliseCF1 with the failure of the smoke exhaust system. A fire in the atrium is considered a worst-case scenario with the largest fire due to the high-ceiling space. For this scenario, only FEDco will be assessed. The doors are still expected to power open.

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

Building Division

Invercargill City
Council
Building Consent
Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER

2019/1381

Table 3 - Robustness Check Scenario Descriptions

Robustness Check Scenario	Location	Description
RC1 (utilising CF1)	GF Fire	Smoke Exhaust System failure. Fire in middle of atrium (escalator void). “Fast” t-squared fire growth rate, i.e. $Q=0.0469t^2$. Maximum fire size = 20 MW or fire size at which sprinklers activate.

5.2.2 Fire and smoke control doors without hold-open devices.

The building has two independent fire separated stairs. The Robustness Check scenario requires fire safety features to be failed only one at a time. Therefore, this scenario is considered addressed by provision of a second stair (that would not simultaneously be affected by failure of a fire/smoke door), and no further analysis is proposed.

5.2.3 Smoke curtain

Potentially a smoke curtain located in the Ground level west connection to the mall (This may not be required due to the beam height and will be confirmed at design stage). The proposed curtain may only descend to 2.5 m above FFL as a smoke barrier/reservoir. Therefore, for the purpose of the Robustness Check design scenario in this means of escape assessment, a failure of the curtain will not adversely impact occupant egress and no further analysis is proposed.

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

6 OCCUPANT CHARACTERISTICS

Occupant characteristics in the anchor building, which may affect occupant response to a fire emergency include:

1. Occupants are generally unfamiliar with the layout of the building.
2. Occupants are generally alert, ambulant, cognitive and able to understand and act on instructions to evacuate.

There will be no sleeping occupants in the anchor building at any time (except the childcare centre).

For the childcare centre, the staff members and the teachers are awake, familiar with the layout of the centre and the escape route.

The children are not expected to initiate the evacuation by themselves and will rely on the staff members to instruct them.

The pre-movement time proposed for the childcare centre is as described in the Egress Design Philosophy.

6.1 Fire Design Occupant Loads

The general assumptions to be used in the fire engineering assessment of the proposed design are provided below. Any alterations to the design that result in the assumptions becoming invalid will be checked as part of the detailed verification and updated loads will be presented at that time.

The following is a summary of the fire design occupant load within the Zone 1 anchor building from C/VM2 Table 3.1. The occupant loads detailed in Table 4 are the maximum number of occupants for the spaces listed (as calculated using the C/VM2 densities).

Table 4 - Summary of Occupant Loads

Level	Description	Area [m2]	Occupant Density [m2/person]	Occupant Load
Ground	Anchor	2091	3.33[1]	628
Ground	Esk St tenancy A	119	3.5	34
Ground	Esk St tenancy B	121	3.5	35
Ground	Esk St tenancy C	120	3.5	34
Ground	Esk St tenancy D	115	3.5	33
Ground	B.O.H (Reserve)	110	100	1
L1	Anchor	2310	3.33[1]	694
L1	B.O.H (Reserve)	313	100	3
L1	Offices	217	10	22
	Anchor space			**1484**
L2	Childcare Centre	-		88 children + staff
	Total (Zone 1)			**1572**

Environmental & Planning Services I.C.C. Document Received

17 Dec 2019

Building Division

Invercargill City Council Building Consent Authority Approved Site Copy

Approved For Issue 27/02/2020

BUILDING CONSENT NUMBER

2019/1381

Explanatory Notes

1. Anchor tenant seeks to have their occupant density to be 3.33p/m^2 as opposed to 3.5p/m^2.
2. The exact occupant load for the Childcare Centre is yet to be confirmed. However, due to the restriction to external play area, a maximum of 88 children is permitted in the Childcare Centre. This is to be confirmed in the detailed design.

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

7 FIRE RESISTANCE RATING TO WITHSTAND BURNOUT

The time equivalence formula shall be used to determine the required fire resistance rating to withstand burnout, as per C/VM2 Equation 2.1.

7.1 Fire Load Energy Density

The time-equivalent formula, as described in C/VM2 2.4.4, shall be used to model the full burnout design fire. The parameters to be used in the calculation are outlined below.

7.1.1 Fire Load Energy Density, e_f

The following is a summary of the fuel load energy density (FLED), e_f, within the building from C/VM2 Table 2.2.

Table 5 - Summary of Fuel Load Energy Density

Level	Activity	Example	FLED [MJ/m²]
G	Spaces for display of goods for sale and B.O.H	96% retail (800 MJ/m²) + 4% B.O.H (1200 MJ/m²). Exact split will depend on updated Architectural plans	816
L1	Spaces for display of goods for sale, office and B.O.H	81% retail (800 MJ/m²) + 8% Office (800 MJ/m²) + 11% B.O.H (1200 MJ/m²) Exact split will depend on updated Architectural plans	844
L2	Childcare	Early childhood centre	800

7.1.2 Thermal Properties Conversion Factor, k_b

Refer to Master Fire Engineering Brief (ref:136249FEB01) for details.

7.1.3 Modification Factor, F_m

Refer to Master Fire Engineering Brief (ref:136249FEB01) for details.

7.1.4 Ventilation Factor, w_f

The ventilation factor, wf, shall be determined as described in accordance with C/VM2 Equation 2.2.

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

8 ANALYSIS TOOLS

8.1 Fire modelling

Due to the complexity of the geometry, the computational fluid dynamics modelling Fire Dynamics Simulator (FDS) Version 6.7.1 will be used for this project. Refer to Appendix B for FDS modelling information.

Further to the Master FEB, the following assumptions and simplifications are made for purposes of fire modelling:

- Fire and smoke separations (including those around lifts) are assumed to have no leakage areas.
- The GF connection to Zone 2 will be modelled as a connection to outside for the purposes of this FEB. When Zone 2 FEB is undertaken, we will allow for Zone 1 scenario (worst case) to interact with the Zone 2.
- The Level 1 connection to Zone 3 will be modelled as an opening to the exterior. Given the Zone 3 is a carpark and alternative means of escape options exist for a relatively small occupant load, this simplification will occur. This opening will not be modelled at any other time.

8.2 Movement of people

The methodology is as described in the Master Fire Engineering Brief. Further to that content, we offer the following supplementary information:

1. A base case Zone 1 consideration will be based on the distribution as per the Master FEB for Zone 1 only i.e no blocking of a route.
2. Non base case that will consider egress for all of Zone 1, 2 and 3 occupants with no exits being considered unavailable. Distribution as per the Master FEB.
3. To facilitate evacuation of a childcare facility, “Do not enter” signs were proposed in the vicinity of access into the Zone 3 carpark. These were intended to inform staff that it would be wiser to use the other exit. We propose that this signage be active when any alarm is initiated from Zone 3 Level 1 or Level 2. Given the methodology used to evacuate the childcare facility, and the inherent delays we need to accommodate, we do not intend on simulating their impact on the Zone 1 RSET. This assumption of the delay being longer than it will take for the remainder of Zone 1 occupants to enter a safe place will be verified as part of the assessment.

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

9 SCENARIOS AND PERFORMANCE CRITERIA FOR ASET VS RSET

The available safe environment time (ASET) is the earliest time period from fire ignition to the time at which one of acceptance criteria reaches a limit state where occupants are egressing the building.

The ASET calculation is to be based on the following acceptance criteria depending on the specific location of the occupants:

- FED_{CO} of <0.3,
- $FED_{thermal}$ of <0.3, and
- Visibility > 10 m

ASET will be taken when the above acceptance criteria (measured at 2.0 m above floor level) is exceeded depending on the specific location of CF and the occupants.

The challenging fires, occupant scenarios and ASET tenability are summaries in the table below.

Table 6 - Design Scenario Summary Matrix

Challenging Fire Scenario	Occupant load[1]/Egress distribution	ASET Tenability
CF1 & CF2 (FDS model)	Base case: • Zone 1 occupants only • All exits available (no blocked exit)	• FEDco only on Zone 1 GF and L1 retail areas (on the basis that adjacent tenancies egress directly to the outside). • Visibility and $FED_{thermal}$ on Zone 1 L1 Retail space. • FEDco only in Zone 1 Stairwell will; be based on the FEDco of the retail floor. • Visibility and $FED_{thermal}$ in Zone 2 GF will only be established in Zone 2 assessment. • No tenability assessed in Zone 3 Carpark.
	Non-Base case RSET (occupants from other Zones interact): • Zone 1, 2 & 3 occupants (Zone 3 L5 - community event). • All exits available (no blocked exit)	
CF3 (B-Risk model)	Base case: • L2 Childcare occupants only. • All exits available (no blocked exit)	• FEDco only on Zone 1 L2 (Childcare Centre). • FEDco will not be measured anywhere else as the occupants will be in appropriate "buffer zones" once they depart the L2 enclosure.
	Non-Base case RSET (occupants from other Zones interact). Due to the long pre-movement time, the egress time from the Childcare centre will be isolated from the remainder of the building therefore no non-base case RSET will be presented – this will need to be verified by one example.	

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Challenging Fire Scenario	Occupant load[1]/Egress distribution	ASET Tenability
RC 1 (FDS model)	Base case: • Zone 1 occupants only. • All exits available (no blocked exit)	• FEDco only on Zone 1 GF and L1 retail areas (on the basis that adjacent tenancies egress directly to the outside). • FEDco only in Zone 1 Stairwell will; be based on the FEDco of the retail floor. FEDco only in Zone 2 GF will only be established in Zone 2 assessment.
	Non-Base case RSET (occupants from other Zones interact): • Zone 1, 2 & 3 occupants (Zone 3 L5 - community event). • All exits available (no blocked exit)	

[1] Refer to the occupant load table and functional modes for a description of the numbers of persons being considered in a space for the calculation of RSET.

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

Building Division

Invercargill City
Council
Building Consent
Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER

2019/1381

10 SUMMARY

The stake holders in the fire safety design for this project are expected to participate in the development of this FEB. The members of this team, including the Authorities Having Jurisdiction, are expected to record their general agreement with the content. The content is then regarded as the official accepted brief for Fire Engineering design.

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Appendix A Preliminary Fire Engineering Sketches

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Legends for the drawing sets

Drawing title references:

Block - **Fire Strategy(FS)** - Drawing number Rev

These drawings represent the Fire Strategy outcomes and are therefore the overall identification of Fire Ratings and Means of Escape intent.

- Sm Smoke separation
- 15 (15)/15/15 Sm
- 30 30 (30)/30/30 Sm
- 45 45 (45)/45/45 Sm
- 60 (60)/60/60 Sm
- 90XXX90 (90)/90/90 Sm
- 120 (120)/120/120 Sm
- 180 (180)/180/180 Sm
- SB Smoke baffle
- Design action or note.
- Design question relating to items outside the scope of NZBC compliance.
- Design question for discussion or further assessment.
- XXXXmm Minimum clear egress width
- VP Vision Panel
- PBDH Panic-bar door hardware, or non-latching door readily pushed open
- EXIT Exit Sign (indicative)
- Egress route (no requirement for direction of door swing) [mimimum 760mm door clear unless noted otherwise]
- Egress route (door to swing in direction of egress) [minimum 760mm door clear unless noted otherwise]
- Egress route (both leaves required for egress) [minimum 1520 door clear unless noted otherwise]
- Exitway
- Final Exit "Safe place"
- NO EXIT No Exit sign
- Electromagnetic Hold Open Device
- Fire Service vehicle access
- Vehicle Attendance Point
- Fire Service Access
- Smoke Detector
- Heat detector

Drawing title references:

Block - **Fire Protection(FP)** - Drawing number Rev

These drawings represent the Fire Protection outcomes and are therefore the overall identification of infrastructure considerations for the Performance Specification.

- Fire Service vehicle access
- Vehicle Attendance Point
- Fire Service Access
- FAP Fire Alarm Panel
- FIP Fire Indicator Panel
- RDU Remote Display Unit (text display)
- Electromagnetic Hold Open Device
- Manual Call Point
- FH Fire Hydrant
- FHI Fire Hydrant Inlets
- Hydrant Outlet
- FSI Fire Sprinkler Inlets
- SVS Sprinkler Valve Set
- BFP Backflow preventer

Drawing title references:

Block - Verification(V) - (no numbering as they are calculations/verification documents)

These sketches represent information used to verify the design complies with the Building Code. They support calculations and are used by the Peer Reviewer, NZFS and Council.

- Design action or note.
- Design question relating to items outside the scope of NZBC compliance.
- Design question for discussion or further assessment.
- Challenging Fire location
- 1 m Travel distance
- DEOP End of dead end travel

Project No.	Sheet No.	Rev
136249	Z1FEB FS 100	A

Holmes
Holmes Fire LP
L2, 254 Montreal St
Christchurch
New Zealand
T: +64 3 365 8855
holmesfire.com

Sketch Title
Legend Page

HWCP Development
Zone 1 Anchor and Childcare Centre

Environmental & Planning Services I.C.C.
Document Received

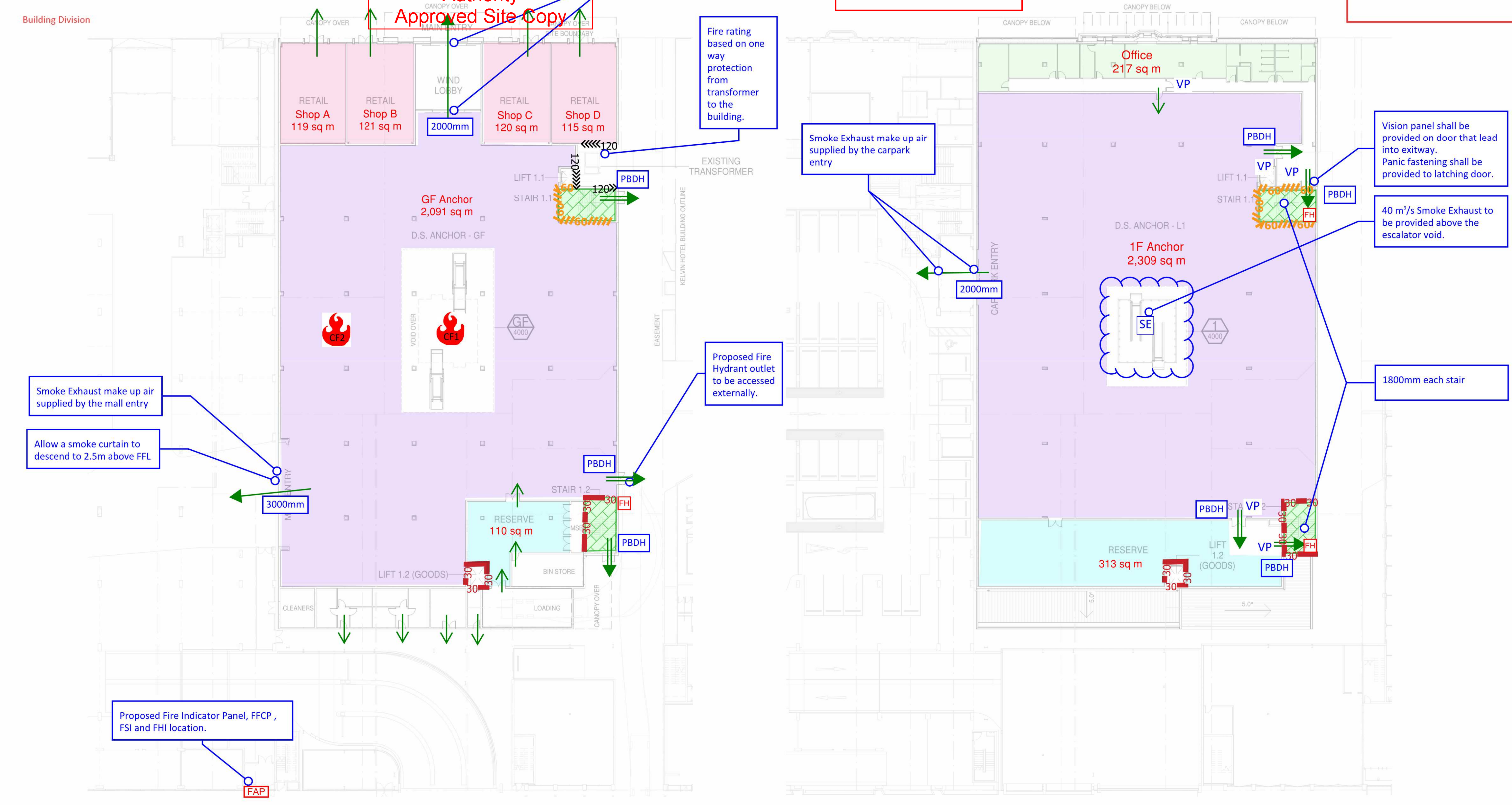
17 Dec 2019

Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381



GF Z1 - GROUND FLOOR - OVERALL
1 : 250

1 Z1 - LEVEL 1 - OVERALL
1 : 250

This sketch does not constitute a complete fire engineering design or detail. Detailed construction drawings are provided by others. Best viewed in colour. Not all fire separations around ducts and shafts are shown.

Holmes

Holmes Fire LP
L2, 254 Montreal St
Christchurch
New Zealand
T: +64 3 365 8855
holmesfire.com

Project Title	HWCP - Invercargill Central
Sketch Title	Zone 1 GF & L1 Fire / Smoke Separations & Means of Escape
Drawn:	ACC
Date:	02 / 05 / 2019
Project No.	136249
Sheet No.	Z1FEB FS 101
Rev	A

HWCP

INVERCARGILL CENTRAL - ZONE 1
TAY STREET & DEE STREET CORNER
INVERCARGILL
917077

PRELIMINARY DESIGN

ZONE 1
OVERALL FLOOR PLANS
Z1-PD-A-1100
D

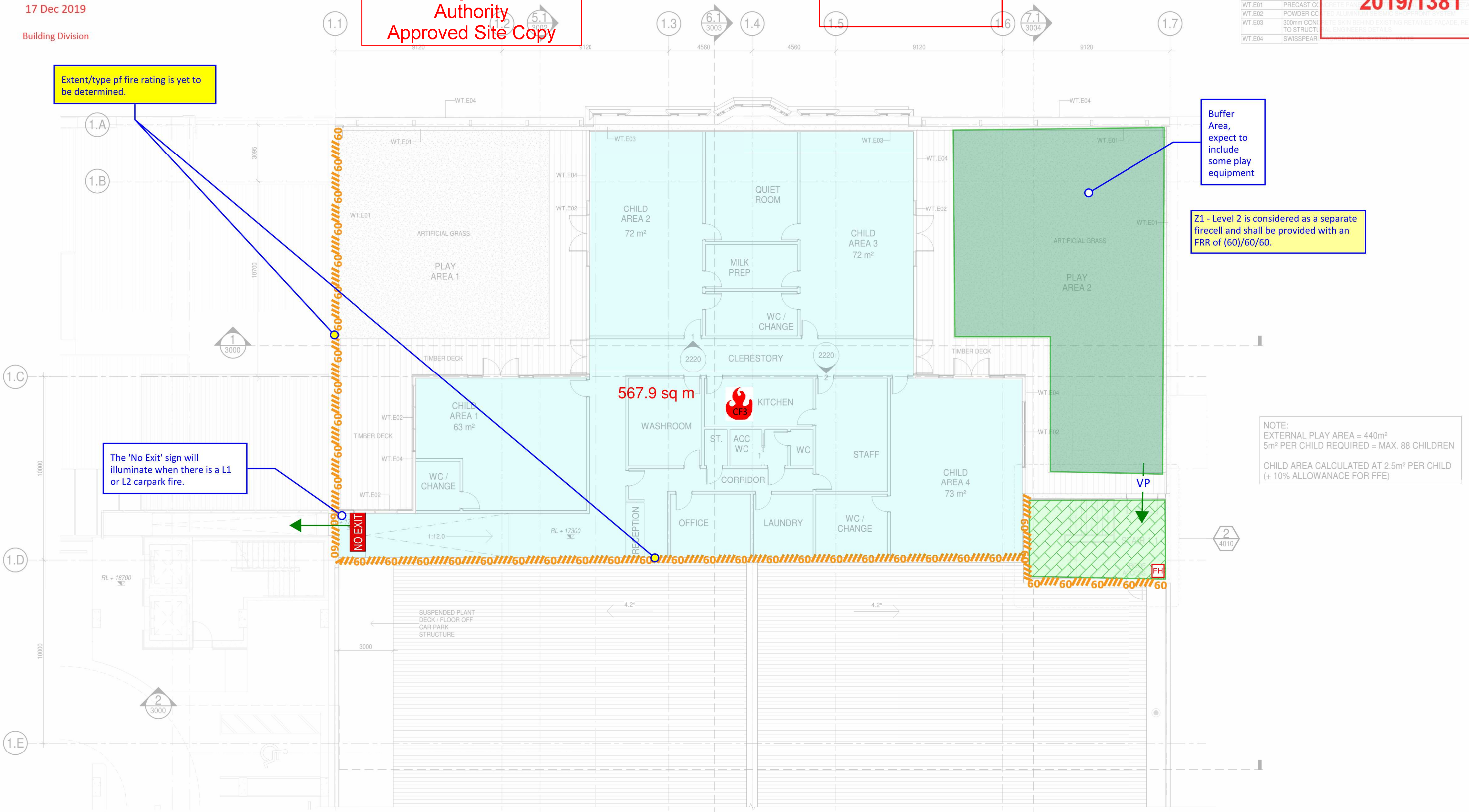
BUCHAN

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381



CHILD CARE FACILITY IS A PRELIMINARY CONCEPT AND IS

This sketch does not constitute a complete fire engineering design or detail. Detailed construction drawings are provided by others. Best viewed in colour. Not all fire separations around ducts and shafts are shown.

Holmes

Holmes Fire LP
L2, 254 Montreal St
Christchurch
New Zealand
T: +64 3 365 8855
holmesfire.com

Project Title	Sketch Title	Drawn: ACC	Date: 02 / 05 / 2019
HWCP - Invercargill Central	Zone 1 L2 Fire / Smoke Separations & Means of Escape		
		Project No. 136249	Sheet No. Z1FEB FS 103
		Rev	A

HWCP

INVERCARGILL CENTRAL - ZONE 1
TAY STREET & DEE STREET CORNER
INVERCARGILL
917077

PRELIMINARY DESIGN

ZONE 1
LEVEL 2 FLOOR PLAN
Z1-PD-A-1105
E

BUCHAN

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

Building Division

Invercargill City
Council
Building Consent
Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER

2019/1381

Appendix B Fire Modelling (FDS)

The following FDS model parameters applies to CF1, CF2 and RC1. CF3 will utilise B-Risk model.

B.1 FDS Input parameters are used:

- Reaction based on the following fuel: $C_{4.14}H_{9.11}O_{2.58}$.
- The input yield quantities for CO, CO_2 and H_20 are those described in C/VM2.

  The calculated yields using the fuel described above align with those required by C/VM2, as follows:

  y_{CO} = 0.04kg/kg
  y_{CO2} = 1.5kg/kg
  y_{H2O} = 0.82kg/kg
  y_{soot} = 0.07kg/kg (assuming y_{soot} = y_C).
- The heat of combustion for the reaction is also specifically input as 20MJ/kg

The fire is modelled as a growing-area square burner, with heat release rate (HRR) input to grow as a 'fast' t^2 fire. In this manner, the overall HRRPUA of the burner is held virtually constant over time; the fire size grows as the physical size of the burner grows.

The maximum HRRPUA is expected to be within a range of 500 – 1000 kW/m^2 as per C/VM2.

Initially the model will be run with a fire that grows up to 20MW in order to determine sprinkler activation time. The time at which sprinkler activation occurs will be used to establish the peak HRR for subsequent models for this fire growth rate.

B.2 FDS Output

Refer to Master Fire Engineering Brief (ref:136249FEB01) for details.

B.3 FDS Grid Size

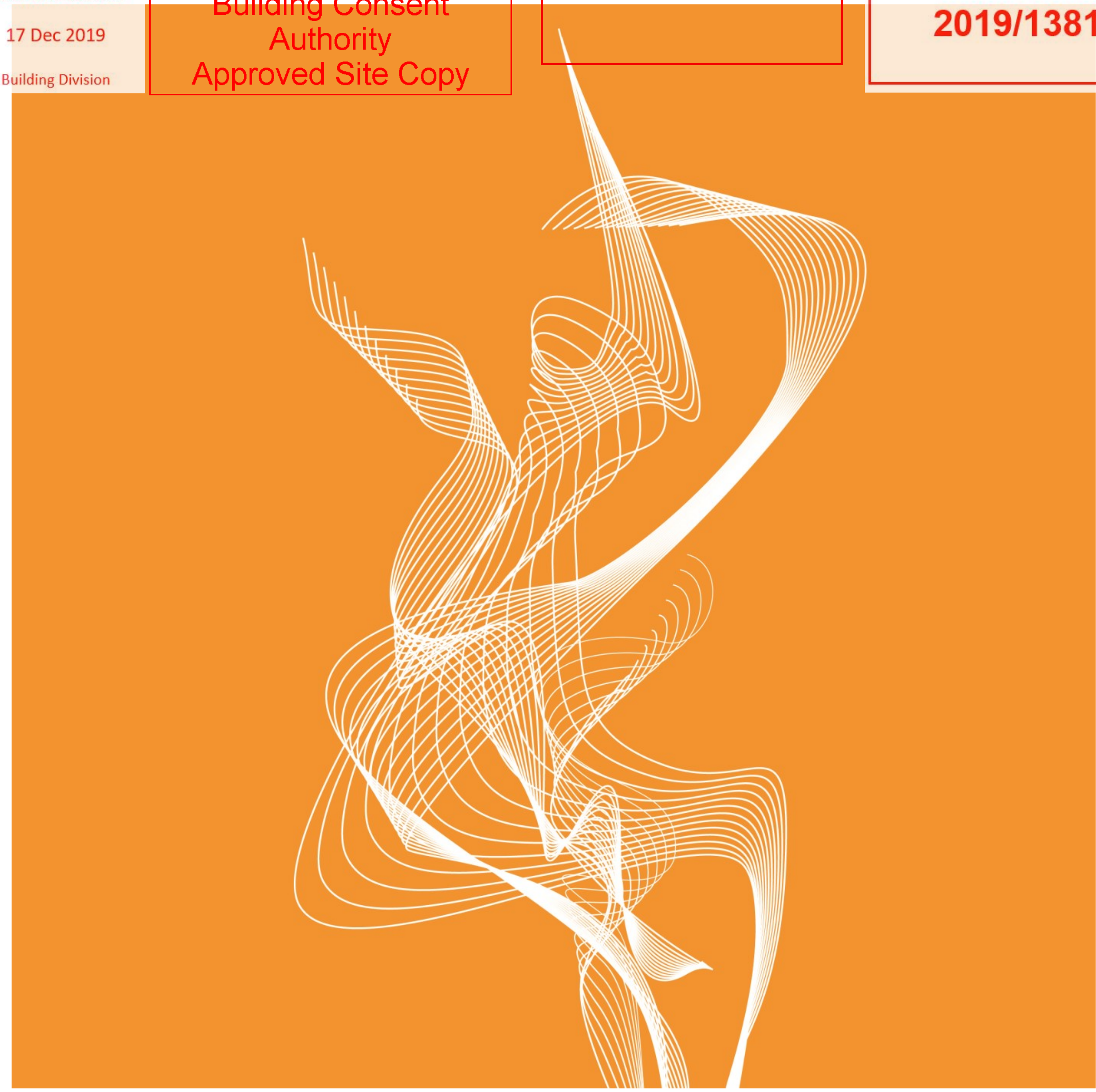
No grid sensitivity study will be performed on the FDS model for the 'fast' t^2 fire. It is assumed the grid sensitivity study carried out for the 'fast' t^2 fire in Zone 3 Carpark Fire Engineering Brief (ref:136249FEB02) is sufficient.

Environmental & Planning
Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381



Zone 1 – D.S. Anchor & Childcare Centre
HWCP Invercargill CBD Development

HWCP Management Ltd

Fire Engineering Verification

Version B
14 October 2019
136249FEV01b.docx

Holmes Fire

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Holmes Fire
Level 2, 254 Montreal Street
Christchurch Central
PO Box 6718
Christchurch 8442
holmesfire.com

Issue Authorisation

Project: Zone 1 – D.S. Anchor & Childcare Centre, HWCP Invercargill CBD Development

Project No. 136249

Version	Date	Status	Prepared	Reviewed
A	28 August 2019	For Approval	ACC	DXM
B	14 October 2019	For Approval	ACC	DXM

Version	Extent of Revision
B	Update in response to peer reviewer comments • BE Scenario – Table 2 • RSET for L1 Anchor

This report caters specifically for the requirements for this project and this client. No warranty is intended or implied for use by any third party and no responsibility is undertaken to any third party for any material contained herein. This report is produced and signed solely on behalf of Holmes Fire and no liability whatsoever accrues to the authors.

The building owner must be aware that the fire safety solutions described in this report may be alternative solutions to those given by the MBIE Acceptable Solutions or Verification Methods. Consideration of protection of the building owner's property is not included unless this has been specifically requested.

Written By:

AMY CHAO
Fire Engineer
BE(Hons), MEngSt (Fire)

Reviewed By:

DARIN MILLAR
Principle
BE(Hons), MEFireE, CMEngNZ, CPEng, IntPE(NZ)

Environmental & Planning
Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Contents

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Figures

Tables

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

1 PURPOSE

The purpose of this document is to demonstrate that the proposed minimum fire safety precautions that are to be installed within the Zone 1 Anchor, HWCP Invercargill CBD Development at Invercargill, achieve compliance with Section 17 of the New Zealand Building Act 2004 with respect to the fire regulations, due to the proposed works.

This document is one of a number of documents prepared by the fire engineer:

- Master Fire Engineering Brief (FEB), ref: 136249FEB01(Master).
- Zone 3 Fire Engineering Brief (FEB), ref: 136249FEB03(D.S. Anchor & Childcare Centre).
- Zone 3 Fire Engineering Strategy (FES), ref: 136249FES01 (D.S. Anchor & Childcare Centre).
- Zone 3 Fire Engineering Sketches (FS).
- Zone 3 Fire Engineering Verification (FEV), ref: 136249FEV01 (D.S. Anchor & Childcare Centre).

The Fire Engineering Verification document is provided for regulatory approval and contains the calculations and engineering background to the fire safety design – the verification showing how the design solution meets the acceptance criteria.

2 FIRE SAFETY EVALUATION AND ANALYSIS METHODS

2.1 Evaluation Methods

Compliance with the Building Code for this project is achieved in accordance with the Verification Method: Framework for Fire Safety Design (C/VM2, July 2014) for New Zealand Building Code Clauses C1 – C6 (2012).

The fire engineering design has been evaluated by following the methodology of the Verification Method, and the analysis of Design Scenarios and associated calculations are detailed within this report.

The challenging fire scenarios have been completed including an ASET/RSET analysis; the fire modelling has been completed using the latest version of FDS (at the time modelling is commenced, version 6.7.1) for the Anchor space and B-Risk 2019.03 for the Childcare space, while the movement times of the occupants (traversal walking and flow times) has been carried out utilising the computer model EvacuatioNZ for the Anchor space and hand calculations (by spreadsheet) for the Childcare space.

3 INTRODUCTION

Zone 1 is a three-storey structure consisting of a large anchor tenancy occupying the ground and level 1 space. In the centre of the ground floor are two elevators that leads from the ground floor to level one which creates an open void. Level one is therefore considered as an intermediate floor rather than fully fire separated first floor. Ground floor has three direction of egress; to the north (Esk St), south-east (Tay St) and south-west (mall) side of the building. Level one has three direction of egress via the north-east stair, south-east stair and the West side carpark. Small retail tenancies unrelated to the Anchor, are accessed directly from Esk St.

Level two is proposed to be a childcare centre that is accessed via the adjacent Zone 3 Carpark or the north-east stair.

For a full description of the different zones and their interrelationship, please refer to the Fire Engineering Briefs.

3.1 Correspondence post FEB

Refer to Appendices for Q&A log. There is no content in the Q&A log that alters the FEB content.

Environmental & Planning Services I.C.C. Document Received
17 Dec 2019
Building Division

Invercargill City Council Building Consent Authority Approved Site Copy

Approved For Issue 27/02/2020

BUILDING CONSENT NUMBER
2019/1381

3.2 Building Use and Fire Design Occupant Loads

The following is a summary of the activities and fire design occupant loads within the building, determined in accordance with C/VM2 Table 3.1.

Table 1 - Occupant Load summary

Location	Activity	Area (m^2)	Occ Density (m^2/person)	Occ Load (ppl)
G	Anchor	2091	3.33[1]	628
G	Esk St tenancy A	119	3.5	34
G	Esk St tenancy B	121	3.5	35
G	Esk St tenancy C	120	3.5	34
G	Esk St tenancy D	115	3.5	33
G	B.O.H (Reserve)	110	100	1
	GF Anchor			**765**
L1	Anchor	2310	3.33[1]	694
L1	B.O.H (Reserve)	313	100	3
L1	Offices	217	10	22
	L1 Anchor			**719**
	ANCHOR SPACE			**1484**
L2	Childcare Centre	-		88 children + 12 staff
ZONE 1 BUILDING TOTAL				**1572**

Explanatory Notes

1. Anchor tenant seeks to have their occupant density to be 3.33p/m^2 as opposed to 3.5p/m^2.
2. The exact occupant load for the Childcare Centre is yet to be confirmed. However, due to the restriction to external play area, a maximum of 88 children is permitted in the Childcare Centre.

4 SUMMARY OF DESIGN SCENARIO COMPLIANCE

Table 2 below identifies C/VM2 fire scenarios in relation to the building assessment. Reference should be made to the FEB and stakeholder agreement correspondence (Appendix F) for the stakeholder agreed fire design methodology.

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Table 2 - Design Scenario Applicability: Summary

Design Scenario	Description	Further Verification Required?	Comment / Reference
BE	Blocked Exit	No	All areas with occupant load greater than 50 people have no less than two exits available and have a dead-end travel distance less than 40 m for occupants not familiar with the building. Both the GF and 1L anchor spaces have occupant load > 250 people. Each level has three designated egresses > 8.0 m apart. 1L anchor space have two stairwells more than 8.0 m apart with the third egress via the carpark. The carpark also has two stairwells more than 20 m apart, each serving more than 250 people.
UT	Unoccupied room, Threatening other rooms	No	Fire suppression is provided by way of sprinkler protection throughout building.
CS	Concealed Space Fire	No	All areas in building provided with automatic detection (sprinklers).
SF	Smouldering Fire	No	Smoke detection in sleeping areas, designed and installed to a recognised national or international standard.
HS	Horizontal Fire Spread	No	Refer to Section 4.1 below.
VS	Vertical Fire Spread	No	Part A: Either by Table 4.2 of C/VM2 or use of non-combustible material. Part B & Part C: The building is provided with automatic sprinkler system.
IS	Internal Surfaces Fire Spread	No	Compliance with NZBC C3.4 is required. Proposed to comply with internal surface finish requirements in accordance with C/VM2 and appropriate C/AS.
FO	Firefighting Operations	Yes	The proposed firefighting facilities for the building, e.g. the fire alarm panel, sprinkler inlets and internal hydrant inlets and outlets, are being addressed directly with FENZ with the agreement with FENZ consolidated in a separate document. Burnout calculation has been assessed and presented in the summary table below in Section 4.2 and in Appendix A.

Rev B

Environmental & Planning Services I.C.C. Document Received

17 Dec 2019

Building Division

Invercargill City Council Building Consent Authority Approved Site Copy

Approved For Issue 27/02/2020

BUILDING CONSENT NUMBER 2019/1381

Design Scenario	Description	Further Verification Required?	Comment / Reference
CF	Challenging Fire	Yes	Three challenging fires has been assessed. Refer to Section 4.3 for a summary of results. Refer to Appendix B for RSET assessment. Refer to Appendix C for ASET assessment. Refer to Appendix D for Smoke Barrier Assessment.
RC	Robustness Check	Yes	Refer to section 4.5 below for a summary of results. Refer to Appendix C for ASET assessment.

4.1 Horizontal Fire Spread

The Anchor building is 40 m from the south relevant boundary across Tay Street and is 19 m from the north relevant boundary across Esk Street. The east side is 6 m from the relevant boundary and the west side faces the Carpark building. Based on the location of relevant boundary and provision of the sprinkler system with independent water supply, 100% unprotected opening on all levels of Zone 1 is acceptable. Refer to Appendix A for overall site plan that showed the relevant boundaries.

The building is provided with automatic sprinkler system with two independent water supplies, one of which is not dependent on town mains and the building shall not be used for storage above 3.0 m.

4.2 Fire Resistance Ratings Summary

The burnout fire resistance rating calculation for the relevant firecells within the building is summarised below, with calculations included in Appendix A.

Table 3 - Firecell Burnout Summary

Firecell	Calculated FRR (min)	FRR Applied to Building (min)
Anchor Building	60	60
L2 Childcare	60	60
L1 Anchor (Intermediate Floor)[1]	30	30

Explanatory Notes:

1) Level 1 Anchor is considered as intermediate floor due to the escalator atrium opening that connects ground floor and Level 1. In accordance with C/VM2 section 4.8, for buildings with an escape height is less than 10 m, intermediate floor and supporting structure shall be provided with an FRR of (30)/30/30. The total intermediate floor area is more than 40% of the firecell area, thus integrity and insulation ratings need to apply to the intermediate floor.

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

4.3 Challenging Fire ASET vs RSET Summary

Table 4 - ASET v RSET Summary

Scenario	Location[1]	ASET (s)	RSET (s)		ASET > RSET
			Base-Case	Non-Base Case	
CF1 (Atrium)	GF Anchor	>1700	209	199	Yes
	L1 Anchor	328	282	284	Yes (Rev B)
	L0 Stair 3 Landing[2]	>1700	295	287	Yes
	L0 Stair 4 Landing[3]	>1700	267	273	Yes
	N Circulation[4]	>1700	-	348	Yes
	Corridor[5]	>1700	-	1537	Yes
	Childcare	>1700	783		Yes
CF2 (Spill plume)	GF Anchor	>1700	193	183	Yes
	L1 Anchor	362	266	268	Yes (Rev B)
	L0 Stair 3 Landing[2]	>1700	279	271	Yes
	L0 Stair 4 Landing[3]	>1700	251	332	Yes
	N Circulation[4]	>1700	-	515	Yes
	Corridor[5]	>1700	-	1521	Yes
	Childcare	>1700	767		Yes
CF3 (Childcare)	GF Anchor	>1700	227	217	Yes
	L1 Anchor	>1700	270	272	Yes (Rev B)
	L0 Stair 3 Landing[2]	>1700	283	275	Yes
	L0 Stair 4 Landing[3]	>1700	255	261	Yes
	N Circulation[4]	>1700	-	350	Yes
	Corridor[5]	>1700	-	1521	Yes
	Childcare	917	711		Yes

Explanatory Notes:

1) Location is the space represented as nodes in EvacuatioNZ.

2) 'L0 Stair3 Landing' is the node that corresponds to the space precede the final exit from Stair 3 (L1 Anchor north stairwell) which is shared by the occupants from L2 Childcare space.

3) 'L0 Stair4 Landing' is the node that corresponds to the space precede the final exit from Stair 4 (i.e. time to clear L1 Anchor south stairwell).

4) 'N Circulation' is the node that corresponds to the space preceding the final exit from the Zone 2 mall area.

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

5) 'Corridor' is the node that corresponds to the space preceding the final exit from the north stairwell from the Zone 3 Carpark area.

As per the above table, ASET > RSET for all locations.

4.4 Grid Resolution Study Summary

Grid resolution study has been assessed in Zone 3 Carpark Fire Engineering Verification Report (136249FEV02) for both a $0.0117t^2$ 'medium' fire and $0.0469t^2$ 'fast' fire. The results showed minimal difference between the results produced from the 0.1 m and the 0.2 m mesh grid sizes which supports the justification that a 0.2 m grid cell size in the near field mesh is adequate for the purpose of life safety assessment. Therefore, no further assessment has been carried out for Zone 1.

4.5 Robustness Check

Robustness Check Scenario (RC1) has utilised CF1 with the failure of the smoke exhaust system. A fire in the atrium is considered a worst-case scenario with the largest fire due to the high-ceiling space. For this scenario, only FEDco has been assessed. The doors are still expected to power open.

Table 5 - RC1 ASET v RSET Summary

Scenario	Location[1]	ASET (s)	RSET (s)		ASET > RSET
			Base-Case	Non-Base Case	
CF1 (Atrium)	GF Anchor	>1700	212	202	Yes
	L1 Anchor	1610	285	287	Yes
	L0 Stair 3 Landing[2]	1610	298	290	Yes
	L0 Stair 4 Landing[3]	1644	270	276	Yes
	N Circulation[4]	>1700	-	351	Yes
	Corridor[5]	>1700	-	1540	Yes
	Childcare	>1700	786		Yes

Rev B

Explanatory Notes:

1) Location is the space represented as nodes in EvacuatioNZ.

2) 'L0 Stair3 Landing' is the node that corresponds to the space precede the final exit from Stair 3 (L1 Anchor north stairwell) which is shared by the occupants from L2 Childcare space.

3) 'L0 Stair4 Landing' is the node that corresponds to the space precede the final exit from Stair 4 (i.e. time to clear L1 Anchor south stairwell).

4) 'N Circulation' is the node that corresponds to the space preceding the final exit from the Zone 2 mall area.

5) 'Corridor' is the node that corresponds to the space preceding the final exit from the north stairwell from the Zone 3 Carpark area.

As per the above table, ASET > RSET for all locations.

Environmental & Planning Services I.C.C. Document Received
17 Dec 2019
Building Division

Invercargill City Council Building Consent Authority Approved Site Copy

Approved For Issue 27/02/2020

BUILDING CONSENT NUMBER 2019/1381

4.6 Smoke Barrier (ULT) Summary

The wall between the Level 1 Anchor and Level 1 carpark is intended to perform as a smoke barrier including the glazed partition. The Smoke Barrier assessment is not applicable for Zone 1 assessment on its own but have been provided as requested in Q&A log from stakeholders for future reference.

Temperature slice file has been placed in front of the wall between Anchor and carpark/mall.

As per Appendix D, the average upper layer temperature on the Anchor side did not exceed 200°C for the duration of fire model from both ground floor and first floor, hence any "smoke barrier" is considered to achieve smoke control performance for the duration of RSET.

Table 6 - Smoke Barrier Summary

Scenario	Location	Temperature (°C)
CF1	GF (between Anchor and Mall)	<50
	L1 (between Anchor and Carpark)	<50
CF2	GF (between Anchor and Mall)	<117
	L1 (between Anchor and Carpark)	<30
RC1	GF (between Anchor and Mall)	<40
	L1 (between Anchor and Carpark)	<80

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Appendix A Design Scenario FO

To achieve C/VM2 Design Scenario FO, refer to the FENZ fire fighting facilities correspondence in a separate document.

Further to the correspondence with FENZ, for the purposes of NZBC C5.5:

- Internal hydrants are located in the north-east and south-east stairwell.

For the purposes of NZBC C6.3, burnout calculation has been carried out as per Section A.1 below. The south-east and north-east stairwell have been designed as exitways with the following fire resistance rating:

- The south-east stairwell that leads to Tay Street is provided with an FRR of (60)/60/60.
- The north-east stairwell that leads to Esk Street is provided with an FRR of (60)/60/60.

Master fire control room, FAP, mimic, FSI and HI locations are as per the FENZ firefighting facilities correspondence provided separately.

A.1 Burnout Calculation

Fire resistance rating to withstand full burnout is calculated using the Eurocode method (refer comment to paragraph 2.4 of C/VM2):

Both the ground floor and Level 1 of the anchor space is considered as the same firecell due to the escalator atrium that connects both floors. The burnout fire resistance rating calculation for the Anchor firecell and the childcare firecell is summarised below, with calculations included in Appendix A.1.

Table 7 - Firecell Burnout Summary

Firecell	FHC	Floor Area (A_f) (m^2)	Openings (m^2)		Rating to withstand burnout (min.)	Proposed FRR (min.)
			Vertical A_v (Av/Af)	Horizontal A_h (Ah/Af)		
Anchor (GF & L1)	2	3549	224.6	n/a	41	60
Anchor (GF only)	2	3510	191	144.4	43	60
Anchor (L1 – concrete roof)	2	3330	33.6	n/a	79	-
Anchor (L1 – thin sheet steel roof)	2	3330	33.6	n/a	49	-
			Weighted average		58	60
Childcare	2	569	69	n/a	40	60

Level 1 Anchor is considered as intermediate floor due to the escalator atrium opening that connects ground floor and Level 1 and are provided with an FRR of (30)/30/30. The total intermediate floor area is more than 40% of the firecell area, thus integrity and insulation ratings need to apply to the intermediate floor.

Attached is the following:

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

- Anchor Burnout Calculation
- L2 Childcare Burnout Calculation
- FSKA.1.01 - FSKA.1.03

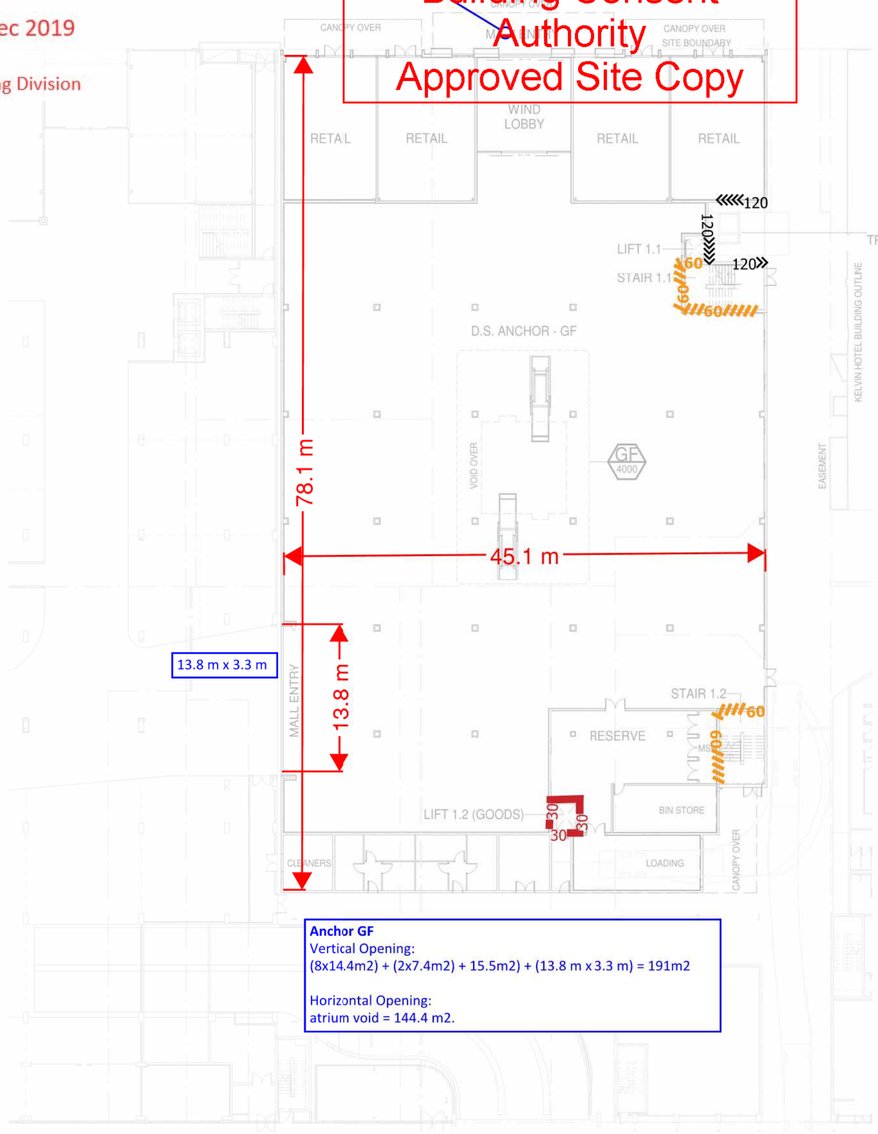
Environmental & Planning
Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Appendix A.1 - Burnout Calculation

Approved For Issue
27/02/2020

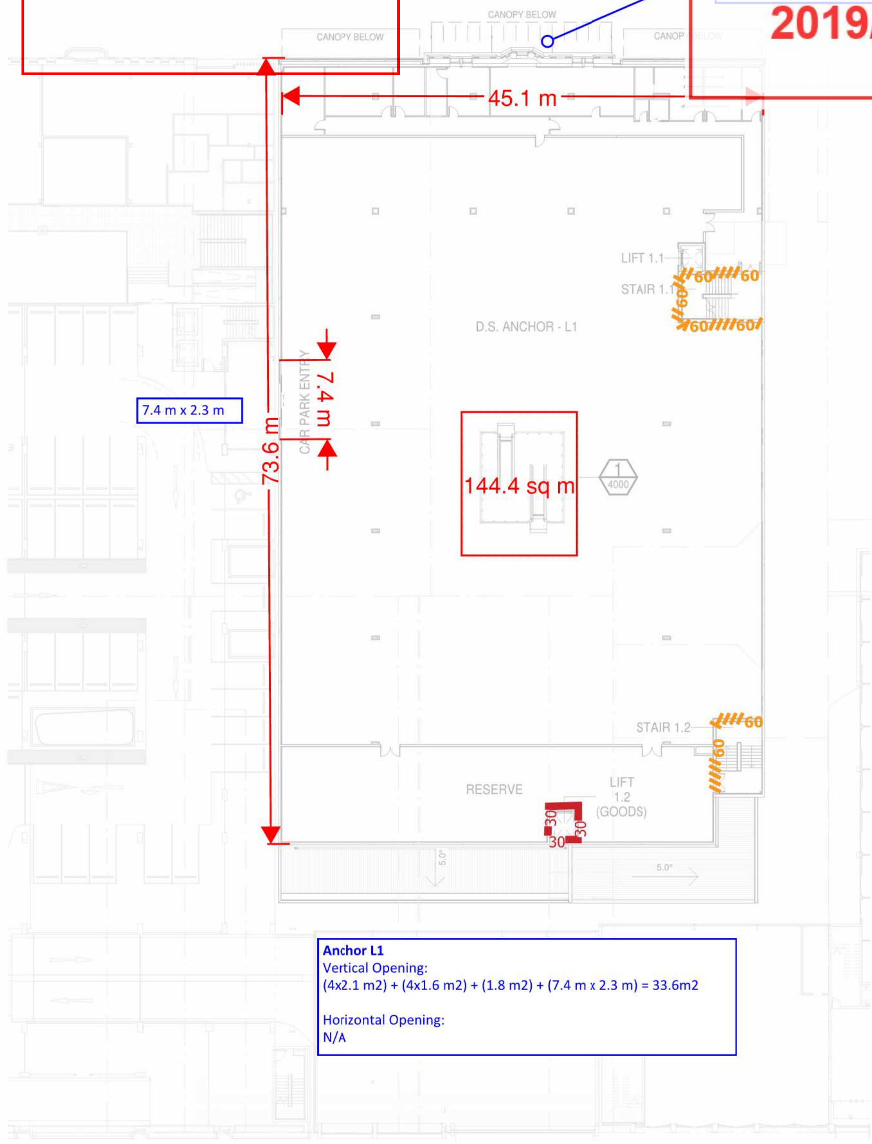
BUILDING CONSENT NUMBER
2019/1381



Anchor GF
Vertical Opening:
(8x14.4m2) + (2x7.4m2) + 15.5m2) + (13.8 m x 3.3 m) = 191m2

Horizontal Opening:
atrium void = 144.4 m2.

GF Z1 - GROUND FLOOR - OVERALL
1 : 250



Anchor L1
Vertical Opening:
(4x2.1 m2) + (4x1.6 m2) + (1.8 m2) + (7.4 m x 2.3 m) = 33.6m2

Horizontal Opening:
N/A

1 Z1 - LEVEL 1 - OVERALL
1 : 250

Holmes
Holmes Fire LP
L2, 254 Montreal St
Christchurch
New Zealand
T: +64 3 365 8855
holmesfire.com

Project Title	Sketch Title	Drawn: ACC	Date: 31 / 07 / 2019	
HWCP - Invercargill Central	Zone 1 Anchor Burnout Calculation Measurement	Project No. 136249	Sheet No. FSK A.1.01	Rev A

HWCP

INVERCARGILL CENTRAL - ZONE 1
TAY STREET & DEE STREET CORNER
INVERCARGILL
917077

PRELIMINARY DESIGN

ZONE 1
OVERALL FLOOR PLANS
Z1-PD-A-1100
D

BUCHAN
Christchurch Studio

Environmental & Planning Services I.C.C.
Document Received

17 Dec 2019

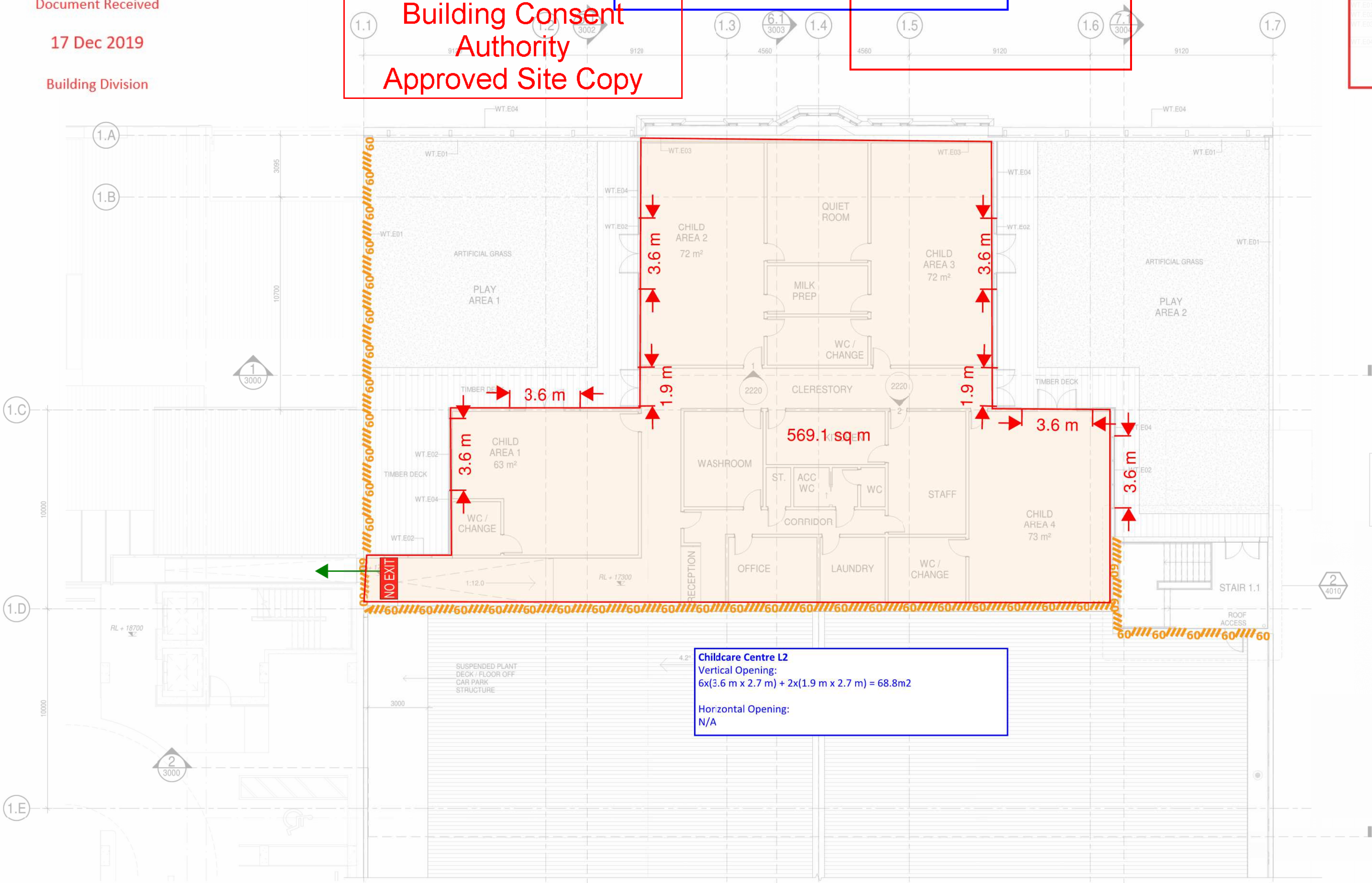
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

Appendix A.1 - Burnout Calculation

BUILDING CONSENT NUMBER
2019/1381



NOTE:
EXTERNAL PLAY AREA = 440m²
5m² PER CHILD REQUIRED = MAX. 88 CHILDREN

CHILD AREA CALCULATED AT 2.5m² PER CHILD
(+ 10% ALLOWANACE FOR FFE)

CHILD CARE FACILITY IS A PRELIMINARY CONCEPT AND IS PENDING OPERATORS REQUIREMENTS. LAYOUTS WILL LIKELY CHANGE ONCE THESE REQUIREMENTS ARE CONFIRMED.

Holmes	Holmes Fire LP L2, 254 Montreal St Christchurch New Zealand T: +64 3 365 8855 holmesfire.com	Project Title HWCP - Invercargill Central	Sketch Title Zone 1 L2 Childcare Burnout Calculation Measurement	Drawn: ACC	Date: 31 / 07 / 2019	
				Project No. 136249	Sheet No. FSK A.1.02	Rev A

HWCP

INVERCARGILL CENTRAL - ZONE 1
TAY STREET & DEE STREET CORNER
INVERCARGILL
917077

PRELIMINARY DESIGN

ZONE 1
LEVEL 2 FLOOR PLAN
Z1-PD-A-1105
E

BUCHAN

Environmental & Planning Services I.C.C.
Document Received

17 Dec 2019

Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Appendix A.1 - Burnout Calculation

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

1 Z1 - NORTH ELEVATION
1101 1 : 100

Holmes	Project Title	Sketch Title	Drawn: ACC	Date: 31 / 07 / 2019	
Holmes Fire LP L2, 254 Montreal St Christchurch New Zealand T: +64 3 365 8855 holmesfire.com	HWCP - Invercargill Central	Zone 1 Burnout Calculation Measurement	Project No. 136249	Sheet No. FSK A.1.03	Rev A

HWCP

INVERCARGILL CENTRAL - ZONE 1
TAY STREET & DEE STREET CORNER
INVERCARGILL
917077

DEVELOPED DESIGN

ZONE 1
PROPOSED ELEVATIONS
Z1-DD-A-2000

C

BUCHAN
Christchurch Studio

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

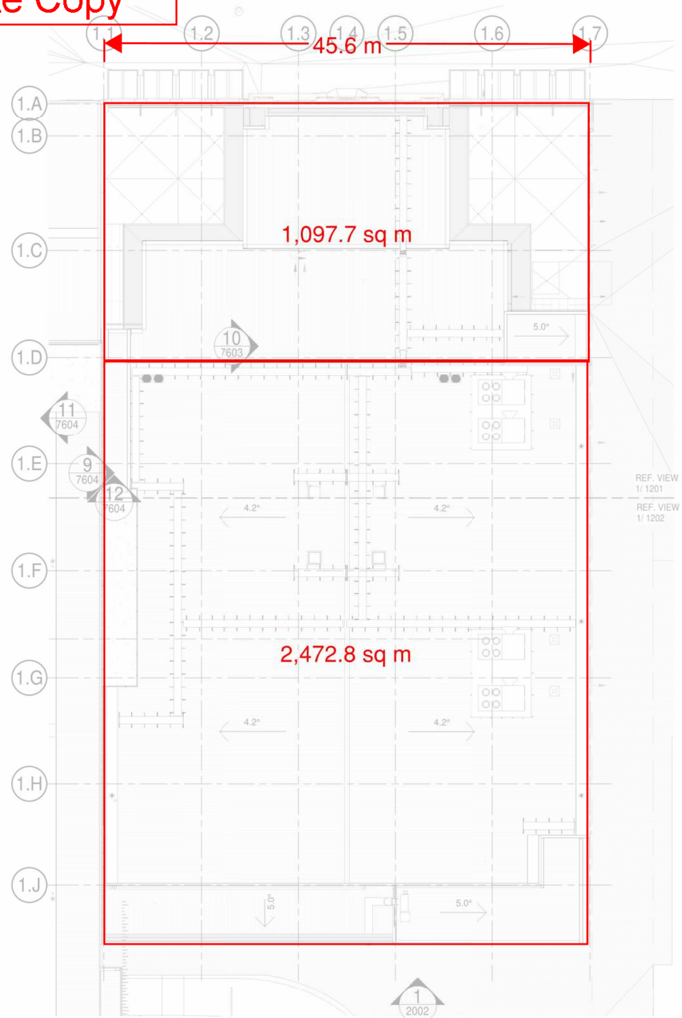
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Appendix A.1 - Burnout Calculation

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381



Holmes	Project Title	Sketch Title	Drawn: ACC	Date: 31 / 07 / 2019
Holmes Fire LP L2, 254 Montreal St Christchurch New Zealand T: +64 3 365 8855 holmesfire.com	HWCP - Invercargill Central	Zone 1 Burnout Calculation Measurement - Rooftop	Project No. 136249	Sheet No. FSK A.1.04 / Rev A

HWCP

INVERCARGILL CENTRAL - ZONE 1
TAY STREET & DEE STREET CORNER
INVERCARGILL
917077

DEVELOPED DESIGN

ZONE 1
OVERALL ROOF PLAN
Z1-DD-A-1200
D

BUCHAN
Christchurch Studio

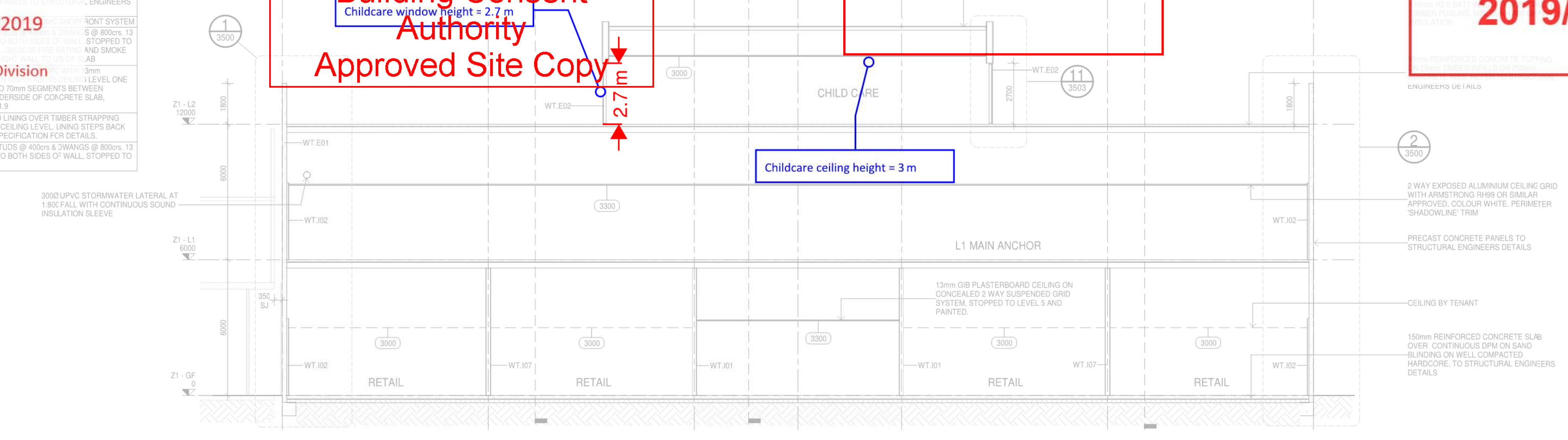
Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

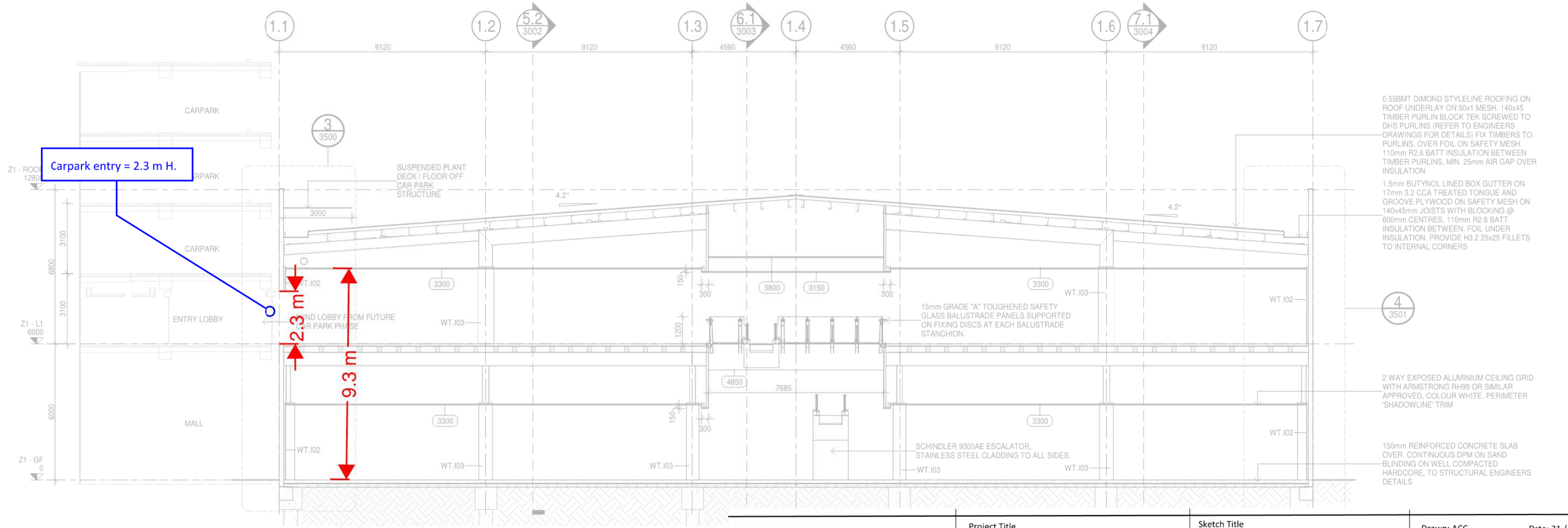
Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Appendix A.1 - Burnout Calculation



1 Z1 - MAIN SECTION 1
1 : 100



2 Z1 - MAIN SECTION 2
1 : 100

Holmes	Holmes Fire LP L2, 254 Montreal St Christchurch New Zealand T: +64 3 365 8855 holmesfire.com	Project Title HWCP - Invercargill Central	Sketch Title Zone 1 Burnout Calculation Measurement - Sections	Drawn: ACC Date: 31 / 07 / 2019 Project No. 136249 Sheet No. FSK A.1.05 Rev A

HWCP
INVERCARGILL
TAY STREET & DEE STREET CORNER
INVERCARGILL
917077
MAIN SECTION 1 & 2
Z1-PD-3000
A
BUCHAN

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

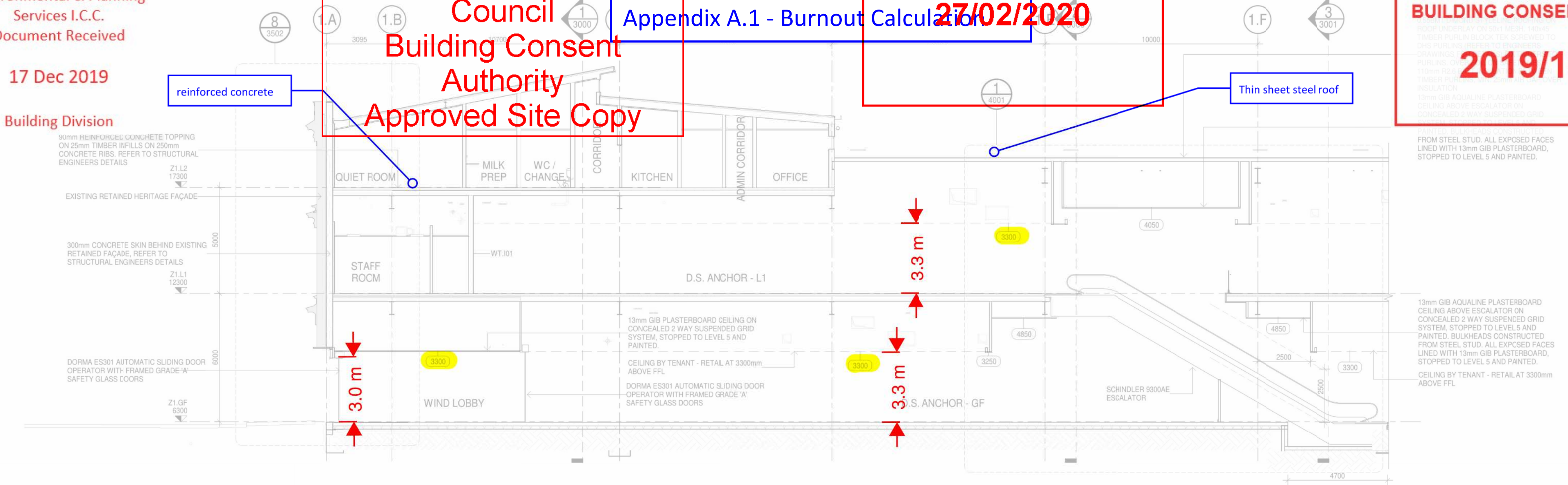
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

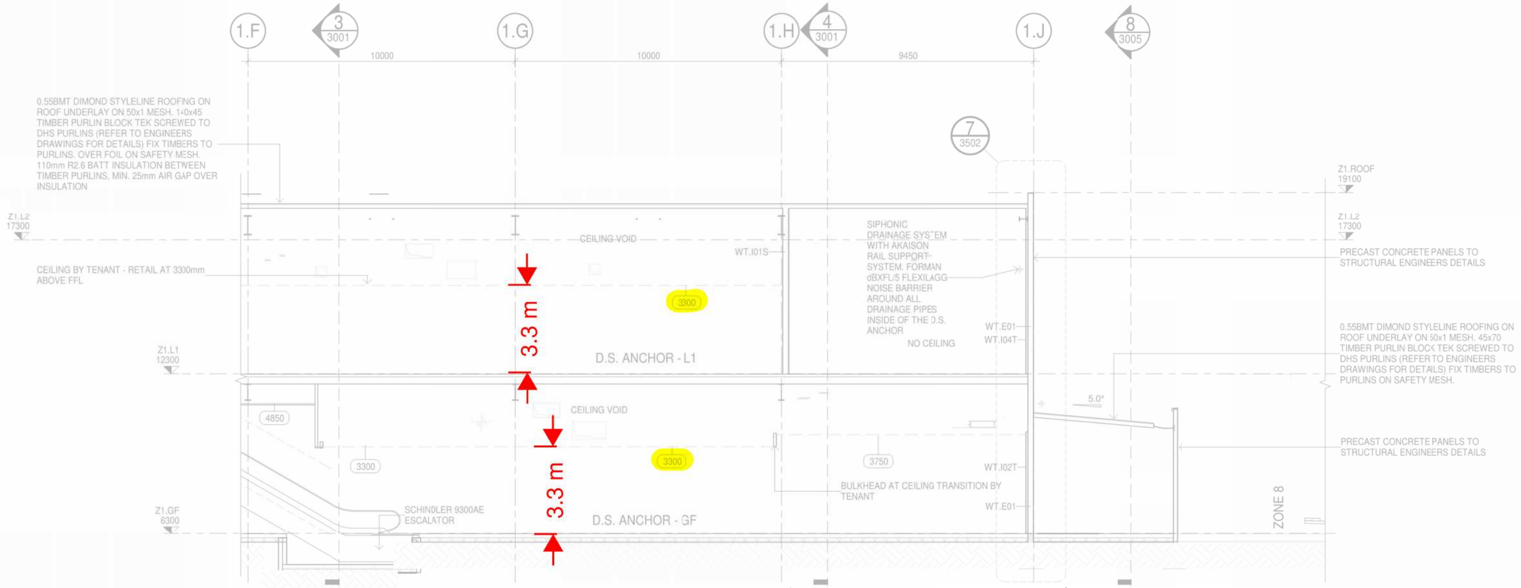
Approved For Issue
27/02/2020

Appendix A.1 - Burnout Calculation

BUILDING CONSENT NUMBER
2019/1381



6.1 / 1101 Z1 - MAIN SECTION 6 - PART 1
1 : 100



6.2 / 1102 Z1 - MAIN SECTION 6 - PA
1 : 100

WALL TYPES	
WALL CODE	DESCRIPTION
WT.E01	PRECAST CONCRETE PANELS TO STRUCTURAL ENGINEERS DETAILS
WT.E03	300mm CONCRETE SKIN BEHIND EXISTING RETAINED FAÇADE, REFER TO STRUCTURAL ENGINEERS DETAILS
WT.I01	190x45 H1.2 TIMBER STUDS @ 400crs & DWANGS @ 800crs. 13mm GIB PLASTERBOARD TO BOTH SIDES OF WALL, STOPPED TO LEVEL 4, PAINT FINISH. 17mm FULL HEIGHT PLYWOOD BETWEEN PLASTERBOARD AND FRAMING TO DS ANCHOR SIDE. FULL HEIGHT WALL TO U/S OF SLAB
WT.I01S	190x45 H1.2 TIMBER STUDS @ 400crs & DWANGS @ 800crs. 13mm GIB PLASTERBOARD TO BOTH SIDES OF WALL, STOPPED TO LEVEL 4, PAINT FINISH. 17mm FULL HEIGHT PLYWOOD BETWEEN PLASTERBOARD AND FRAMING TO DS ANCHOR SIDE. SMOKE SEPARATION REQUIRED. R2.2 BATTS TO ACHIEVE GIB SYSTEM GST132 FOR ACOUSTICS. FULL HEIGHT WALL TO U/S OF SLAB
WT.I02T	70mm H1.2 TIMBER STRAPPING @ 600crs. ON DPC WITH 13mm PLASTERBOARD TAKEN 100mm ABOVE CEILING LEVEL ONE SIDE. 75mm LOFTED TO 70mm SEGMENTS BETWEEN STRAPPING UP TO UNDERSIDE OF CONCRETE SLAB, R2.2 BATTS
WT.I04T	70mm H1.2 TIMBER STRAPPING ON DPC WITH 12mm MDF ONE SIDE. ONE COAT OF CLEAR POLYURETHANE. 75mm LOFTED TO 70mm SEGMENTS BETWEEN STRAPPING UP TO UNDERSIDE OF CONCRETE SLAB, MINIMUM VALUE OF R2.2
WT.I32	BULKHEAD AT CEILING TRANSITION BY TENANT

Holmes	Project Title	Sketch Title	
Holmes Fire LP L2, 254 Montreal St Christchurch New Zealand T: +64 3 365 8855 holmesfire.com	HWCP - Invercargill Central	Zone 1 Burnout Calculation Measurement - Sections	Drawn: ACC — Date: 31 / 07 / 2019 Project No. 136249 — Sheet No. FSK A.1.06 — Rev A

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

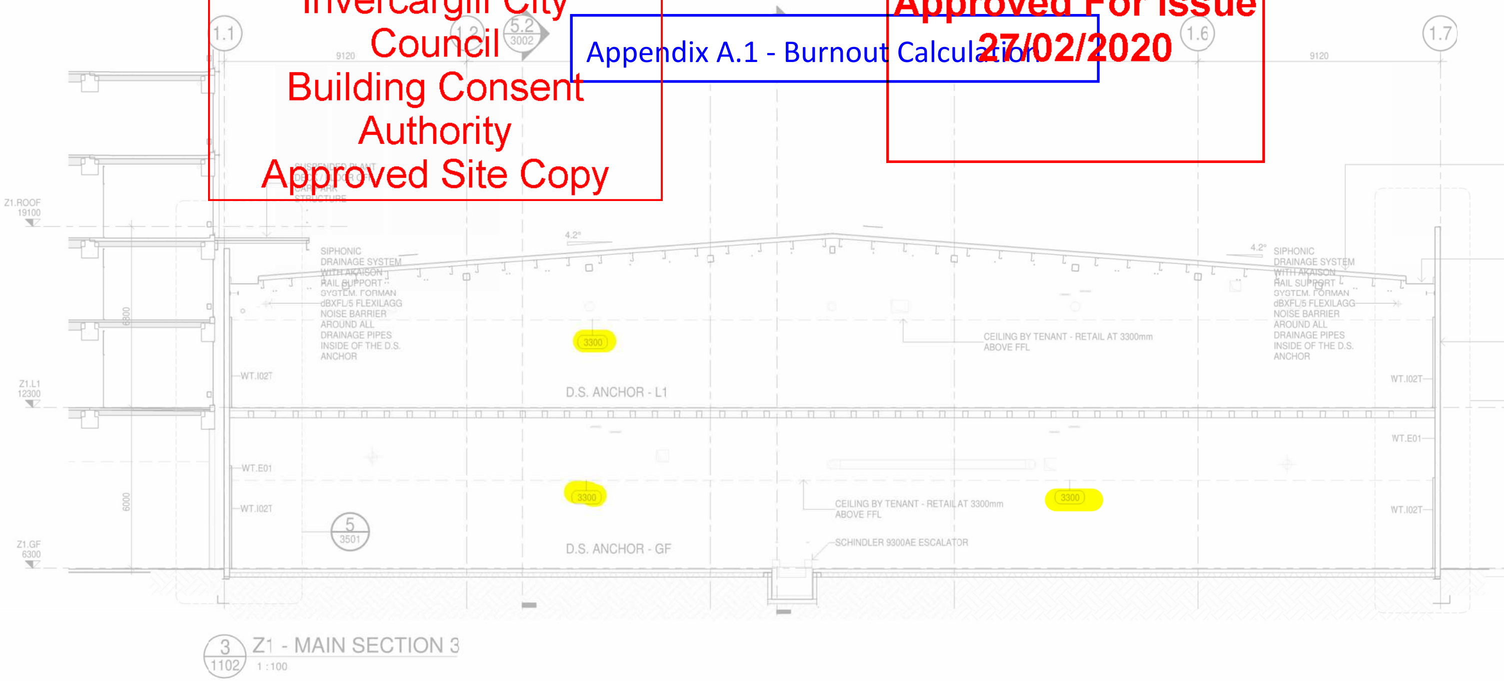
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Appendix A.1 - Burnout Calculation

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381



3 Z1 - MAIN SECTION 3
1102 1 : 100

WALL TYPES	
WALL CODE	DESCRIPTION
WT.E01	PRECAST CONCRETE PANELS TO STRUCTURAL ENGINEERS DETAILS
WT.I02T	70mm H1.2 TIMBER STRAPPING @ 600crs. ON DPC WITH 13mm PLASTERBOARD TAKEN 100mm ABOVE CEILING LEVEL ONE SIDE. 75mm LOFTED TO 70mm SEGMENTS BETWEEN STRAPPING UP TO UNDERSIDE OF CONCRETE SLAB, R2.2 BATTS
WT.I03	13mm PLASTERBOARD LINING OVER TIMBER STRAPPING, STOPS 100mm ABOVE CEILING LEVEL. LINING STEPS BACK AT BASE
WT.I04	45mm H1.2 TIMBER STRAPPING ON DPC WITH 12mm MDF ONE SIDE. ONE COAT OF CLEAR POLYURETHANE
WT.I04T	70mm H1.2 TIMBER STRAPPING ON DPC WITH 12mm MDF ONE SIDE. ONE COAT OF CLEAR POLYURETHANE. 75mm LOFTED TO 70mm SEGMENTS BETWEEN STRAPPING UP TO UNDERSIDE OF CONCRETE SLAB, MINIMUM VALUE OF R2.2
WT.I05T	190x45 H1.2 TIMBER STUDS @ 400crs & DWANGS @ 800crs. FULL HEIGHT WALL. 13mm GIB PLASTERBOARD , STOPPED TO LEVEL 4, PAINT FINISH ON 17mm FULL HEIGHT PLYWOOD TO DS ANCHOR SIDE. 12mm MR MDF TO RESERVE SIDE, 4600mm HIGH. R2.6 INSULATION FULL HEIGHT.
WT.I06T	140x45 H1.2 TIMBER STUDS @ 400crs & DWANGS @ 800crs. 13mm GIB PLASTERBOARD TO BOTH SIDES OF WALL, STOPPED TO LEVEL 4. EARTHWOOL INSULATION WITHIN FRAME. FULL HEIGHT WALL
WT.I11	9mm VILLABOARD LINING FIXED BACK TO 140x45 H1.2 TREATED TIMBER FRAMING @ MAX 600 CRS TAKEN 100mm PASSED CEILING HEIGHT. CLAD WITH 400x400x15mm "CREAME MARPHIL" MARBLE TILES.
[illegible]	BULKHEAD AT CEILING TRANSITION BY TENANT

4 Z1 - MAIN SECTION 4
1102 1 : 100

Holmes	Holmes Fire LP L2, 254 Montreal St Christchurch New Zealand T: +64 3 365 8855 holmesfire.com	Project Title HWCP - Invercargill Central	Sketch Title Zone 1 Burnout Calculation Measurement - Sections	Drawn: ACC Date: 31 / 07 / 2019 Project No. 136249 Sheet No. FSK A.1.07 Rev A

HWCP

INVERCARGILL CENTRAL - ZONE 1
TAY STREET & DEE STREET CORNER
INVERCARGILL
917077

DEVELOPED DESIGN

ZONE 1
MAIN SECTION 3 & 4
Z1-DD-A-3001
E

BUCHAN
Christchurch Studio

Environmental & Planning Services I.C.C. Document Received
17 Dec 2019
Building Division

Invercargill City Council Building Consent Authority Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Appendix A1 - Burnout Calculation

Holmes Fire

Holmes

Equivalent Fire Severity Calculation

Ref 1: Spearpoint, M.J., Fire Engineering Design Guide - Third Edition, Centre for Advanced Engineering, University of Canterbury, 2008. Ch. 6.4

Ref 2: C/VM2 Verification Method: Framework for Fire Safety Design (July 2014) *For New Zealand Building Code Clauses C1-6 Protection from Fire*

Job No.	136249
Project Name:	HWCP Zone 1 Anchor
By:	ACC
Space:	Anchor - GF & L1

Whole building - including both ground floor and level 1

$t_e = e_f k_b k_m w_f$ (minutes)

where:
- t_e = Time equivalence fire severity
- e_f = Design fire load energy density
- k_b = Thermal properties conversion factor
- w_f = Ventilation factor
- k_m = Modification factor for load-bearing structure material

Firecell lining materials =	Normal weight concrete ceiling and floors		k_b =	0.065	
			w_f =	(6/H)^0.3*(0.62+90*(0.4-H27)^4/(1+(b_v*H28)))	
Fire cell width, W =	45.5	m			
Fire cell length, L =	78	m	Calculated w_f =	1.56	w_f >= 0.50 (C/VM2)
Fire cell height, H =	9.3	m	Use w_f =	1.56	
Floor area, A_f =	3549.0	m^2	Calcuted $\alpha_v = A_v/A_f$ =	0.063	
Vertical openings, A_v =	224.6	m^2	Use $\alpha_v = A_v/A_f$ =	0.063	0.025 <= α_v <= 0.25 (C/VM2)
Horizontal openings, A_h =		m^2	$\alpha_h = A_h/A_f$ =	0.00	
			b_v=	20	b_f >= 10
Fire Load Energy Density =	800 MJ/m2		FLED =	812 MJ	
F_m factor for FLED = C/VM2 Table 2.2	Sprinklered: structural elements		F_m =	0.50	
			e_f =	406 MJ	
Burnout Rating for firecell, t_e =	**41**	**minutes**			
Rating for structural material =	Unprotected steel members		k_m =	1.00	km >= 1 (C/VM2)
			Av(heq)0.5/At=	0.036	0.02 <= to <=0.20
Av Height of Openings, h_{eq}=	2.3	m (relevant to unprotected steel, only)			
Time equivalence value, t_e =	41	minutes			

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Appendix A1 - Burnout Calculation

Holmes Fire

Holmes

Equivalent Fire Severity Calculation

Ref 1: Spearpoint, M.J., Fire Engineering Design Guide - Third Edition,
Centre for Advanced Engineering, University of Canterbury, 2008. Ch. 6.4

Ref 2: C/VM2 Verification Method: Framework for Fire Safety Design (July 2014)
For New Zealand Building Code Clauses C1-6 Protection from Fire

Job No.	136249
Project Name:	HWCP Zone 1 Anchor
By:	ACC
Space:	Ground Floor Anchor

Ground floor only.

$t_e = e_f k_b k_m w_f$ (minutes)

where:

- t_e = Time equivalence fire severity
- e_f = Design fire load energy density
- k_b = Thermal properties conversion factor
- w_f = Ventilation factor
- k_m = Modification factor for load-bearing structure material

Firecell lining materials =	Normal weight concrete ceiling and floors		k_b =	0.065	
			w_f =	(6/H)^0.3*(0.62+90*(0.4-H27)^4/(1+(b_v*H28)))	
Fire cell width, W =	45	m	Calculated w_f =	1.60	w_f >= 0.50 (C/VM2)
Fire cell length, L =	78	m	Use w_f =	1.60	
Fire cell height, H =	3.3	m			
Floor area, A_f =	3510.0	m^2	Calcuted $a_v = A_v/A_f$ =	0.054	
Vertical openings, A_v =	191.0	m^2	Use $a_v = A_v/A_f$ =	0.054	0.025 <= a_v <= 0.25 (C/VM2)
Horizontal openings, A_h =	144.4	m^2	$a_h = A_h/A_f$ =	0.04	
			b_v=	19	b_f >= 10
Fire Load Energy Density =	800 MJ/m2		FLED =	822 MJ	
F_m factor for FLED = C/VM2 Table 2.2	Sprinklered: structural elements		F_m =	0.50	
			e_f =	411 MJ	
Burnout Rating for firecell, t_e =	**43**	**minutes**			
Rating for structural material =	Unprotected steel members		k_m =	1.00	km >= 1 (C/VM2)
			Av(heq)0.5/At=	0.034	0.02 <= to <=0.20
Av Height of Openings, h_{eq}=	1.9	m (relevant to unprotected steel, only)			
Time equivalence value, t_e =	43	minutes			

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Appendix A1 - Burnout Calculation
Holmes Fire

Holmes

Equivalent Fire Severity Calculation

Ref 1: Spearpoint, M.J., Fire Engineering Design Guide - Third Edition, Centre for Advanced Engineering, University of Canterbury, 2008. Ch. 6.4

Ref 2: C/VM2 Verification Method: Framework for Fire Safety Design (July 2014)
For New Zealand Building Code Clauses C1-6 Protection from Fire

Job No.	136249
Project Name:	HWCP Zone 1 Anchor
By:	ACC
Space:	L1 Anchor - Concrete roof

Level 1 only - with concrete roof.
Note the roof to Level 1 is partial concrete and partial thin sheet steel.

$t_e = e_f k_b k_m w_f$ (minutes)

where:

- t_e = Time equivalence fire severity
- e_f = Design fire load energy density
- k_b = Thermal properties conversion factor
- w_f = Ventilation factor
- k_m = Modification factor for load-bearing structure material

Firecell lining materials =	Normal weight concrete ceiling and floors		k_b =	0.065	
			w_f =	(6/H)^0.3*(0.62+90*(0.4-H27)^4/(1+(b_v*H28)))	
Fire cell width, W =	45	m	Calculated w_f =	2.87	w_f >= 0.50 (C/VM2)
Fire cell length, L =	74	m	Use w_f =	2.87	
Fire cell height, H =	3.3	m			
Floor area, A_f =	3330	m^2	Calcuted $\alpha_v = A_v/A_f$ =	0.010	
Vertical openings, A_v =	33.6	m^2	Use $\alpha_v = A_v/A_f$ =	0.025	0.025 <= α_v <= 0.25 (C/VM2)
Horizontal openings, A_h =		m^2	$\alpha_h = A_h/A_f$ =	0.00	
			b_v=	16	b_f >= 10
Fire Load Energy Density =	800 MJ/m2		FLED =	847 MJ	
F_m factor for FLED = C/VM2 Table 2.2	Sprinklered: structural elements		F_m =	0.50	
			e_f =	423.5 MJ	
Burnout Rating for firecell, t_e =	**79**	**minutes**			
Rating for structural material =	Unprotected steel members		k_m =	1.00	km >= 1 (C/VM2)
			Av(heq)0.5/At=	0.007	0.02 <= to <=0.20
Av Height of Openings, h_{eq}=	2.3	m (relevant to unprotected steel, only)			
Time equivalence value, t_e =	79	minutes			

Environmental & Planning
Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

Appendix A1 - Burnout Calculation

BUILDING CONSENT NUMBER
2019/1381

Holmes Fire

Equivalent Fire Severity Calculation

Holmes

Ref 1: Spearpoint, M.J., Fire Engineering Design Guide - Third Edition, Centre for Advanced Engineering, University of Canterbury, 2008. Ch. 6.4

Ref 2: C/VM2 Verification Method: Framework for Fire Safety Design (July 2014)
For New Zealand Building Code Clauses C1-6 Protection from Fire

Job No.	136249
Project Name:	HWCP Zone 1 Anchor
By:	ACC
Space:	L1 Anchor - thin sheet steel roof

Level 1 only - with thin sheet steel roof.
Note the roof to Level 1 is partial concrete and partial thin sheet steel.

$t_e = e_f k_b k_m w_f$ (minutes)

where:
- t_e = Time equivalence fire severity
- e_f = Design fire load energy density
- k_b = Thermal properties conversion factor
- w_f = Ventilation factor
- k_m = Modification factor for load-bearing structure material

Firecell lining materials =	Thin sheet steel roof and any wall system		k_b =	0.04	
			w_f =	(6/H)^0.3*(0.62+90*(0.4-H27)^4/(1+(b_v*H28)))	
Fire cell width, W =	45	m	Calculated w_f =	2.87	w_f >= 0.50 (C/VM2)
Fire cell length, L =	74	m	Use w_f =	2.87	
Fire cell height, H =	3.3	m	Calcuted $a_v = A_v/A_f$ =	0.010	
Floor area, A_f =	3330	m^2	Use $a_v = A_v/A_f$ =	0.025	0.025 <= a_v <= 0.25 (C/VM2)
Vertical openings, A_v =	33.62	m^2	$a_h = A_h/A_f$ =	0.00	
Horizontal openings, A_h =		m^2	b_v=	16	b_f >= 10
Fire Load Energy Density =	800 MJ/m2		FLED =	847 MJ	
F_m factor for FLED = C/VM2 Table 2.2	Sprinklered: structural elements		F_m =	0.50	
			e_f =	423.5 MJ	
Burnout Rating for firecell, t_e =	**49**	**minutes**			
Rating for structural material =	Unprotected steel members		k_m =	1.00	km >= 1 (C/VM2)
Av Height of Openings, h_{eq}=	2.3	m (relevant to unprotected steel, only)	Av(heq)0.5/At=	0.007	0.02 <= to <=0.20
Time equivalence value, t_e =	49	minutes			

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Appendix A1 - Burnout Calculation

Level 1 Anchor Space - Weighted FRR

Job No.	136249
Project Name:	HWCP Zone 1 Anchor
By:	ACC
Space:	L1 Anchor

Level 1 only - weighted FRR calculation for Level 1 anchor space to include both the concrete roof and thin sheet steel roof.

1L	Area (m2)	Weighting factors	FRR	weighted FRR
Concrete roof	1098	0.31	79.0	24.3
thin sheet steel roof	2473	0.69	49.0	33.9
Total	3571	1.00		**58**

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Appendix A1 - Burnout Calculation

Holmes Fire

Holmes

Equivalent Fire Severity Calculation

Ref 1: Spearpoint, M.J., Fire Engineering Design Guide - Third Edition, Centre for Advanced Engineering, University of Canterbury, 2008. Ch. 6.4

Ref 2: C/VM2 Verification Method: Framework for Fire Safety Design (July 2014) *For New Zealand Building Code Clauses C1-6 Protection from Fire*

Job No.	136249
Project Name:	HWCP Zone 1 Anchor
By:	ACC
Space:	Zone 1 L2 Childcare Centre

$t_e = e_f k_b k_m w_f$ (minutes)

where:

t_e = Time equivalence fire severity
e_f = Design fire load energy density
k_b = Thermal properties conversion factor
w_f = Ventilation factor
k_m = Modification factor for load-bearing structure material

Firecell lining materials =	Normal weight concrete ceiling and floors		k_b =	0.065		
			w_f =	(6/H)^0.3*(0.62+90*(0.4-H27)^4/(1+(b_v*H28)))		
Fire cell width, W =		m	Calculated w_f =	1.44		w_f >= 0.50 (C/VM2)
Fire cell length, L =		m	Use w_f =	1.44		
Fire cell height, H =	3	m	Calcuted $a_v = A_v/A_f$ =	0.121		
Floor area, A_f =	569	m^2				
Vertical openings, A_v =	68.58	m^2	Use $a_v = A_v/A_f$ =	0.121		0.025 <= a_v <= 0.25 (C/VM2)
Horizontal openings, A_h =		m^2	$a_h = A_h/A_f$ =	0.00		
			b_v=	27		b_f >= 10
Fire Load Energy Density =	800 MJ/m2		FLED =	847	MJ	
F_m factor for FLED = C/VM2 Table 2.2	Sprinklered: structural elements		F_m =	0.50		
			e_f =	423.5	MJ	
Burnout Rating for firecell, t_e =	**40**	**minutes**				

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Appendix B RSET Assessment

B.1 Childcare Centre RSET time - Hand Calculation

RSET time for the Childcare centre has utilised hand calculation with a summary shown in Table 8 below and spreadsheet calculation shown in Section B.2.1 and B.2.2:

Table 8 - Childcare RSET Summary

CF	Smoke Detection Time, td (s)	RSET (without td) (s)	RSET[1] (s)
CF1	41	742	783
CF2	25	742	767
CF3	29	682	711
RC1	44	742	786

Explanatory Notes:

1) The RSET time is taken till the last person leaving the building.

B.1.1 RSET time for fire located within the Childcare centre

Zone 1 Level 2 Childcare
Challenging Fire 3 - Fire located within the Childcare

RSET component	Inputs			Value	
t_d	determined by B-Risk using C/VM2 input parameters (smoke activation)			29 s	
t_{n-}	As per C/VM2			30 s	
t_{pre}	Pre-movement time (C/VM2 Table 3.3) for teachers			60 s	
t_{pre}	Pre-movement time 60 seconds per staff per child (88 children + 12 staff) 88/12 = 8 trips to get children to buffer area 8 trips x 60 s each trip = 480 s			480 s	Total time to Buffer Area = 600 s
t_{trav}	= distance / walking speed (= distance/S) *distance (assumed)* = 35.4 *m* S = 0.7 *m/s*		51		
t_{flow}	= distance / walking speed (= distance/S) *distance* = 30.5 *m* *S* = 0.5 *m/s*		61		
t_{move}	= *the combination of* t_{flow} *and* t_{trav}		tflow	112 s	
RSET	$= (t_d + t_n + t_{pre}) + t_{move}$		RSET =	**711 s**	

B.1.2 RSET time for fire remote from Childcare centre

The RSET time for a fire remote from the Childcare centre did not include the detection time.

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Zone 1 Level 2 Childcare
RSET for fire remote from the Childcare Centre

RSET component	Inputs		Value	
t_d	determined by B-Risk using C/VM2 input parameters (smoke activation)			s
t_{n-}	As per C/VM2		30	s
t_{pre}	Pre-movement time (C/VM2 Table 3.3) for teachers		120	s
t_{pre}	Pre-movement time 60 seconds per staff per child (88 children + 12 staff) 88/12 = 8 trips to get children to buffer area 8 trips x 60 s each trip = 480 s		480	s
t_{trav}	= distance / walking speed (= distance/S) *distance (assumed)* = 35.4 *m* S = 0.7 *m/s*	51		
t_{flow}	= distance / walking speed (= distance/S) *distance* = 30.5 *m* *S* = 0.5 *m/s*	61		
t_{move}	*= the combination of t_{flow} and t_{trav}*	**tflow**	112	s
RSET	$= (t_d + t_n + t_{pre}) + t_{move}$	**RSET =**	**742**	**s**

Total time to Buffer Area = 600 s

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

B.2 EvacuatioNZ Model Input Data

A total of two egress scenarios are assessed, a base case and the non-base case as per agreed in the Zone 1 FEB for Challenging Fire 1 and 2. Refer to the master FEB for the sketches indicating the proposed egress distributions.

The following table summarises input data utilised for the RSET calculation within the EvacuatioNZ model for ground floor and first floor Anchor.

Table 9 - EvacuatioNZ Input Data

Input	Comment
Occupant Loads	For the base case egress model, we have limited the model to: • Ground Floor Anchor. • First Floor Anchor. For the non-base case egress model, we have included the following areas: • Ground Floor Anchor. • First Floor Anchor. • Zone 3 Carpark building L1 – L4 – utilising Zone 3 FEV occupant load. • Zone 3 Carpark building L5 with an occupant load of 999 people. • Zone 2 Mall Ground Floor – utilising Master FEB occupant load. Note the Zone 2 mall numbers may need to be refined at a later stage. If occupant load increased significantly in the future stage, we will re-address the assessment to incorporate the additional occupant load.
Egress Routes	As agreed in Master FEB.
Detection Time	Detection time is not included in EvacuatioNZ modelling results. For all Challenging Fires, smoke detector activation time is utilised for detection time (Time derived from FDS and B-Risk Results).
Notification Time	Notification time of 30 seconds is utilised as agreed in Master FEB. This is included in EvacuatioNZ modelling.
Pre-Movement Time	Pre-movement times, as agreed in the Master FEB, on basis of voice alarm: • 30 seconds, if within enclosure of fire origin. • 60 seconds, if remote from enclosure of fire origin.
Modelled Areas/Nodes	The actual floor areas have not been modelled in EvacuatioNZ., it is expected that queuing time will govern due to the number of occupants. Therefore, floor area (thus travel time) will not be a dominant factor. Hand calculation was carried out to verify that travel distance is not the governing factor on both ground floor and first floor but rather the queuing time. Therefore, the actual floor areas have not been modelled in EvacuatioNZ. Refer to attached EvacuatioNZ diagram for detailed model information with hand calculation validation shown in Appendix B.5.
Egress Widths	EvacuatioNZ makes deduction to the input clear widths to account for the boundary layer relative to a single opening.

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Input	Comment
Distribution Weighting	As agreed in Master FEB.

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

B.3 RSET for base case

The following figure represents clearance times from each level for Base case for Challenging Fire 1, 2, 3 and RC1 utilising EvacuatioNZ model.

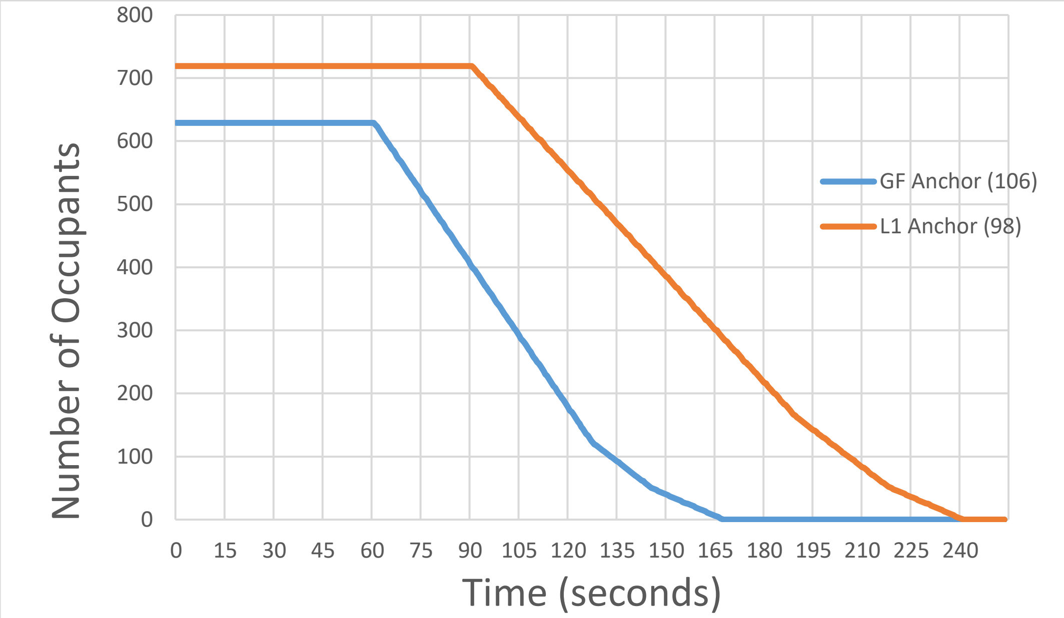


Figure 1 - EvacuatioNZ Node Clearance Times in anchor space for Base case CF1, CF2 and RC1.

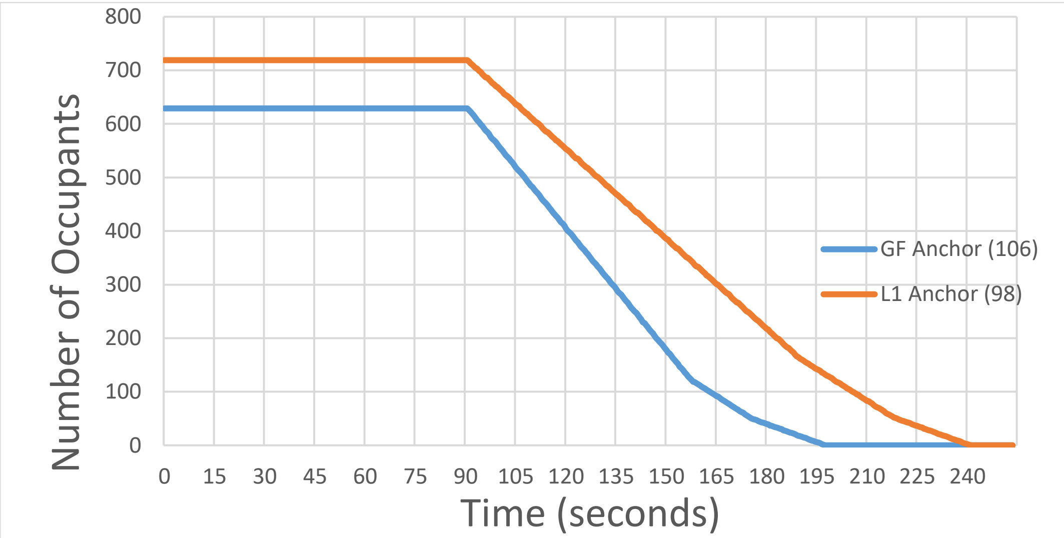


Figure 2 - EvacuatioNZ Node Clearance Times in anchor space for Base case CF3.

The following table summarises clearance times for various nodes:

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Table 10 - Clearance Time for Base case.

Location[1]	Clearance Time[2,3] (excl. detection time) (s)	
	CF1, CF2 & RC1[2]	CF3[3]
GF Anchor	168	198
L1 Anchor	241	241
L1 Stair 3 Landing[4]	237	237
L1 Anchor-S BoH[5]	194	194
L0 Stair 3 Landing[6]	254	254
L0 Stair 4 landing[7]	226	226

Explanatory Notes:

1) Location is the space represented as nodes in EvacuatioNZ.

2) The Clearance Time for Challenging Fire Scenarios CF1, CF2 and Robustness Check Scenario RC1 includes notification time of 30 sec and pre-movement time of 30 sec for ground floor anchor space and 60 sec for first floor anchor space.

3) The Clearance Time for Challenging Fire Scenario CF3 includes notification time of 30 sec and pre-movement time of 60 sec for ground floor and first floor anchor space.

4) 'L1 Stair 3 Landing' is the node that corresponds to the lobby space before entering into Stair 3 which indicates the queuing clear time preceding stair 3.

5) 'L1 Anchor-S BoH' is the node that corresponds to the lobby space before entering into Stair 4 which indicate the queuing clear time preceding stair 4.

6) 'L0 Stair3 Landing' is the node that corresponds to the space precede the final exit from Stair 3 (L1 Anchor north stairwell) which is shared by the occupants from L2 Childcare space.

7) 'L0 Stair4 Landing' is the node that corresponds to the space precede the final exit from Stair 4 (i.e. time to clear L1 Anchor south stairwell).

The following table summarises the RSET for various nodes:

Table 11 - RSET time for Base case.

CF	Location	Smoke Detection Time[1] (s)	RSET[2] (s)
CF1	GF Anchor	41	209
	L1 Anchor		282
	L1 Stair 3 Landing[3]		278
	L1 Anchor-S BoH[4]		235
	L0 Stair 3 Landing[5]		295
	L0 Stair 4 landing[6]		267
CF2	GF Anchor	25	193

Rev B

Environmental & Planning Services I.C.C. Document Received 17 Dec 2019 Building Division

Invercargill City Council Building Consent Authority Approved Site Copy

Approved For Issue 27/02/2020

BUILDING CONSENT NUMBER 2019/1381

CF	Location	Smoke Detection Time[1] (s)	RSET[2] (s)	
	L1 Anchor		266	Rev B
	L1 Stair 3 Landing[3]		262	
	L1 Anchor-S BoH[4]		219	
	L0 Stair 3 Landing[5]		279	
	L0 Stair 4 landing[6]		251	
CF3	GF Anchor	29	227	
	L1 Anchor		270	Rev B
	L1 Stair 3 Landing[3]		266	
	L1 Anchor-S BoH[4]		223	
	L0 Stair 3 Landing[5]		283	
	L0 Stair 4 landing[6]		255	
RC1	GF Anchor	44	212	
	L1 Anchor		285	Rev B
	L1 Stair 3 Landing[3]		281	
	L1 Anchor-S BoH[4]		238	
	L0 Stair 3 Landing[5]		298	
	L0 Stair 4 landing[6]		270	

Explanatory notes:

1) Refer to Appendix C for a summary of the FDS results and smoke activation time.
2) RSET is calculated by the sum of 'Clearance Time' plus 'Smoke Detection Time.
3) 'L1 Stair 3 Landing' is the node that corresponds to the lobby space before entering into Stair 3 which indicates the queuing clear time preceding stair 3.
4) 'L1 Anchor-S BoH' is the node that corresponds to the lobby space before entering into Stair 4 which indicate the queuing clear time preceding stair 4.
5) 'L0 Stair3 Landing' is the node that corresponds to the space precede the final exit from Stair 3 (L1 Anchor north stairwell) which is shared by the occupants from L2 Childcare space.
6) 'L0 Stair4 Landing' is the node that corresponds to the space precede the final exit from Stair 4 (i.e. time to clear L1 Anchor south stairwell).

B.3.1 Childcare centre Evacuation – Base Case

Stair 3 from the anchor space is the designated share egress for both Level 1 Anchor space and L2 Childcare centre. As can be seen above in Table 11, the time taken for the L1 Anchor occupant to egress via stair 3 for all three challenging fires are less than 300 seconds while the pre-movement time for the childcare building is 600 seconds for a fire within the Childcare centre and 660 seconds for a fire remote

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

Building Division

Invercargill City
Council
Building Consent
Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER

2019/1381

from the Childcare centre. Therefore, the egress time from the Childcare centre can be considered as isolated from the remainder of the building.

Attached is the following:

- EvacNZ model Setup FSK Z1 B.3.01
- Base case EvacuatioNZ Setup.
- Base case EvacuatioNZ Output file.

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

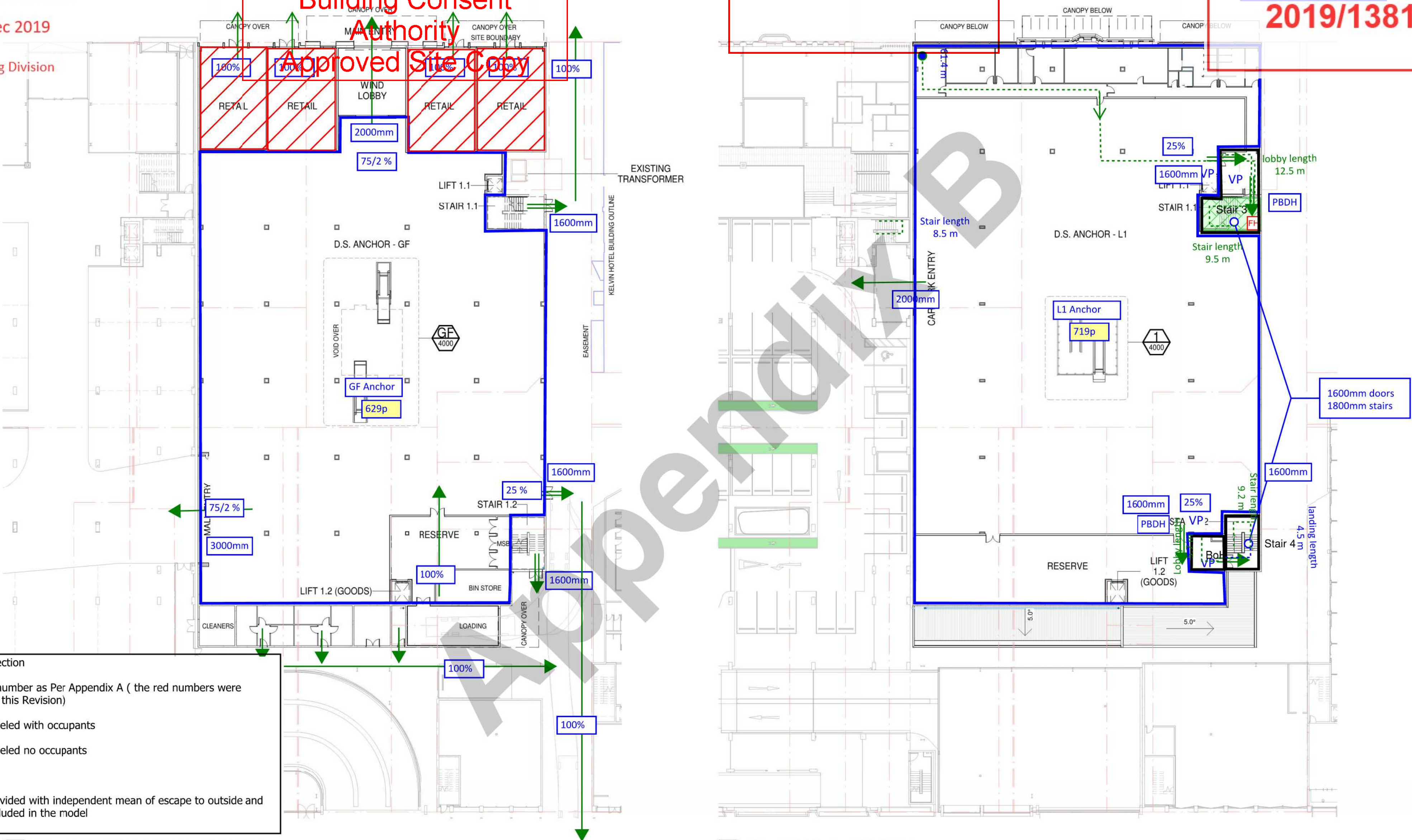
Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Appendix B.3

Appendix B



GF Z1 - GROUND FLOOR - OVERALL
1 : 250

1 Z1 - LEVEL 1 - OVERALL
1 : 250

- Egress Direction
- 11p Occupant number as Per Appendix A (the red numbers were updated in this Revision)
- Space modeled with occupants
- Space modeled no occupants
- Safe Place
- Spaces provided with independent mean of escape to outside and are not included in the model

This sketch does not constitute a complete fire engineering design or detail. Detailed construction drawings are provided by others. Best viewed in colour. Not all fire separations around ducts and shafts are shown.

Holmes

Holmes Fire LP
L2, 254 Montreal St
Christchurch
New Zealand
T: +64 3 365 8855
holmesfire.com

Project Title	Sketch Title	Drawn: ACC	Date: 30 / 07 / 2019	
HWCP - Invercargill Central	Zone 1 GF & L1 Travel Distance Measurement	Project No. 136249	Sheet No. FSK Z1 B.3.01	Rev A

Rev.	Date	Description	Iss.	Appr.
A	27.11.18	FOR COMMENT	BH	JB
B	10.01.19	PRELIMINARY DESIGN	BH	JB
C	21.03.19	PRELIMINARY DESIGN	BH	DA
D	17.04.19	FOR INFORMATION	JT	DA

Keyplan: EXISTING CINEMA, ZONE 1, KELVIN

Do not scale this drawing. Verify all dimensions on site before commencing any work. Copyright © 2019Buchan. This drawing remains the property of The Buchan Group New Zealand Pty Ltd. Reproduction in whole or in part without prior consent is forbidden.

File: C:\TBG - Revit Projects\917077 - AR-PD - INVERCARGILL - ZONE 1 - ANCHOR - 2019_Jessica.Tuboltsev.buchan.rvt

HWCP

Project
INVERCARGILL CENTRAL - ZONE 1
TAY STREET & DEE STREET CORNER
INVERCARGILL
Project Number
917077

Status
PRELIMINARY DESIGN
Date Plotted 17/04/2019 2:44:26 PM
Date Issued 21.03.19
Scale 1 : 250 @A1

Drawing Title
ZONE 1
OVERALL FLOOR PLANS
Drawing Number
Z1-PD-A-1100
Revision
D

BUCHAN
Christchurch Studio
+ 64 3 377 2973 / buchangroup.co.nz

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

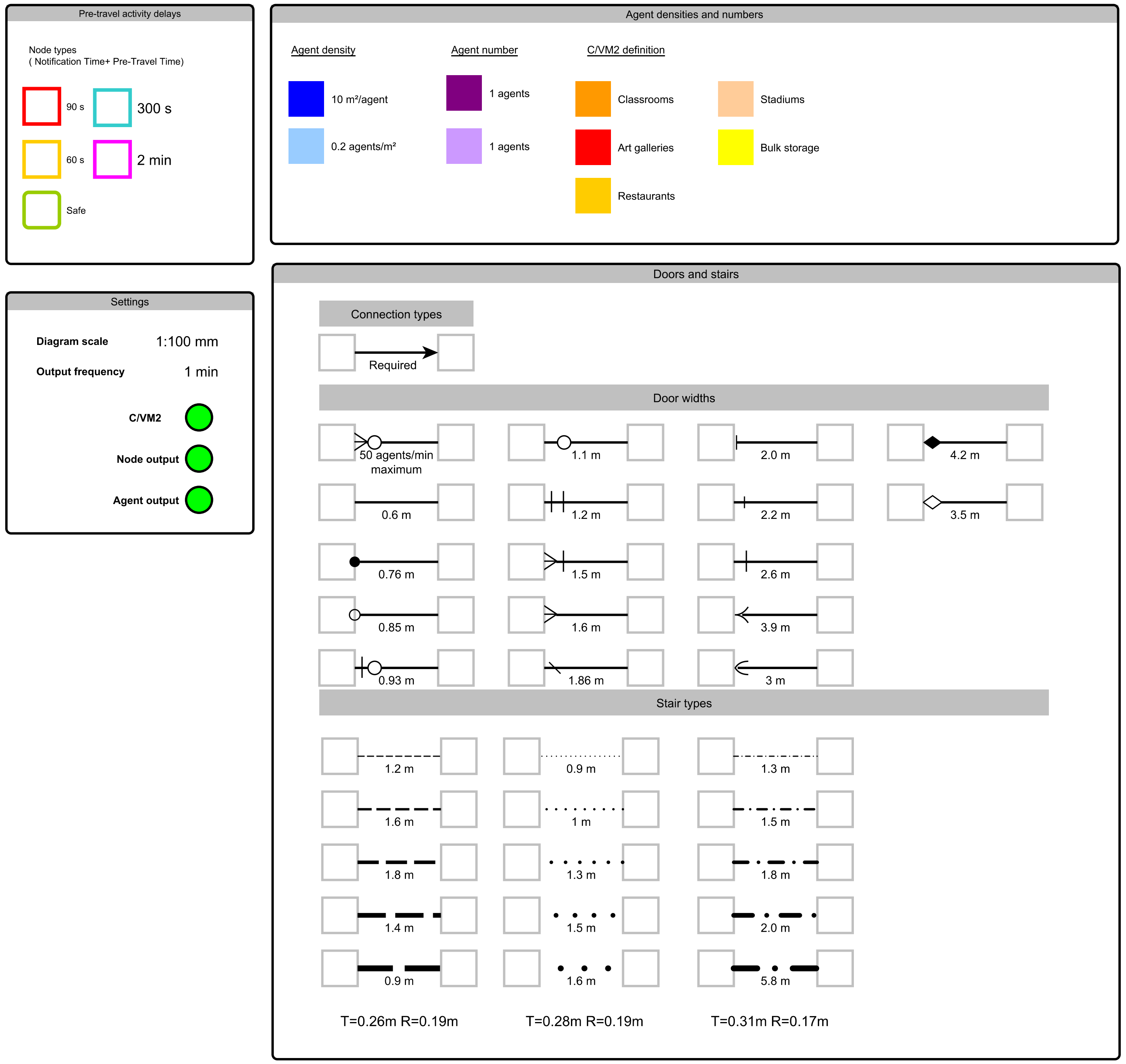
Invercargill City Council
Building Consent Authority
Approved Site Copy

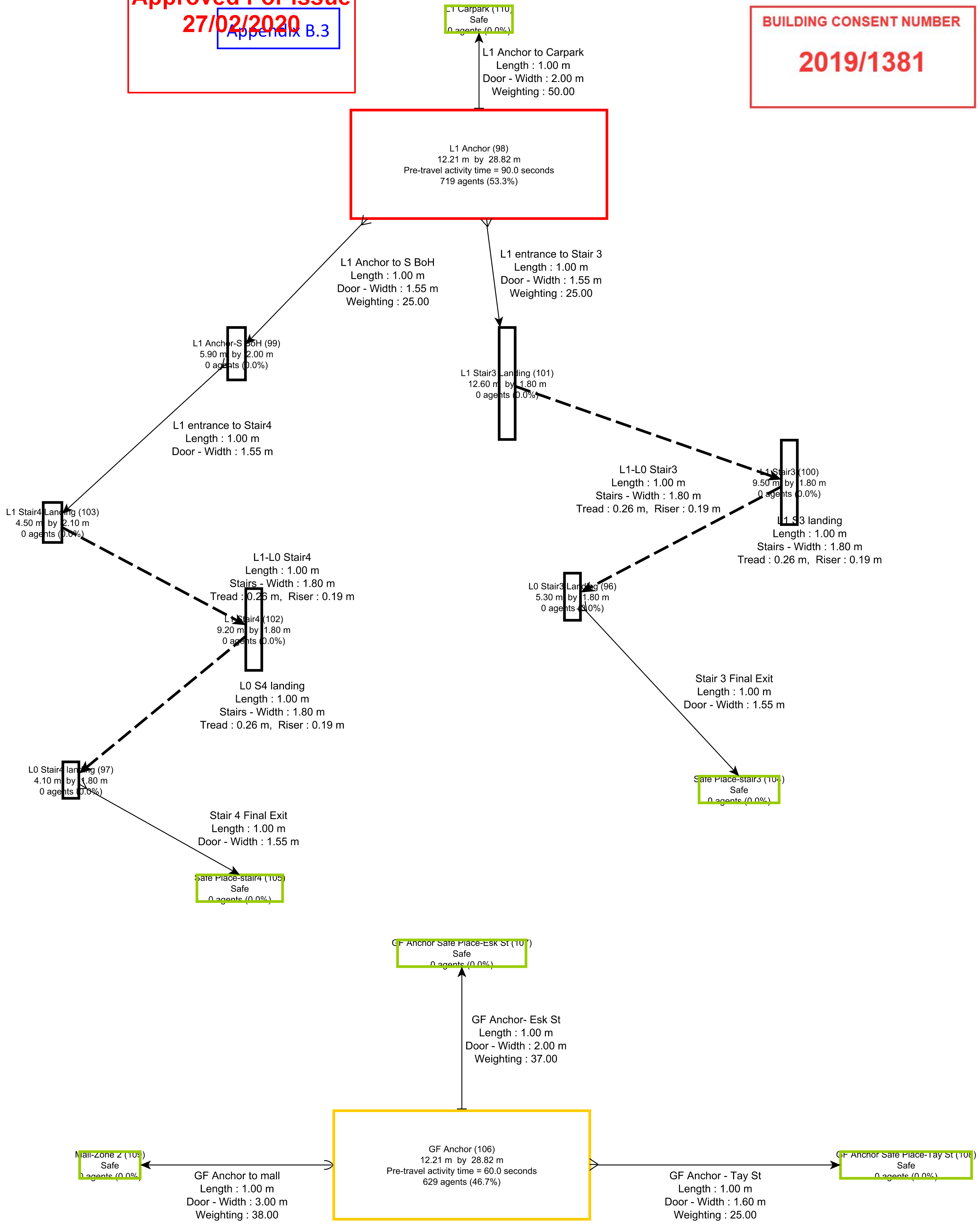
EvacuatioNZ model for:
Base Case
- Challenging Fire 1 (CF1)
- Challenging Fire 2 (CF2)
- Robustness Check (RC1)

Approved For Issue
27/02/2020

Appendix B.3

BUILDING CONSENT NUMBER
2019/1381





Environmental & Planning
Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

EvacuatioNZ model for:
Base Case
- Challenging Fire 1 (CF1)
- Challenging Fire 2 (CF2)
- Robustness Check (RC1)

Results file for EvacuatioNZ version 2.11 (Sep 19 2016)
S:\136249\4.0 HF DESIGN\6 Calculations & Verifications\EGRESS\EVACNZ\Zone 1\Zone1_BaseCase\BaseCase_v3 qu time\results_136249.html
Started at 13:59:38 on Tuesday 27 August 2019

EvacuatioNZ

Michael Spearpoint
University of Canterbury
version 2.11 - Holmes Fire release (Sep 19 2016)

This software version is exclusively licensed to Holmes Fire Ltd and is not to be used by any other party.

Contents

Nodes

Node **L1 Carpark** - Safe
Connections : L1 Anchor to Carpark,

Node **Mall-Zone 2** - Safe
Connections : GF Anchor to mall,

Node **GF Anchor Safe Place-Tay St** - Safe
Connections : GF Anchor - Tay St,

Node **GF Anchor Safe Place-Esk St** - Safe
Connections : GF Anchor- Esk St,

Node **GF Anchor**
Dimensions 12.21 m by 28.82 m
Connections : GF Anchor to mall, GF Anchor - Tay St, GF Anchor- Esk St,

Node **Safe Place-stair4** - Safe
Connections : Stair 4 Final Exit,

Node **Safe Place-stair3** - Safe
Connections : Stair 3 Final Exit,

Node **L1 Stair4 Landing**
Dimensions 4.50 m by 2.10 m
Connections : L1-L0 Stair4, L1 entrance to Stair4,

Node **L1 Stair4**
Dimensions 9.20 m by 1.80 m
Connections : L0 S4 landing, L1-L0 Stair4,

Node **L1 Stair3 Landing**

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Appendix B.3

Dimensions 12.60 m by 1.80 m
Connections : L1 entrance to Stair 3, L1-L0 Stair3,

Node **L1 Stair3**
Dimensions 9.50 m by 1.80 m
Connections : L1 S3 landing, L1-L0 Stair3,

Node **L1 Anchor-S BoH**
Dimensions 5.90 m by 2.00 m
Connections : L1 Anchor to S BoH, L1 entrance to Stair4,

Node **L1 Anchor**
Dimensions 12.21 m by 28.82 m
Connections : L1 entrance to Stair 3, L1 Anchor to S BoH, L1 Anchor to Carpark,

Node **L0 Stair4 landing**
Dimensions 4.10 m by 1.80 m
Connections : Stair 4 Final Exit, L0 S4 landing,

Node **L0 Stair3 Landing**
Dimensions 5.30 m by 1.80 m
Connections : Stair 3 Final Exit, L1 S3 landing,

Connections

Connection **L1-L0 Stair3**
Length 1.00 m
Connecting L1 Stair3 Landing to L1 Stair3 (target node for required path)
Stairs width 1.80 m, tread 0.26 m, riser 0.19 m

Connection **L1 S3 landing**
Length 1.00 m
Connecting L1 Stair3 to L0 Stair3 Landing (target node for required path)
Stairs width 1.80 m, tread 0.26 m, riser 0.19 m

Connection **L1 entrance to Stair4**
Length 1.00 m
Connecting L1 Anchor-S BoH to L1 Stair4 Landing (target node for required path)
Door width 1.55 m, specific flow 1.33 persons/s per m eff. width (restricted by closer)

Connection **L1-L0 Stair4**
Length 1.00 m
Connecting L1 Stair4 Landing to L1 Stair4 (target node for required path)
Stairs width 1.80 m, tread 0.26 m, riser 0.19 m

Connection **L0 S4 landing**
Length 1.00 m
Connecting L1 Stair4 to L0 Stair4 landing (target node for required path)
Stairs width 1.80 m, tread 0.26 m, riser 0.19 m

Connection **Stair 4 Final Exit**
Length 1.00 m
Connecting L0 Stair4 landing to Safe Place-stair4 (target node for required path)
Door width 1.55 m, specific flow 1.33 persons/s per m eff. width (restricted by closer)

Connection **Stair 3 Final Exit**
Length 1.00 m

Environmental & Planning Services I.C.C. Document Received 17 Dec 2019 Building Division

Invercargill City Council Building Consent Authority Approved Site Copy

EvacuatioNZ model for:
Base Case
- Challenging Fire 1 (CF1)
- Challenging Fire 2 (CF2)
- Robustness Check (RC1)

Connecting L0 Stair3 Landing to Safe Place-stair3 (target node for required path)
Door width 1.55 m, specific flow 1.33 persons/s per m eff. width (restricted by closer)

Connection **L1 Anchor to Carpark**
Length 1.00 m
Connecting L1 Anchor to L1 Carpark (target node for required path)
Door width 2.00 m, specific flow 1.33 persons/s per m eff. width

Connection **L1 Anchor to S BoH**
Length 1.00 m
Connecting L1 Anchor to L1 Anchor-S BoH (target node for required path)
Door width 1.55 m, specific flow 1.33 persons/s per m eff. width (restricted by closer)

Connection **L1 entrance to Stair 3**
Length 1.00 m
Connecting L1 Anchor to L1 Stair3 Landing (target node for required path)
Door width 1.55 m, specific flow 1.33 persons/s per m eff. width (restricted by closer)

Connection **GF Anchor- Esk St**
Length 1.00 m
Connecting GF Anchor to GF Anchor Safe Place-Esk St (target node for required path)
Door width 2.00 m, specific flow 1.33 persons/s per m eff. width

Connection **GF Anchor - Tay St**
Length 1.00 m
Connecting GF Anchor to GF Anchor Safe Place-Tay St (target node for required path)
Door width 1.60 m, specific flow 1.33 persons/s per m eff. width

Connection **GF Anchor to mall**
Length 1.00 m
Connecting GF Anchor to Mall-Zone 2 (target node for required path)
Door width 3.00 m, specific flow 1.33 persons/s per m eff. width

Population

Name	Number	Density (agents/m^2)	Density (m^2/agent)
L1 Anchor	719	2.04	0.49
GF Anchor	629	1.79	0.56

Results

Simulation run 1 : Total number of agents = 1348

Node GF Anchor clear at 167.5 s
Node L1 Anchor clear at 241.0 s

Last agent to leave node GF Anchor was 'Agent #720' at 167.5 s
Last agent to leave node L1 Stair4 Landing was 'Agent #12' at 210.5 s
Last agent to leave node L1 Stair4 was 'Agent #12' at 220.0 s
Last agent to leave node L1 Stair3 Landing was 'Agent #1' at 236.5 s
Last agent to leave node L1 Stair3 was 'Agent #1' at 248.5 s

Time to clear GF Anchor space

Time for last occupant to enter into stair 3 (i.e. no queuing in front of stair 3)

Approved For Issue 27/02/2020

BUILDING CONSENT NUMBER 2019/1381

Appendix B.3

Last agent to leave node L1 Anchor-S BoH was 'Agent #7' at 193.5 s
Last agent to leave node L1 Anchor was 'Agent #2' at 241.0 s
Last agent to leave node L0 Stair4 landing was 'Agent #12' at 225.5 s
Last agent to leave node L0 Stair3 Landing was 'Agent #1' at 253.0 s

Total number of agents in safe node L1 Carpark = 340
Total number of agents in safe node Mall-Zone 2 = 240
Total number of agents in safe node GF Anchor Safe Place-Tay St = 147
Total number of agents in safe node GF Anchor Safe Place-Esk St = 242
Total number of agents in safe node Safe Place-stair4 = 166
Total number of agents in safe node Safe Place-stair3 = 213

Total evacuation time = 253.50 s

Completed at 13:59:41 on Tuesday 27 August

Time for last occupant to enter into stair 4 (i.e. no queuing in front of stair 4)

Time for last person from Level 1 Anchor to leave stair 3. This stair is the designated egress stairwell for the Childcare Centre on Level 2.

Time to clear L1 Anchor space (last person to enter into L1 carpark)

Time for last person from Level 1 Anchor to leave stair 4.

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

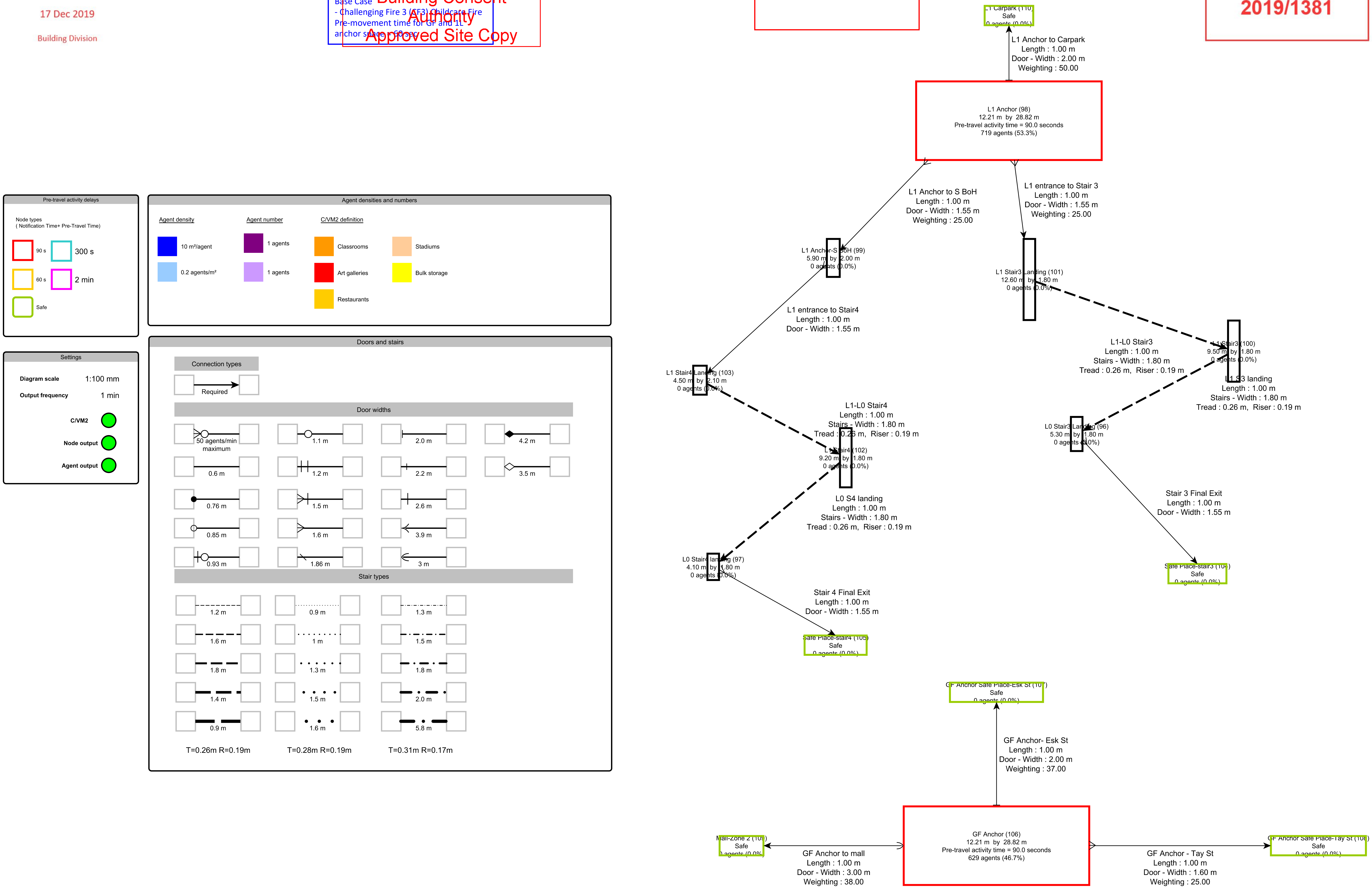
Invercargill City Council
Building Consent Authority
Approved Site Copy

EvacuationNZ model for:
Base Case
- Challenging Fire 3 (CF3) Childcare Fire
Pre-movement time for GF and 1L anchor space = 60 sec

Approved For Issue
27/02/2020

Appendix B.3

BUILDING CONSENT NUMBER
2019/1381



Environmental & Planning
Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

EvacuatioNZ model for:
Base Case
- Challenging Fire 3 (CF3) Childcare Fire
Pre-movement time for GF and 1L
anchor space = 60 sec

Results file for EvacuatioNZ version 2.11 (Sep 19 2016)
S:\136249\4.0 HF DESIGN\6 Calculations & Verifications\EGRESS\EVACNZ\Zone 1\Zone1_BaseCase\BaseCase_Childcare\results_136249.html
Started at 14:47:16 on Tuesday 27 August 2019

EvacuatioNZ

Michael Spearpoint
University of Canterbury
version 2.11 - Holmes Fire release (Sep 19 2016)

This software version is exclusively licensed to Holmes Fire Ltd and is not to be used by any other party.

Contents

Nodes

Node **L1 Carpark** - Safe
Connections : L1 Anchor to Carpark,

Node **Mall-Zone 2** - Safe
Connections : GF Anchor to mall,

Node **GF Anchor Safe Place-Tay St** - Safe
Connections : GF Anchor - Tay St,

Node **GF Anchor Safe Place-Esk St** - Safe
Connections : GF Anchor- Esk St,

Node **GF Anchor**
Dimensions 12.21 m by 28.82 m
Connections : GF Anchor to mall, GF Anchor - Tay St, GF Anchor- Esk St,

Node **Safe Place-stair4** - Safe
Connections : Stair 4 Final Exit,

Node **Safe Place-stair3** - Safe
Connections : Stair 3 Final Exit,

Node **L1 Stair4 Landing**
Dimensions 4.50 m by 2.10 m
Connections : L1-L0 Stair4, L1 entrance to Stair4,

Node **L1 Stair4**
Dimensions 9.20 m by 1.80 m
Connections : L0 S4 landing, L1-L0 Stair4,

Node **L1 Stair3 Landing**

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Appendix B.3

Dimensions 12.60 m by 1.80 m
Connections : L1 entrance to Stair 3, L1-L0 Stair3,

Node **L1 Stair3**
Dimensions 9.50 m by 1.80 m
Connections : L1 S3 landing, L1-L0 Stair3,

Node **L1 Anchor-S BoH**
Dimensions 5.90 m by 2.00 m
Connections : L1 Anchor to S BoH, L1 entrance to Stair4,

Node **L1 Anchor**
Dimensions 12.21 m by 28.82 m
Connections : L1 entrance to Stair 3, L1 Anchor to S BoH, L1 Anchor to Carpark,

Node **L0 Stair4 landing**
Dimensions 4.10 m by 1.80 m
Connections : Stair 4 Final Exit, L0 S4 landing,

Node **L0 Stair3 Landing**
Dimensions 5.30 m by 1.80 m
Connections : Stair 3 Final Exit, L1 S3 landing,

Connections

Connection **L1-L0 Stair3**
Length 1.00 m
Connecting L1 Stair3 Landing to L1 Stair3 (target node for required path)
Stairs width 1.80 m, tread 0.26 m, riser 0.19 m

Connection **L1 S3 landing**
Length 1.00 m
Connecting L1 Stair3 to L0 Stair3 Landing (target node for required path)
Stairs width 1.80 m, tread 0.26 m, riser 0.19 m

Connection **L1 entrance to Stair4**
Length 1.00 m
Connecting L1 Anchor-S BoH to L1 Stair4 Landing (target node for required path)
Door width 1.55 m, specific flow 1.33 persons/s per m eff. width (restricted by closer)

Connection **L1-L0 Stair4**
Length 1.00 m
Connecting L1 Stair4 Landing to L1 Stair4 (target node for required path)
Stairs width 1.80 m, tread 0.26 m, riser 0.19 m

Connection **L0 S4 landing**
Length 1.00 m
Connecting L1 Stair4 to L0 Stair4 landing (target node for required path)
Stairs width 1.80 m, tread 0.26 m, riser 0.19 m

Connection **Stair 4 Final Exit**
Length 1.00 m
Connecting L0 Stair4 landing to Safe Place-stair4 (target node for required path)
Door width 1.55 m, specific flow 1.33 persons/s per m eff. width (restricted by closer)

Connection **Stair 3 Final Exit**
Length 1.00 m

Environmental & Planning
Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

EvacuatioNZ model for:
Base Case
- Challenging Fire 3 (CF3)
Childcare Fire
Pre-movement time for GF and 1L anchor space = 60 sec

Connecting L0 Stair3 Landing to Safe Place-stair3 (target node for required path)
Door width 1.55 m, specific flow 1.33 persons/s per m eff. width (restricted by closer)

Connection **L1 Anchor to Carpark**
Length 1.00 m
Connecting L1 Anchor to L1 Carpark (target node for required path)
Door width 2.00 m, specific flow 1.33 persons/s per m eff. width

Connection **L1 Anchor to S BoH**
Length 1.00 m
Connecting L1 Anchor to L1 Anchor-S BoH (target node for required path)
Door width 1.55 m, specific flow 1.33 persons/s per m eff. width (restricted by closer)

Connection **L1 entrance to Stair 3**
Length 1.00 m
Connecting L1 Anchor to L1 Stair3 Landing (target node for required path)
Door width 1.55 m, specific flow 1.33 persons/s per m eff. width (restricted by closer)

Connection **GF Anchor- Esk St**
Length 1.00 m
Connecting GF Anchor to GF Anchor Safe Place-Esk St (target node for required path)
Door width 2.00 m, specific flow 1.33 persons/s per m eff. width

Connection **GF Anchor - Tay St**
Length 1.00 m
Connecting GF Anchor to GF Anchor Safe Place-Tay St (target node for required path)
Door width 1.60 m, specific flow 1.33 persons/s per m eff. width

Connection **GF Anchor to mall**
Length 1.00 m
Connecting GF Anchor to Mall-Zone 2 (target node for required path)
Door width 3.00 m, specific flow 1.33 persons/s per m eff. width

Population

Name	Number	Density (agents/m^2)	Density (m^2/agent)
L1 Anchor	719	2.04	0.49
GF Anchor	629	1.79	0.56

Results

Simulation run 1 : Total number of agents = 1348

Node GF Anchor clear at 197.5 s
Node L1 Anchor clear at 241.0 s

Last agent to leave node GF Anchor was 'Agent #720' at 197.5 s
Last agent to leave node L1 Stair4 Landing was 'Agent #12' at 210.5 s
Last agent to leave node L1 Stair4 was 'Agent #12' at 220.0 s
Last agent to leave node L1 Stair3 Landing was 'Agent #1' at 236.5 s
Last agent to leave node L1 Stair3 was 'Agent #1' at 248.5 s

Time to clear GF Anchor space

Time for last occupant to enter into stair 3 (i.e. no queuing in front of stair 3)

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Appendix B.3

Last agent to leave node L1 Anchor-S BoH was 'Agent #7' at 193.5 s
Last agent to leave node L1 Anchor was 'Agent #2' at 241.0 s
Last agent to leave node L0 Stair4 landing was 'Agent #12' at 225.5 s
Last agent to leave node L0 Stair3 Landing was 'Agent #1' at 253.0 s

Total number of agents in safe node L1 Carpark = 340
Total number of agents in safe node Mall-Zone 2 = 240
Total number of agents in safe node GF Anchor Safe Place-Tay St = 147
Total number of agents in safe node GF Anchor Safe Place-Esk St = 242
Total number of agents in safe node Safe Place-stair4 = 166
Total number of agents in safe node Safe Place-stair3 = 213

Total evacuation time = 253.50 s

Completed at 14:47:19 on Tuesday 27 August

Time for last occupant to enter into stair 4 (i.e. no queuing in front of stair 4)

Time for last person from Level 1 Anchor to leave stair 3. This stair is the designated egress stairwell for the Childcare Centre on Level 2.

Time to clear L1 Anchor space (last person to enter into L1 carpark)

Time for last person from Level 1 Anchor to leave stair 4.

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

B.4 RSET for non-base case

The RSET time for Non-Base case is shown below. The non-base case egress model includes the following areas:

- Zone 2 ground floor and level one mall area, and
- Zone 3 Carpark area (utilizing the non-base case scenario where a crowd activity occurs on L5 of the carpark).

The following figure represents clearance times taken from EvacuatioNZ model for Non-Base case.

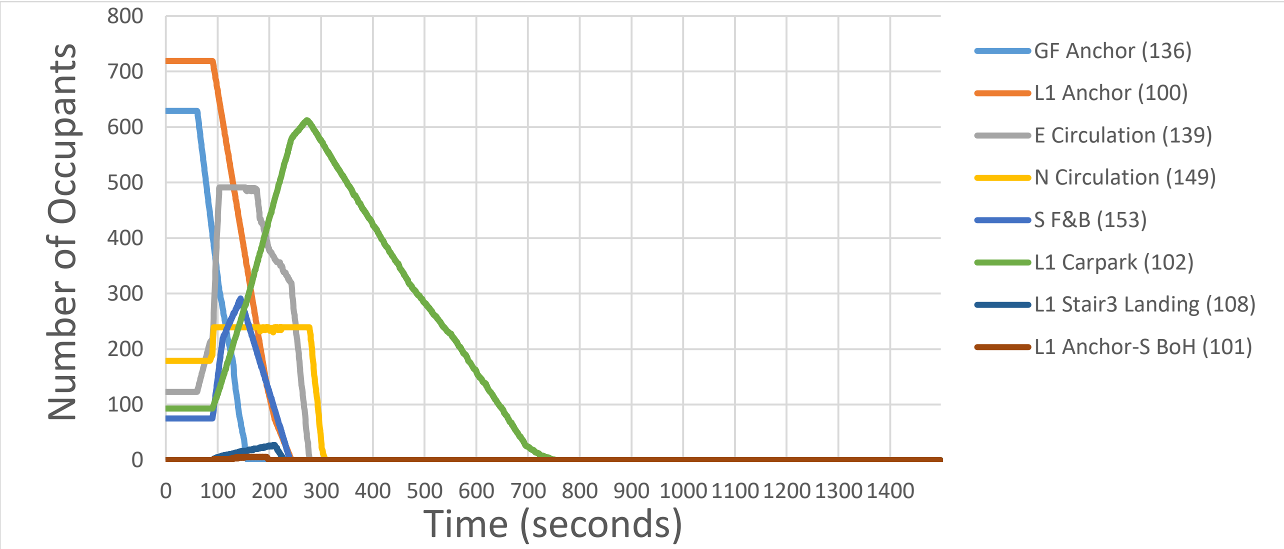


Figure 3 - EvacuatioNZ Node Clearance Times for Non-Base case CF1, CF2 and RC1.

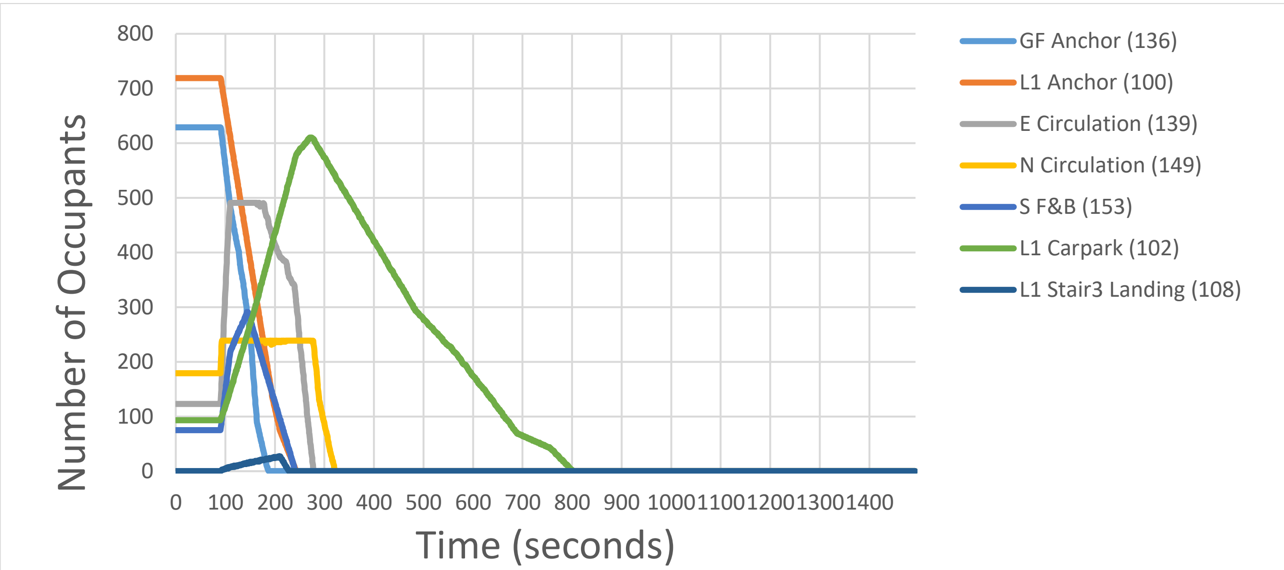


Figure 4 - EvacuatioNZ Node Clearance Times for Non-Base case CF3.

Environmental & Planning Services I.C.C. Document Received
17 Dec 2019
Building Division

Invercargill City Council Building Consent Authority Approved Site Copy

Approved For Issue 27/02/2020

BUILDING CONSENT NUMBER
2019/1381

The following table summarises clearance times for various nodes:

Table 12 - Output Data for Non-Base case.

Location[1]	Clearance Time[2,3] (excl. detection time) (s)	
	CF1, CF2 & RC1[2]	CF3[3]
GF Anchor	158	188
L1 Anchor	243	243
L1 Stair 3 Landing[4]	229	229
L1 Anchor-S BoH[5]	199	199
L1 Carpark	751	802
N Circulation[6]	307	321
Corridor[7]	1496	1492
L0 Stair3 Landing[8]	246	246
L0 Stair 4 landing[9]	232	232

Explanatory Notes:

1) Location is the space represented as nodes in EvacuatioNZ.

2) The Clearance Time for Challenging Fire Scenarios CF1, CF2 and Robustness Check Scenario RC1 includes notification time of 30 sec and pre-movement time of 30 sec for ground floor anchor space and 60 sec for first floor anchor space.

3) The Clearance Time for Challenging Fire Scenario CF3 includes notification time of 30 sec and pre-movement time of 60 sec for ground floor and first floor anchor space.

4) 'L1 Stair 3 Landing' is the node that corresponds to the lobby space before entering into Stair 3 which indicates the queuing clear time preceding stair 3.

5) 'L1 Anchor-S BoH' is the node that corresponds to the lobby space before entering into Stair 4 which indicate the queuing clear time preceding stair 4.

6) 'N Circulation' is the node that corresponds to the space precede the final exit from the Zone 2 ground floor mall space and is taken as the node where the last person leaves GF Anchor.

7) 'Corridor' is the node that corresponds to the space precede the final exit from Zone 3 Carpark building.

8) 'L0 Stair3 Landing' is the node that corresponds to the space precede the final exit from Stair 3 (i.e. time to clear L1 Anchor north stairwell) which is shared by the occupants from L2 Childcare space.

9) 'L0 Stair4 Landing' is the node that corresponds to the space precede the final exit from Stair 4 (i.e. time to clear L1 Anchor south stairwell).

The following table summarises RSET for various nodes:

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Table 13 - RSET time for Non-Base case.

CF	Location	Smoke Detector Activation Time[1] (s)	RSET[2] (s)
CF1	GF Anchor	41	199
	L1 Anchor		284
	L1 Stair 3 Landing[3]		270
	L1 Anchor-S BoH[4]		240
	L1 Carpark		792
	N Circulation[5]		348
	Corridor[6]		1537
	L0 Stair3 Landing[7]		287
	L0 Stair 4 landing[8]		273
CF2	GF Anchor	25	183
	L1 Anchor		268
	L1 Stair 3 Landing[3]		254
	L1 Anchor-S BoH[4]		224
	L1 Carpark		776
	N Circulation[5]		332
	Corridor[6]		1521
	L0 Stair3 Landing[7]		271
	L0 Stair 4 landing[8]		257
CF3	GF Anchor	29	217
	L1 Anchor		272
	L1 Stair 3 Landing[3]		258
	L1 Anchor-S BoH[4]		228
	L1 Carpark		831
	N Circulation[5]		350
	Corridor[6]		1521
	L0 Stair3 Landing[7]		275
	L0 Stair 4 landing[8]		261
RC1	GF Anchor	44	202
	L1 Anchor		287
	L1 Stair 3 Landing[3]		273
	L1 Anchor-S BoH[4]		243

Environmental & Planning Services I.C.C. Document Received

17 Dec 2019

Building Division

Invercargill City Council Building Consent Authority Approved Site Copy

Approved For Issue 27/02/2020

BUILDING CONSENT NUMBER

2019/1381

CF	Location	Smoke Detector Activation Time[1] (s)	RSET[2] (s)
	L1 Carpark		795
	N Circulation[5]		351
	Corridor[6]		1540
	L0 Stair3 Landing[7]		290
	L0 Stair 4 landing[8]		276

Explanatory notes:

1) Refer to Appendix C for a summary of the FDS results and smoke activation time.

2) RSET is calculated by the sum of Clearance Time plus smoke detector activation time.

3) 'L1 Stair 3 Landing' is the node that corresponds to the lobby space before entering into Stair 3 which indicates the queuing clear time preceding stair 3.

4) 'L1 Anchor-S BoH' is the node that corresponds to the lobby space before entering into Stair 4 which indicate the queuing clear time preceding stair 4.

5) 'N Circulation' is the node that corresponds to the space precede the final exit from the Zone 2 ground floor mall space and is taken as the node where the last person leaves GF Anchor.

6) 'Corridor' is the node that corresponds to the space precede the final exit from Zone 3 Carpark building and is taken as the node where the last per son leaves L1 Anchor.

7) 'L0 Stair3 Landing' is the node that corresponds to the space precede the final exit from Stair 3 (L1 Anchor north stairwell) which is shared by the occupants from L2 Childcare space.

8) 'L0 Stair4 Landing' is the node that corresponds to the space precede the final exit from Stair 4 (i.e. time to clear L1 Anchor south stairwell).

B.4.1 Childcare Centre Evacuation – Non-Base Case

Stair 3 from the anchor space is the designated share egress for both Level 1 Anchor space and L2 Childcare centre. As can be seen above in Table 13, the time taken for the L1 Anchor occupant to egress via stair 3 for all three challenging fires are less than 300 seconds while the pre-movement time for the childcare building is 600 seconds for a fire within the Childcare centre and 660 seconds for a fire remote from the Childcare centre. Therefore, the egress time from the Childcare centre can be considered as isolated from the remainder of the building.

Attached is the following:

- EvacNZ model Setup FSK B.01 – B.06
- Non-Base case EvacuatioNZ Setup.
- Non-Base case EvacuatioNZ Output file.

Environmental & Planning Services I.C.C. Document Received

17 Dec 2019

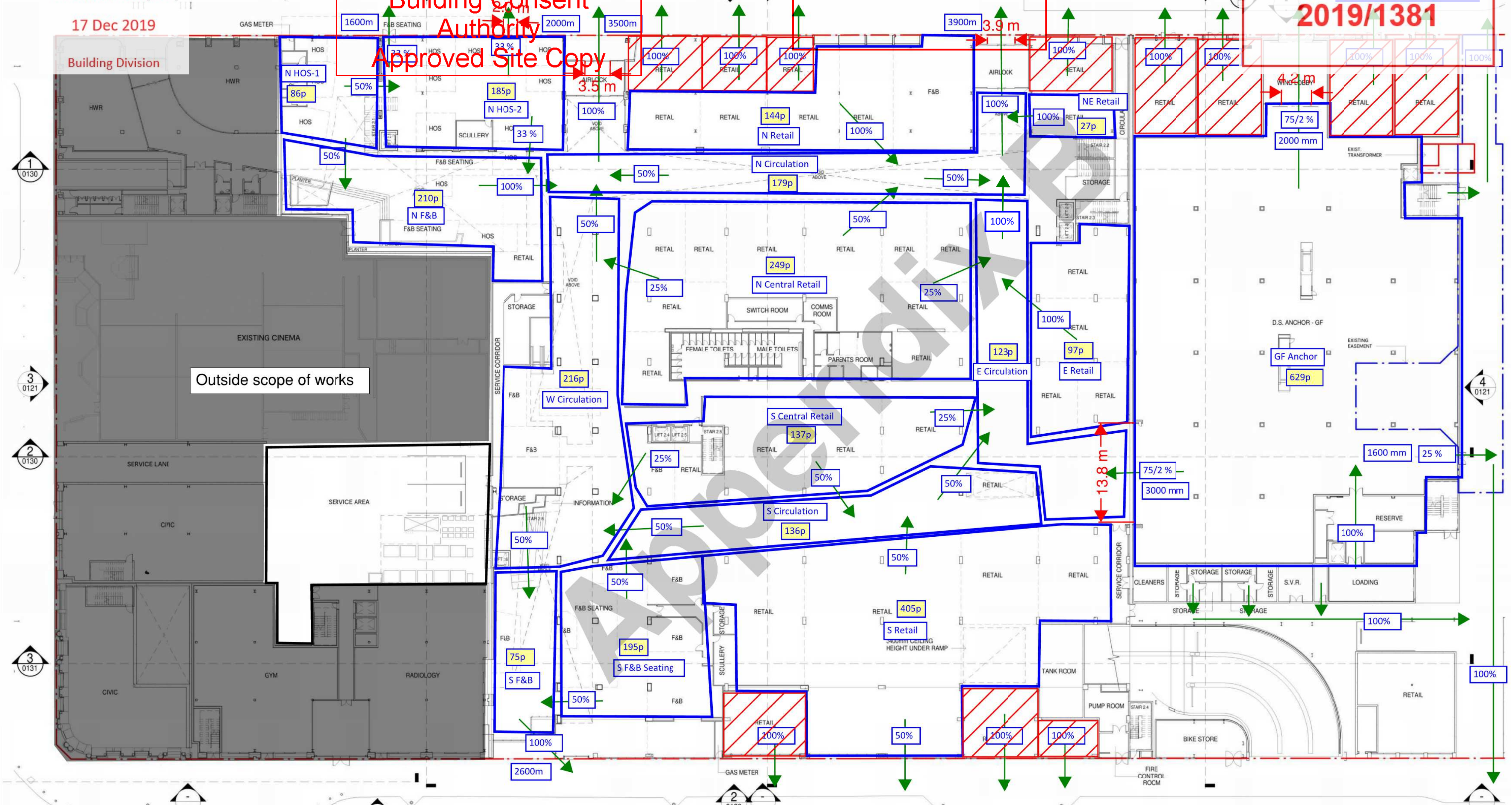
Building Division

Invercargill City Council Building Consent Authority Approved Site Copy

Approved For Issue 27/02/2020

BUILDING CONSENT NUMBER 2019/1381

Appendix B.4



Egress Direction

11p Occupant number as Per Appendix A (the red numbers were updated in this Revision)

Space modeled with occupants

Space modeled no occupants

Safe Place

Spaces provided with independent mean of escape to outside and are not included in the model

Holmes

PROJECT: HWCP Invercargill CBD Development

JOB NO: 136249 DATE: 27/06/2019

FSK B.02 - EvacuatioNZ modelling setup L1 REV: A

HWCP

Project
INVERCARGILL CENTRAL
TAY STREET & DEE STREET CORNER
INVERCARGILL

Project Number 917077

Status
PRELIMINARY DESIGN

Date Plotted 5/04/2019 11:45:05 AM

Scale 1 : 250 @A1

Drawing Title
SITE PLAN
Z1 - Z6 OVERALL GROUND FLOOR PLAN

Drawing Number
Z0-PD-A-0110

BUCHAN

Christchurch Studio
+64 3 377 2973 / buchangroup.co.nz

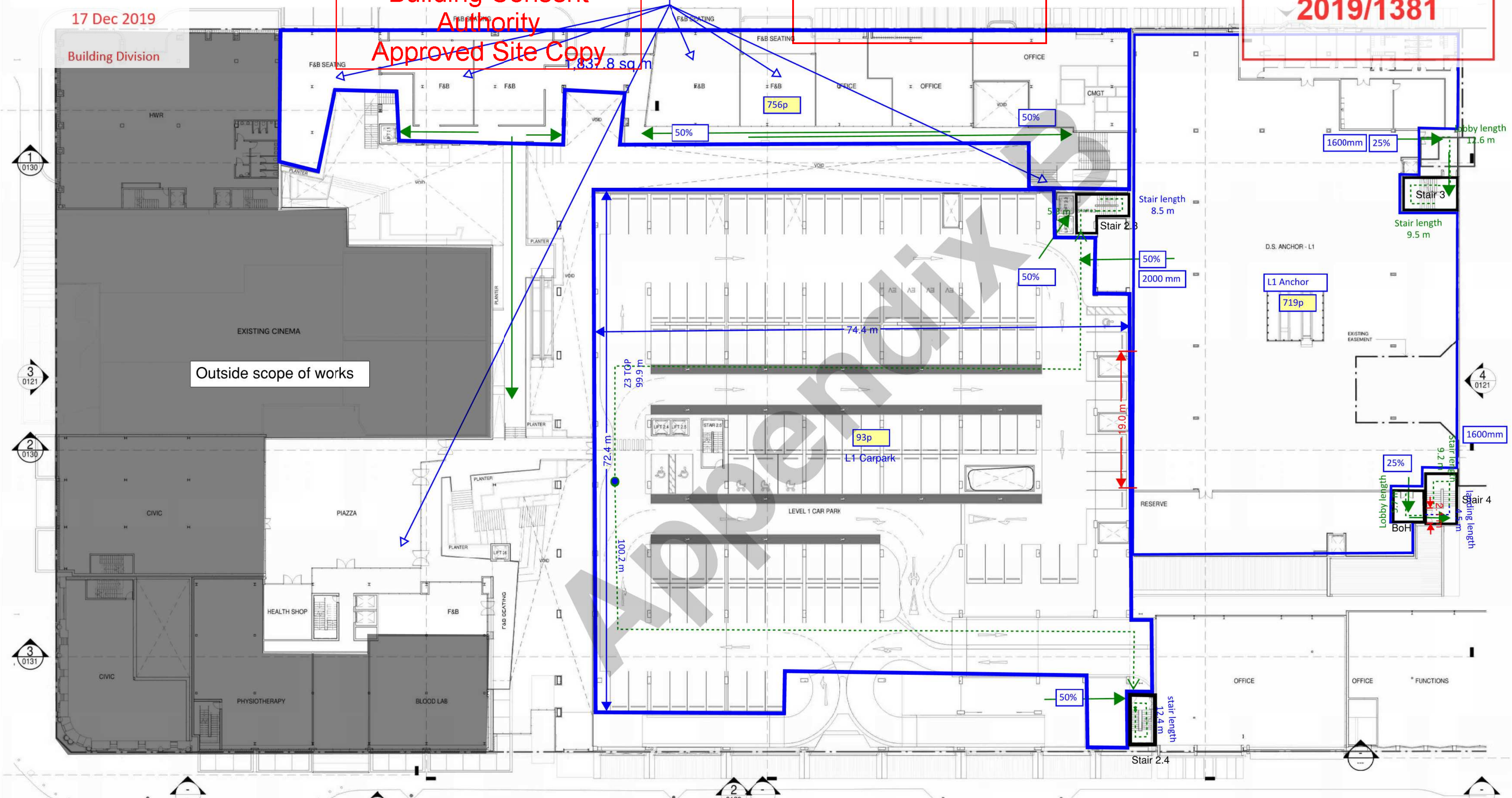
Environmental & Planning Services I.C.C. Document Received
17 Dec 2019
Building Division

Invercargill City Council Building Consent Authority Approved Site Copy

Approved For Issue 27/02/2020

BUILDING CONSENT NUMBER 2019/1381

Appendix B.4



→	Egress Direction
11p	Occupant number as Per Appendix A (the red numbers were updated in this Revision)
Blue box	Space modeled with occupants
Black box	Space modeled no occupants
Green box	Safe Place
Hatched red	Spaces provided with independent mean of escape to outside and are not included in the model

Holmes
PROJECT: HWCP Invercargill CBD Development
JOB NO: 136249 DATE: 27/06/2019
FSK B.02 - EvacuatioNZ modelling setup L1 REV: A

HWCP

INVERCARGILL CENTRAL
TAY STREET & DEE STREET CORNER
INVERCARGILL
Project Number 917077

Drawing Title
SITE PLAN
Z1 - Z6 OVERALL LEVEL 1 FLOOR PLAN
Drawing Number
Z0-PD-A-0111

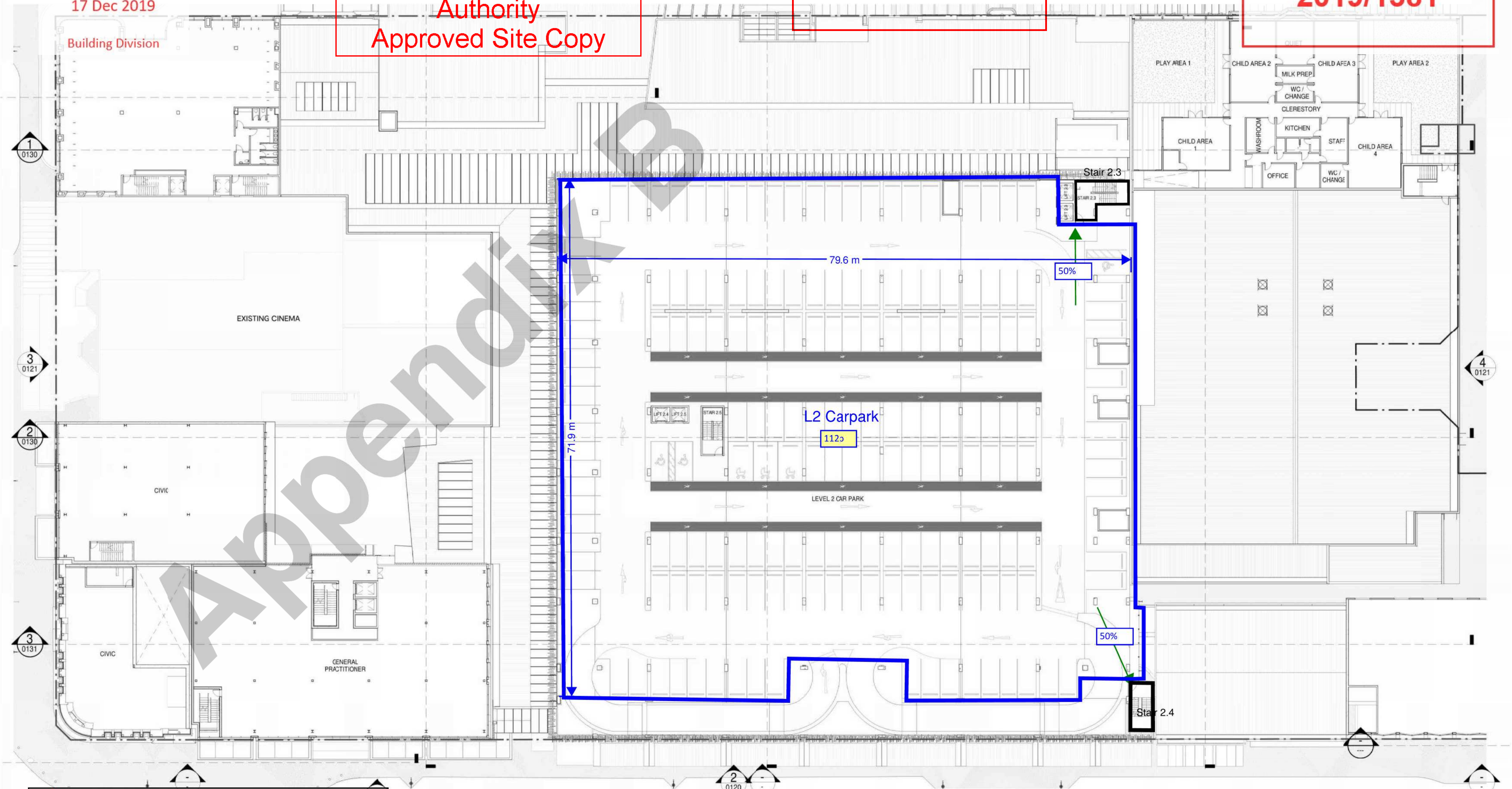
Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Appendix B.4



(green arrow)	Egress Direction
11p	Occupant number as Per Appendix A (the red numbers were updated in this Revision)
(blue box)	Space modeled with occupants
(black box)	Space modeled no occupants
(green box)	Safe Place
(red hatched box)	Spaces provided with independent mean of escape to outside and are not included in the model

Holmes
PROJECT: HWCP Invercargill CBD Development
JOB NO: 136249 DATE: 27/06/2019
FSK B.03 - EvacuatioNZ modelling setup L2 REV: A

HWCP

Project
INVERCARGILL CENTRAL
TAY STREET & DEE STREET CORNER
INVERCARGILL
Project Number
917077

Drawing Title
SITE PLAN
Z1 - Z6 OVERALL LEVEL 2 FLOOR PLAN
Drawing Number
Z0-PD-A-0112

Environmental & Planning Services I.C.C. Document Received

17 Dec 2019

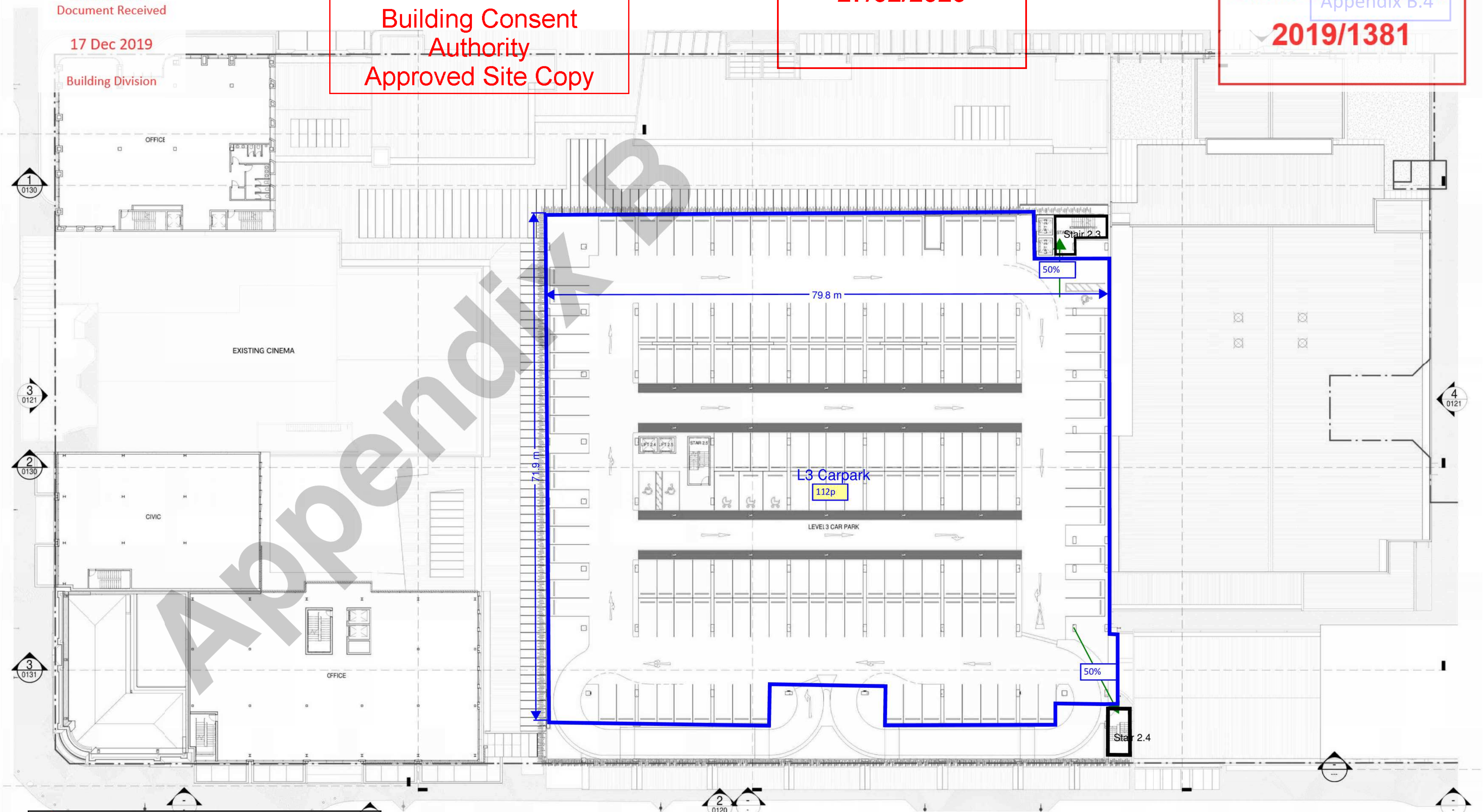
Building Division

Invercargill City Council Building Consent Authority Approved Site Copy

Approved For Issue 27/02/2020

BUILDING CONSENT NUMBER 2019/1381

Appendix B.4



Egress Direction

11p Occupant number as Per Appendix A (the red numbers were updated in this Revision)

Space modeled with occupants

Space modeled no occupants

Safe Place

Spaces provided with independent mean of escape to outside and are not included in the model

Holmes

PROJECT: HWCP Invercargill CBD Development

JOB NO: 136249 DATE: 27/06/2019

FSK B.04 - EvacuatioNZ modelling setup L3 REV: A

HWCP

Project
INVERCARGILL CENTRAL
TAY STREET & DEE STREET CORNER
INVERCARGILL

Project Number
917077

Drawing Title
SITE PLAN
Z1 - Z6 OVERALL LEVEL 3 FLOOR PLAN

Drawing Number
Z0-PD-A-0113

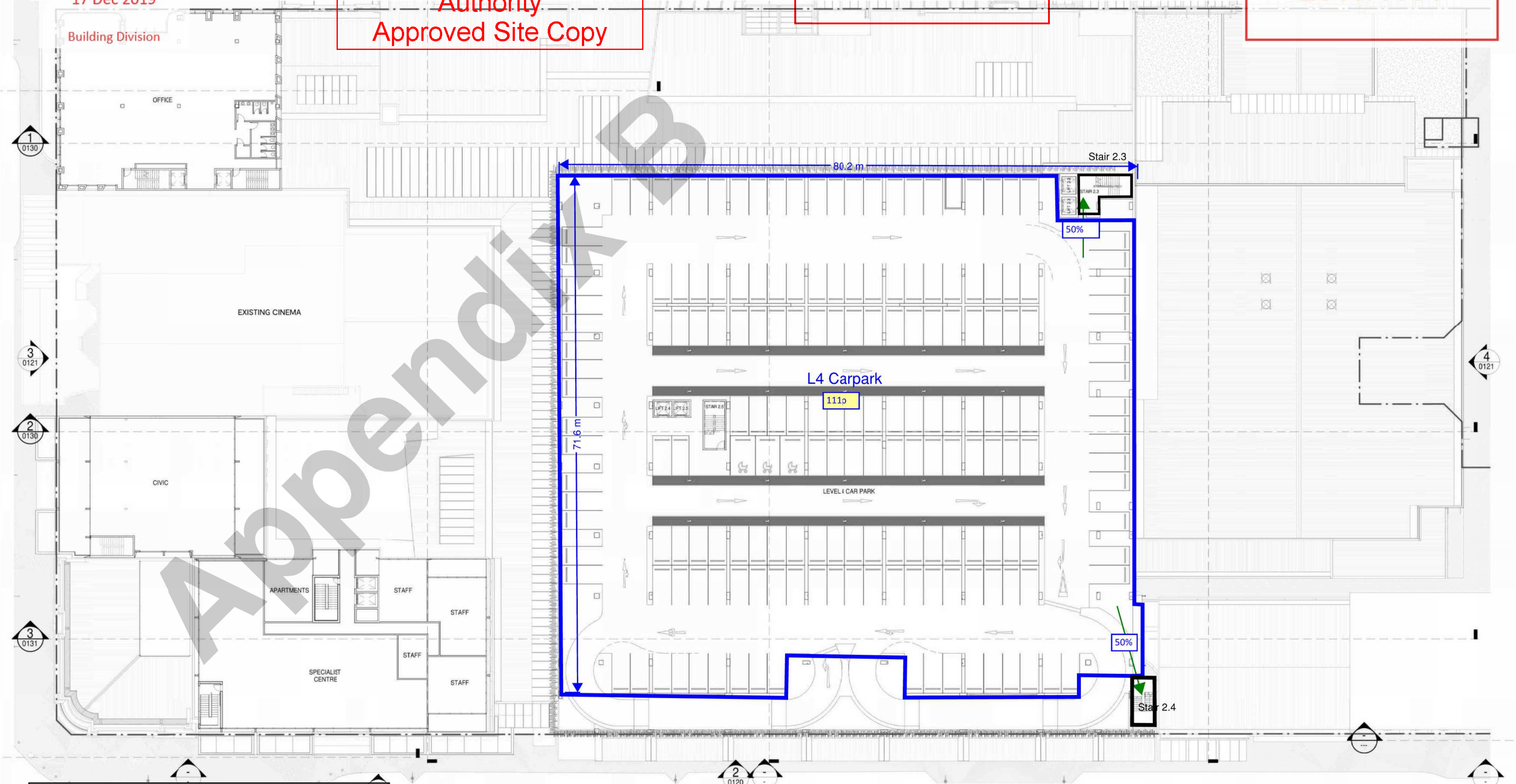
Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Appendix B.4



- Egress Direction
- 11p Occupant number as Per Appendix A (the red numbers were updated in this Revision)
- Space modeled with occupants
- Space modeled no occupants
- Safe Place
- Spaces provided with independent mean of escape to outside and are not included in the model

Holmes

PROJECT: HWCP Invercargill CBD Development

JOB NO: 136249 DATE: 27/06/2019

FSK B.05 - EvacuatioNZ modelling setup L4 REV: A

HWCP

Project
INVERCARGILL CENTRAL
TAY STREET & DEE STREET CORNER
INVERCARGILL
Project Number
917077

Drawing Title
SITE PLAN
Z1 - Z6 OVERALL LEVEL 4 FLOOR PLAN
Drawing Number
Z0-PD-A-0114

Environmental & Planning Services I.C.C. Document Received

17 Dec 2019

Building Division

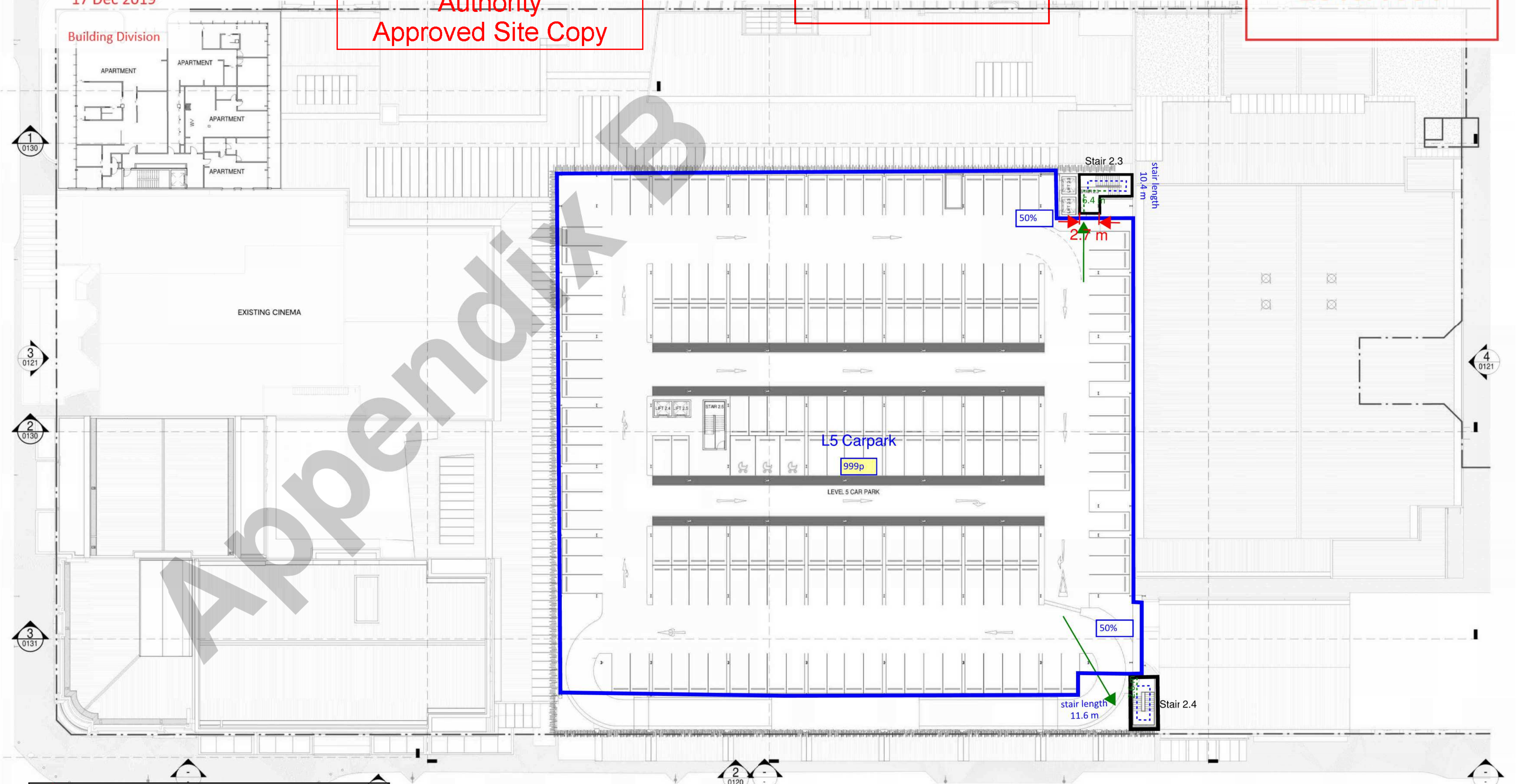
Invercargill City Council Building Consent Authority Approved Site Copy

Approved For Issue 27/02/2020

BUILDING CONSENT NUMBER

2019/1381

Appendix B.4



- Egress Direction
- 11p — Occupant number as Per Appendix A (the red numbers were updated in this Revision)
- Space modeled with occupants
- Space modeled no occupants
- Safe Place
- Spaces provided with independent mean of escape to outside and are not included in the model

Holmes

PROJECT: HWCP Invercargill CBD Development

JOB NO: 136249 DATE: 27/06/2019

FSK B.06 - EvacuatioNZ modelling setup L5 REV: A

HWCP

Project: INVERCARGILL CENTRAL
TAY STREET & DEE STREET CORNER
INVERCARGILL

Project Number: 917077

Drawing Title: SITE PLAN
Z1 - Z6 OVERALL LEVEL 5 FLOOR PLAN

Drawing Number: Z0-PD-A-0115

Environmental & Planning Services I.C.C.
Document Received

17 Dec 2019

Building Division

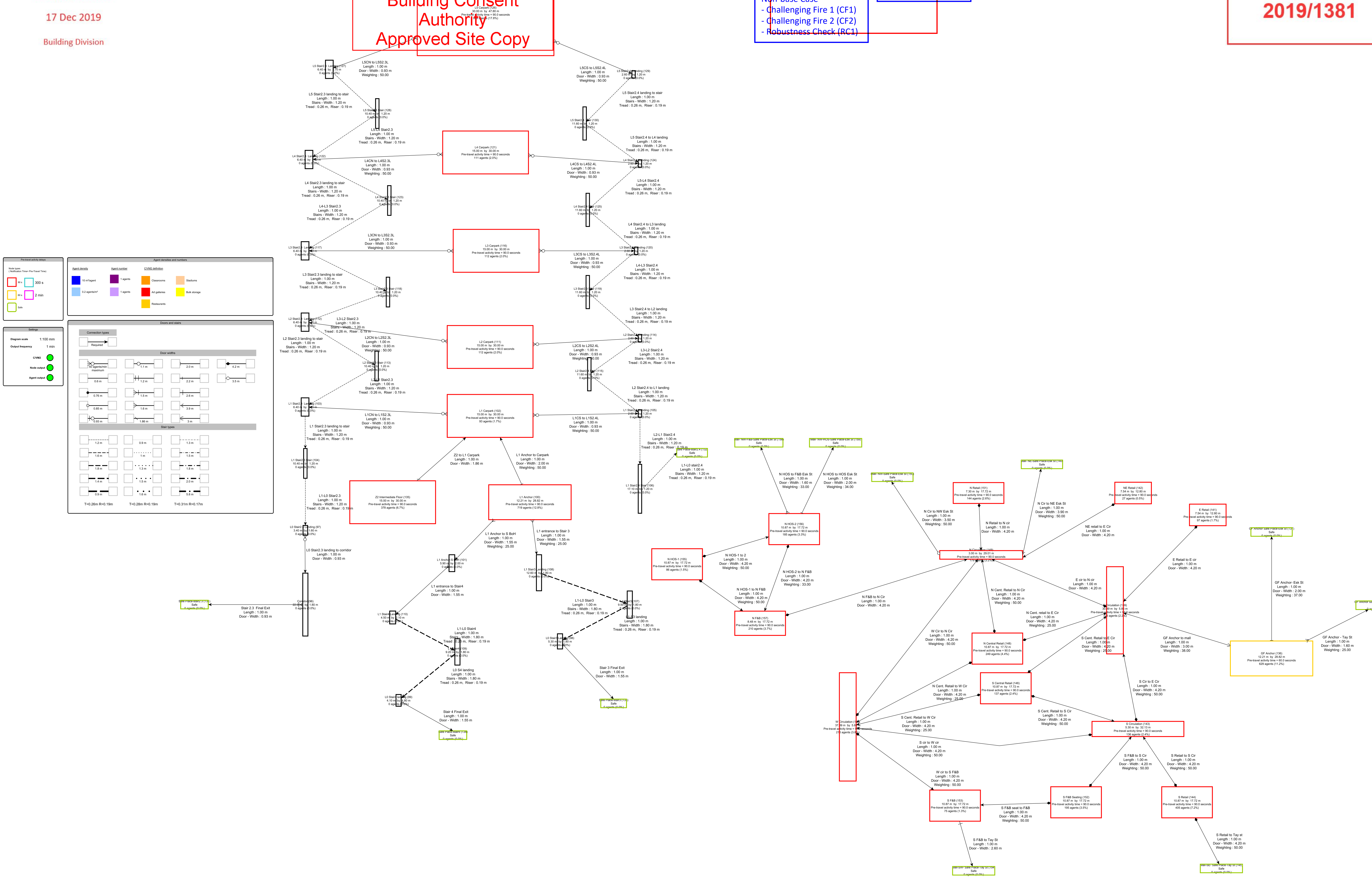
Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

EvacuationNZ model for:
Non-base Case
- Challenging Fire 1 (CF1)
- Challenging Fire 2 (CF2)
- Robustness Check (RC1)

Appendix B.4

BUILDING CONSENT NUMBER
2019/1381



Environmental & Planning
Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

EvacuatioNZ model for:
Non-base Case
- Challenging Fire 1 (CF1)
- Challenging Fire 2 (CF2)
- Robustness Check (RC1)

Results file for EvacuatioNZ version 2.11 (Sep 19 2016)
S:\136249\4.0 HF DESIGN\6 Calculations & Verifications\EGRESS\EVACNZ\Zone 1\Zone1_NonBaseCase queuing time\results_136249.html
Started at 10:50:36 on Monday 26 August 2019

EvacuatioNZ

Michael Spearpoint
University of Canterbury
version 2.11 - Holmes Fire release (Sep 19 2016)

This software version is exclusively licensed to Holmes Fire Ltd and is not to be used by any other party.

Contents

Nodes

Node **Mall- NW-HOS-Safe Place-Esk St** - Safe
Connections : N HOS to HOS Esk St,

Node **Mall- NW-F&B-Safe Place-Esk St** - Safe
Connections : N HOS to F&B Esk St,

Node **N F&B**
Dimensions 8.48 m by 17.72 m
Connections : N F&B to N Cir, N HOS-2 to N F&B, N HOS-1 to N F&B,

Node **N HOS-2**
Dimensions 10.87 m by 17.72 m
Connections : N HOS-2 to N F&B, N HOS to HOS Esk St, N HOS to F&B Esk St, N HOS-1 to 2,

Node **N HOS-1**
Dimensions 10.87 m by 17.72 m
Connections : N HOS-1 to N F&B, N HOS-1 to 2,

Node **Mall-SW- Safe Place-Tay St** - Safe
Connections : S F&B to Tay St,

Node **S F&B**
Dimensions 10.87 m by 17.72 m
Connections : W cir to S F&B, S F&B seat to F&B, S F&B to Tay St,

Node **S F&B Seating**
Dimensions 10.87 m by 17.72 m
Connections : S F&B to S Cir, S F&B seat to F&B,

Node **N Retail**
Dimensions 7.30 m by 17.72 m
Connections : N Retail to N cir,

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Appendix B.4

Node **Mall- NW-Safe Place-Esk St** - Safe
Connections : N Cir to NW Esk St,

Node **N Circulation**
Dimensions 3.00 m by 29.01 m
Connections : E cir to N cir, N F&B to N Cir, W Cir to N Cir, N Retail to N cir, N Cir to NW Esk St, N Cent. Retail to N Cir, NE retail to E Cir, N Cir to NE Esk St,

Node **N Central Retail**
Dimensions 10.87 m by 17.72 m
Connections : N Cent. Retail to W Cir, N Cent. retail to E Cir, N Cent. Retail to N Cir,

Node **W Circulation**
Dimensions 37.89 m by 5.86 m
Connections : S cir to W cir, W cir to S F&B, W Cir to N Cir, N Cent. Retail to W Cir, S Cent. Retail to W Cir,

Node **S Central Retail**
Dimensions 10.87 m by 17.72 m
Connections : S Cent. Retail to W Cir, S Cent. Retail to E Cir, S Cent. Retail to S Cir,

Node **Mall-SE- Safe Place-Tay St** - Safe
Connections : S Retail to Tay st,

Node **S Retail**
Dimensions 10.87 m by 17.72 m
Connections : S Retail to Tay st, S Retail to S Cir,

Node **S Circulation**
Dimensions 5.30 m by 32.13 m
Connections : S cir to W cir, S F&B to S Cir, S Cent. Retail to S Cir, S Retail to S Cir, S Cir to E Cir,

Node **NE Retail**
Dimensions 7.54 m by 12.80 m
Connections : NE retail to E Cir,

Node **E Retail**
Dimensions 7.54 m by 12.80 m
Connections : E Retail to E cir,

Node **Mall- NE-Safe Place-Esk St** - Safe
Connections : N Cir to NE Esk St,

Node **E Circulation**
Dimensions 30.49 m by 5.86 m
Connections : E cir to N cir, N Cent. retail to E Cir, S Cent. Retail to E Cir, S Cir to E Cir, E Retail to E cir, GF Anchor to mall,

Node **GF Anchor Safe Place-Tay St** - Safe
Connections : GF Anchor - Tay St,

Node **GF Anchor Safe Place-Esk St** - Safe
Connections : GF Anchor- Esk St,

Node **GF Anchor**
Dimensions 12.21 m by 28.82 m
Connections : GF Anchor to mall, GF Anchor - Tay St, GF Anchor- Esk St,

Environmental & Planning
Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

EvacuatioNZ model for:
Non-base Case
- Challenging Fire 1 (CF1)
- Challenging Fire 2 (CF2)
- Robustness Check (RC1)

Node **Z2 Intermediate Floor**
Dimensions 15.00 m by 30.00 m
Connections : Z2 to L1 Carpark,

Node **Safe Place-stair4** - Safe
Connections : Stair 4 Final Exit,

Node **Safe Place-stair3** - Safe
Connections : Stair 3 Final Exit,

Node **Safe Place-stair2.4** - Safe
Connections : L1-L0 stair2.4,

Node **Safe Place-stair2.3** - Safe
Connections : Stair 2.3 Final Exit,

Node **L5 Stair2.4 stair**
Dimensions 11.60 m by 1.20 m
Connections : L5 Stair2.4 landing to stair, L5 Stair2.4 to L4 landing,

Node **L5 Stair2.4 Landing**
Dimensions 2.60 m by 1.20 m
Connections : L5 Stair2.4 landing to stair, L5CS to L5S2.4L,

Node **L5 Stair2.3 Stair**
Dimensions 10.40 m by 1.20 m
Connections : L5 Stair2.3 landing to stair, L5-L4 Stair2.3,

Node **L5 Stair2.3 Landing**
Dimensions 6.40 m by 2.70 m
Connections : L5 Stair2.3 landing to stair, L5CN to L5S2.3L,

Node **L5 Carpark**
Dimensions 30.00 m by 47.80 m
Connections : L5CN to L5S2.3L, L5CS to L5S2.4L,

Node **L4 Stair2.4 Stair**
Dimensions 11.60 m by 1.20 m
Connections : L5-L4 Stair2.4, L4 Stair2.4 to L3 landing,

Node **L4 Stair2.4 Landing**
Dimensions 2.60 m by 1.20 m
Connections : L5-L4 Stair2.4, L4CS to L4S2.4L, L5 Stair2.4 to L4 landing,

Node **L4 Stair2.3 Stair**
Dimensions 10.40 m by 1.20 m
Connections : L4 Stair2.3 landing to stair, L4-L3 Stair2.3,

Node **L4 Stair2.3 Landing**
Dimensions 6.40 m by 2.70 m
Connections : L4 Stair2.3 landing to stair, L4CN to L4S2.3L, L5-L4 Stair2.3,

Node **L4 Carpark**
Dimensions 15.00 m by 30.00 m
Connections : L4CN to L4S2.3L, L4CS to L4S2.4L,

Node **L3 Stair2.4 Landing**
Dimensions 2.60 m by 1.20 m

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Appendix B.4

Connections : L4-L3 Stair2.4, L3CS to L3S2.4L, L4 Stair2.4 to L3 landing,

Node **L3 Stair2.3 Stair**
Dimensions 11.60 m by 1.20 m
Connections : L4-L3 Stair2.4, L3 Stair2.4 to L2 landing,

Node **L3 Stair2.3 Stair**
Dimensions 10.40 m by 1.20 m
Connections : L3 Stair2.3 landing to stair, L3-L2 Stair2.3,

Node **L3 Stair2.3 Landing**
Dimensions 6.40 m by 2.70 m
Connections : L3 Stair2.3 landing to stair, L3CN to L3S2.3L, L4-L3 Stair2.3,

Node **L3 Carpark**
Dimensions 15.00 m by 30.00 m
Connections : L3CS to L3S2.4L, L3CN to L3S2.3L,

Node **L2 Stair2.4 Stair**
Dimensions 11.60 m by 1.20 m
Connections : L3-L2 Stair2.4, L2 Stair2.4 to L1 landing,

Node **L2 Stair2.4 Landing**
Dimensions 2.60 m by 1.20 m
Connections : L3-L2 Stair2.4, L2CS to L2S2.4L, L3 Stair2.4 to L2 landing,

Node **L2 Stair2.3 Stair**
Dimensions 10.40 m by 1.20 m
Connections : L2 Stair2.3 landing to stair, L2-L1 Stair2.3,

Node **L2 Stair2.3 Landing**
Dimensions 6.40 m by 2.70 m
Connections : L2 Stair2.3 landing to stair, L2CN to L2S2.3L, L3-L2 Stair2.3,

Node **L2 Carpark**
Dimensions 15.00 m by 30.00 m
Connections : L2CS to L2S2.4L, L2CN to L2S2.3L,

Node **L1 Stair4 Landing**
Dimensions 4.50 m by 2.10 m
Connections : L1-L0 Stair4, L1 entrance to Stair4,

Node **L1 Stair4**
Dimensions 9.20 m by 1.80 m
Connections : L0 S4 landing, L1-L0 Stair4,

Node **L1 Stair3 Landing**
Dimensions 12.60 m by 1.80 m
Connections : L1 entrance to Stair 3, L1-L0 Stair3,

Node **L1 Stair3**
Dimensions 9.50 m by 1.80 m
Connections : L1 S3 landing, L1-L0 Stair3,

Node **L1 Stair2.4 Stair**
Dimensions 17.10 m by 1.20 m
Connections : L2-L1 Stair2.4, L1-L0 stair2.4,

Environmental & Planning
Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

EvacuatioNZ model for:
Non-base Case
- Challenging Fire 1 (CF1)
- Challenging Fire 2 (CF2)
- Robustness Check (RC1)

Node **L1 Stair2.4 Landing**
Dimensions 2.60 m by 1.20 m
Connections : L2-L1 Stair2.4, L1CS to L1S2.4L, L2 Stair2.4 to L1 landing,

Node **L1 Stair2.3 Stair**
Dimensions 10.40 m by 1.20 m
Connections : L1 Stair2.3 landing to stair, L1-L0 Stiar2.3,

Node **L1 Stair2.3 Landing**
Dimensions 6.40 m by 2.70 m
Connections : L1 Stair2.3 landing to stair, L1CN to L1S2.3L, L2-L1 Stair2.3,

Node **L1 Carpark**
Dimensions 15.00 m by 30.00 m
Connections : Z2 to L1 Carpark, L1 Anchor to Carpark, L1CS to L1S2.4L, L1CN to L1S2.3L,

Node **L1 Anchor-S BoH**
Dimensions 5.90 m by 2.00 m
Connections : L1 Anchor to S BoH, L1 entrance to Stair4,

Node **L1 Anchor**
Dimensions 12.21 m by 28.82 m
Connections : L1 entrance to Stair 3, L1 Anchor to S BoH, L1 Anchor to Carpark,

Node **L0 Stair4 landing**
Dimensions 4.10 m by 1.80 m
Connections : Stair 4 Final Exit, L0 S4 landing,

Node **L0 Stair3 Landing**
Dimensions 5.30 m by 1.80 m
Connections : Stair 3 Final Exit, L1 S3 landing,

Node **L0 Stair2.3 Landing**
Dimensions 3.40 m by 1.60 m
Connections : L1-L0 Stiar2.3, L0 Stair2.3 landing to corridor,

Node **Corridor**
Dimensions 22.00 m by 1.80 m
Connections : Stair 2.3 Final Exit, L0 Stair2.3 landing to corridor,

Connections

Connection **L0 Stair2.3 landing to corridor**
Length 1.00 m
Connecting L0 Stair2.3 Landing to Corridor (target node for required path)
Door width 0.93 m, specific flow 1.33 persons/s per m eff. width

Connection **Stair 2.3 Final Exit**
Length 1.00 m
Connecting Corridor to Safe Place-stair2.3 (target node for required path)
Door width 0.93 m, specific flow 1.33 persons/s per m eff. width (restricted by closer)

Connection **L1-L0 stair2.4**
Length 1.00 m
Connecting L1 Stair2.4 Stair to Safe Place-stair2.4 (target node for required path)
Stairs width 1.20 m, tread 0.26 m, riser 0.19 m

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Appendix B.4

Connection **L2 Stair2.4 to L1 landing**
Length 1.00 m
Connecting L2 Stair2.4 Stair to L1 Stair2.4 Landing (target node for required path)
Stairs width 1.20 m, tread 0.26 m, riser 0.19 m

Connection **L3 Stair2.4 to L2 landing**
Length 1.00 m
Connecting L3 Stair2.3 Stair to L2 Stair2.4 Landing (target node for required path)
Stairs width 1.20 m, tread 0.26 m, riser 0.19 m

Connection **L4 Stair2.4 to L3 landing**
Length 1.00 m
Connecting L4 Stair2.4 Stair to L3 Stair2.4 Landing (target node for required path)
Stairs width 1.20 m, tread 0.26 m, riser 0.19 m

Connection **L5 Stair2.4 to L4 landing**
Length 1.00 m
Connecting L5 Stair2.4 stair to L4 Stair2.4 Landing (target node for required path)
Stairs width 1.20 m, tread 0.26 m, riser 0.19 m

Connection **L1-L0 Stiar2.3**
Length 1.00 m
Connecting L1 Stair2.3 Stair to L0 Stair2.3 Landing (target node for required path)
Stairs width 1.20 m, tread 0.26 m, riser 0.19 m

Connection **L2-L1 Stair2.3**
Length 1.00 m
Connecting L2 Stair2.3 Stair to L1 Stair2.3 Landing (target node for required path)
Stairs width 1.20 m, tread 0.26 m, riser 0.19 m

Connection **L3-L2 Stair2.3**
Length 1.00 m
Connecting L3 Stair2.3 Stair to L2 Stair2.3 Landing (target node for required path)
Stairs width 1.20 m, tread 0.26 m, riser 0.19 m

Connection **L4-L3 Stair2.3**
Length 1.00 m
Connecting L4 Stair2.3 Stair to L3 Stair2.3 Landing (target node for required path)
Stairs width 1.20 m, tread 0.26 m, riser 0.19 m

Connection **L5CS to L5S2.4L**
Length 1.00 m
Connecting L5 Carpark to L5 Stair2.4 Landing (target node for required path)
Door width 0.93 m, specific flow 1.33 persons/s per m eff. width

Connection **L5CN to L5S2.3L**
Length 1.00 m
Connecting L5 Carpark to L5 Stair2.3 Landing (target node for required path)
Door width 0.93 m, specific flow 1.33 persons/s per m eff. width

Connection **L5-L4 Stair2.3**
Length 1.00 m
Connecting L5 Stair2.3 Stair to L4 Stair2.3 Landing (target node for required path)
Stairs width 1.20 m, tread 0.26 m, riser 0.19 m

Connection **L1CN to L1S2.3L**
Length 1.00 m
Connecting L1 Carpark to L1 Stair2.3 Landing (target node for required path)

Invercargill City Council
Building Consent Authority
Approved Site Copy

Environmental & Planning
Services I.C.C.
Document Received
17 Dec 2019
Building Division

EvacuatioNZ model for:
Non-base Case
- Challenging Fire 1 (CF1)
- Challenging Fire 2 (CF2)
- Robustness Check (RC1)

Door width 0.93 m, specific flow 1.33 persons/s per m eff. width

Connection **L1CS to L1S2.4L**
Length 1.00 m
Connecting L1 Carpark to L1 Stair2.4 Landing (target node for required path)
Door width 0.93 m, specific flow 1.33 persons/s per m eff. width

Connection **L2CN to L2S2.3L**
Length 1.00 m
Connecting L2 Carpark to L2 Stair2.3 Landing (target node for required path)
Door width 0.93 m, specific flow 1.33 persons/s per m eff. width

Connection **L2CS to L2S2.4L**
Length 1.00 m
Connecting L2 Carpark to L2 Stair2.4 Landing (target node for required path)
Door width 0.93 m, specific flow 1.33 persons/s per m eff. width

Connection **L3CN to L3S2.3L**
Length 1.00 m
Connecting L3 Carpark to L3 Stair2.3 Landing (target node for required path)
Door width 0.93 m, specific flow 1.33 persons/s per m eff. width

Connection **L3CS to L3S2.4L**
Length 1.00 m
Connecting L3 Carpark to L3 Stair2.4 Landing (target node for required path)
Door width 0.93 m, specific flow 1.33 persons/s per m eff. width

Connection **L4CS to L4S2.4L**
Length 1.00 m
Connecting L4 Carpark to L4 Stair2.4 Landing (target node for required path)
Door width 0.93 m, specific flow 1.33 persons/s per m eff. width

Connection **L4CN to L4S2.3L**
Length 1.00 m
Connecting L4 Carpark to L4 Stair2.3 Landing (target node for required path)
Door width 0.93 m, specific flow 1.33 persons/s per m eff. width

Connection **L5 Stair2.4 landing to stair**
Length 1.00 m
Connecting L5 Stair2.4 Landing to L5 Stair2.4 stair (target node for required path)
Stairs width 1.20 m, tread 0.26 m, riser 0.19 m

Connection **L5-L4 Stair2.4**
Length 1.00 m
Connecting L4 Stair2.4 Landing to L4 Stair2.4 Stair (target node for required path)
Stairs width 1.20 m, tread 0.26 m, riser 0.19 m

Connection **L4-L3 Stair2.4**
Length 1.00 m
Connecting L3 Stair2.4 Landing to L3 Stair2.3 Stair (target node for required path)
Stairs width 1.20 m, tread 0.26 m, riser 0.19 m

Connection **L3-L2 Stair2.4**
Length 1.00 m
Connecting L2 Stair2.4 Landing to L2 Stair2.4 Stair (target node for required path)
Stairs width 1.20 m, tread 0.26 m, riser 0.19 m

Connection **L2-L1 Stair2.4**

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Appendix B.4

Length 1.00 m
Connecting L1 Stair2.4 Landing to L1 Stair2.4 Stair (target node for required path)
Stairs width 1.20 m, tread 0.26 m, riser 0.19 m

Connection **L5 Stair2.3 landing to stair**
Length 1.00 m
Connecting L5 Stair2.3 Landing to L5 Stair2.3 Stair (target node for required path)
Stairs width 1.20 m, tread 0.26 m, riser 0.19 m

Connection **L4 Stair2.3 landing to stair**
Length 1.00 m
Connecting L4 Stair2.3 Landing to L4 Stair2.3 Stair (target node for required path)
Stairs width 1.20 m, tread 0.26 m, riser 0.19 m

Connection **L3 Stair2.3 landing to stair**
Length 1.00 m
Connecting L3 Stair2.3 Landing to L3 Stair2.3 Stair (target node for required path)
Stairs width 1.20 m, tread 0.26 m, riser 0.19 m

Connection **L2 Stair2.3 landing to stair**
Length 1.00 m
Connecting L2 Stair2.3 Landing to L2 Stair2.3 Stair (target node for required path)
Stairs width 1.20 m, tread 0.26 m, riser 0.19 m

Connection **L1 Stair2.3 landing to stair**
Length 1.00 m
Connecting L1 Stair2.3 Landing to L1 Stair2.3 Stair (target node for required path)
Stairs width 1.20 m, tread 0.26 m, riser 0.19 m

Connection **L1-L0 Stair3**
Length 1.00 m
Connecting L1 Stair3 Landing to L1 Stair3 (target node for required path)
Stairs width 1.80 m, tread 0.26 m, riser 0.19 m

Connection **L1 S3 landing**
Length 1.00 m
Connecting L1 Stair3 to L0 Stair3 Landing (target node for required path)
Stairs width 1.80 m, tread 0.26 m, riser 0.19 m

Connection **L1 entrance to Stair4**
Length 1.00 m
Connecting L1 Anchor-S BoH to L1 Stair4 Landing (target node for required path)
Door width 1.55 m, specific flow 1.33 persons/s per m eff. width (restricted by closer)

Connection **L1-L0 Stair4**
Length 1.00 m
Connecting L1 Stair4 Landing to L1 Stair4 (target node for required path)
Stairs width 1.80 m, tread 0.26 m, riser 0.19 m

Connection **L0 S4 landing**
Length 1.00 m
Connecting L1 Stair4 to L0 Stair4 landing (target node for required path)
Stairs width 1.80 m, tread 0.26 m, riser 0.19 m

Connection **Stair 4 Final Exit**
Length 1.00 m
Connecting L0 Stair4 landing to Safe Place-stair4 (target node for required path)
Door width 1.55 m, specific flow 1.33 persons/s per m eff. width (restricted by closer)

Environmental & Planning
Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

EvacuatioNZ model for:
Non-base Case
- Challenging Fire 1 (CF1)
- Challenging Fire 2 (CF2)
- Robustness Check (RC1)

Connection **Stair 3 Final Exit**
Length 1.00 m
Connecting L0 Stair3 Landing to Safe Place-stair3 (target node for required path)
Door width 1.55 m, specific flow 1.33 persons/s per m eff. width (restricted by closer)

Connection **L1 Anchor to Carpark**
Length 1.00 m
Connecting L1 Anchor to L1 Carpark (target node for required path)
Door width 2.00 m, specific flow 1.33 persons/s per m eff. width

Connection **Z2 to L1 Carpark**
Length 1.00 m
Connecting Z2 Intermediate Floor to L1 Carpark (target node for required path)
Door width 1.86 m, specific flow 1.33 persons/s per m eff. width

Connection **L1 Anchor to S BoH**
Length 1.00 m
Connecting L1 Anchor to L1 Anchor-S BoH (target node for required path)
Door width 1.55 m, specific flow 1.33 persons/s per m eff. width (restricted by closer)

Connection **L1 entrance to Stair 3**
Length 1.00 m
Connecting L1 Anchor to L1 Stair3 Landing (target node for required path)
Door width 1.55 m, specific flow 1.33 persons/s per m eff. width (restricted by closer)

Connection **GF Anchor- Esk St**
Length 1.00 m
Connecting GF Anchor to GF Anchor Safe Place-Esk St (target node for required path)
Door width 2.00 m, specific flow 1.33 persons/s per m eff. width

Connection **GF Anchor - Tay St**
Length 1.00 m
Connecting GF Anchor to GF Anchor Safe Place-Tay St (target node for required path)
Door width 1.60 m, specific flow 1.33 persons/s per m eff. width

Connection **GF Anchor to mall**
Length 1.00 m
Connecting GF Anchor to E Circulation (target node for required path)
Door width 3.00 m, specific flow 1.33 persons/s per m eff. width

Connection **N Cir to NE Esk St**
Length 1.00 m
Connecting N Circulation to Mall- NE-Safe Place-Esk St (target node for required path)
Door width 3.90 m, specific flow 1.33 persons/s per m eff. width

Connection **NE retail to E Cir**
Length 1.00 m
Connecting NE Retail to N Circulation (target node for required path)
Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Connection **E Retail to E cir**
Length 1.00 m
Connecting E Retail to E Circulation (target node for required path)
Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Connection **S Cir to E Cir**
Length 1.00 m
Connecting S Circulation to E Circulation (target node for required path)

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Appendix B.4

Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Connection **S Retail to S Cir**
Length 1.00 m
Connecting S Retail to S Circulation (target node for required path)
Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Connection **S Retail to Tay st**
Length 1.00 m
Connecting S Retail to Mall-SE- Safe Place-Tay St (target node for required path)
Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Connection **S Cent. Retail to S Cir**
Length 1.00 m
Connecting S Central Retail to S Circulation (target node for required path)
Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Connection **S Cent. Retail to E Cir**
Length 1.00 m
Connecting S Central Retail to E Circulation (target node for required path)
Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Connection **S Cent. Retail to W Cir**
Length 1.00 m
Connecting S Central Retail to W Circulation (target node for required path)
Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Connection **N Cent. Retail to N Cir**
Length 1.00 m
Connecting N Central Retail to N Circulation (target node for required path)
Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Connection **N Cent. retail to E Cir**
Length 1.00 m
Connecting N Central Retail to E Circulation (target node for required path)
Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Connection **N Cent. Retail to W Cir**
Length 1.00 m
Connecting N Central Retail to W Circulation (target node for required path)
Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Connection **N Cir to NW Esk St**
Length 1.00 m
Connecting N Circulation to Mall- NW-Safe Place-Esk St (target node for required path)
Door width 3.50 m, specific flow 1.33 persons/s per m eff. width

Connection **N Retail to N cir**
Length 1.00 m
Connecting N Retail to N Circulation (target node for required path)
Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Connection **W Cir to N Cir**
Length 1.00 m
Connecting W Circulation to N Circulation (target node for required path)
Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Connection **S F&B to Tay St**

Environmental & Planning
Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

EvacuatioNZ model for:
Non-base Case
- Challenging Fire 1 (CF1)
- Challenging Fire 2 (CF2)
- Robustness Check (RC1)

Length 1.00 m
Connecting S F&B to Mall-SW- Safe Place-Tay St (target node for required path)
Door width 2.60 m, specific flow 1.33 persons/s per m eff. width

Connection **S F&B seat to F&B**
Length 1.00 m
Connecting S F&B Seating to S F&B (target node for required path)
Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Connection **S F&B to S Cir**
Length 1.00 m
Connecting S F&B Seating to S Circulation (target node for required path)
Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Connection **W cir to S F&B**
Length 1.00 m
Connecting W Circulation to S F&B (target node for required path)
Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Connection **N HOS-1 to 2**
Length 1.00 m
Connecting N HOS-1 to N HOS-2 (target node for required path)
Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Connection **N HOS-1 to N F&B**
Length 1.00 m
Connecting N HOS-1 to N F&B (target node for required path)
Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Connection **N HOS to F&B Esk St**
Length 1.00 m
Connecting N HOS-2 to Mall- NW-F&B-Safe Place-Esk St (target node for required path)
Door width 1.60 m, specific flow 1.33 persons/s per m eff. width

Connection **N HOS to HOS Esk St**
Length 1.00 m
Connecting N HOS-2 to Mall- NW-HOS-Safe Place-Esk St (target node for required path)
Door width 2.00 m, specific flow 1.33 persons/s per m eff. width

Connection **N HOS-2 to N F&B**
Length 1.00 m
Connecting N HOS-2 to N F&B (target node for required path)
Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Connection **N F&B to N Cir**
Length 1.00 m
Connecting N F&B to N Circulation (target node for required path)
Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Connection **S cir to W cir**
Length 1.00 m
Connecting S Circulation to W Circulation (target node for required path)
Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Connection **E cir to N cir**
Length 1.00 m
Connecting E Circulation to N Circulation (target node for required path)
Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Appendix B.4

Population

Name	Number	Density (agents/m^2)	Density (m^2/agent)
L1 Anchor	719	2.04	0.49
L1 Carpark	93	0.21	4.84
L2 Carpark	112	0.25	4.02
L3 Carpark	112	0.25	4.02
L4 Carpark	111	0.25	4.05
L5 Carpark	999	0.70	1.44
Z2 Intermediate Floor	378	0.84	1.19
GF Anchor	629	1.79	0.56
E Circulation	123	0.69	1.45
E Retail	97	1.01	0.99
NE Retail	27	0.28	3.57
S Circulation	136	0.80	1.25
S Retail	405	2.10	0.48
S Central Retail	137	0.71	1.41
W Circulation	216	0.97	1.03
N Central Retail	249	1.29	0.77
N Circulation	179	2.06	0.49
N Retail	144	1.11	0.90
S F&B Seating	195	1.01	0.99
S F&B	75	0.39	2.57
N HOS-1	86	0.45	2.24
N HOS-2	185	0.96	1.04
N F&B	210	1.40	0.72

Results

Simulation run 1 : Total number of agents = 5617

Node N HOS-1 clear at 98.5 s
Node S Central Retail clear at 103.5 s
Node S F&B Seating clear at 109.5 s
Node NE Retail clear at 130.0 s
Node S Retail clear at 132.0 s

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

EvacuatioNZ model for:
Non-base Case
- Challenging Fire 1 (CF1)
- Challenging Fire 2 (CF2)
- Robustness Check (RC1)

Node N HOS-2 clear at 136.0 s
Node E Retail clear at 152.0 s
Node GF Anchor clear at 157.5 s
Node N Central Retail clear at 160.0 s
Node S Circulation clear at 176.0 s
Node L3 Carpark clear at 185.5 s
Node L2 Carpark clear at 201.0 s
Node N F&B clear at 228.5 s
Node W Circulation clear at 231.0 s
Node S F&B clear at 239.5 s
Node N Retail clear at 242.5 s
Node L1 Anchor clear at 243.0 s
Node Z2 Intermediate Floor clear at 272.5 s
Node E Circulation clear at 277.5 s
Node N Circulation clear at 307.0 s
Node L4 Carpark clear at 508.5 s
Node L1 Carpark clear at 751.0 s
Node L5 Carpark clear at 1050.5 s

Time for last person to leave the ground floor mall space.

Last agent to leave node N F&B was 'Agent #5137' at 228.5 s
Last agent to leave node N HOS-2 was 'Agent #5144' at 136.0 s
Last agent to leave node N HOS-1 was 'Agent #5137' at 98.5 s
Last agent to leave node S F&B was 'Agent #3538' at 239.5 s
Last agent to leave node S F&B Seating was 'Agent #4867' at 109.5 s
Last agent to leave node N Retail was 'Agent #4723' at 242.5 s
Last agent to leave node N Circulation was 'Agent #2529' at 307.0 s
Last agent to leave node N Central Retail was 'Agent #4300' at 160.0 s
Last agent to leave node W Circulation was 'Agent #4869' at 231.0 s
Last agent to leave node S Central Retail was 'Agent #3943' at 103.5 s
Last agent to leave node S Retail was 'Agent #3539' at 132.0 s
Last agent to leave node S Circulation was 'Agent #3537' at 176.0 s
Last agent to leave node NE Retail was 'Agent #3374' at 130.0 s
Last agent to leave node E Retail was 'Agent #3277' at 152.0 s
Last agent to leave node E Circulation was 'Agent #2526' at 277.5 s
Last agent to leave node GF Anchor was 'Agent #2525' at 157.5 s
Last agent to leave node Z2 Intermediate Floor was 'Agent #2147' at 272.5 s
Last agent to leave node L5 Stair2.4 stair was 'Agent #1148' at 1105.0 s
Last agent to leave node L5 Stair2.4 Landing was 'Agent #1148' at 1061.0 s
Last agent to leave node L5 Stair2.3 Stair was 'Agent #1149' at 1038.5 s
Last agent to leave node L5 Stair2.3 Landing was 'Agent #1149' at 996.5 s
Last agent to leave node L5 Carpark was 'Agent #1148' at 1050.5 s
Last agent to leave node L4 Stair2.4 Stair was 'Agent #1148' at 1159.0 s
Last agent to leave node L4 Stair2.4 Landing was 'Agent #1148' at 1115.5 s
Last agent to leave node L4 Stair2.3 Stair was 'Agent #1149' at 1136.5 s
Last agent to leave node L4 Stair2.3 Landing was 'Agent #1149' at 1095.0 s
Last agent to leave node L4 Carpark was 'Agent #1040' at 508.5 s
Last agent to leave node L3 Stair2.4 Landing was 'Agent #1148' at 1170.0 s
Last agent to leave node L3 Stair2.3 Stair was 'Agent #1148' at 1213.5 s
Last agent to leave node L3 Stair2.3 Stair was 'Agent #1149' at 1235.5 s
Last agent to leave node L3 Stair2.3 Landing was 'Agent #1149' at 1194.5 s
Last agent to leave node L3 Carpark was 'Agent #928' at 185.5 s
Last agent to leave node L2 Stair2.4 Stair was 'Agent #1148' at 1266.5 s

Time for GF Anchor space to clear.

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Appendix B.4

Last agent to leave node L2 Stair2.4 Landing was 'Agent #1148' at 1224.0 s
Last agent to leave node L2 Stair2.3 Stair was 'Agent #1149' at 1333.5 s
Last agent to leave node L2 Stair2.3 Landing was 'Agent #1149' at 1293.0 s
Last agent to leave node L2 Carpark was 'Agent #813' at 201.0 s
Last agent to leave node L1 Stair4 Landing was 'Agent #3' at 215.0 s
Last agent to leave node L1 Stair4 was 'Agent #3' at 226.0 s
Last agent to leave node L1 Stair3 Landing was 'Agent #5' at 228.5 s
Last agent to leave node L1 Stair3 was 'Agent #5' at 240.0 s
Last agent to leave node L1 Stair2.4 Stair was 'Agent #1148' at 1335.5 s
Last agent to leave node L1 Stair2.4 Landing was 'Agent #1148' at 1277.0 s
Last agent to leave node L1 Stair2.3 Stair was 'Agent #1149' at 1432.0 s
Last agent to leave node L1 Stair2.3 Landing was 'Agent #1149' at 1390.5 s
Last agent to leave node L1 Carpark was 'Agent #1' at 751.0 s
Last agent to leave node L1 Anchor-S BoH was 'Agent #3' at 198.5 s
Last agent to leave node L1 Anchor was 'Agent #1' at 243.0 s
Last agent to leave node L0 Stair4 landing was 'Agent #3' at 231.5 s
Last agent to leave node L0 Stair3 Landing was 'Agent #5' at 245.5 s
Last agent to leave node L0 Stair2.3 Landing was 'Agent #1151' at 1449.5 s
Last agent to leave node Corridor was 'Agent #1151' at 1496.0 s

Time for last person to enter into stair 3 (i.e. time to clear the queue in front of stair 3).

Time for last person to enter into stair 4 (i.e. time to clear the queue in front of stair 4).

Time for last person from Level 1 anchor space to leave Stair 4.

Total number of agents in safe node Mall- NW-HOS-Safe Place-Esk St = 69
Total number of agents in safe node Mall- NW-F&B-Safe Place-Esk St = 78
Total number of agents in safe node Mall-SW- Safe Place-Tay St = 454
Total number of agents in safe node Mall- NW-Safe Place-Esk St = 906
Total number of agents in safe node Mall-SE- Safe Place-Tay St = 214
Total number of agents in safe node Mall- NE-Safe Place-Esk St = 992
Total number of agents in safe node GF Anchor Safe Place-Tay St = 161
Total number of agents in safe node GF Anchor Safe Place-Esk St = 219
Total number of agents in safe node Safe Place-stair4 = 174
Total number of agents in safe node Safe Place-stair3 = 200
Total number of agents in safe node Safe Place-stair2.4 = 1050
Total number of agents in safe node Safe Place-stair2.3 = 1100

Time for last person from Level 1 anchor space to leave Stair 3. This is the designated egress stair for the Childcare Centre on Level 2.

Total evacuation time = 1496.50 s

Time for L1 Anchor space to clear.

Time for last person to leave the car park building.

Completed at 10:51:21 on Monday 26 August 2019

Environmental & Planning Services I.C.C. Document Received

17 Dec 2019

Building Division

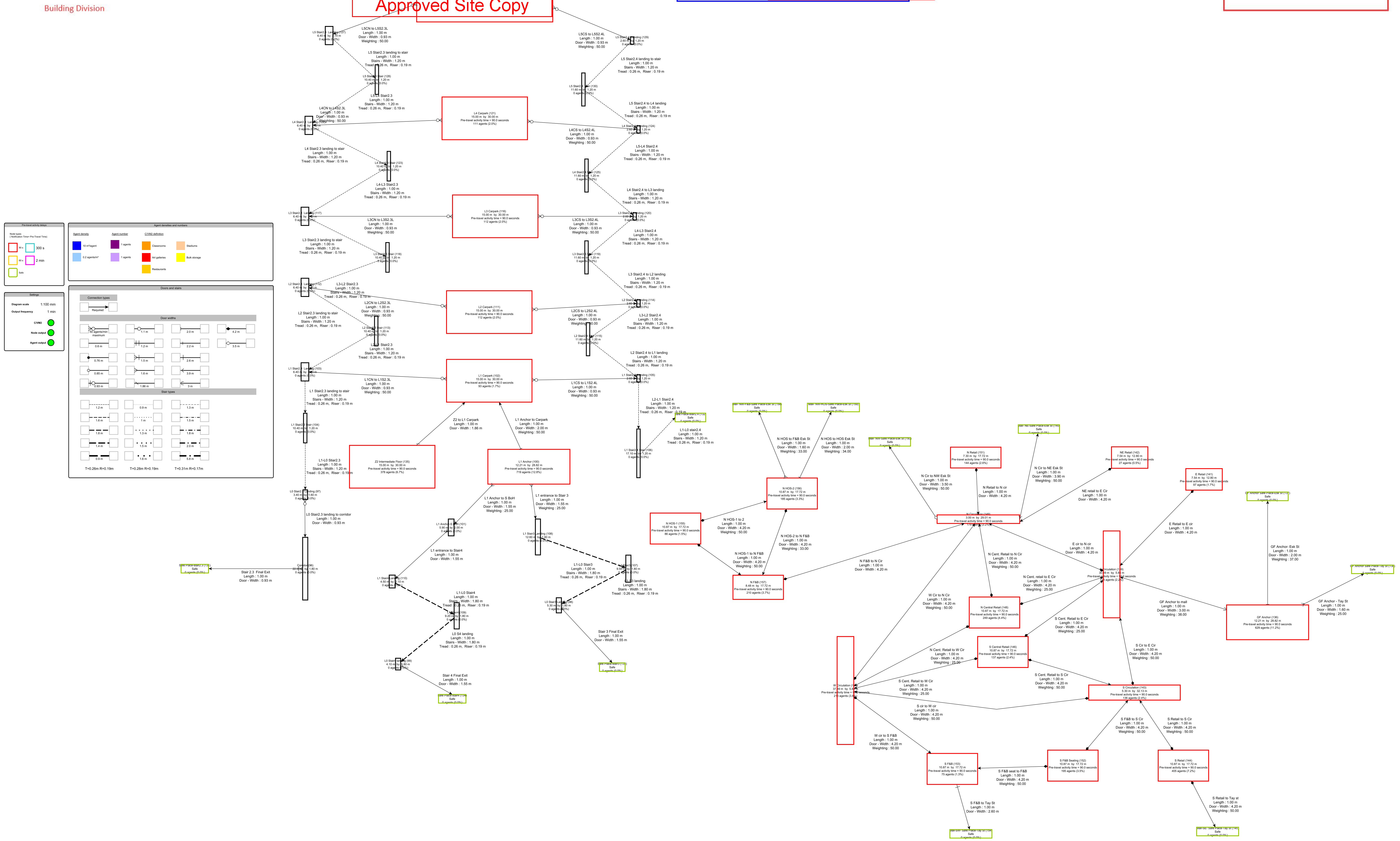
Invercargill City Council Building Consent Authority Approved Site Copy

Approved For Issue 27/02/2020

EvacuationNZ model for:
Non-base Case
- Challenging Fire 3 (CF3) Childcare Fire
Pre-movement time for GF and 1L anchor space = 60 sec

Appendix B.4

BUILDING CONSENT NUMBER 2019/1381



Environmental & Planning
Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Results file for EvacuatioNZ version 2.11 (Sep 19 2016)
S:\136249\4.0 HF DESIGN\6 Calculations & Verifications\EGRE
\results_136249.html
Started at 10:05:45 on Monday 26 August 2019

EvacuatioNZ model for:
Non-base Case
- Challenging Fire 3 (CF3) Childcare Fire
Pre-movement time for GF and 1L anchor space = 60 sec

EvacuatioNZ

Michael Spearpoint
University of Canterbury
version 2.11 - Holmes Fire release (Sep 19 2016)

This software version is exclusively licensed to Holmes Fire Ltd and is not to be used by any other party.

Contents

Nodes

Node **Mall- NW-HOS-Safe Place-Esk St** - Safe
Connections : N HOS to HOS Esk St,

Node **Mall- NW-F&B-Safe Place-Esk St** - Safe
Connections : N HOS to F&B Esk St,

Node **N F&B**
Dimensions 8.48 m by 17.72 m
Connections : N F&B to N Cir, N HOS-2 to N F&B, N HOS-1 to N F&B,

Node **N HOS-2**
Dimensions 10.87 m by 17.72 m
Connections : N HOS-2 to N F&B, N HOS to HOS Esk St, N HOS to F&B Esk St, N HOS-1 to 2,

Node **N HOS-1**
Dimensions 10.87 m by 17.72 m
Connections : N HOS-1 to N F&B, N HOS-1 to 2,

Node **Mall-SW- Safe Place-Tay St** - Safe
Connections : S F&B to Tay St,

Node **S F&B**
Dimensions 10.87 m by 17.72 m
Connections : W cir to S F&B, S F&B seat to F&B, S F&B to Tay St,

Node **S F&B Seating**
Dimensions 10.87 m by 17.72 m
Connections : S F&B to S Cir, S F&B seat to F&B,

Node **N Retail**
Dimensions 7.30 m by 17.72 m
Connections : N Retail to N cir,

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Appendix B.4

Node **Mall- NW-Safe Place-Esk St** - Safe
Connections : N Cir to NW Esk St,

Node **N Circulation**
Dimensions 3.00 m by 29.01 m
Connections : E cir to N cir, N F&B to N Cir, W Cir to N Cir, N Retail to N cir, N Cir to NW Esk St, N Cent. Retail to N Cir, NE retail to E Cir, N Cir to NE Esk St,

Node **N Central Retail**
Dimensions 10.87 m by 17.72 m
Connections : N Cent. Retail to W Cir, N Cent. retail to E Cir, N Cent. Retail to N Cir,

Node **W Circulation**
Dimensions 37.89 m by 5.86 m
Connections : S cir to W cir, W cir to S F&B, W Cir to N Cir, N Cent. Retail to W Cir, S Cent. Retail to W Cir,

Node **S Central Retail**
Dimensions 10.87 m by 17.72 m
Connections : S Cent. Retail to W Cir, S Cent. Retail to E Cir, S Cent. Retail to S Cir,

Node **Mall-SE- Safe Place-Tay St** - Safe
Connections : S Retail to Tay st,

Node **S Retail**
Dimensions 10.87 m by 17.72 m
Connections : S Retail to Tay st, S Retail to S Cir,

Node **S Circulation**
Dimensions 5.30 m by 32.13 m
Connections : S cir to W cir, S F&B to S Cir, S Cent. Retail to S Cir, S Retail to S Cir, S Cir to E Cir,

Node **NE Retail**
Dimensions 7.54 m by 12.80 m
Connections : NE retail to E Cir,

Node **E Retail**
Dimensions 7.54 m by 12.80 m
Connections : E Retail to E cir,

Node **Mall- NE-Safe Place-Esk St** - Safe
Connections : N Cir to NE Esk St,

Node **E Circulation**
Dimensions 30.49 m by 5.86 m
Connections : E cir to N cir, N Cent. retail to E Cir, S Cent. Retail to E Cir, S Cir to E Cir, E Retail to E cir, GF Anchor to mall,

Node **GF Anchor Safe Place-Tay St** - Safe
Connections : GF Anchor - Tay St,

Node **GF Anchor Safe Place-Esk St** - Safe
Connections : GF Anchor- Esk St,

Node **GF Anchor**
Dimensions 12.21 m by 28.82 m
Connections : GF Anchor to mall, GF Anchor - Tay St, GF Anchor- Esk St,

Environmental & Planning Services I.C.C. Document Received 17 Dec 2019 Building Division

Invercargill City Council Building Consent Authority Approved Site Copy

EvacuatioNZ model for:
Non-base Case
- Challenging Fire 3 (CF3) Childcare Fire
Pre-movement time for GF and 1L anchor space = 60 sec

Node **Z2 Intermediate Floor**
Dimensions 15.00 m by 30.00 m
Connections : Z2 to L1 Carpark,

Node **Safe Place-stair4** - Safe
Connections : Stair 4 Final Exit,

Node **Safe Place-stair3** - Safe
Connections : Stair 3 Final Exit,

Node **Safe Place-stair2.4** - Safe
Connections : L1-L0 stair2.4,

Node **Safe Place-stair2.3** - Safe
Connections : Stair 2.3 Final Exit,

Node **L5 Stair2.4 stair**
Dimensions 11.60 m by 1.20 m
Connections : L5 Stair2.4 landing to stair, L5 Stair2.4 to L4 landing,

Node **L5 Stair2.4 Landing**
Dimensions 2.60 m by 1.20 m
Connections : L5 Stair2.4 landing to stair, L5CS to L5S2.4L,

Node **L5 Stair2.3 Stair**
Dimensions 10.40 m by 1.20 m
Connections : L5 Stair2.3 landing to stair, L5-L4 Stair2.3,

Node **L5 Stair2.3 Landing**
Dimensions 6.40 m by 2.70 m
Connections : L5 Stair2.3 landing to stair, L5CN to L5S2.3L,

Node **L5 Carpark**
Dimensions 30.00 m by 47.80 m
Connections : L5CN to L5S2.3L, L5CS to L5S2.4L,

Node **L4 Stair2.4 Stair**
Dimensions 11.60 m by 1.20 m
Connections : L5-L4 Stair2.4, L4 Stair2.4 to L3 landing,

Node **L4 Stair2.4 Landing**
Dimensions 2.60 m by 1.20 m
Connections : L5-L4 Stair2.4, L4CS to L4S2.4L, L5 Stair2.4 to L4 landing,

Node **L4 Stair2.3 Stair**
Dimensions 10.40 m by 1.20 m
Connections : L4 Stair2.3 landing to stair, L4-L3 Stair2.3,

Node **L4 Stair2.3 Landing**
Dimensions 6.40 m by 2.70 m
Connections : L4 Stair2.3 landing to stair, L4CN to L4S2.3L, L5-L4 Stair2.3,

Node **L4 Carpark**
Dimensions 15.00 m by 30.00 m
Connections : L4CN to L4S2.3L, L4CS to L4S2.4L,

Node **L3 Stair2.4 Landing**
Dimensions 2.60 m by 1.20 m

Approved For Issue 27/02/2020

BUILDING CONSENT NUMBER 2019/1381

Appendix B.4

Connections : L4-L3 Stair2.4, L3CS to L3S2.4L, L4 Stair2.4 to L3 landing,

Node **L3 Stair2.3 Stair**
Dimensions 11.60 m by 1.20 m
Connections : L4-L3 Stair2.4, L3 Stair2.4 to L2 landing,

Node **L3 Stair2.3 Stair**
Dimensions 10.40 m by 1.20 m
Connections : L3 Stair2.3 landing to stair, L3-L2 Stair2.3,

Node **L3 Stair2.3 Landing**
Dimensions 6.40 m by 2.70 m
Connections : L3 Stair2.3 landing to stair, L3CN to L3S2.3L, L4-L3 Stair2.3,

Node **L3 Carpark**
Dimensions 15.00 m by 30.00 m
Connections : L3CS to L3S2.4L, L3CN to L3S2.3L,

Node **L2 Stair2.4 Stair**
Dimensions 11.60 m by 1.20 m
Connections : L3-L2 Stair2.4, L2 Stair2.4 to L1 landing,

Node **L2 Stair2.4 Landing**
Dimensions 2.60 m by 1.20 m
Connections : L3-L2 Stair2.4, L2CS to L2S2.4L, L3 Stair2.4 to L2 landing,

Node **L2 Stair2.3 Stair**
Dimensions 10.40 m by 1.20 m
Connections : L2 Stair2.3 landing to stair, L2-L1 Stair2.3,

Node **L2 Stair2.3 Landing**
Dimensions 6.40 m by 2.70 m
Connections : L2 Stair2.3 landing to stair, L2CN to L2S2.3L, L3-L2 Stair2.3,

Node **L2 Carpark**
Dimensions 15.00 m by 30.00 m
Connections : L2CS to L2S2.4L, L2CN to L2S2.3L,

Node **L1 Stair4 Landing**
Dimensions 4.50 m by 2.10 m
Connections : L1-L0 Stair4, L1 entrance to Stair4,

Node **L1 Stair4**
Dimensions 9.20 m by 1.80 m
Connections : L0 S4 landing, L1-L0 Stair4,

Node **L1 Stair3 Landing**
Dimensions 12.60 m by 1.80 m
Connections : L1 entrance to Stair 3, L1-L0 Stair3,

Node **L1 Stair3**
Dimensions 9.50 m by 1.80 m
Connections : L1 S3 landing, L1-L0 Stair3,

Node **L1 Stair2.4 Stair**
Dimensions 17.10 m by 1.20 m
Connections : L2-L1 Stair2.4, L1-L0 stair2.4,

Environmental & Planning
Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

EvacuatioNZ model for:
Non-base Case
- Challenging Fire 3 (CF3) Childcare Fire
Pre-movement time for GF and 1L anchor space = 60 sec

Node **L1 Stair2.4 Landing**
Dimensions 2.60 m by 1.20 m
Connections : L2-L1 Stair2.4, L1CS to L1S2.4L, L2 Stair2.4 to L1 landing,

Node **L1 Stair2.3 Stair**
Dimensions 10.40 m by 1.20 m
Connections : L1 Stair2.3 landing to stair, L1-L0 Stiar2.3,

Node **L1 Stair2.3 Landing**
Dimensions 6.40 m by 2.70 m
Connections : L1 Stair2.3 landing to stair, L1CN to L1S2.3L, L2-L1 Stair2.3,

Node **L1 Carpark**
Dimensions 15.00 m by 30.00 m
Connections : Z2 to L1 Carpark, L1 Anchor to Carpark, L1CS to L1S2.4L, L1CN to L1S2.3L,

Node **L1 Anchor-S BoH**
Dimensions 5.90 m by 2.00 m
Connections : L1 Anchor to S BoH, L1 entrance to Stair4,

Node **L1 Anchor**
Dimensions 12.21 m by 28.82 m
Connections : L1 entrance to Stair 3, L1 Anchor to S BoH, L1 Anchor to Carpark,

Node **L0 Stair4 landing**
Dimensions 4.10 m by 1.80 m
Connections : Stair 4 Final Exit, L0 S4 landing,

Node **L0 Stair3 Landing**
Dimensions 5.30 m by 1.80 m
Connections : Stair 3 Final Exit, L1 S3 landing,

Node **L0 Stair2.3 Landing**
Dimensions 3.40 m by 1.60 m
Connections : L1-L0 Stiar2.3, L0 Stair2.3 landing to corridor,

Node **Corridor**
Dimensions 22.00 m by 1.80 m
Connections : Stair 2.3 Final Exit, L0 Stair2.3 landing to corridor,

Connections

Connection **L0 Stair2.3 landing to corridor**
Length 1.00 m
Connecting L0 Stair2.3 Landing to Corridor (target node for required path)
Door width 0.93 m, specific flow 1.33 persons/s per m eff. width

Connection **Stair 2.3 Final Exit**
Length 1.00 m
Connecting Corridor to Safe Place-stair2.3 (target node for required path)
Door width 0.93 m, specific flow 1.33 persons/s per m eff. width (restricted by closer)

Connection **L1-L0 stair2.4**
Length 1.00 m
Connecting L1 Stair2.4 Stair to Safe Place-stair2.4 (target node for required path)
Stairs width 1.20 m, tread 0.26 m, riser 0.19 m

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Appendix B.4

Connection **L2 Stair2.4 to L1 landing**
Length 1.00 m
Connecting L2 Stair2.4 Stair to L1 Stair2.4 Landing (target node for required path)
Stairs width 1.20 m, tread 0.26 m, riser 0.19 m

Connection **L3 Stair2.4 to L2 landing**
Length 1.00 m
Connecting L3 Stair2.3 Stair to L2 Stair2.4 Landing (target node for required path)
Stairs width 1.20 m, tread 0.26 m, riser 0.19 m

Connection **L4 Stair2.4 to L3 landing**
Length 1.00 m
Connecting L4 Stair2.4 Stair to L3 Stair2.4 Landing (target node for required path)
Stairs width 1.20 m, tread 0.26 m, riser 0.19 m

Connection **L5 Stair2.4 to L4 landing**
Length 1.00 m
Connecting L5 Stair2.4 stair to L4 Stair2.4 Landing (target node for required path)
Stairs width 1.20 m, tread 0.26 m, riser 0.19 m

Connection **L1-L0 Stiar2.3**
Length 1.00 m
Connecting L1 Stair2.3 Stair to L0 Stair2.3 Landing (target node for required path)
Stairs width 1.20 m, tread 0.26 m, riser 0.19 m

Connection **L2-L1 Stair2.3**
Length 1.00 m
Connecting L2 Stair2.3 Stair to L1 Stair2.3 Landing (target node for required path)
Stairs width 1.20 m, tread 0.26 m, riser 0.19 m

Connection **L3-L2 Stair2.3**
Length 1.00 m
Connecting L3 Stair2.3 Stair to L2 Stair2.3 Landing (target node for required path)
Stairs width 1.20 m, tread 0.26 m, riser 0.19 m

Connection **L4-L3 Stair2.3**
Length 1.00 m
Connecting L4 Stair2.3 Stair to L3 Stair2.3 Landing (target node for required path)
Stairs width 1.20 m, tread 0.26 m, riser 0.19 m

Connection **L5CS to L5S2.4L**
Length 1.00 m
Connecting L5 Carpark to L5 Stair2.4 Landing (target node for required path)
Door width 0.93 m, specific flow 1.33 persons/s per m eff. width

Connection **L5CN to L5S2.3L**
Length 1.00 m
Connecting L5 Carpark to L5 Stair2.3 Landing (target node for required path)
Door width 0.93 m, specific flow 1.33 persons/s per m eff. width

Connection **L5-L4 Stair2.3**
Length 1.00 m
Connecting L5 Stair2.3 Stair to L4 Stair2.3 Landing (target node for required path)
Stairs width 1.20 m, tread 0.26 m, riser 0.19 m

Connection **L1CN to L1S2.3L**
Length 1.00 m
Connecting L1 Carpark to L1 Stair2.3 Landing (target node for required path)

Environmental & Planning
Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

EvacuatioNZ model for:
Non-base Case
- Challenging Fire 3 (CF3)
Childcare Fire
Pre-movement time for GF and 1L anchor space = 60 sec

Door width 0.93 m, specific flow 1.33 persons/s per m eff. width

Connection **L1CS to L1S2.4L**
Length 1.00 m
Connecting L1 Carpark to L1 Stair2.4 Landing (target node for required path)
Door width 0.93 m, specific flow 1.33 persons/s per m eff. width

Connection **L2CN to L2S2.3L**
Length 1.00 m
Connecting L2 Carpark to L2 Stair2.3 Landing (target node for required path)
Door width 0.93 m, specific flow 1.33 persons/s per m eff. width

Connection **L2CS to L2S2.4L**
Length 1.00 m
Connecting L2 Carpark to L2 Stair2.4 Landing (target node for required path)
Door width 0.93 m, specific flow 1.33 persons/s per m eff. width

Connection **L3CN to L3S2.3L**
Length 1.00 m
Connecting L3 Carpark to L3 Stair2.3 Landing (target node for required path)
Door width 0.93 m, specific flow 1.33 persons/s per m eff. width

Connection **L3CS to L3S2.4L**
Length 1.00 m
Connecting L3 Carpark to L3 Stair2.4 Landing (target node for required path)
Door width 0.93 m, specific flow 1.33 persons/s per m eff. width

Connection **L4CS to L4S2.4L**
Length 1.00 m
Connecting L4 Carpark to L4 Stair2.4 Landing (target node for required path)
Door width 0.93 m, specific flow 1.33 persons/s per m eff. width

Connection **L4CN to L4S2.3L**
Length 1.00 m
Connecting L4 Carpark to L4 Stair2.3 Landing (target node for required path)
Door width 0.93 m, specific flow 1.33 persons/s per m eff. width

Connection **L5 Stair2.4 landing to stair**
Length 1.00 m
Connecting L5 Stair2.4 Landing to L5 Stair2.4 stair (target node for required path)
Stairs width 1.20 m, tread 0.26 m, riser 0.19 m

Connection **L5-L4 Stair2.4**
Length 1.00 m
Connecting L4 Stair2.4 Landing to L4 Stair2.4 Stair (target node for required path)
Stairs width 1.20 m, tread 0.26 m, riser 0.19 m

Connection **L4-L3 Stair2.4**
Length 1.00 m
Connecting L3 Stair2.4 Landing to L3 Stair2.3 Stair (target node for required path)
Stairs width 1.20 m, tread 0.26 m, riser 0.19 m

Connection **L3-L2 Stair2.4**
Length 1.00 m
Connecting L2 Stair2.4 Landing to L2 Stair2.4 Stair (target node for required path)
Stairs width 1.20 m, tread 0.26 m, riser 0.19 m

Connection **L2-L1 Stair2.4**

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Appendix B.4

Length 1.00 m
Connecting L1 Stair2.4 Landing to L1 Stair2.4 Stair (target node for required path)
Stairs width 1.20 m, tread 0.26 m, riser 0.19 m

Connection **L5 Stair2.3 landing to stair**
Length 1.00 m
Connecting L5 Stair2.3 Landing to L5 Stair2.3 Stair (target node for required path)
Stairs width 1.20 m, tread 0.26 m, riser 0.19 m

Connection **L4 Stair2.3 landing to stair**
Length 1.00 m
Connecting L4 Stair2.3 Landing to L4 Stair2.3 Stair (target node for required path)
Stairs width 1.20 m, tread 0.26 m, riser 0.19 m

Connection **L3 Stair2.3 landing to stair**
Length 1.00 m
Connecting L3 Stair2.3 Landing to L3 Stair2.3 Stair (target node for required path)
Stairs width 1.20 m, tread 0.26 m, riser 0.19 m

Connection **L2 Stair2.3 landing to stair**
Length 1.00 m
Connecting L2 Stair2.3 Landing to L2 Stair2.3 Stair (target node for required path)
Stairs width 1.20 m, tread 0.26 m, riser 0.19 m

Connection **L1 Stair2.3 landing to stair**
Length 1.00 m
Connecting L1 Stair2.3 Landing to L1 Stair2.3 Stair (target node for required path)
Stairs width 1.20 m, tread 0.26 m, riser 0.19 m

Connection **L1-L0 Stair3**
Length 1.00 m
Connecting L1 Stair3 Landing to L1 Stair3 (target node for required path)
Stairs width 1.80 m, tread 0.26 m, riser 0.19 m

Connection **L1 S3 landing**
Length 1.00 m
Connecting L1 Stair3 to L0 Stair3 Landing (target node for required path)
Stairs width 1.80 m, tread 0.26 m, riser 0.19 m

Connection **L1 entrance to Stair4**
Length 1.00 m
Connecting L1 Anchor-S BoH to L1 Stair4 Landing (target node for required path)
Door width 1.55 m, specific flow 1.33 persons/s per m eff. width (restricted by closer)

Connection **L1-L0 Stair4**
Length 1.00 m
Connecting L1 Stair4 Landing to L1 Stair4 (target node for required path)
Stairs width 1.80 m, tread 0.26 m, riser 0.19 m

Connection **L0 S4 landing**
Length 1.00 m
Connecting L1 Stair4 to L0 Stair4 landing (target node for required path)
Stairs width 1.80 m, tread 0.26 m, riser 0.19 m

Connection **Stair 4 Final Exit**
Length 1.00 m
Connecting L0 Stair4 landing to Safe Place-stair4 (target node for required path)
Door width 1.55 m, specific flow 1.33 persons/s per m eff. width (restricted by closer)

Environmental & Planning
Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

EvacuatioNZ model for:
Non-base Case
- Challenging Fire 3 (CF3)
Childcare Fire
Pre-movement time for GF and 1L anchor space = 60 sec

Connection **Stair 3 Final Exit**
Length 1.00 m
Connecting L0 Stair3 Landing to Safe Place-stair3 (target node for required path)
Door width 1.55 m, specific flow 1.33 persons/s per m eff. width (restricted by closer)

Connection **L1 Anchor to Carpark**
Length 1.00 m
Connecting L1 Anchor to L1 Carpark (target node for required path)
Door width 2.00 m, specific flow 1.33 persons/s per m eff. width

Connection **Z2 to L1 Carpark**
Length 1.00 m
Connecting Z2 Intermediate Floor to L1 Carpark (target node for required path)
Door width 1.86 m, specific flow 1.33 persons/s per m eff. width

Connection **L1 Anchor to S BoH**
Length 1.00 m
Connecting L1 Anchor to L1 Anchor-S BoH (target node for required path)
Door width 1.55 m, specific flow 1.33 persons/s per m eff. width (restricted by closer)

Connection **L1 entrance to Stair 3**
Length 1.00 m
Connecting L1 Anchor to L1 Stair3 Landing (target node for required path)
Door width 1.55 m, specific flow 1.33 persons/s per m eff. width (restricted by closer)

Connection **GF Anchor- Esk St**
Length 1.00 m
Connecting GF Anchor to GF Anchor Safe Place-Esk St (target node for required path)
Door width 2.00 m, specific flow 1.33 persons/s per m eff. width

Connection **GF Anchor - Tay St**
Length 1.00 m
Connecting GF Anchor to GF Anchor Safe Place-Tay St (target node for required path)
Door width 1.60 m, specific flow 1.33 persons/s per m eff. width

Connection **GF Anchor to mall**
Length 1.00 m
Connecting GF Anchor to E Circulation (target node for required path)
Door width 3.00 m, specific flow 1.33 persons/s per m eff. width

Connection **N Cir to NE Esk St**
Length 1.00 m
Connecting N Circulation to Mall- NE-Safe Place-Esk St (target node for required path)
Door width 3.90 m, specific flow 1.33 persons/s per m eff. width

Connection **NE retail to E Cir**
Length 1.00 m
Connecting NE Retail to N Circulation (target node for required path)
Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Connection **E Retail to E cir**
Length 1.00 m
Connecting E Retail to E Circulation (target node for required path)
Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Connection **S Cir to E Cir**
Length 1.00 m
Connecting S Circulation to E Circulation (target node for required path)

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Appendix B.4

Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Connection **S Retail to S Cir**
Length 1.00 m
Connecting S Retail to S Circulation (target node for required path)
Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Connection **S Retail to Tay st**
Length 1.00 m
Connecting S Retail to Mall-SE- Safe Place-Tay St (target node for required path)
Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Connection **S Cent. Retail to S Cir**
Length 1.00 m
Connecting S Central Retail to S Circulation (target node for required path)
Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Connection **S Cent. Retail to E Cir**
Length 1.00 m
Connecting S Central Retail to E Circulation (target node for required path)
Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Connection **S Cent. Retail to W Cir**
Length 1.00 m
Connecting S Central Retail to W Circulation (target node for required path)
Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Connection **N Cent. Retail to N Cir**
Length 1.00 m
Connecting N Central Retail to N Circulation (target node for required path)
Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Connection **N Cent. retail to E Cir**
Length 1.00 m
Connecting N Central Retail to E Circulation (target node for required path)
Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Connection **N Cent. Retail to W Cir**
Length 1.00 m
Connecting N Central Retail to W Circulation (target node for required path)
Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Connection **N Cir to NW Esk St**
Length 1.00 m
Connecting N Circulation to Mall- NW-Safe Place-Esk St (target node for required path)
Door width 3.50 m, specific flow 1.33 persons/s per m eff. width

Connection **N Retail to N cir**
Length 1.00 m
Connecting N Retail to N Circulation (target node for required path)
Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Connection **W Cir to N Cir**
Length 1.00 m
Connecting W Circulation to N Circulation (target node for required path)
Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Connection **S F&B to Tay St**

Environmental & Planning
Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

EvacuatioNZ model for:
Non-base Case
- Challenging Fire 3 (CF3) Childcare Fire
Pre-movement time for GF and 1L anchor space = 60 sec

Length 1.00 m
Connecting S F&B to Mall-SW- Safe Place-Tay S...
Door width 2.60 m, specific flow 1.33 persons/s...

Connection **S F&B seat to F&B**
Length 1.00 m
Connecting S F&B Seating to S F&B (target node for required path)
Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Connection **S F&B to S Cir**
Length 1.00 m
Connecting S F&B Seating to S Circulation (target node for required path)
Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Connection **W cir to S F&B**
Length 1.00 m
Connecting W Circulation to S F&B (target node for required path)
Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Connection **N HOS-1 to 2**
Length 1.00 m
Connecting N HOS-1 to N HOS-2 (target node for required path)
Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Connection **N HOS-1 to N F&B**
Length 1.00 m
Connecting N HOS-1 to N F&B (target node for required path)
Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Connection **N HOS to F&B Esk St**
Length 1.00 m
Connecting N HOS-2 to Mall- NW-F&B-Safe Place-Esk St (target node for required path)
Door width 1.60 m, specific flow 1.33 persons/s per m eff. width

Connection **N HOS to HOS Esk St**
Length 1.00 m
Connecting N HOS-2 to Mall- NW-HOS-Safe Place-Esk St (target node for required path)
Door width 2.00 m, specific flow 1.33 persons/s per m eff. width

Connection **N HOS-2 to N F&B**
Length 1.00 m
Connecting N HOS-2 to N F&B (target node for required path)
Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Connection **N F&B to N Cir**
Length 1.00 m
Connecting N F&B to N Circulation (target node for required path)
Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Connection **S cir to W cir**
Length 1.00 m
Connecting S Circulation to W Circulation (target node for required path)
Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Connection **E cir to N cir**
Length 1.00 m
Connecting E Circulation to N Circulation (target node for required path)
Door width 4.20 m, specific flow 1.33 persons/s per m eff. width

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Appendix B.4

Population

Name	Number	Density (agents/m²)	Density (m²/agent)
L1 Anchor	719	2.04	0.49
L1 Carpark	93	0.21	4.84
L2 Carpark	112	0.25	4.02
L3 Carpark	112	0.25	4.02
L4 Carpark	111	0.25	4.05
L5 Carpark	999	0.70	1.44
Z2 Intermediate Floor	378	0.84	1.19
GF Anchor	629	1.79	0.56
E Circulation	123	0.69	1.45
E Retail	97	1.01	0.99
NE Retail	27	0.28	3.57
S Circulation	136	0.80	1.25
S Retail	405	2.10	0.48
S Central Retail	137	0.71	1.41
W Circulation	216	0.97	1.03
N Central Retail	249	1.29	0.77
N Circulation	179	2.06	0.49
N Retail	144	1.11	0.90
S F&B Seating	195	1.01	0.99
S F&B	75	0.39	2.57
N HOS-1	86	0.45	2.24
N HOS-2	185	0.96	1.04
N F&B	210	1.40	0.72

Results

Simulation run 1 : Total number of agents = 5617

Node N HOS-1 clear at 98.5 s
Node S Central Retail clear at 103.5 s
Node E Retail clear at 109.0 s
Node S F&B Seating clear at 109.5 s
Node N Central Retail clear at 120.0 s

Environmental & Planning
Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

EvacuatioNZ model for:
Non-base Case
- Challenging Fire 3 (CF3) Childcare Fire
Pre-movement time for GF and 1L anchor space = 60 sec

Node S Retail clear at 132.0 s
Node N HOS-2 clear at 135.5 s
Node NE Retail clear at 138.0 s
Node S Circulation clear at 178.5 s
Node L3 Carpark clear at 185.5 s
Node GF Anchor clear at 187.5 s
Node L2 Carpark clear at 201.0 s
Node N F&B clear at 223.0 s
Node W Circulation clear at 229.0 s
Node N Retail clear at 240.0 s
Node S F&B clear at 241.0 s
Node L1 Anchor clear at 243.0 s
Node Z2 Intermediate Floor clear at 272.5 s
Node E Circulation clear at 277.5 s
Node N Circulation clear at 321.0 s
Node L4 Carpark clear at 506.0 s
Node L1 Carpark clear at 802.0 s
Node L5 Carpark clear at 1049.5 s

Time for last person to leave the ground floor mall space.

Last agent to leave node N F&B was 'Agent #5138' at 223.0 s
Last agent to leave node N HOS-2 was 'Agent #5148' at 135.5 s
Last agent to leave node N HOS-1 was 'Agent #5137' at 98.5 s
Last agent to leave node S F&B was 'Agent #3538' at 241.0 s
Last agent to leave node S F&B Seating was 'Agent #4867' at 109.5 s
Last agent to leave node N Retail was 'Agent #4723' at 240.0 s
Last agent to leave node N Circulation was 'Agent #3544' at 321.0 s
Last agent to leave node N Central Retail was 'Agent #4296' at 120.0 s
Last agent to leave node W Circulation was 'Agent #4871' at 229.0 s
Last agent to leave node S Central Retail was 'Agent #3943' at 103.5 s
Last agent to leave node S Retail was 'Agent #3539' at 132.0 s
Last agent to leave node S Circulation was 'Agent #3537' at 178.5 s
Last agent to leave node NE Retail was 'Agent #3374' at 138.0 s
Last agent to leave node E Retail was 'Agent #3277' at 109.0 s
Last agent to leave node E Circulation was 'Agent #3537' at 277.5 s
Last agent to leave node GF Anchor was 'Agent #2525' at 187.5 s
Last agent to leave node Z2 Intermediate Floor was 'Agent #2147' at 272.5 s
Last agent to leave node L5 Stair2.4 stair was 'Agent #1148' at 1103.5 s
Last agent to leave node L5 Stair2.4 Landing was 'Agent #1148' at 1060.0 s
Last agent to leave node L5 Stair2.3 Stair was 'Agent #1149' at 1033.0 s
Last agent to leave node L5 Stair2.3 Landing was 'Agent #1149' at 992.5 s
Last agent to leave node L5 Carpark was 'Agent #1148' at 1049.5 s
Last agent to leave node L4 Stair2.4 Stair was 'Agent #1148' at 1158.5 s
Last agent to leave node L4 Stair2.4 Landing was 'Agent #1148' at 1114.5 s
Last agent to leave node L4 Stair2.3 Stair was 'Agent #1149' at 1132.0 s
Last agent to leave node L4 Stair2.3 Landing was 'Agent #1149' at 1091.0 s
Last agent to leave node L4 Carpark was 'Agent #1040' at 506.0 s
Last agent to leave node L3 Stair2.4 Landing was 'Agent #1148' at 1169.0 s
Last agent to leave node L3 Stair2.3 Stair was 'Agent #1148' at 1212.5 s
Last agent to leave node L3 Stair2.3 Stair was 'Agent #1149' at 1232.0 s
Last agent to leave node L3 Stair2.3 Landing was 'Agent #1149' at 1190.5 s
Last agent to leave node L3 Carpark was 'Agent #928' at 185.5 s
Last agent to leave node L2 Stair2.4 Stair was 'Agent #1148' at 1266.5 s

Time for GF Anchor space to clear.

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Appendix B.4

Last agent to leave node L2 Stair2.4 Landing was 'Agent #1148' at 1223.0 s
Last agent to leave node L2 Stair2.3 Stair was 'Agent #1149' at 1328.5 s
Last agent to leave node L2 Stair2.3 Landing was 'Agent #1149' at 1289.0 s
Last agent to leave node L2 Carpark was 'Agent #813' at 201.0 s
Last agent to leave node L1 Stair4 Landing was 'Agent #3' at 215.0 s
Last agent to leave node L1 Stair4 was 'Agent #3' at 226.0 s
Last agent to leave node L1 Stair3 Landing was 'Agent #5' at 228.5 s
Last agent to leave node L1 Stair3 was 'Agent #5' at 240.0 s
Last agent to leave node L1 Stair2.4 Stair was 'Agent #1148' at 1338.0 s
Last agent to leave node L1 Stair2.4 Landing was 'Agent #1148' at 1276.0 s
Last agent to leave node L1 Stair2.3 Stair was 'Agent #1149' at 1427.0 s
Last agent to leave node L1 Stair2.3 Landing was 'Agent #1149' at 1387.5 s
Last agent to leave node L1 Carpark was 'Agent #2148' at 802.0 s
Last agent to leave node L1 Anchor-S BoH was 'Agent #3' at 198.5 s
Last agent to leave node L1 Anchor was 'Agent #1' at 243.0 s
Last agent to leave node L0 Stair4 landing was 'Agent #3' at 231.5 s
Last agent to leave node L0 Stair3 Landing was 'Agent #5' at 245.5 s
Last agent to leave node L0 Stair2.3 Landing was 'Agent #1149' at 1444.5 s
Last agent to leave node Corridor was 'Agent #1149' at 1491.5 s

Time for last person to enter into stair 3 (i.e. time to clear the queue in front of stair 3).

Time for last person to enter into stair 4 (i.e. time to clear the queue in front of stair 4).

Time for last person from Level 1 anchor space to leave Stair 4.

Time for last person from Level 1 anchor space to leave Stair 3. This is the designated egress stair for the Childcare Centre on Level 2.

Total number of agents in safe node Mall- NW-HOS-Safe Place-Esk St = 75
Total number of agents in safe node Mall- NW-F&B-Safe Place-Esk St = 77
Total number of agents in safe node Mall-SW- Safe Place-Tay St = 458
Total number of agents in safe node Mall- NW-Safe Place-Esk St = 962
Total number of agents in safe node Mall-SE- Safe Place-Tay St = 214
Total number of agents in safe node Mall- NE-Safe Place-Esk St = 927
Total number of agents in safe node GF Anchor Safe Place-Tay St = 161
Total number of agents in safe node GF Anchor Safe Place-Esk St = 219
Total number of agents in safe node Safe Place-stair4 = 174
Total number of agents in safe node Safe Place-stair3 = 200
Total number of agents in safe node Safe Place-stair2.4 = 1055
Total number of agents in safe node Safe Place-stair2.3 = 1095

Total evacuation time = 1492.00 s

Time for L1 Anchor space to clear.

Time for last person to leave the car park building.

Completed at 10:06:30 on Monday 26 August 2019

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

B.5 Hand-calculation Validation of EvacuatioNZ

To validate the presented EvacuatioNZ results, hand-calculation of travel / flow times is undertaken for key areas. Hand-calculations are undertaken as per V/VM2, section 3.2.5.

EvacuatioNZ results from Base case evacuation are utilised in comparison.

Table 14 - Hand-calculation Validation

Location	Total Occupancy Using Egress (ppl)	Hand-calculation			EvacuatioNZ RSET (s)
		Travel Time (s)	Flow Time (s)	RSET (s)	
GF Anchor	629	36	84	144[1]	168[1]
L1 Anchor	719	52	142	232[2]	241[2]

Explanatory notes:

1) The RSET time did not include smoke detection time but does include t_n (30s) and t_{pre} (30s).

2) The RSET time did not include smoke detection time but does include t_n (30s) and t_{pre} (60s).

The RSET times (excluding the smoke detection time) are generally similar between EvacuatioNZ results and hand-calculations. The minor difference may be due to occupant interaction leading to queueing and as such reducing flow through various bottle-necks.

It is considered that the derived EvacuatioNZ modelling results are supported by crude overall building evacuation estimates by hand calculations.

It is also noted from Table 14 above that the travel time from both ground floor and Level 1 are less than the flow time. This is consistent with the assumption that flow time governs due to the large number of occupants presented within the space.

Attached is the following:

- Hand calculation for flow time validation.

Environmental & Planning
Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Holmes

136249
24/05/2019

Travel distance v.s. Flow calculation validation.
Level 1 Anchor Space

RSET component	Inputs		Value
t_d	determined by FDS using C/VM2 input parameters (heat detection)		0 s
t_{n-}	As per C/VM2		30 s
t_{pre}	Pre-movement time (C/VM2 Table 3.3) for occupants awake, alert, unfamiliar and within the enclosure of origin		60 s
t_{trav}	= distance / walking speed (= distance/S) *distance (assumed)* = 52 *m* S = 1.2 *m/s*	43	
t_{flow}	= #ppl / F_c *#ppl* = 719 *ppl* *See flow capacity calc - total for 3 exits, Fc* = 304 *ppl/min* *Fc* = 5.1 *ppl/s*	142	
t_{move}	= *the larger of* t_{flow} *and* t_{trav}	**tflow**	142 s
RSET	$= (t_d + t_n + t_{pre}) + t_{move}$	**RSET =**	**232 *s***

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Flow capacity of egress route elements

Job No. 136249
Name: HWCP Zone 1
By: ACC
Date: 16/07/2019

Egress route / space: Ground Floor

Summary - inputs and outputs

Doorset clear width: $W_{(d)}$ = 2000 mm — 134 ppl/min
leaves per doorset: = 1 leaves
Self-closer fitted? No

Automatic sliding door for both ground floor and level 1 carpark entrance.

Doorset clear width: $W_{(d)}$ = 3000 mm — 213 ppl/min
leaves per doorset: = 0 leaves
Self-closer fitted? No

Opening into mall

Doorset clear width: $W_{(d)}$ = 1600 mm — 100 ppl/min
leaves per doorset: = 2 leaves
Self-closer fitted? Yes

Double leaf door

Calculations (Reference: C/VM2)

Door flow capacity	$W_{(d)}$ =	2000 mm	
Boundary layer (each side) =		0.15 m	C/VM2 Table 3.5 (Door)
Effective width	$W_{e(d)}$ =	1.70 m	
Door flow capacity	$F_{c\,(door)}$ =	$(1-aD)kD\,W_{e(d)}$	
	k =	1.40	C/VM2: k = 1.4 for horizontal travel
	a =	0.266	C/VM2: a = 0.266
	D =	1.90 ppl/m^2	C/VM2 Density at flow constriction
Calculated capacity	$F_{c\,(door)}$ =	2.24 ppl/s	
Calculated $F_{c\,(door)}$ per leaf =		134 ppl/min/leaf	
Would closers restrict capacity? =		No	"Yes" if Fc (door) per leaf >50ppl/min
Design flow capacity	$F_{c\,(door)}$ =	2.24 ppl/s	
		134 ppl/min	

Door flow capacity	$W_{(d)}$ =	3000 mm	
Boundary layer (each side) =		0.15 m	C/VM2 Table 3.5 (Door)
Effective width	$W_{e(d)}$ =	2.70 m	
Door flow capacity	$F_{c\,(door)}$ =	$(1-aD)kD\,W_{e(d)}$	
	k =	1.40	C/VM2: k = 1.4 for horizontal travel
	a =	0.266	C/VM2: a = 0.266
	D =	1.90 ppl/m^2	C/VM2 Density at flow constriction
Calculated capacity	$F_{c\,(door)}$ =	3.55 ppl/s	
Calculated $F_{c\,(door)}$ per leaf =		#DIV/0! ppl/min/leaf	
Would closers restrict capacity? =		No	"Yes" if Fc (door) per leaf >50ppl/min
Design flow capacity	$F_{c\,(door)}$ =	3.55 ppl/s	
		213.1 ppl/min	

Door flow capacity	$W_{(d)}$ =	1600 mm	
Boundary layer (each side) =		0.15 m	C/VM2 Table 3.5 (Door)
Effective width	$W_{e(d)}$ =	1.30 m	
Door flow capacity	$F_{c\,(door)}$ =	$(1-aD)kD\,W_{e(d)}$	
	k =	1.40	C/VM2: k = 1.4 for horizontal travel
	a =	0.266	C/VM2: a = 0.266
	D =	1.90 ppl/m^2	C/VM2 Density at flow constriction
Calculated capacity	$F_{c\,(door)}$ =	1.71 ppl/s	
Calculated $F_{c\,(door)}$ per leaf =		51 ppl/min/leaf	
Would closers restrict capacity? =		Yes	"Yes" if Fc (door) per leaf >50ppl/min
Design flow capacity	$F_{c\,(door)}$ =	1.67 ppl/s	
		100 ppl/min	

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
Appendix B.5
2019/1381

Flow capacity of egress route elements

Job No. 136249
Name: HWCP Zone 1
By: ACC
Date: 16/07/2019

Egress route / space: Level one

Summary - inputs and outputs

Corridor width:	$W_{(c)}$ =	2000 mm	126 ppl/min	
Stair width:	$W_{(s)}$ =	1800 mm	85 ppl/min	
Stair geometry:	Stair tread =	254		
	Stair riser =	191 mm		
Doorset clear width:	$W_{(d)}$ =	1600 mm	100 ppl/min	Double leaf door into stairwells
# leaves per doorset:	=	2 leaves		
Self-closer fitted?		Yes		

Calculations (Reference: C/VM2)

a) Corridor flow capacity

Boundary layer (each side) =		0.2 m	C/VM2 Table 3.5 (corridor/ramp wall)
Effective width	$W_{e(c)}$ =	1.60 m	
Corridor flow capacity	$F_{c\ (corridor)}$ =	$(1-aD)kDW_{e(c)}$	
	k =	1.40	C/VM2: k = 1.4 for horizontal travel
	a =	0.266	C/VM2: a = 0.266
	D =	1.90 ppl/m^2	C/VM2 Density at flow constriction
Corridor flow capacity	$F_{c\ (corridor)}$ =	2.11 ppl/s	

b) Stair flow capacity

Boundary layer (each side) =		0.15 m	C/VM2 Table 3.5 (stair walls/side tread)
Effective width	$W_{e(s)}$ =	1.50 m	
Stair flow capacity	$F_{c\ (stair)}$ =	$(1-aD)k_sDW_{e(s)}$	
	k_s =	1	C/VM2 Table 3.4 (closest riser/tread)
	a =	0.266	C/VM2: a = 0.266
	D =	1.90	C/VM2 Density at flow constriction
Stair flow capacity	$F_{c\ (stair)}$ =	1.41 ppl/s	
Travel speed in full stair	S =	$\varsigma_s - ak_sD$ m/s	S = k - akD (k from Table 3-14.5)
	S =	0.49 m/s	C/VM2 Table 3.4 (closest riser/tread)
Travel speed, unimpeded	S_{max} =	0.85 m/s	i.e. for very low occupant density

c) Door flow capacity

Boundary layer (each side) =		0.15 m	C/VM2 Table 3.5 (Door)
Effective width	$W_{e(d)}$ =	1.30 m	
Door flow capacity	$F_{c\ (door)}$ =	$(1-aD)kDW_{e(d)}$	
	k =	1.40	C/VM2: k = 1.4 for horizontal travel
	a =	0.266	C/VM2: a = 0.266
	D =	1.90 ppl/m^2	C/VM2 Density at flow constriction
	$F_{c\ (door)}$ =	1.71 ppl/s	Based only on width
	=	51 ppl/min/leaf	
Would closers restrict capacity? =		Yes	
Design flow capacity	$F_{c\ (door)}$ =	1.67 ppl/s	Accounting for closers and # leaves
	=	100 ppl/min	"Yes" if Fc (door) per leaf >50ppl/min

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Appendix B.5

Holmes

136249 Zone 3
28/06/2019

Travel distance v.s. Flow calculation validation.
Ground Floor Anchor Space

RSET component	Inputs		Value
t_d	determined by FDS using C/VM2 input parameters (smoke detection)		s
t_{n-}	As per C/VM2		30 s
t_{pre}	Pre-movement time (C/VM2 Table 3.3) for occupants awake, alert, unfamiliar and within the enclosure of origin		30 s
t_{trav}	= distance / walking speed (= distance/S) *distance (assumed)* = 43 *m* S = 1.2 *m/s*	36	
t_{flow}	= #ppl / F_c *#ppl* = 629 *ppl* *See flow capacity calc - total for 3 exits, Fc* = 447 *ppl/min* *Fc* = 7.5 *ppl/s*	84	
t_{move}	*= the larger of* t_{flow} *and* t_{trav}	**tflow**	84 s
RSET	$= (t_d + t_n + t_{pre}) + t_{move}$	**RSET =**	**144 s**

= 134 ppl/min (Auto. sliding door)
+ 213 ppl/min (opening into mall)
+ 100 ppl/min (1600 mm double leaf door)

Environmental & Planning Services I.C.C. Document Received

17 Dec 2019

Building Division

Invercargill City Council Building Consent Authority Approved Site Copy

Approved For Issue 27/02/2020

BUILDING CONSENT NUMBER 2019/1381

Appendix B.5

Holmes

HWGP
136249
24/05/2019

Travel distance v.s. Flow calculation validation.
Level 1 Anchor Space

RSET component	Inputs		Value
t_d	determined by FDS using C/VM2 input parameters (heat detection)		0 s
t_{n-}	As per C/VM2		30 s
t_{pre}	Pre-movement time (C/VM2 Table 3.3) for occupants awake, alert, unfamiliar and within the enclosure of origin		60 s
t_{trav}	= distance / walking speed (= distance/S) *distance (assumed)* = 52 *m* S = 1.2 *m/s*	43	
t_{flow}	= #ppl / F_c *#ppl* = 719 *ppl* *See flow capacity calc - total for 3 exits, Fc* = 304 *ppl/min* *Fc* = 5.1 *ppl/s*	142	
t_{move}	= *the larger of* t_{flow} *and* t_{trav}	**tflow**	142 s
RSET	$= (t_d + t_n + t_{pre}) + t_{move}$	**RSET =**	**232 s**

= 85 ppl/min (Stair 3)
+ 85 ppl/min (Stair 4)
+ 134 ppl/min (Auto. sliding door)

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

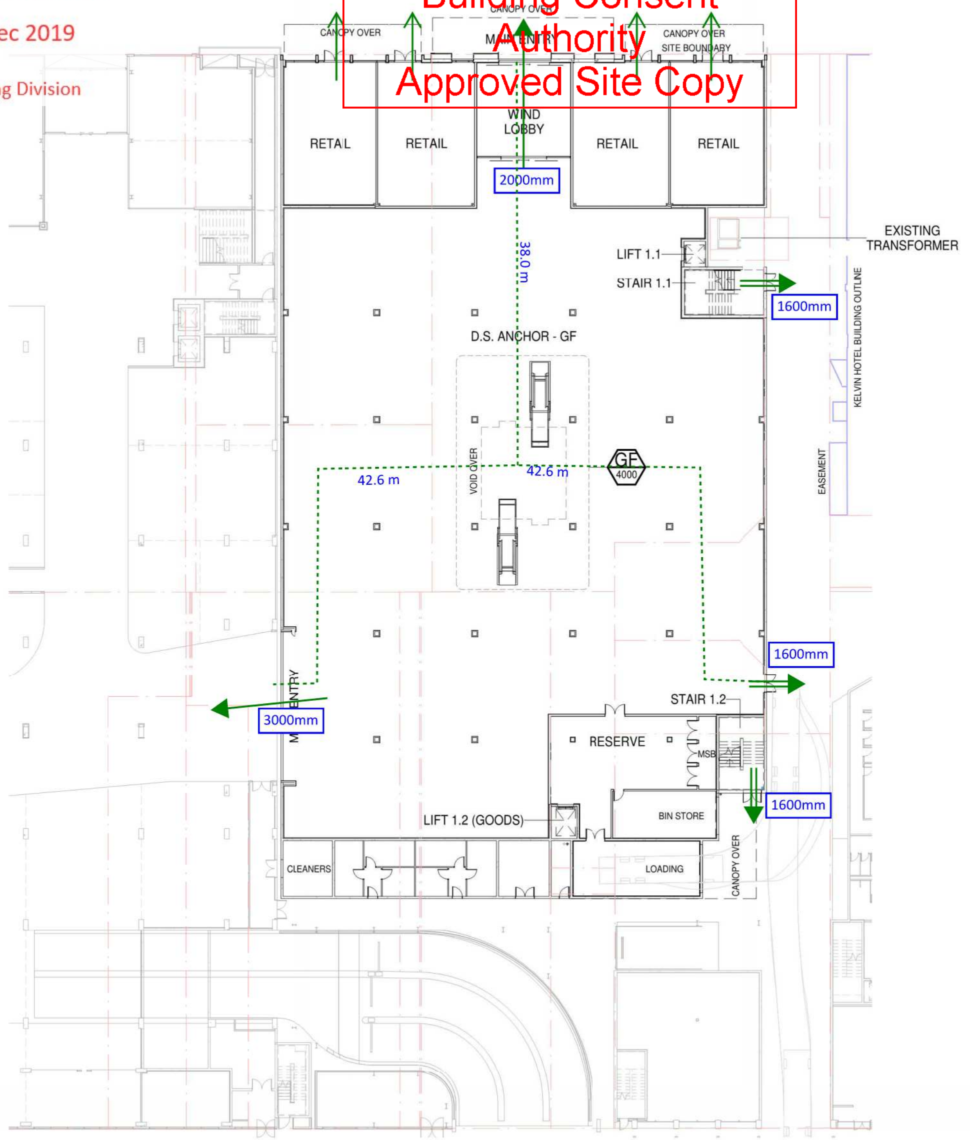
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

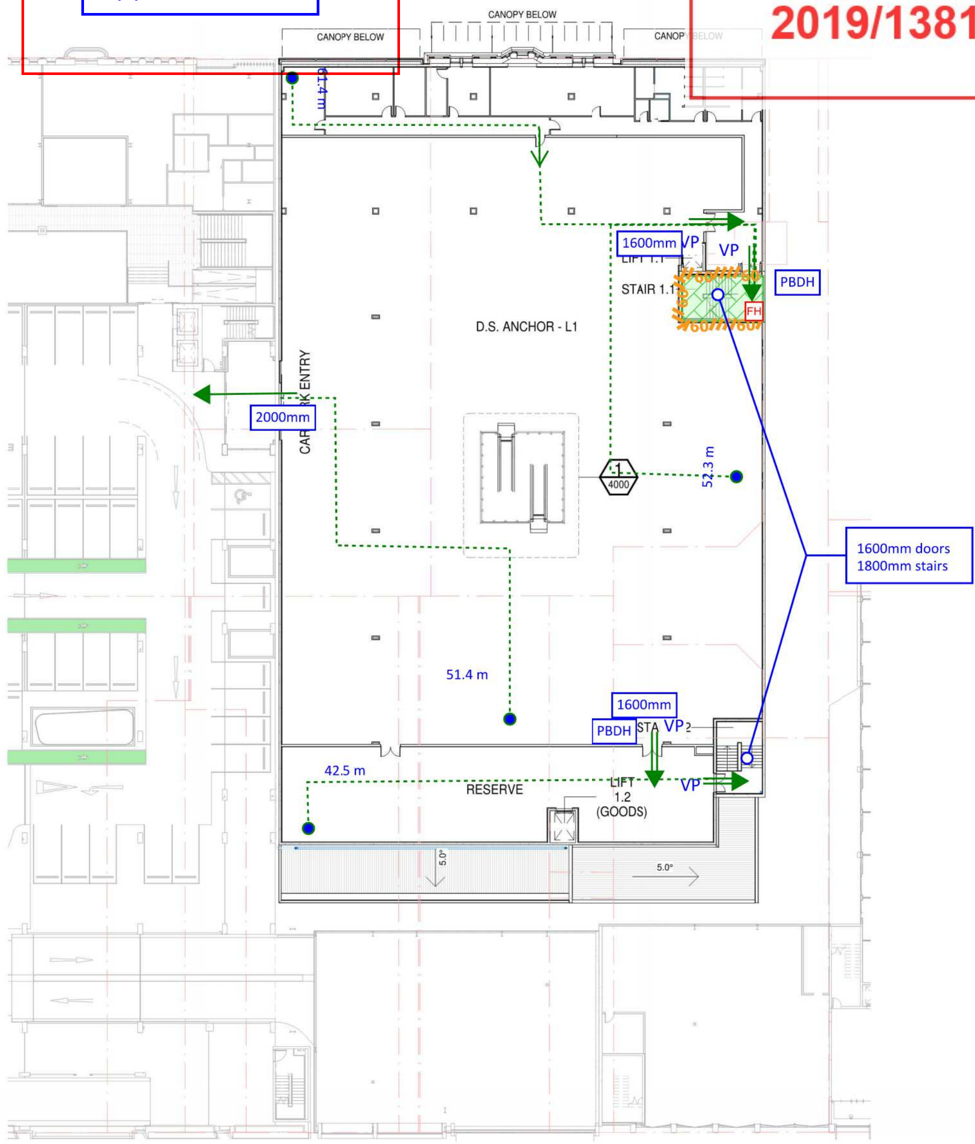
Approved For Issue
27/02/2020

Appendix B.5

BUILDING CONSENT NUMBER
2019/1381



GF Z1 - GROUND FLOOR - OVERALL
1 : 250



1 Z1 - LEVEL 1 - OVERALL
1 : 250

This sketch does not constitute a complete fire engineering design or detail. Detailed construction drawings are provided by others. Best viewed in colour. Not all fire separations around ducts and shafts are shown.

Holmes

Holmes Fire LP
L2, 254 Montreal St
Christchurch
New Zealand
T: +64 3 365 8855
holmesfire.com

Project Title
HWCP - Invercargill Central

Sketch Title
Zone 1 GF & L1
Travel Distance
Measurement

Drawn: ACC
Date: 30 / 07 / 2019

Project No.	Sheet No.	Rev
136249	Z1 B.5	A

Rev.	Date	Description	Iss.	Appr.
A	27.11.18	FOR COMMENT	BH	JB
B	10.01.19	PRELIMINARY DESIGN	BH	JB
C	21.03.19	PRELIMINARY DESIGN	BH	DA
D	17.04.19	FOR INFORMATION	JT	DA

Keyplan
EXISTING CINEMA
ZONE 1
KELVIN

Do not scale this drawing. Verify all dimensions on site before commencing any work. Copyright © 2019Buchan. This drawing remains the property of The Buchan Group New Zealand Pty Ltd. Reproduction in whole or in part without prior consent is forbidden.

File
C:\TBG - Revit Projects\917077 - AR-PD - INVERCARGILL - ZONE 1 - ANCHOR - 2019_Jessica.Tuboltsev.buchan.rvt

HWCP

Project
INVERCARGILL CENTRAL - ZONE 1
TAY STREET & DEE STREET CORNER
INVERCARGILL
Project Number
917077

Status
PRELIMINARY DESIGN
Date Plotted 17/04/2019 2:44:26 PM
Date Issued 21.03.19
Scale 1 : 250 @A1

Drawing Title
ZONE 1
OVERALL FLOOR PLANS
Drawing Number
Z1-PD-A-1100
Revision
D

BUCHAN
Christchurch Studio
+64 3 377 2973 / buchangroup.co.nz

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council Building Consent Authority Approved Site Copy

Approved For Issue 27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Appendix C ASET Assessment

C.1 ASET for Challenging Fire CF1

Challenging Fire CF1 locates a fire centrally within the atrium on the ground floor, modelled within FDS. The fire is subject to (quick response) sprinkler control.

Table 15 - Sprinkler Activation time for CF1

(Quick Response) Sprinkler activation in FDS (s)	Sprinkler activation modelled for HRR control (s)
265	265

The graph below shows the comparison between the HRR output of the FDS burner modelled in Challenging Fire CF1 against that specified in C/VM2 ($0.0469t^2$).

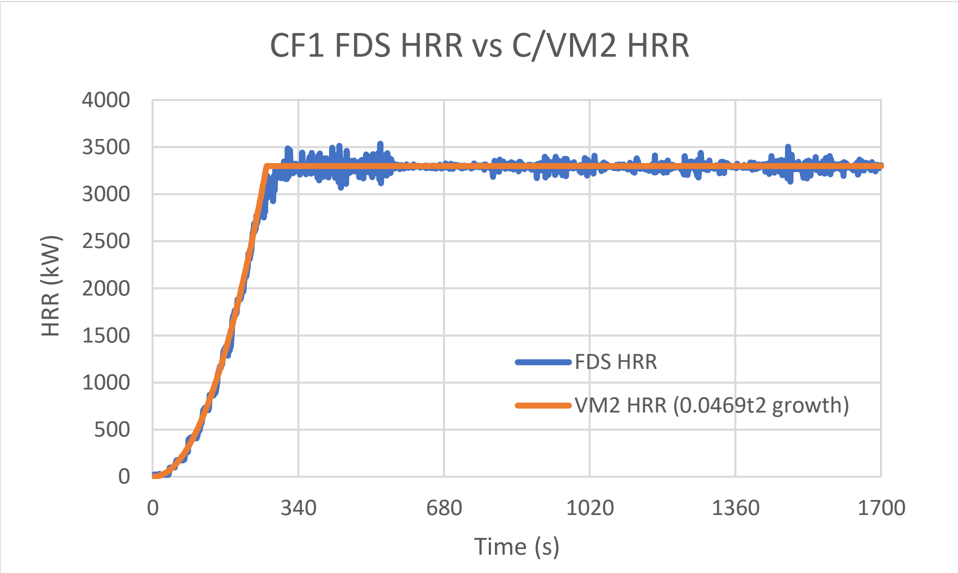


Figure 5 - CF1 FDS HRR vs VM2 HRR

C.1.1 CF1 ASET Summary

Tenability was assessed by FEDco slice files located 2m above each floor. The table below showed the tenability for each floor.

Table 16 - CF1 ASET

Floor Level	Location	Time at Tenability (s)			ASET (s)
		Visibility = 10m	$FED_{thermal}$ = 0.3 (temp. @ 50°C)	FED_{CO} = 0.3	
GF	Retail	N/A	N/A	>1700	>1700
	SW Entry to Mall	N/A	N/A	>1700	>1700
	Main Entry (Esk St)	N/A	N/A	>1700	>1700
	SE Exit to Tay St	N/A	N/A	>1700	>1700

Environmental & Planning Services I.C.C. Document Received
17 Dec 2019
Building Division

Invercargill City Council Building Consent Authority Approved Site Copy

Approved For Issue 27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Floor Level	Location	Time at Tenability (s)			ASET (s)
		Visibility = 10m	$FED_{thermal}$ = 0.3 (temp. @ 50°C)	FED_{CO} = 0.3	
L1	Retail	213	>1700	>1700	213
	Entry to Carpark	328	>1700	>1700	328
	Entry to Stair 3	386	>1700	>1700	386
	Entry to Stair 4	311	>1700	>1700	311
	Stair 3	N/A	N/A	>1700	>1700
	Stair 4	N/A	N/A	>1700	>1700

The results are shown below in FDS slice files and graphs.

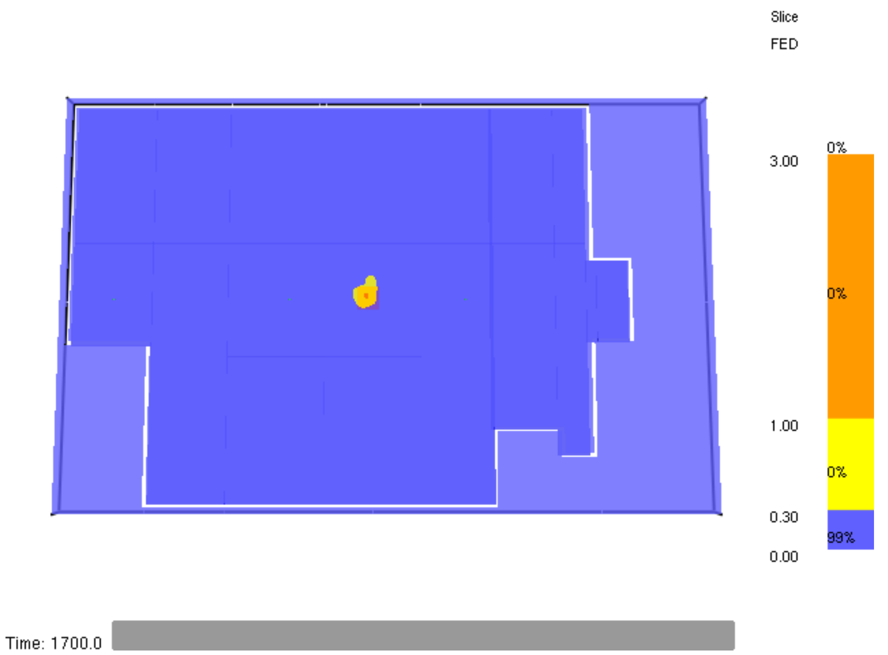


Figure 6 - CF1 FEDco slice file at 2.0 m above Ground Floor at 1700 s

Environmental & Planning Services I.C.C. Document Received
17 Dec 2019
Building Division

Invercargill City Council Building Consent Authority Approved Site Copy

Approved For Issue 27/02/2020

BUILDING CONSENT NUMBER 2019/1381

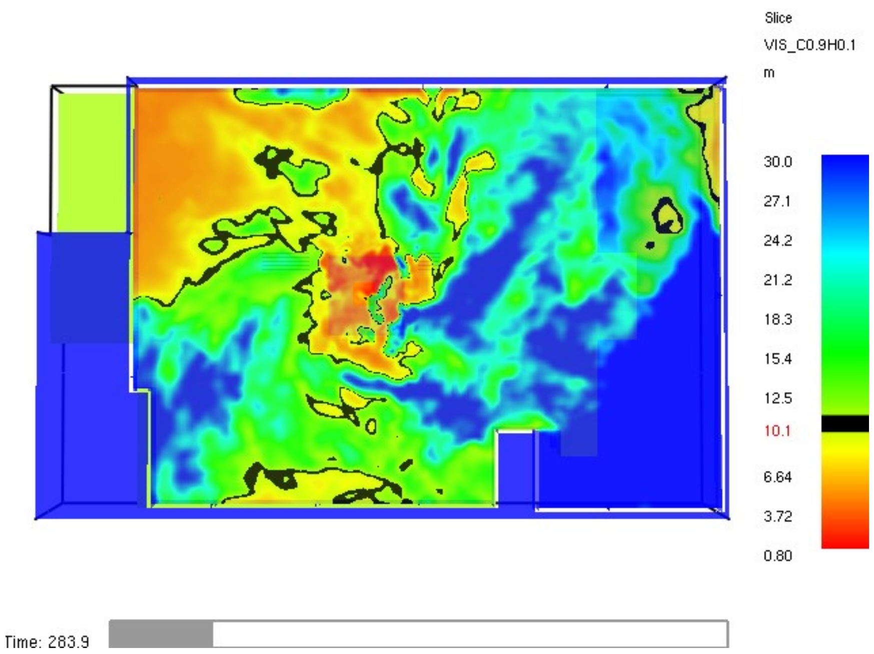


Figure 7 - CF1 Visibility slice file at 2.0 m above Level 1 floor at 284 s

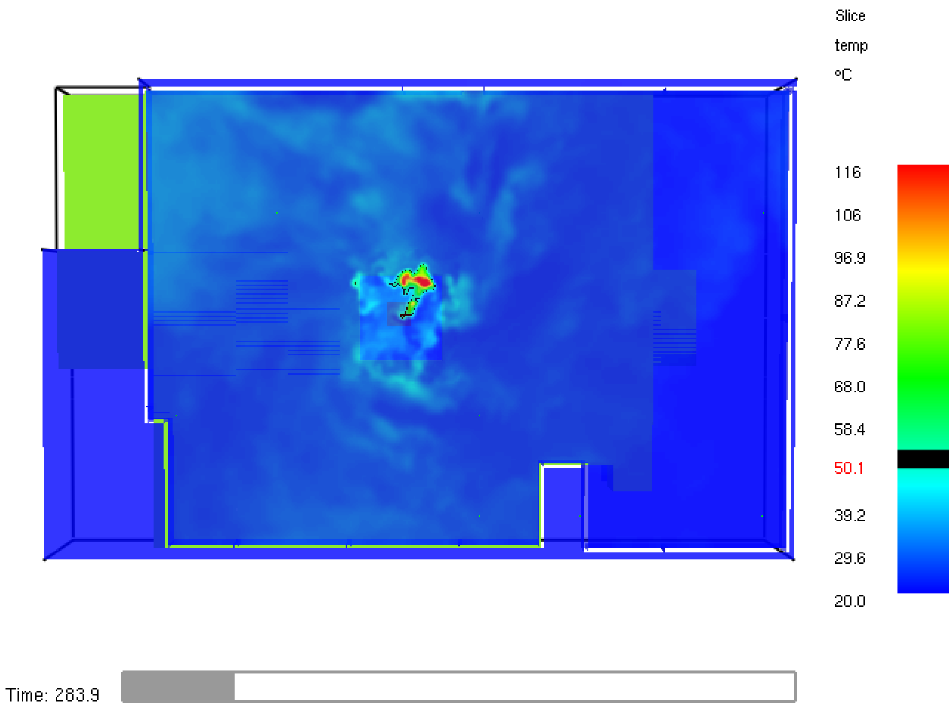


Figure 8 - CF1 Temperature slice file at 2.0 m above Level 1 floor at 284 s

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

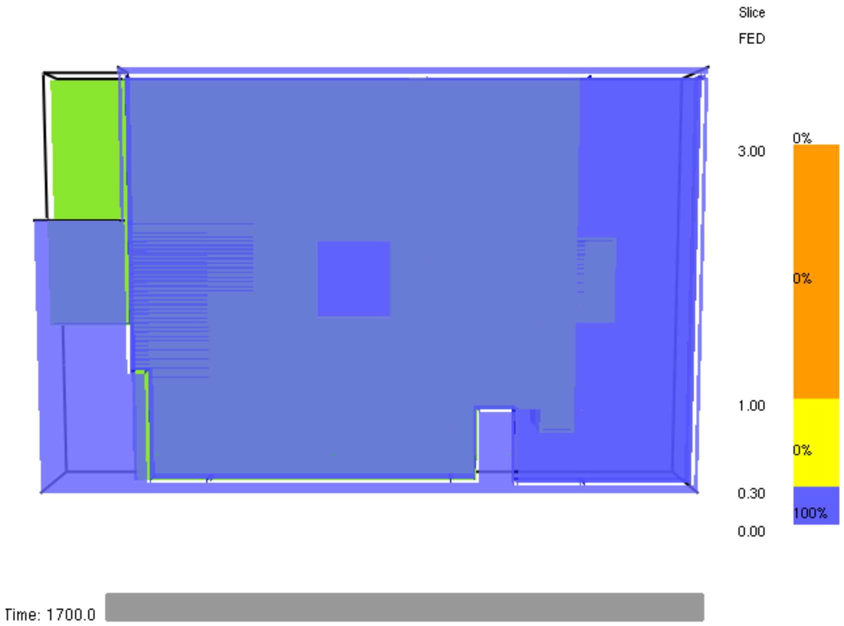


Figure 9 - CF1 FEDco slice file at 2.0 m above Level 1 floor at 1700 s

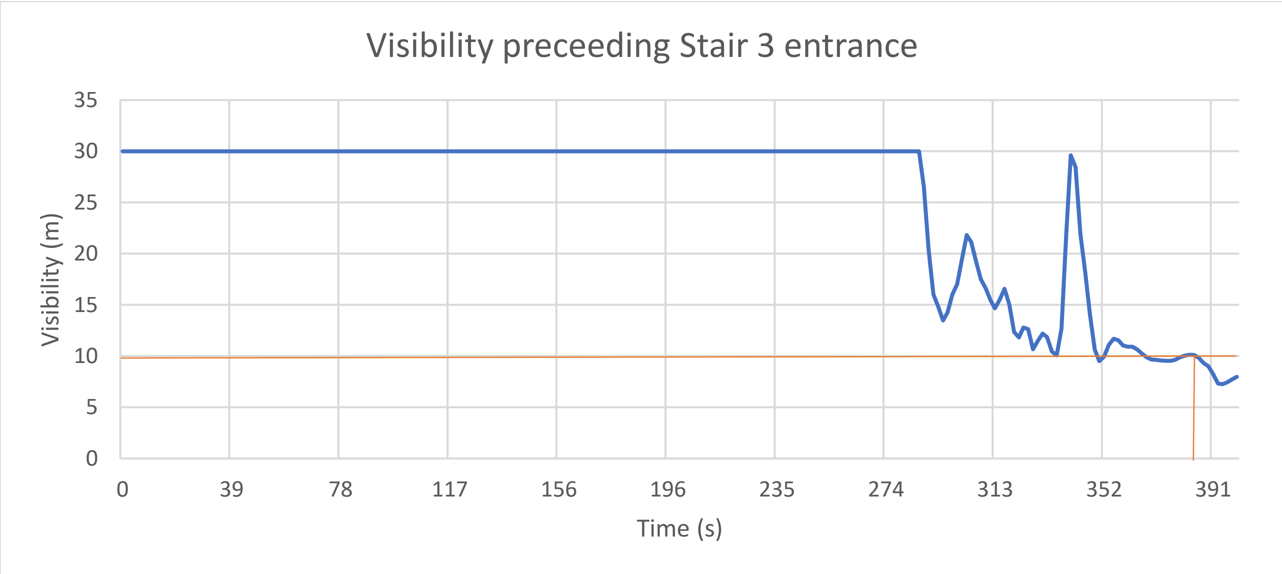


Figure 10 - CF1 Visibility proceeding stair 3 entrance

Environmental & Planning Services I.C.C. Document Received

17 Dec 2019

Building Division

Invercargill City Council Building Consent Authority Approved Site Copy

Approved For Issue 27/02/2020

BUILDING CONSENT NUMBER 2019/1381

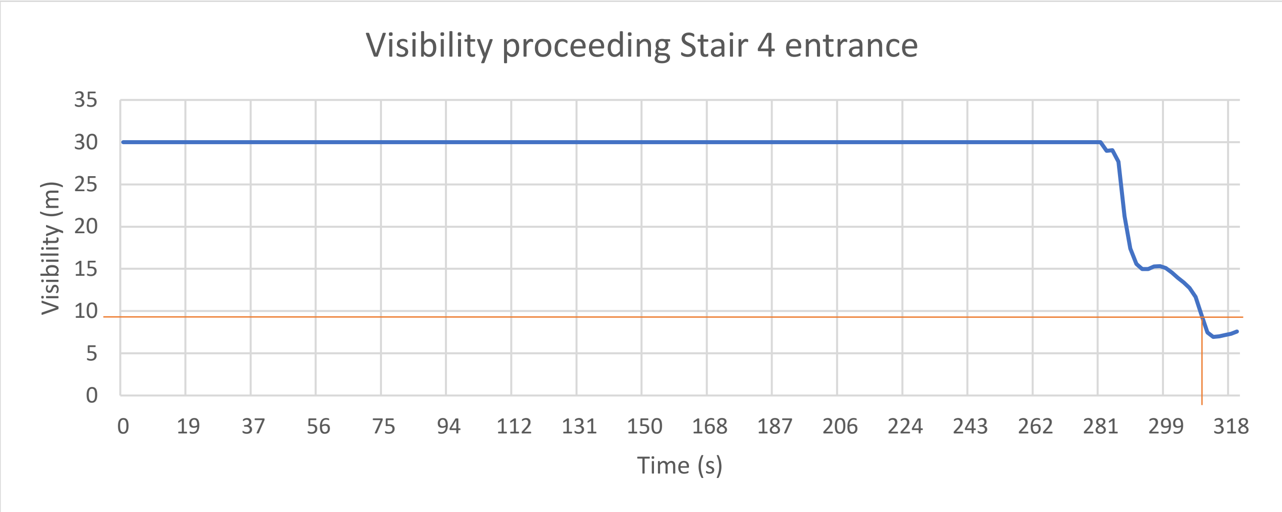


Figure 11 - CF1 Visibility proceeding stair 4 entrance

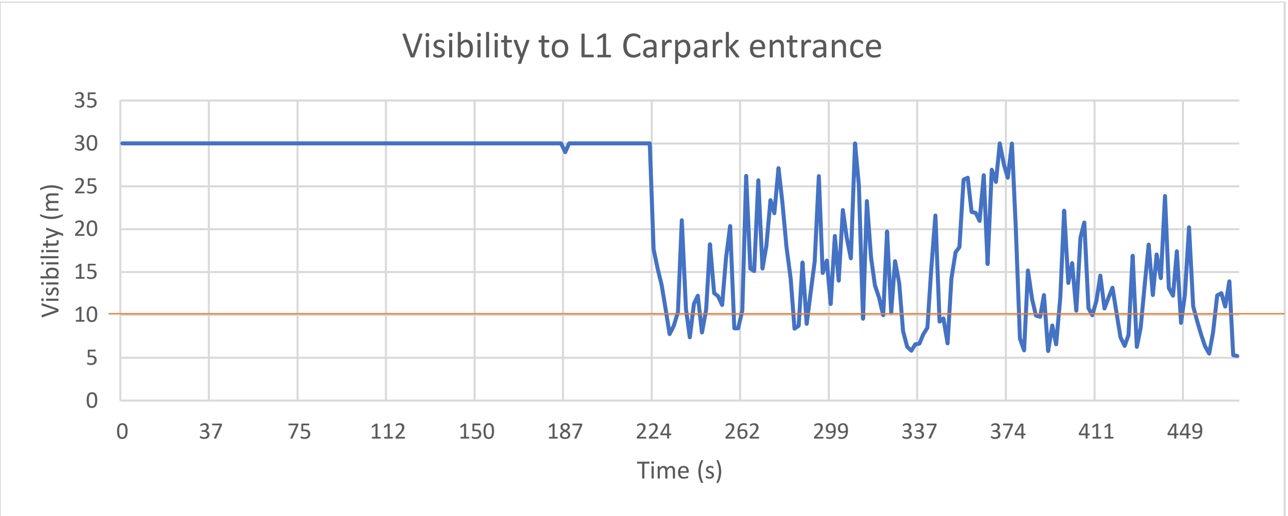


Figure 12 - CF1 Visibility proceeding Level 1 Carpark entrance

C.1.2 CF1 ASET vs RSET Assessment

Table 17 - CF1 ASET vs RSET Summary

Floor Level	Location[1]	ASET (s)	RSET (s)		ASET > RSET
			Base Case	Non-Base Case	
GF	GF Anchor	>1700	209	199	Yes
	N Circulation[2]	>1700	-	348	Yes
L1	L1 Anchor	213[8]	161[9]		Yes
	Entry to Carpark	328[10]	282	284	Yes
	L1 Stair 3 Landing[3]	386	278	270	Yes

Rev B

Environmental & Planning Services I.C.C. Document Received
17 Dec 2019
Building Division

Invercargill City Council Building Consent Authority Approved Site Copy

Approved For Issue 27/02/2020

BUILDING CONSENT NUMBER 2019/1381

Floor Level	Location[1]	ASET (s)	RSET (s)		ASET > RSET
			Base Case	Non-Base Case	
	L1 Anchor-S BoH[4]	311	282	240	Yes
	L0 Stair 3 Landing[5]	>1700	295	287	Yes
	L0 Stair 4 Landing[6]	>1700	267	273	Yes
	Corridor[7]	>1700	-	1537	Yes
L2	Childcare Centre	>1700	783		Yes

Rev B

Explanatory Notes:

1) Location is the space represented as nodes in EvacuatioNZ.

2) 'N Circulation' is the node that corresponds to the space precede the final exit from the Zone 2 ground floor mall space and is taken as the node where the last person leaves GF Anchor.

3) 'L1 Stair 3 Landing' is the node that corresponds to the lobby space before entering into Stair 3 which indicates the queuing clear time preceding stair 3.

4) 'L1 Anchor-S BoH' is the node that corresponds to the lobby space before entering into Stair 4 which indicate the queuing clear time preceding stair 4.

5) 'L0 Stair3 Landing' is the node that corresponds to the space precede the final exit from Stair 3 (i.e. time to clear L1 Anchor north stairwell) which is shared by the occupants from L2 Childcare space.

6) 'L0 Stair4 Landing' is the node that corresponds to the space precede the final exit from Stair 4 (i.e. time to clear L1 Anchor south stairwell).

7) 'Corridor' is the node that corresponds to the space precede the final exit from Zone 3 Carpark building.

8) Visibility in the south west corner starts to fail around 213 seconds as shown above in Figure 7. This is due to the smoke hitting the walls and roll down reducing the visibility at 2.0 m above level 1 floor. The RSET for occupants to move away from the south west corner and queue at the exit is approximately 161 seconds as calculated below. Therefore, the ASET vs RSET passes in this location.

9) RSET to start queuing at exit is approximately 161 seconds as calculated below.

t_d (s)	t_n (s)	t_{pre} (s)	t_{travel} (s)	RSET (s)
41	30	60	35m at 1.2m/s = 30	161

10) Visibility (10 m) in the near vicinity of entry to L1 carpark starts to fail intermittently around 231 seconds. The intermittent failure was:

- Short in duration (approximately 2 seconds at a time),
- Location being within 2m of door (further is clear),
- Level of visibility in short duration loss is only approximately 8m visibility.

Environmental & Planning
Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

The intermittent failure of visibility at 10 m continued until 328 seconds when the visibility (10m) failed for 10 seconds and is considered as the time to visibility failure. It is also noted that:

- Visibility (10m) to stair 3 and stair 4 entrance remained clear for the duration of evacuation of L1 Anchor space providing occupants with alternative egress routes.
- $FED_{thermal}$ and FED_{co} were maintained for the duration of L1 evacuation (284 seconds).

Therefore, given the above reasoning, it is considered that intermittent failure from 231 sec to 328 sec will not negatively impede occupant egress thus not considered as a failure of visibility.

As shown above in Table 17, ASET is greater than RSET for all locations.

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

C.2 ASET for Challenging Fire CF2

Challenging Fire CF2 locates a fire in the SW corner of ground floor Anchor to simulate a spill plume fire, modelled within FDS. The SW corner of the ground floor Anchor has the highest ceiling throughout the ground floor Anchor. The fire is subject to sprinkler control. As agreed in the Zone 1 FEB, B-Risk model has been used to find the sprinkler activation time for Challenging Fire 2 with number used as the sprinkler activation time in the FDS model.

Figure 13 below showed the B-Risk model that simulate the part of ground floor Anchor with the highest ceiling. Openings simulated within the B-Risk model has been taken directly from the floor plan measurement as shown in Appendix C.2.

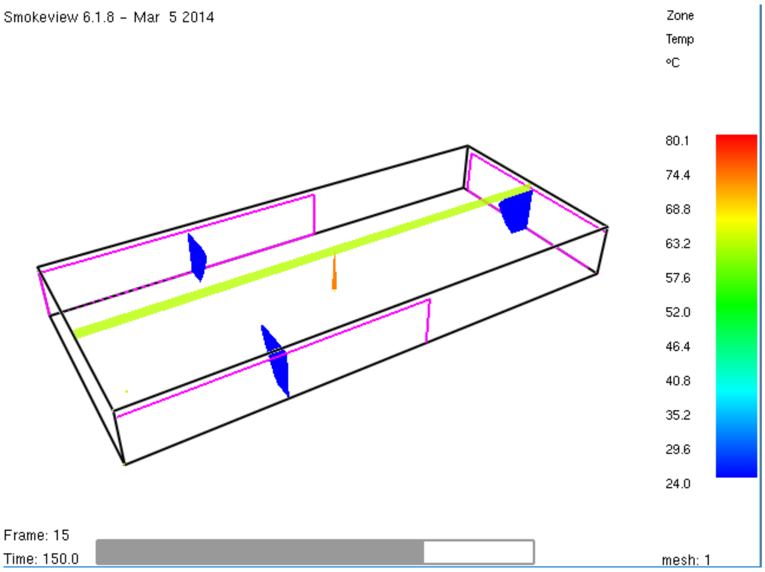


Figure 13 - CF2 Visual representation of B-Risk simulation

Table 18 - Sprinkler Activation time for CF2

(Quick Response) Sprinkler activation in B-Risk (s)	Sprinkler activation modelled for HRR control (s)
180	180

The graph below shows the comparison between the HRR output of the FDS burner modelled in Challenging Fire CF2 against that specified in C/VM2 ($0.0469t^2$)

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

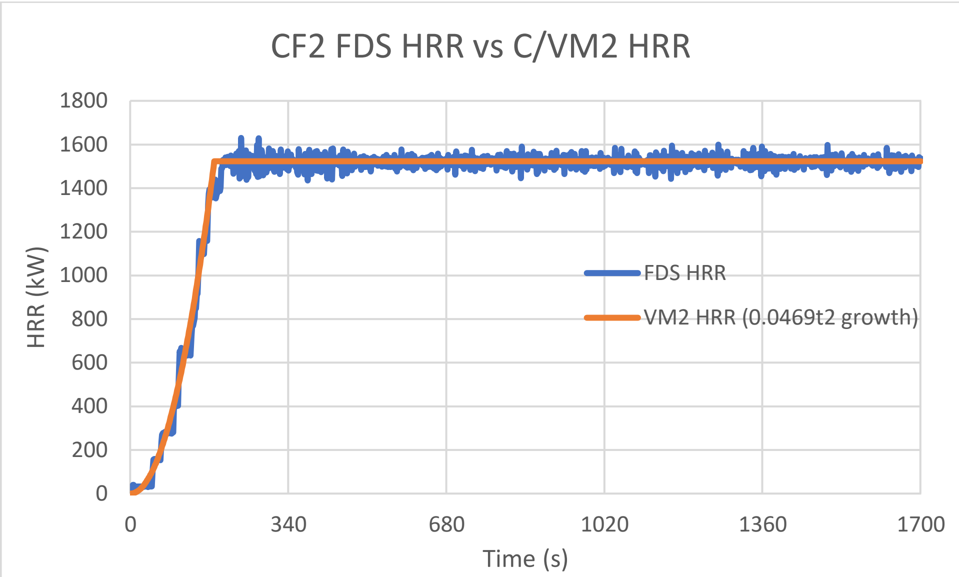


Figure 14 - CF2 FDS HRR v.s. VM2 HRR

C.2.1 CF2 ASET Summary

Tenability was assessed by FEDco slice files located 2m above ground floor and level 1. The table below showed the tenability for each floor.

Table 19 - CF2 ASET

Floor Level	Location	Time at Tenability (s)			ASET (s)
		Visibility = 10m	$FED_{thermal}$ = 0.3 (temp. at 50°C)	FED_{CO} = 0.3	
GF	Retail	N/A	N/A	>1700	>1700
	SW Entry to Mall	N/A	N/A	>1700	>1700
	Main Entry (Esk St)	N/A	N/A	>1700	>1700
	SE Exit to Tay St	N/A	N/A	>1700	>1700
1L	Retail	362	>1700	>1700	362
	Entry to Carpark	1360	>1700	>1700	1360
	Entry to Stair 3	469	>1700	>1700	469
	Entry to Stair 4	362	>1700	>1700	362
	Stair 3	N/A	N/A	>1700	>1700
	Stair 4	N/A	N/A	>1700	>1700

Environmental & Planning
Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

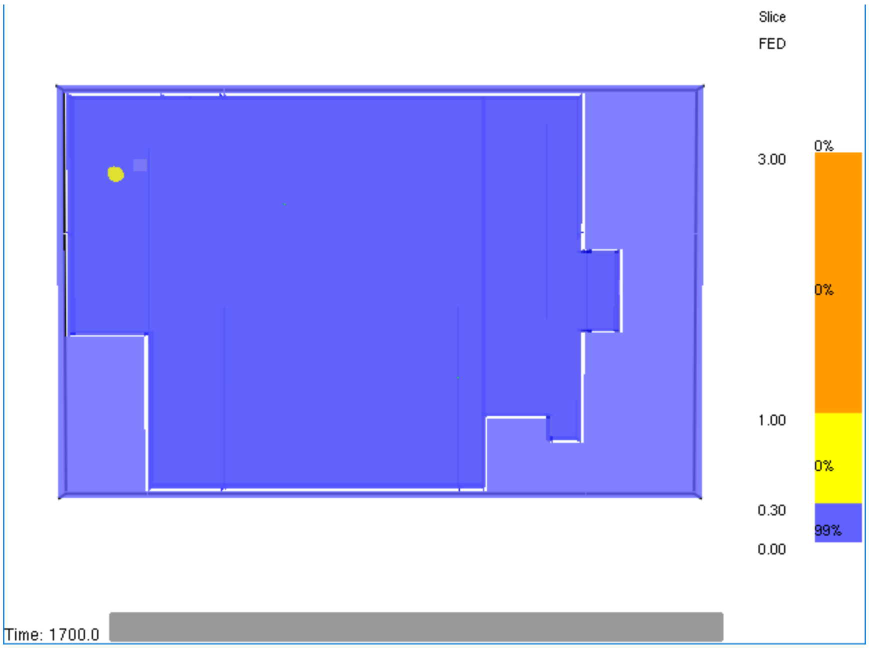


Figure 15 - CF2 FEDco slice file at 2.0 m above Ground Floor at 1700 s

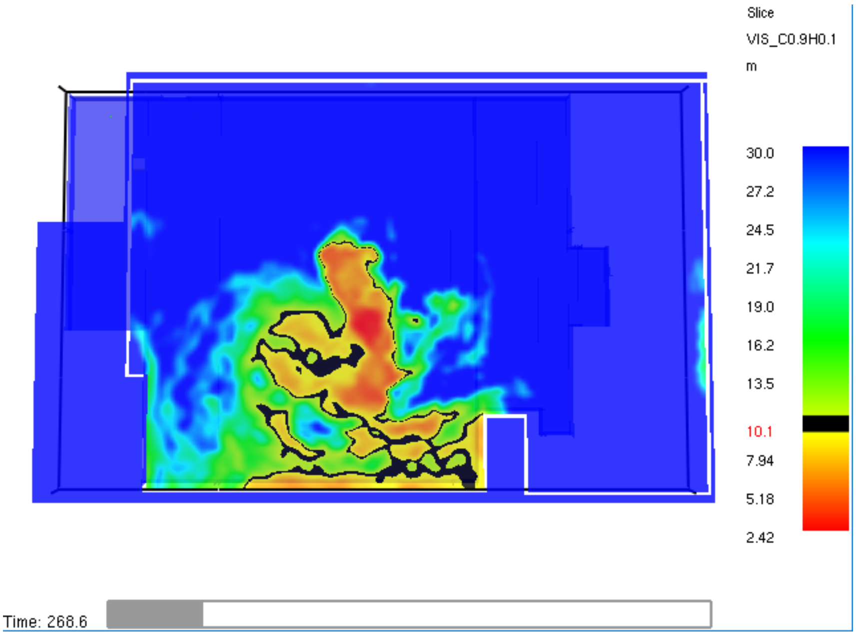


Figure 16 - CF2 Visibility slice file on Level 1 Anchor at 268 s

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

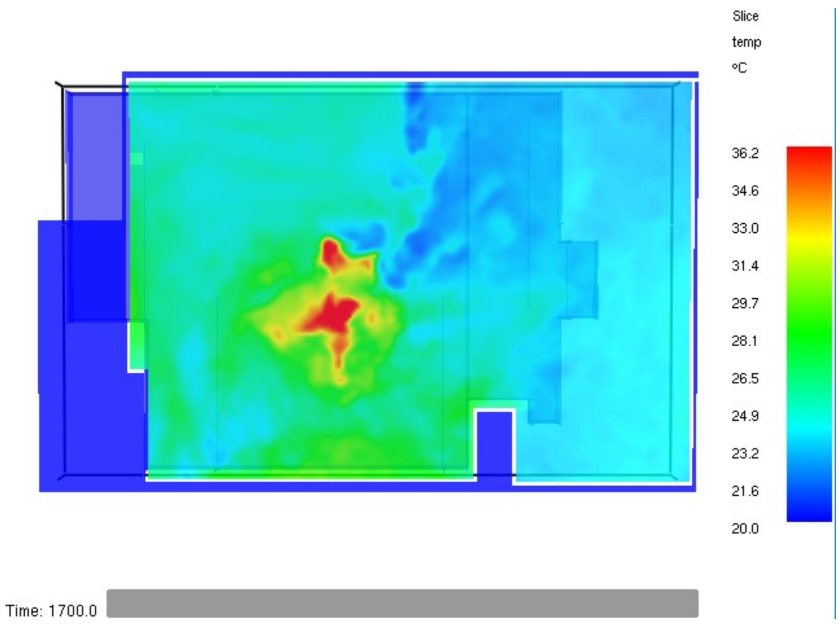


Figure 17 - CF2 Temperature slice file on Level 1 Anchor at 1700 s

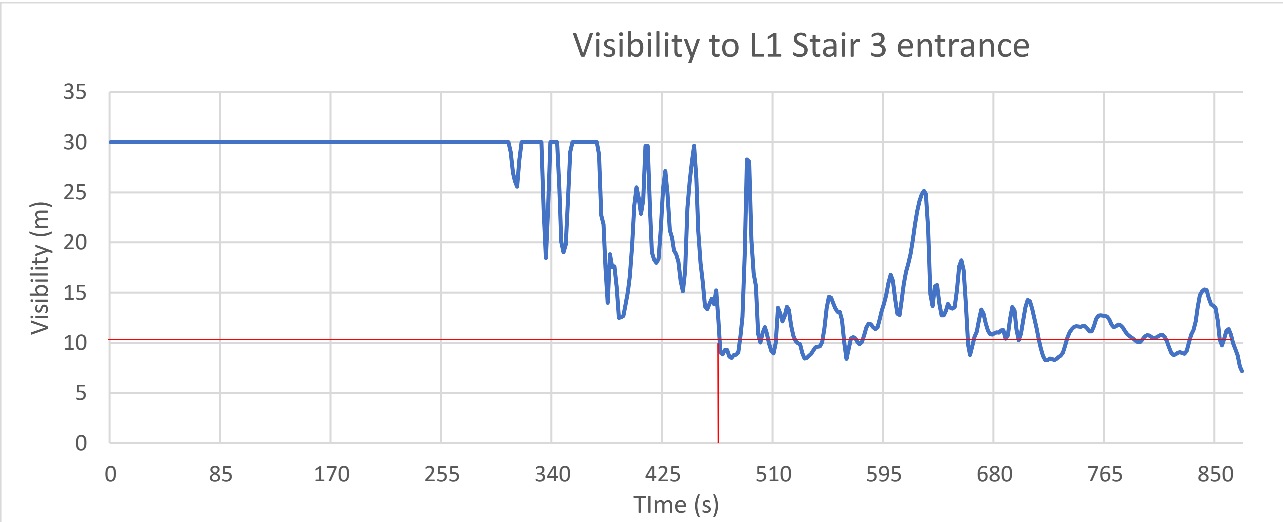


Figure 18 - CF2 Visibility at 2.0 m above Level 1 floor Stair 3 entrance

Environmental & Planning Services I.C.C. Document Received

17 Dec 2019

Building Division

Invercargill City Council Building Consent Authority Approved Site Copy

Approved For Issue 27/02/2020

BUILDING CONSENT NUMBER 2019/1381

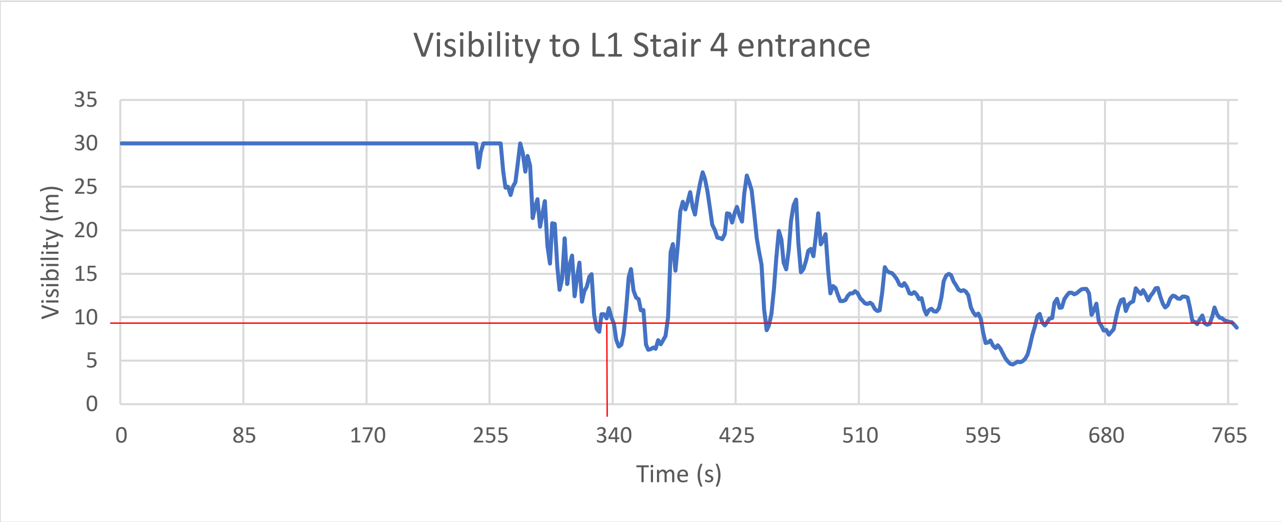


Figure 19 - CF2 Visibility at 2.0 m above Level 1 floor Stair 4 entrance

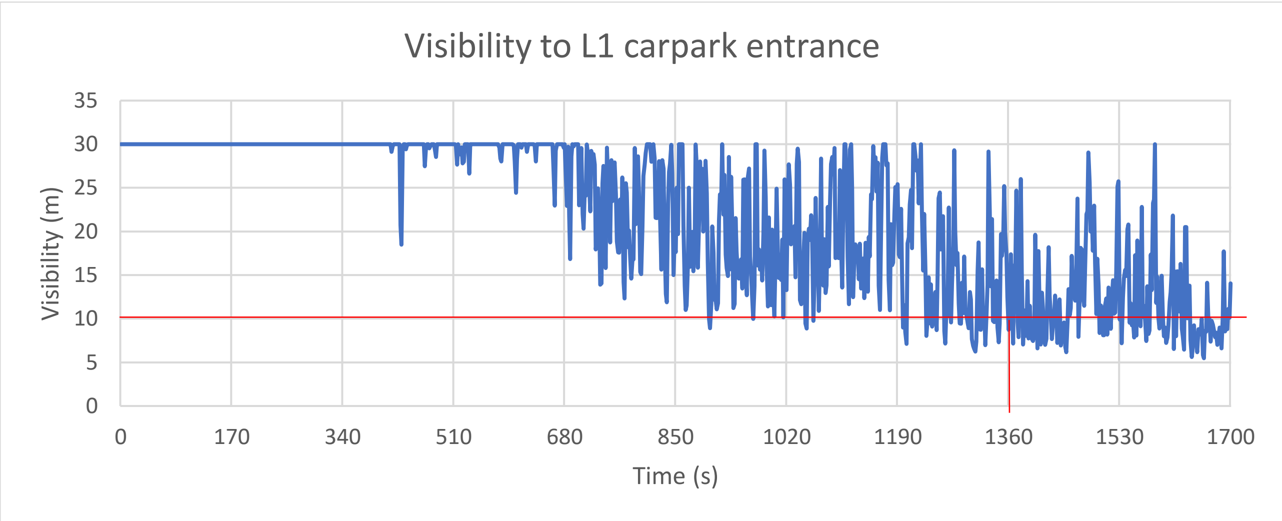


Figure 20 - CF2 Visibility at 2.0 m above Level 1 floor to L1 Carpark entrance

As shown above in Figure 16 and Figure 19, the visibility first starts to fail on the east side of atrium at 281 seconds followed by the failure of visibility on the south side of the atrium around 340 seconds before slowing moving towards the south wall (BoH wall) with intermittent failure starting around 600 seconds as shown in Figure 20.

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

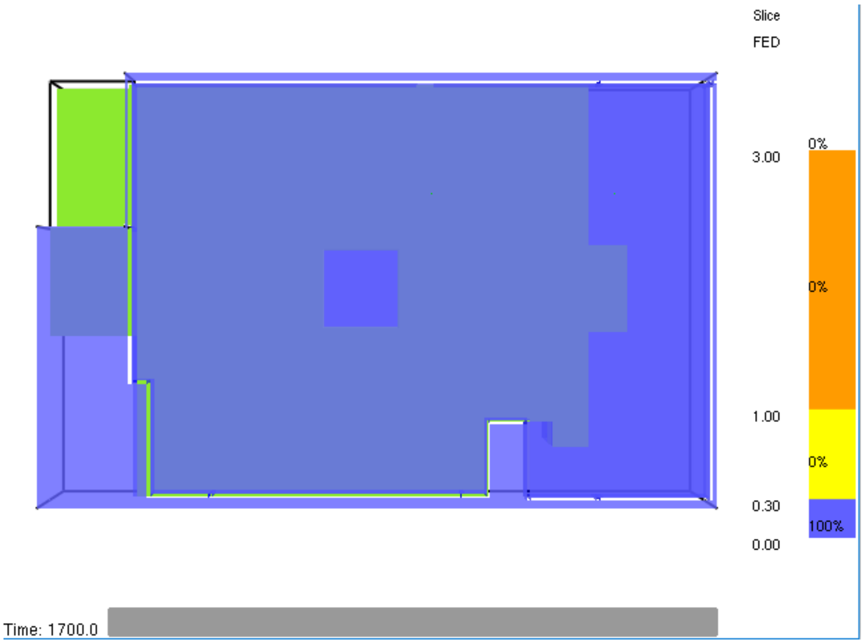


Figure 21 - CF2 FEDco slice file at 2.0 m above Level 1 floor at 1700 s

C.2.2 CF2 ASET vs RSET Assessment

Table 20 - CF2 ASET vs RSET Summary

Floor Level	Location[1]	ASET (s)	RSET (s)		ASET > RSET
			Base Case	Non-Base Case	
GF	GF Anchor	>1700	193	183	Yes
	N Circulation[2]	>1700	-	332	Yes
L1	L1 Anchor	362	266	268	Yes
	Entry to Carpark	1360	266	268	Yes
	L1 Stair 3 Landing[3]	469	262	254	Yes
	L1 Anchor-S BoH[4]	362	266	224	Yes
	L0 Stair 3 Landing[5]	>1700	279	271	Yes
	L0 Stair 4 Landing[6]	>1700	251	257	Yes
	Corridor[7]	>1700	-	1521	Yes
L2	Childcare Centre	>1700	767		Yes

Rev B
Rev B
Rev B

Explanatory Notes:

1) Location is the space represented as nodes in EvacuatioNZ.

2) 'N Circulation' is the node that corresponds to the space precede the final exit from the Zone 2 ground floor mall space and is taken as the node where the last person leaves GF Anchor.

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

3) 'L1 Stair 3 Landing' is the node that corresponds to the lobby space before entering into Stair 3 which indicates the queuing clear time preceding stair 3.

4) 'L1 Anchor-S BoH' is the node that corresponds to the lobby space before entering into Stair 4 which indicate the queuing clear time preceding stair 4.

5) 'L0 Stair3 Landing' is the node that corresponds to the space precede the final exit from Stair 3 (i.e. time to clear L1 Anchor north stairwell) which is shared by the occupants from L2 Childcare space.

6) 'L0 Stair4 Landing' is the node that corresponds to the space precede the final exit from Stair 4 (i.e. time to clear L1 Anchor south stairwell).

7) 'Corridor' is the node that corresponds to the space precede the final exit from Zone 3 Carpark building.

As shown above in Table 20, ASET is greater than RSET for all locations.

Attached is the following:

- B-Risk results for sprinkler activation time
- FSK C.2.01 – C.2.03

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

Appendix C.2 - B-Risk Geometry for CF2 Sprinkler Activation time for CF2

BUILDING CONSENT NUMBER
2019/1381

GF Z1 - GROUND FLOOR - OVERALL
1 : 250

1 Z1 - LEVEL 1 - OVERALL

Holmes

Holmes Fire LP
L2, 254 Montreal St
Christchurch
New Zealand
T: +64 3 365 8855
holmesfire.com

Project Title
HWCP Zone 1

Sketch Title
B-Risk Geometry for CF2
Fire location

Drawn: Author
Date: 31 / 07 / 2019

Project No.	Sheet No.	Rev
136249	FSK C.2.01	A

Rev.	Date	Description	Iss.	Appr.
A	27.11.18	FOR COMMENT	BH	JB
B	10.01.19	PRELIMINARY DESIGN	BH	JB
C	21.03.19	PRELIMINARY DESIGN	BH	DA
D	17.04.19	FOR INFORMATION	JT	DA

Keyplan
EXISTING CINEMA
ZONE 1
KELVIN

Do not scale this drawing. Verify all dimensions on site before commencing any work. Copyright © 2019Buchan. This drawing remains the property of The Buchan Group New Zealand Pty Ltd. Reproduction in whole or in part without prior consent is forbidden.

File
C:\TBG - Revit Projects\917077 - AR-PD - INVERCARGILL - ZONE 1 - ANCHOR - 2019_Jessica.Tuboltsev.buchan.rvt

HWCP

Project
INVERCARGILL CENTRAL - ZONE 1
TAY STREET & DEE STREET CORNER
INVERCARGILL
Project Number
917077

Status
PRELIMINARY DESIGN
Date Plotted 17/04/2019 2:44:26 PM
Date Issued 21.03.19
Scale 1 : 250 @A1

Drawing Title
ZONE 1
OVERALL FLOOR PLANS
Drawing Number
Z1-PD-A-1100
Revision
D

BUCHAN
Christchurch Studio
+ 64 3 377 2973 / buchangroup.co.nz

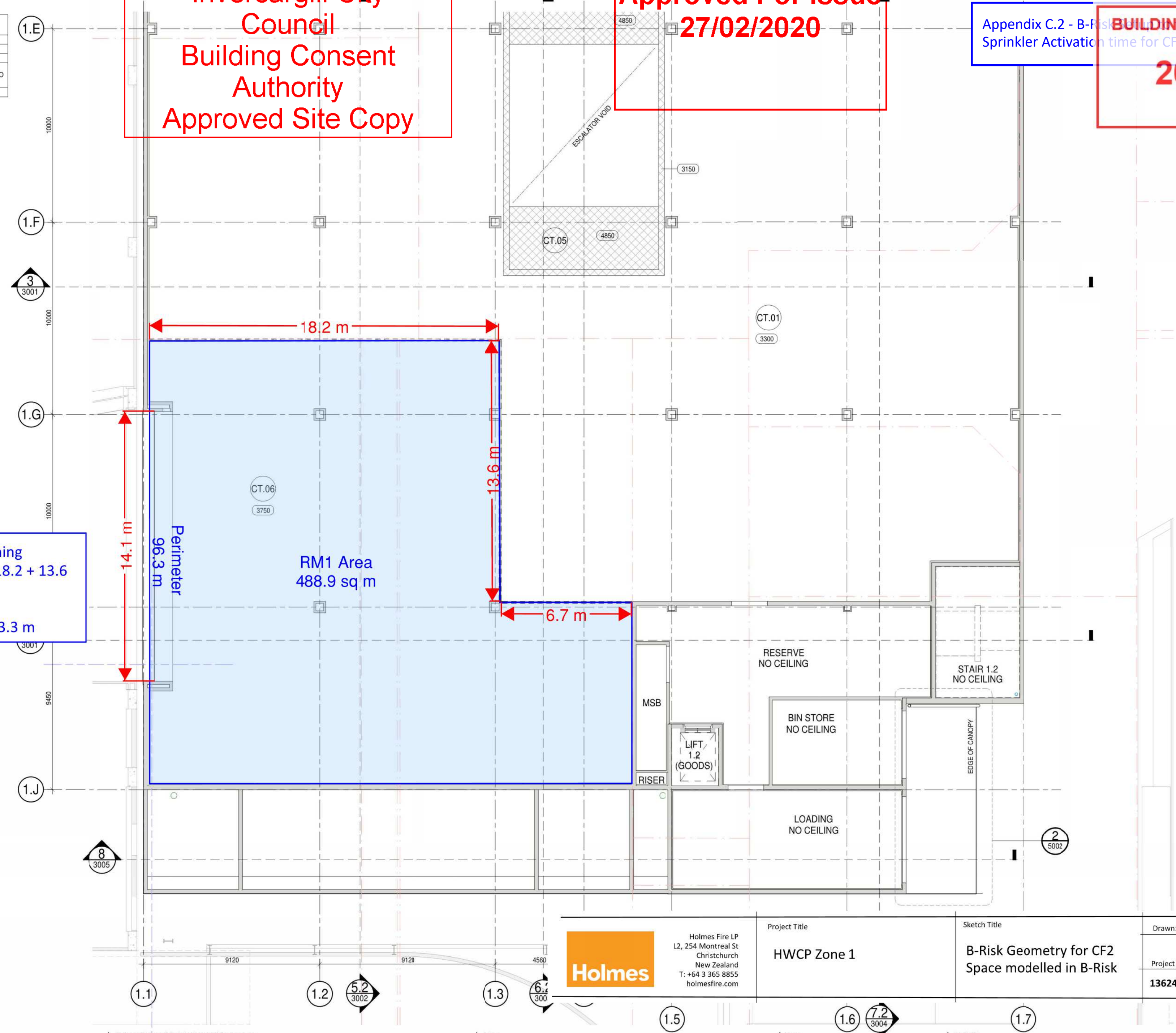
Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

Appendix C.2 - B-Risk ... Sprinkler Activation time for CF2

BUILDING CONSENT NUMBER
2019/1381



Total vertical opening (Length) = 14.1 + 18.2 + 13.6 + 6.7 = 52.6 m

Opening Height = 3.3 m

Holmes Fire LP, L2, 254 Montreal St, Christchurch, New Zealand, T: +64 3 365 8855, holmesfire.com	Project Title: HWCP Zone 1	Sketch Title: B-Risk Geometry for CF2 Space modelled in B-Risk	Drawn: Author; Date: 31 / 07 / 2019
			Project No. 136249; Sheet No. FSK C.2.02; Rev A

Rev.	Date	Description	Iss.	Appr.
A	27.11.18	FOR COMMENT	BH	JB
B	10.01.19	PRELIMINARY DESIGN	BH	JB
C	21.03.19	PRELIMINARY DESIGN	BH	DA

HWCP

Project: INVERCARGILL CENTRAL - ZONE 1
TAY STREET & DEE STREET CORNER
INVERCARGILL
Project Number 917077

Status: PRELIMINARY DESIGN
Date Plotted 05-Apr-19 2:18:27 PM
Date Issued 21.03.19
Scale 1 : 100 @A1

Drawing Title: ZONE 1
GROUND FLOOR REFLECTED CEILING PLAN - PART 2
Drawing Number Z1-PD-A-1402
Revision C

BUCHAN
Christchurch Studio +64 3 377 2973 / buchangroup.co.nz

Environmental & Planning Services I.C.C. Document Received 17 Dec 2019 Building Division

Invercargill City Council Building Consent Authority Approved Site Copy

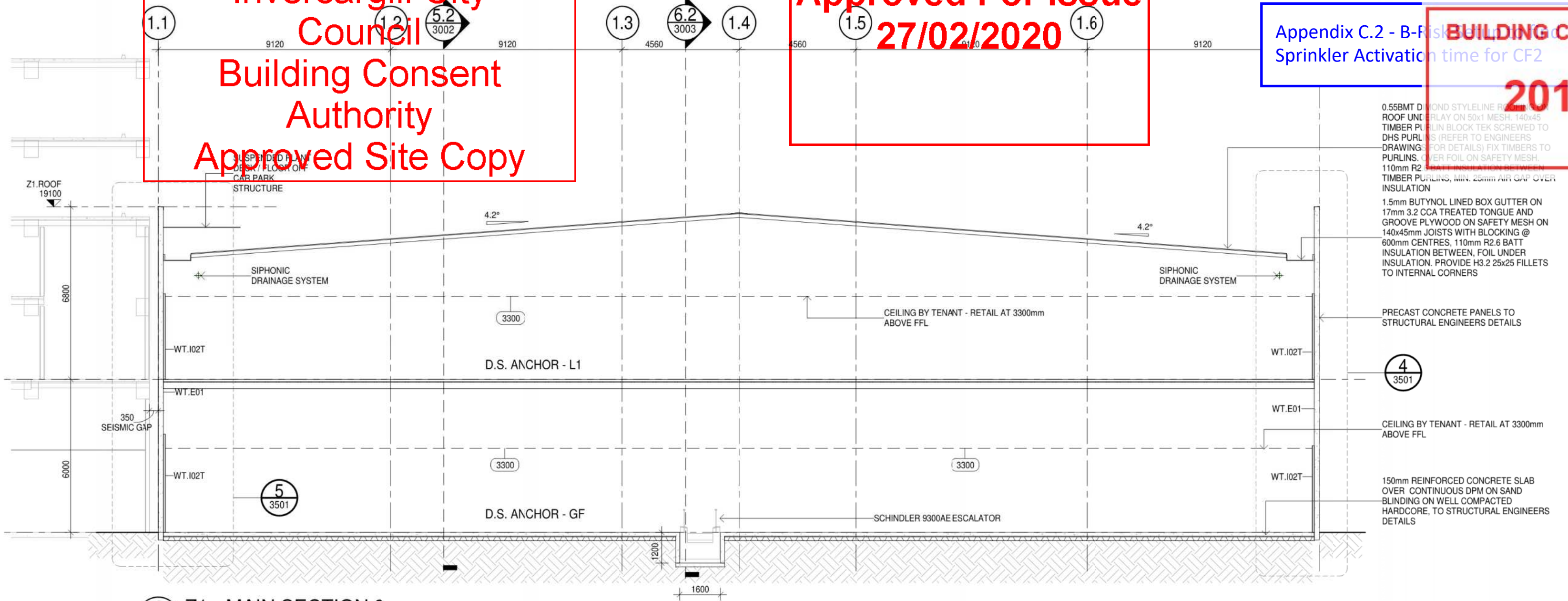
Approved For Issue 27/02/2020

Appendix C.2 - B-Risk Geometry and Sprinkler Activation time for CF2

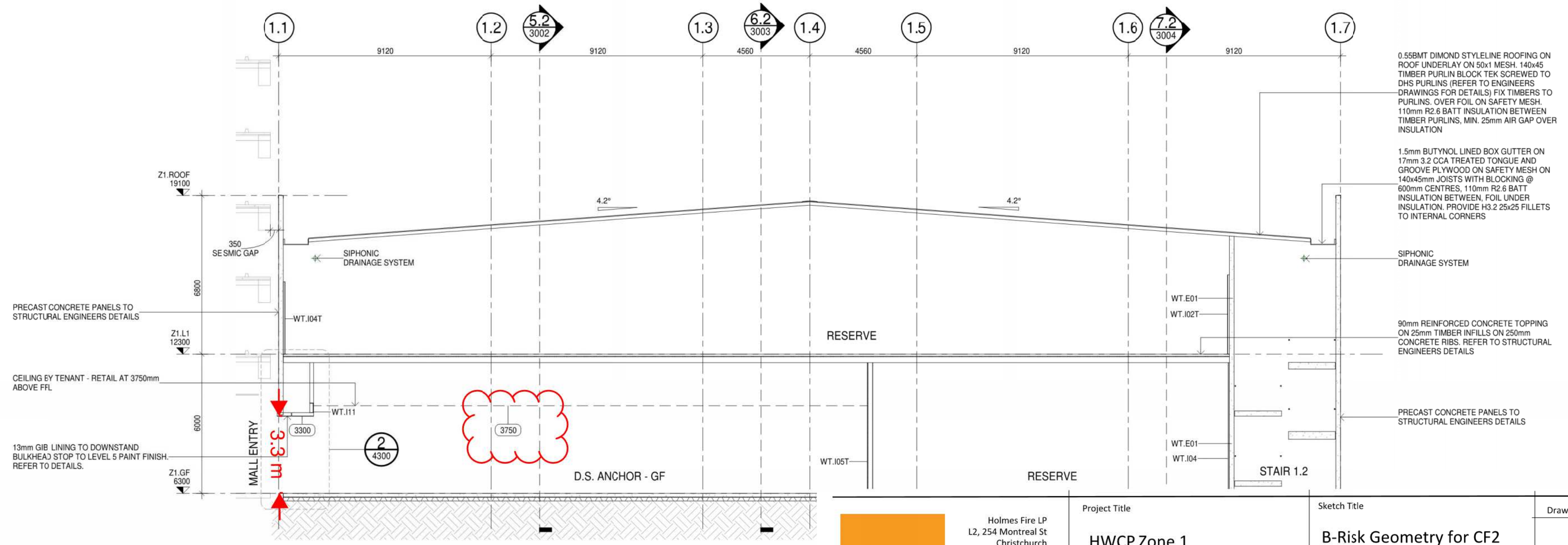
BUILDING CONSENT NUMBER 2019/1381

WALL TYPES

WALL CODE	
WT.E01	PRECAST CONCRETE PANELS TO STRUCTURAL ENGINEERS DETAILS
WT.I02T	70mm H1.2 TIMBER STRAPPING @ 600crs. ON DPC WITH 13mm PLASTERBOARD TAKEN 100mm ABOVE CEILING LEVEL ONE SIDE. 75mm LOFTED TO 70mm SEGMENTS BETWEEN STRAPPING UP TO UNDERSIDE OF CONCRETE SLAB, MINIMUM VALUE OF R1.9
WT.I04	45mm TIMBER STRAPPING ON DPC WITH 12mm MDF ONE SIDE. ONE COAT OF CLEAR POLYURETHANE
WT.I04T	70mm H1.2 TIMBER STRAPPING ON DPC WITH 12mm MDF ONE SIDE. ONE COAT OF CLEAR POLYURETHANE. 75mm LOFTED TO 70mm SEGMENTS BETWEEN STRAPPING UP TO UNDERSIDE OF CONCRETE SLAB, MINIMUM VALUE OF R1.9
WT.I05T	190x45 H1.2 TIMBER STUDS @ 400crs & DWANGS @ 800crs. 13mm GIB PLASTERBOARD , STOPPED TO LEVEL 4, PAINT FINISH ON 17mm FULL HEIGHT PLYWOOD TO DS ANCHOR SIDE. 12mm MR MDF TO RESERVE SIDE, 4600mm HIGH. EARTHWOOL INSULATION WITHIN FRAME. SMOKE SEPARATION REQUIRED
WT.I11	9mm VILLABOARD LINING FIXED BACK TO 140x45 H1.2 TREATED TIMBER FRAMING @ MAX 600 CRS TAKEN 100mm PASSED CEILING HEIGHT. CLAD WITH 400x400x15mm "CREAME MARPHIL" MARBLE TILES.



3 / 1102 Z1 - MAIN SECTION 3 1 : 100



4 / 1102 Z1 - MAIN SECTION 4 1 : 100

Holmes	Holmes Fire LP, L2, 254 Montreal St, Christchurch, New Zealand, T: +64 3 365 8855, holmesfire.com	Project Title: HWCP Zone 1	Sketch Title: B-Risk Geometry for CF2 Opening modelled	Drawn: Author	Date: 31 / 07 / 2019	
				Project No. 136249	Sheet No. FSK C.2.03	Rev A

Rev.	Date	Description	Iss.	Appr.
A	27.11.18	FOR COMMENT	BH	JB
B	10.01.19	PRELIMINARY DESIGN	BH	JB
C	21.03.19	PRELIMINARY DESIGN	BH	DA

Keyplan: EXISTING CINEMA, ZONE 1, KELVIN

Do not scale this drawing. Verify all dimensions on site before commencing any work. Copyright © 2019Buchan. This drawing remains the property of The Buchan Group New Zealand Pty Ltd. Reproduction in whole or in part without prior consent is forbidden.

File: C:\TBG - Revit Projects\917077 - AR-PD - INVERCARGILL - ZONE 1 - ANCHOR - 2019_bhunting.rvt

HWCP

Project: INVERCARGILL CENTRAL - ZONE 1, TAY STREET & DEE STREET CORNER, INVERCARGILL
Project Number: 917077

Status: PRELIMINARY DESIGN
Date Plotted: 05-Apr-19 2:18:52 PM
Date Issued: 21.03.19
Scale: 1 : 100 @A1

Drawing Title: ZONE 1 MAIN SECTION 3 & 4
Drawing Number: Z1-PD-A-3001
Revision: C

BUCHAN
Christchurch Studio, + 64 3 377 2973 / buchangroup.co.nz

Invercargill City Council
Building Consent Authority
Approved Site Copy

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

```
July 31, 2019 11:17:29
B-RISK Fire Simulator and Design Fire Tool (Ver 2019.03)

Input Filename : input1.xml
Base File : C:\Users\amy.chao\Documents\B-
RISK\riskdata\basemodel_default\basemodel_default.xml

User Mode : C/VM2
Simulation Time = 200.00 seconds.
Initial Time-Step = 1.00 seconds.



====================================================================
Description of Rooms
====================================================================
Room 1 : GF Anchor
         Room Length (m) =                                 33.60
         Room Width (m) =                                  14.60
         Maximum Room Height (m) =                         3.75
         Minimum Room Height (m) =                         3.75
         Floor Elevation (m) =                             0.000
         Absolute X Position (m) =                         0.000
         Absolute Y Position (m) =                         0.000
         Room 1 has a flat ceiling.
         Shape Factor (Af/H^2) =                           34.9

         Wall Surface is plasterboard
         Wall Density (kg/m3) =                            810.0
         Wall Conductivity (W/m.K) =                       0.160
         Wall Specific Heat (J/kg.K) =                     900
         Wall Emissivity =                                 0.88
         Wall Thickness (mm) =                             13.0
         SQROOT Thermal Inertia (J.m-2.s-1/2.K-1) =        342

         Ceiling Surface is plasterboard
         Ceiling Density (kg/m3) =                         810.0
         Ceiling Conductivity (W/m.K) =                    0.160
         Ceiling Specific Heat (J/kg.K) =                  900
         Ceiling Emissivity =                              0.88
         Ceiling Thickness (mm) =                          13.0
         SQROOT Thermal Inertia (J.m-2.s-1/2.K-1) =        342

         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
         SQROOT Thermal Inertia (J.m-2.s-1/2.K-1) =        1558

====================================================================
Wall Vents
====================================================================
Vent  1 : Mall Opening
                   From room 1 to 2
                   Right  face of room 1
                   Offset (m) =                            0.000
                   Vent Width (m) =                        14.100
                   Vent Height (m) =                       3.300
                   Vent Sill Height (m) =                  0.000
                   Vent Soffit Height (m) =                3.300
                   Opening Time (sec) =                    0
                   Closing Time (sec) =                    0
                   Discharge Coefficient (-) =             0.680

Vent  2 : opening2
                   From room 1 to 2
                   Front face of room 1
                   Offset (m) =                            0.000
                   Vent Width (m) =                        19.000
                   Vent Height (m) =                       3.300
                   Vent Sill Height (m) =                  0.000
```

Approved For Issue
27/02/2020

Appendix C.2 - B-Risk
Sprinkler Activation time for CF2

BUILDING CONSENT NUMBER
2019/1381

```
                   Vent Soffit Height (m) =                3.300
                   Opening Time (sec) =                    0
                   Closing Time (sec) =                    0
                   Discharge Coefficient (-) =             0.680

Vent  3 : Opening1
                   From room 1 to 2
                   Rear  face of room 1
                   Offset (m) =                            0.000
                   Vent Width (m) =                        19.500
                   Vent Height (m) =                       3.300
                   Vent Sill Height (m) =                  0.000
                   Vent Soffit Height (m) =                3.300
                   Opening Time (sec) =                    0
                   Closing Time (sec) =                    0
                   Discharge Coefficient (-) =             0.680

====================================================================
Ceiling/Floor Vents
====================================================================
====================================================================
Ambient Conditions
====================================================================
Interior Temp (C) =                                        24.0
Exterior Temp (C) =                                        15.0
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)                                        0
2. End Time (sec)                                          0
2. Room                                                    0
3. Start Time (sec)                                        0
3. End Time (sec)                                          0
3. Room                                                    0

====================================================================
Sprinkler / Detector Parameters
====================================================================
         Ceiling Jet model used is NIST JET.
         Sprinkler System Reliability                      1.000
         Sprinkler Probability of Suppression              0.000
         Sprinkler Cooling Coefficient                     1.000

         Sprinkler ID                                      1
         Room                                              1
         Response Time Index (m.s)^1/2 =                   50
         Sprinkler C-Factor (m/s)^1/2 =                    0.65
         Water Spray Density (mm/min) =                    4.20
         Radial Distance (m) =                             3.250
         Distance below ceiling (m) =                      0.025
         Actuation Temperature (deg C) =                   68.0

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

         Smoke Detector ID                                 1
         Room                                              1
         Radial Distance from Plume (m) =                  7.00
         Distance below Ceiling (m) =                      0.025
         Smoke Optical Density for Alarm (1/m)             0.097
         Detector Characteristic Length Number (m) =       15.00
         Detector response is based on OD outside the detector chamber.
```

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

```
====================================================================
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
Stoichiometric air/fuel ratio                              0.0

Burning objects are manually positioned in room.
Enhanced burning submodel is                               OFF

Burning Object No 1
description
              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
              Location, X-coordinate (m) =                 17.000
              Location, Y-coordinate (m) =                 7.200
              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.

====================================================================
Flame Spread Inputs
====================================================================
This simulation includes flame spread on linings.
Cone Calorimeter Ignition data is correlated using the Flux Time Product method.

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

0 min    00 sec
         (0 sec)                      Room 1    Outside

         Layer (m)                    3.750
         Upper Temp (C)               24.0
         Lower Temp (C)               24.0
         Unconstrained HRR (kW)       0.0
         HRR (kW)                     0.0
         Q* =                         0.0000
         Visibility (m) at 2m         20+
         FED gases on egress path = 0.000
         FED thermal on egress path = 0.000

0 min    10 sec
         (10 sec)                     Room 1    Outside

         Layer (m)                    3.741
         Upper Temp (C)               24.6
         Lower Temp (C)               22.3
         Unconstrained HRR (kW)       4.7
         HRR (kW)                     4.7
         Q* =                         0.0002
         Visibility (m) at 2m         20+
         FED gases on egress path = 0.000
         FED thermal on egress path = 0.000

0 min    20 sec
         (20 sec)                     Room 1    Outside

         Layer (m)                    3.722
         Upper Temp (C)               26.2
         Lower Temp (C)               21.1
         Unconstrained HRR (kW)       18.8
         HRR (kW)                     18.8
         Q* =                         0.0006
         Visibility (m) at 2m         20+
         FED gases on egress path = 0.000
         FED thermal on egress path = 0.000

0 min    30 sec
         (30 sec)                     Room 1    Outside

         Layer (m)                    3.695
         Upper Temp (C)               27.9
         Lower Temp (C)               20.1
         Unconstrained HRR (kW)       42.2
         HRR (kW)                     42.2
         Q* =                         0.0014
         Visibility (m) at 2m         20+
         FED gases on egress path = 0.000
         FED thermal on egress path = 0.000

0 min    40 sec
         (40 sec)                     Room 1    Outside

         Layer (m)                    3.659
         Upper Temp (C)               30.0
         Lower Temp (C)               19.4
         Unconstrained HRR (kW)       75.0
         HRR (kW)                     75.0
         Q* =                         0.0025
         Visibility (m) at 2m         20+
         FED gases on egress path = 0.000
         FED thermal on egress path = 0.000

0 min    50 sec
         (50 sec)                     Room 1    Outside

         Layer (m)                    3.615
         Upper Temp (C)               32.3
         Lower Temp (C)               18.9
         Unconstrained HRR (kW)       117.3
         HRR (kW)                     117.3
         Q* =                         0.0039
         Visibility (m) at 2m         20+
         FED gases on egress path = 0.000
         FED thermal on egress path = 0.000

1 min    00 sec
         (60 sec)                     Room 1    Outside

         Layer (m)                    3.562
         Upper Temp (C)               34.7
         Lower Temp (C)               18.4
         Unconstrained HRR (kW)       168.8
         HRR (kW)                     168.8
         Q* =                         0.0056
         Visibility (m) at 2m         20+
         FED gases on egress path = 0.000
         FED thermal on egress path = 0.000
```

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

```
 1 min    10 sec
          (70 sec)                     Room 1    Outside

          Layer (m)                    3.502
          Upper Temp (C)               37.1
          Lower Temp (C)               18.1
          Unconstrained HRR (kW)       229.8
          HRR (kW)                     229.8
          Q* =                         0.0076
          Visibility (m) at 2m         20+
          FED gases on egress path = 0.000
          FED thermal on egress path = 0.000

 1 min    20 sec
          (80 sec)                     Room 1    Outside

          Layer (m)                    3.433
          Upper Temp (C)               39.5
          Lower Temp (C)               17.9
          Unconstrained HRR (kW)       300.2
          HRR (kW)                     300.2
          Q* =                         0.0099
          Visibility (m) at 2m         20+
          FED gases on egress path = 0.000
          FED thermal on egress path = 0.000

 1 min    30 sec
          (90 sec)                     Room 1    Outside

          Layer (m)                    3.356
          Upper Temp (C)               42.1
          Lower Temp (C)               17.7
          Unconstrained HRR (kW)       379.9
          HRR (kW)                     379.9
          Q* =                         0.0126
          Visibility (m) at 2m         20+
          FED gases on egress path = 0.000
          FED thermal on egress path = 0.000

 1 min    40 sec
          (100 sec)                    Room 1    Outside

          Layer (m)                    3.273
          Upper Temp (C)               44.8
          Lower Temp (C)               17.6
          Unconstrained HRR (kW)       469.0
          HRR (kW)                     469.0
          Q* =                         0.0155
          Visibility (m) at 2m         20+
          FED gases on egress path = 0.000
          FED thermal on egress path = 0.000

 1 min    50 sec
          (110 sec)                    Room 1    Outside

          Layer (m)                    3.206
          Upper Temp (C)               47.8
          Lower Temp (C)               17.5
          Unconstrained HRR (kW)       567.5
          HRR (kW)                     567.5
          Q* =                         0.0188
          Visibility (m) at 2m         20+
          FED gases on egress path = 0.000
          FED thermal on egress path = 0.000

 2 min    00 sec
          (120 sec)                    Room 1    Outside

          Layer (m)                    3.159
          Upper Temp (C)               51.0
          Lower Temp (C)               17.5
          Unconstrained HRR (kW)       675.4
          HRR (kW)                     675.4
          Q* =                         0.0223
          Visibility (m) at 2m         20+
          FED gases on egress path = 0.000
          FED thermal on egress path = 0.000

 2 min    10 sec
          (130 sec)                    Room 1    Outside

          Layer (m)                    3.125
          Upper Temp (C)               54.5
          Lower Temp (C)               17.5
          Unconstrained HRR (kW)       792.6
          HRR (kW)                     792.6
          Q* =                         0.0262
          Visibility (m) at 2m         20+
          FED gases on egress path = 0.000
          FED thermal on egress path = 0.000

 2 min    20 sec
          (140 sec)                    Room 1    Outside

          Layer (m)                    3.099
          Upper Temp (C)               58.3
          Lower Temp (C)               17.6
          Unconstrained HRR (kW)       919.2
          HRR (kW)                     919.2
          Q* =                         0.0304
          Visibility (m) at 2m         20+
          FED gases on egress path = 0.000
          FED thermal on egress path = 0.000

 2 min    30 sec
          (150 sec)                    Room 1    Outside

          Layer (m)                    3.079
          Upper Temp (C)               62.4
          Lower Temp (C)               17.7
          Unconstrained HRR (kW)       1055.3
          HRR (kW)                     1055.3
          Q* =                         0.0349
          Visibility (m) at 2m         20+
          FED gases on egress path = 0.000
          FED thermal on egress path = 0.000

 2 min    40 sec
          (160 sec)                    Room 1    Outside

          Layer (m)                    3.062
          Upper Temp (C)               66.6
          Lower Temp (C)               17.9
          Unconstrained HRR (kW)       1200.6
          HRR (kW)                     1200.6
          Q* =                         0.0397
          Visibility (m) at 2m         20+
          FED gases on egress path = 0.000
          FED thermal on egress path = 0.000

 2 min    50 sec
          (170 sec)                    Room 1    Outside

          Layer (m)                    3.048
          Upper Temp (C)               70.9
          Lower Temp (C)               18.0
          Unconstrained HRR (kW)       1355.4
          HRR (kW)                     1355.4
          Q* =                         0.0448
          Visibility (m) at 2m         20+
          FED gases on egress path = 0.000
          FED thermal on egress path = 0.000

 3 min    00 sec
          (180 sec)                    Room 1    Outside

          Layer (m)                    3.035
          Upper Temp (C)               75.3
```

Environmental & Planning
Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City
Council
Building Consent
Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

```
          Lower Temp (C)                18.2
          Unconstrained HRR (kW)        1519.6
          HRR (kW)                      1519.6
          Q* =                          0.0503
          Visibility (m) at 2m          20+
          FED gases on egress path = 0.000
          FED thermal on egress path = 0.000

3 min     10 sec
          (190 sec)                     Room 1     Outside

          Layer (m)                     3.030
          Upper Temp (C)                78.4
          Lower Temp (C)                18.4
          Unconstrained HRR (kW)        1519.6
          HRR (kW)                      1519.6
          Q* =                          0.0503
          Visibility (m) at 2m          20+
          FED gases on egress path = 0.000
          FED thermal on egress path = 0.000

3 min     20 sec
          (200 sec)                     Room 1     Outside

          Layer (m)                     3.032
          Upper Temp (C)                80.1
          Lower Temp (C)                18.6
          Unconstrained HRR (kW)        1519.6
          HRR (kW)                      1519.6
          Q* =                          0.0503
          Visibility (m) at 2m          20+
          FED gases on egress path = 0.000
          FED thermal on egress path = 0.000


====================================================================
Event Log
====================================================================
Simulation Finished.
Sprinkler Effectiveness 1
Fire HRR is controlled by sprinkler
180 Sec. Sprinkler 1 responded.
32 sec. Smoke detector 1 operates in room 1
0 sec. Item 1 description ignited.
Iteration 1


====================================================================
Computer Run-Time = 1.6 seconds.
====================================================================
```

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

C.3 ASET for Challenging Fire CF3

Challenging Fire CF3 locates a fire in the kitchen of the Level 2 Childcare centre, modelled in B-Risk. The fire is subject to (quick response) sprinkler control. All internal doors assumed to be open for the duration of the model while the external doors are modelled for the duration of egress. Figure 22 below showed the B-Risk model.

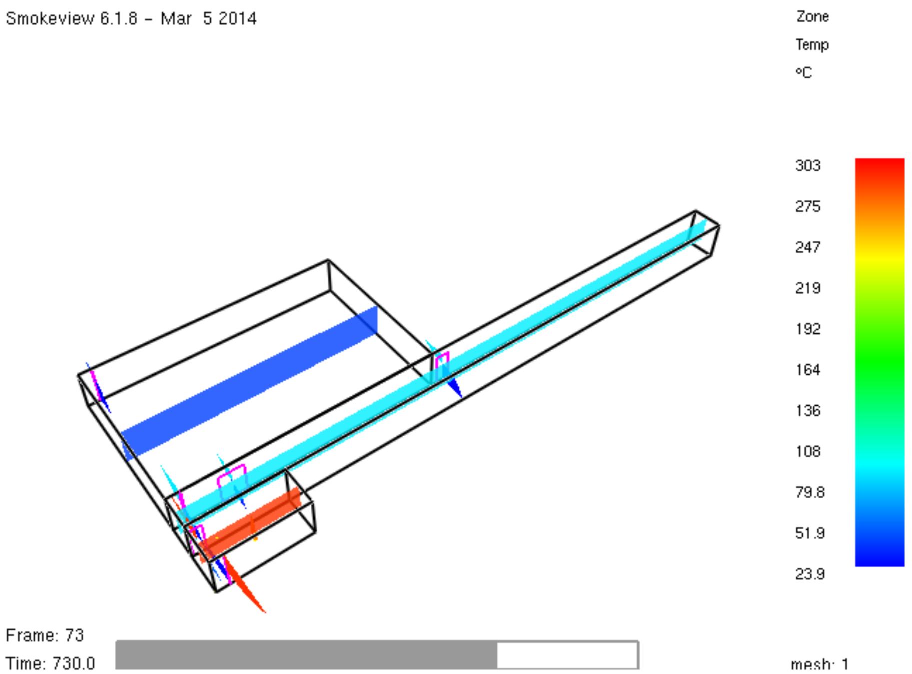


Figure 22 - CF3 Visual representation of B-Risk simulation

The heat release rate for CF3 is shown below in Figure 23.

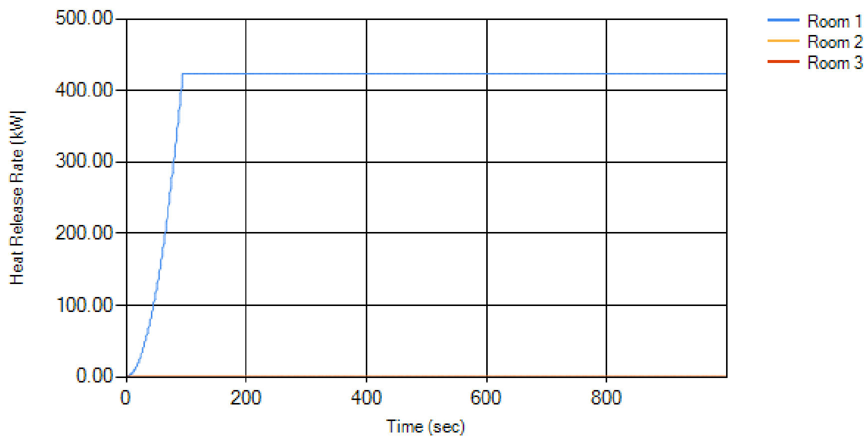


Figure 23 - CF3 FDS HRR v.s. VM2 HRR

C.3.1 CF3 ASET Summary

Tenability is limited to the FEDco outputs in spaces remote from fire origin as shown below in Figure 24 and Figure 25. The FEDco failed at 915 seconds in the Corridor (Room 2).

Environmental & Planning Services I.C.C. Document Received

17 Dec 2019

Building Division

Invercargill City Council Building Consent Authority Approved Site Copy

Approved For Issue 27/02/2020

BUILDING CONSENT NUMBER 2019/1381

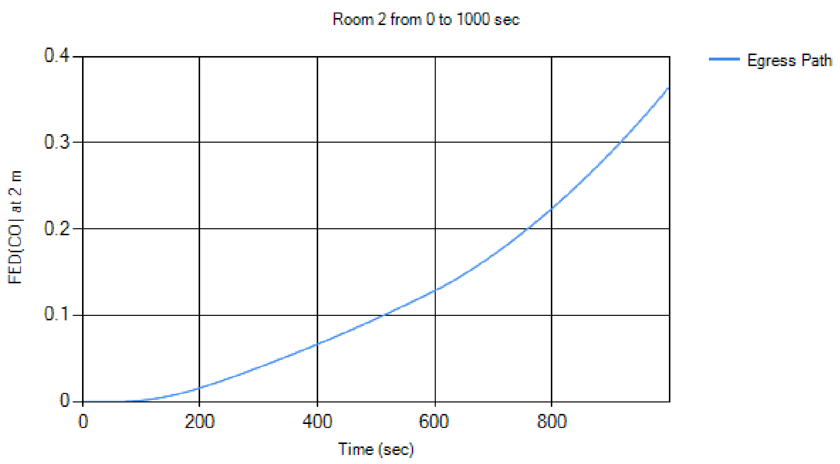


Figure 24 - CF3 FEDco in Room 2 (corridor)

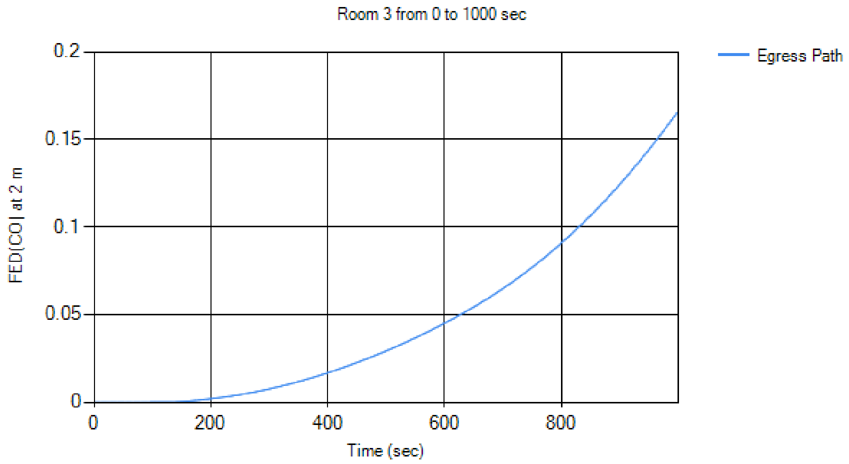


Figure 25 - CF3 FEDco in Room 3 (Childcare)

A summary of the ASET for Challenging Fire 3 is shown below in Table 21.

Table 21 - CF3 ASET Summary

Room	Time @ FED_{CO} = 0.3 (s)	ASET (s)
Corridor (RM2)	917	917
Childcare space (RM3)	>1000	

C.3.2 CF3 ASET vs RSET Assessment

Table 22 - CF3 ASET vs RSET Summary

Floor Level	Location[1]	ASET (s)	RSET (s)		ASET > RSET
			Base Case	Non-Base Case	
GF	GF Anchor	>1700	227	217	Yes

Environmental & Planning Services I.C.C. Document Received
17 Dec 2019
Building Division

Invercargill City Council Building Consent Authority Approved Site Copy

Approved For Issue 27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Floor Level	Location[1]	ASET (s)	RSET (s)		ASET > RSET
			Base Case	Non-Base Case	
	N Circulation[2]	>1700	-	350	Yes
L1	L1 Anchor	>1700	270	272	Yes
	Entry to Carpark	>1700	270	272	Yes
	L1 Stair 3 Landing[3]	>1700	266	258	Yes
	L1 Anchor-S BoH[4]	>1700	270	228	Yes
	L0 Stair 3 Landing[5]	>1700	283	275	Yes
	L0 Stair 4 Landing[6]	>1700	255	261	Yes
	Corridor[7]	>1700	-	1521	Yes
L2	Childcare Centre	917	711		Yes

Rev B
Rev B
Rev B

Explanatory Notes:

1) Location is the space represented as nodes in EvacuatioNZ.

2) 'N Circulation' is the node that corresponds to the space precede the final exit from the Zone 2 ground floor mall space and is taken as the node where the last person leaves GF Anchor.

3) 'L1 Stair 3 Landing' is the node that corresponds to the lobby space before entering into Stair 3 which indicates the queuing clear time preceding stair 3.

4) 'L1 Anchor-S BoH' is the node that corresponds to the lobby space before entering into Stair 4 which indicate the queuing clear time preceding stair 4.

5) 'L0 Stair3 Landing' is the node that corresponds to the space precede the final exit from Stair 3 (i.e. time to clear L1 Anchor north stairwell) which is shared by the occupants from L2 Childcare space.

6) 'L0 Stair4 Landing' is the node that corresponds to the space precede the final exit from Stair 4 (i.e. time to clear L1 Anchor south stairwell).

7) 'Corridor' is the node that corresponds to the space precede the final exit from Zone 3 Carpark building.

8) As shown above in Table 22, ASET is greater than RSET for all locations.

Attached is the following:

- B-Risk results
- FSK C.3.01 – C.3.02

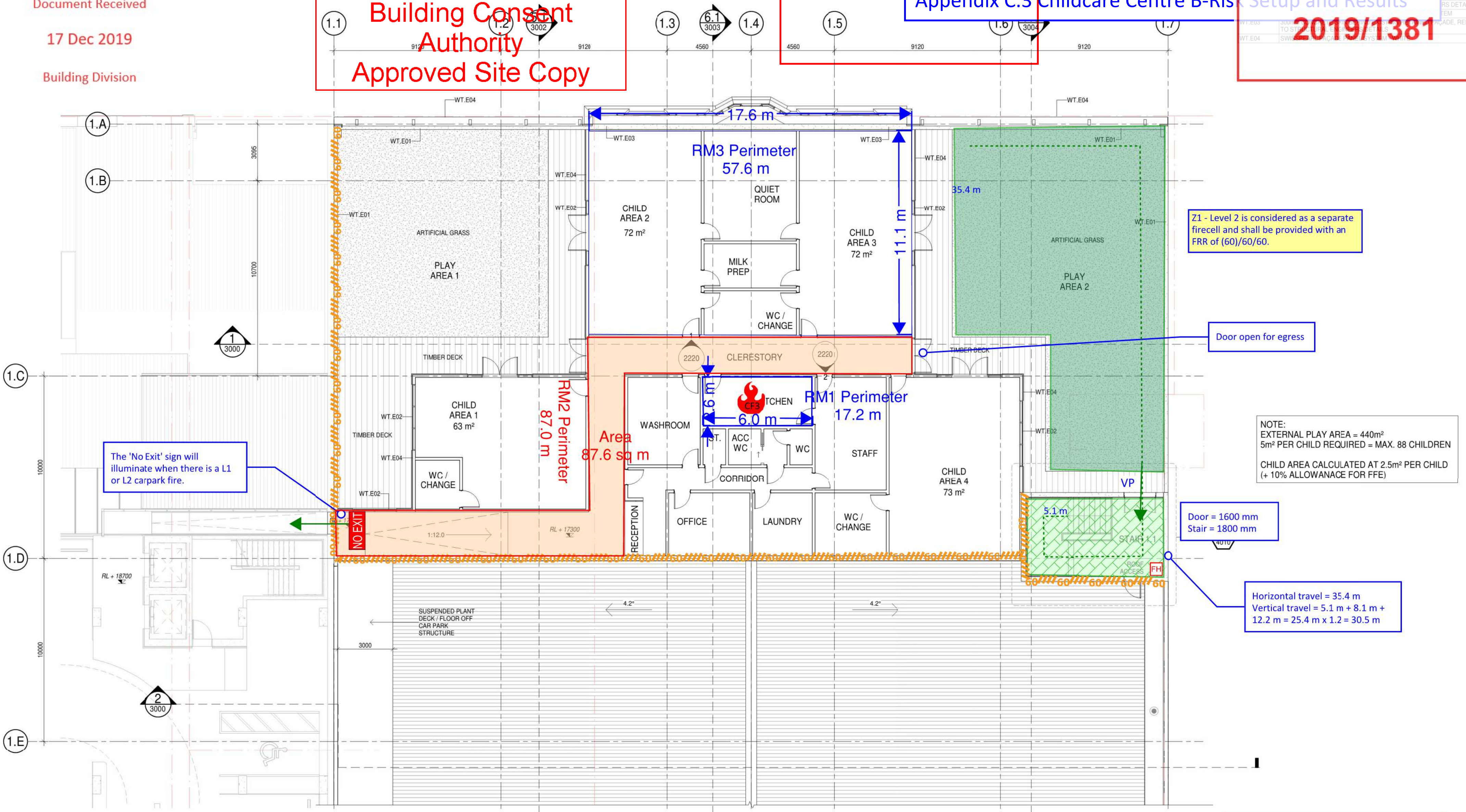
Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

Appendix C.3 Childcare Centre B-Risk Setup and Results

BUILDING CONSENT NUMBER
2019/1381



CHILD CARE FACILITY IS A PRELIMINARY CONCEPT AND IS PENDING OPERATORS REQUIREMENTS. LAYOUTS WILL LIKELY CHANGE ONCE THESE REQUIREMENTS ARE CONFIRMED.

Holmes	Project Title	Sketch Title	Drawn: ACC	Date: 02 / 05 / 2019
Holmes Fire LP, L2, 254 Montreal St, Christchurch, New Zealand, T: +64 3 365 8855, holmesfire.com	HWCP - Invercargill Central	Zone 1 L2 B-Risk Geometry - Floor Plan	Project No. 136249	Sheet No. FSK C.3.01 / Rev A

HWCP

INVERCARGILL CENTRAL - ZONE 1
TAY STREET & DEE STREET CORNER
INVERCARGILL
Project Number 917077

PRELIMINARY DESIGN
Date Plotted 05-Apr-19 2:18:12 PM
Date Issued 21.03.19
Scale As indicated @A1

ZONE 1
LEVEL 2 FLOOR PLAN
Drawing Number Z1-PD-A-1105
Revision E

BUCHAN
Christchurch Studio
+64 3 377 2973 / buchangroup.co.nz

Environmental & Planning
Services I.C.C.
Document Received
17 Dec 2019
Building Division

WALL TYPES

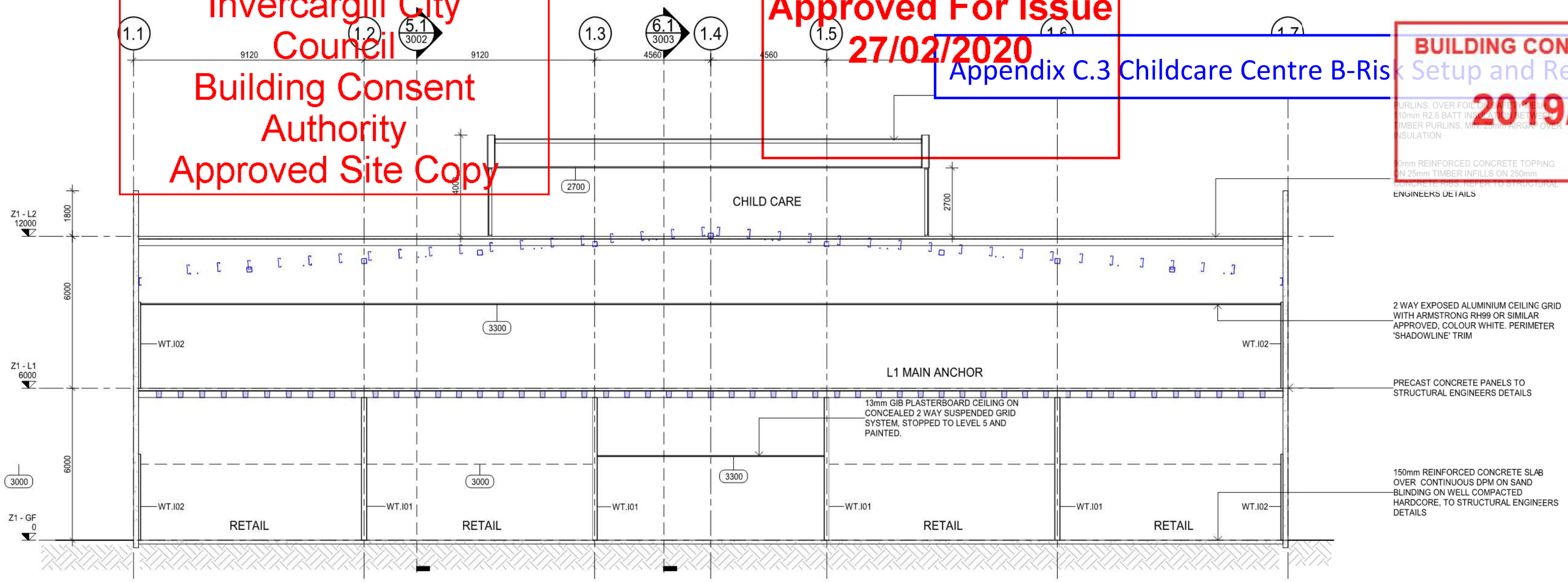
WALL TYPE CODE	DESCRIPTION
WT.E01	PRECAST CONCRETE PANELS TO STRUCTURAL ENGINEERS DETAILS
WT.I01	190x45 H1.2 TIMBER STUDS @ 400crs & DWANGS @ 800crs. 13 GIB PLASTERBOARD TO BOTH SIDES OF WALL, STOPPED TO LEVEL 4, PAINT FINISH
WT.I02	70mm H1.2 TIMBER STRAPPING ON DPC WITH 13mm PLASTERBOARD TAKEN 100mm ABOVE CEILING LEVEL ONE SIDE. INSULATION BETWEEN FRAMING
WT.I03	90x45 H1.2 TIMBER FRAMING, DWANGS & 800crs WITH 13mm PLASTERBOARD ONE SIDE TAKEN 100mm ABOVE CEILING LEVEL ONE SIDE. LINING STEPS BACK AT BASE, REFER TO SPECIFICATION FOR DETAILS.

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

Appendix C.3 Childcare Centre B-Risk Setup and Results

BUILDING CONSENT NUMBER
2019/1381



1 MAIN SECTION 1
1 : 100

Holmes

Holmes Fire LP
L2, 254 Montreal St
Christchurch
New Zealand
T: +64 3 365 8855
holmesfire.com

Project Title	Sketch Title	Drawn: ACC	Date: 02 / 05 / 2019	
HWCP - Invercargill Central	Zone 1 L2 B-Risk Geometry - Section	Project No.	Sheet No.	Rev
		136249	FSK C.3.02	A

Rev.	Date	Description	Iss.	Appr.

Keyplan: EXISTING CINEMA; ZONE 1

Do not scale this drawing. Verify all dimensions on site before commencing any work. Copyright © 2018 Buchan. This drawing remains the property of The Buchan Group New Zealand Pty Ltd. Reproduction in whole or in part without prior consent is forbidden.

File
C:\T3G - Revit Projects\917077 - PD - INVERCARGILL - ZONE 1 - ANCHOR - 2019_bhunting.rvt

HWCP

Project
INVERCARGILL CENTRAL - ZONE 1
TAY STREET & DEE STREET CORNER
INVERCARGILL
Project Number
917077

Status
PRELIMINARY DESIGN
Date Plotted 11/20/2018 11:39:46 AM
Date Issued
Scale 1 : 100 @A1

Drawing Title
ZONE 1
MAIN SECTION 1 & 2
Drawing Number
Z1-PD-3000
Revision

BUCHAN
Christchurch Studio
+ 64 3 377 2973 / buchangroup.co.nz

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Job Name	HWCP Zone 1 Childcare
Job Number	136249
Name	ACC
Date	19-Jul-19

B-Risk Checklist

CF3 RM 1 - kitchen

Building Parameters

Volume, V_R =		m^3
Floor area, A_F =	15.6	m^2
Perimeter, P =	17.2	m

Model Inputs

Length, L =	6.0	m
Width, W =	2.6	m
Height, H =	2.7	m

Shape Factor

Average enclosure height =	2.7	m	
SF =	2		Single room OK

Non-dimensional HRR Parameter

HRR (peak or value at RSET) =	459.7	kW	
Non-dimensional HRR =	0.03		Within recommended limit

Note: Applies to room of fire origin only and only during the period of interest

Leakage

Leakage wall area (m2)=	46.4
Leakage area (x0.001m2/m2)	0.0464
Leakage width (m)	0.017

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Job Name	HWCP Zone 1 Childcare
Job Number	136249
Name	ACC
Date	19-Jul-19

B-Risk Checklist

CF1 RM 2 - Corridor

Building Parameters

Volume, V_R =		m^3
Floor area, A_F =	87.6	m^2
Perimeter, P =	87	m

Model Inputs

Length, L =	41.4	m
Width, W =	2.1	m
Height, H =	2.7	m

Shape Factor

Average enclosure height =	2.7	m	
SF =	12		Single room OK

Non-dimensional HRR Parameter

HRR (peak or value at RSET) =	0	kW	
Non-dimensional HRR =	0.00		Within recommended limit

Note: Applies to room of fire origin only and only during the period of interest

Leakage

Leakage wall area (m2)=	234.9
Leakage area (x0.001m2/m2)	0.2349
Leakage width(m)	0.087

Rev.01

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

Building Division

Invercargill City
Council
Building Consent
Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Job Name	HWCP Zone 1 Childcare
Job Number	136249
Name	ACC
Date	19-Jul-19

B-Risk Checklist

CF3 RM3 - Child carea

Building Parameters

Volume, V_R =		m^3
Floor area, A_F =	195.36	m^2
Perimeter, P =	57.6	m

Model Inputs

Length, L =	17.6	m
Width, W =	11.1	m
Height, H =	2.7	m

Shape Factor

Average enclosure height =	2.7	m	
SF =	27		Single room OK

Non-dimensional HRR Parameter

HRR (peak or value at RSET) =	0	kW	
Non-dimensional HRR =	0.00		Within recommended limit

Note: Applies to room of fire origin only and only during the period of interest

Leakage

Leakage wall area (m2)=	155.5
Leakage area (x0.001m2/m2)	0.1555
Leakage width (m)	0.058

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

```
July 31, 2019 12:15:00
B-RISK Fire Simulator and Design Fire Tool (Ver 2019.03)

Input Filename : input1.xml
Base File : C:\Users\amy.chao\Documents\B-RISK\riskdata\basemodel_136249_Zone1_CF3
\basemodel_136249_Zone1_CF3.xml

User Mode : C/VM2
Simulation Time = 1000.00 seconds.
Initial Time-Step = 1.00 seconds.


====================================================================
Description of Rooms
====================================================================
Room 1 : Kitchen
         Room Length (m) =                                  6.00
         Room Width (m) =                                   2.60
         Maximum Room Height (m) =                          2.70
         Minimum Room Height (m) =                          2.70
         Floor Elevation (m) =                              0.000
         Absolute X Position (m) =                          0.000
         Absolute Y Position (m) =                          0.000
         Room 1 has a flat ceiling.
         Shape Factor (Af/H^2) =                            2.1

         Wall Surface is plasterboard
         Wall Density (kg/m3) =                             810.0
         Wall Conductivity (W/m.K) =                        0.160
         Wall Specific Heat (J/kg.K) =                      900
         Wall Emissivity =                                  0.88
         Wall Thickness (mm) =                              13.0
         SQROOT Thermal Inertia (J.m-2.s-1/2.K-1) =         342

         Ceiling Surface is plasterboard
         Ceiling Density (kg/m3) =                          810.0
         Ceiling Conductivity (W/m.K) =                     0.160
         Ceiling Specific Heat (J/kg.K) =                   900
         Ceiling Emissivity =                               0.88
         Ceiling Thickness (mm) =                           13.0
         SQROOT Thermal Inertia (J.m-2.s-1/2.K-1) =         342

         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
         SQROOT Thermal Inertia (J.m-2.s-1/2.K-1) =         1558

Room 2 : Corridor
         Room Length (m) =                                  41.40
         Room Width (m) =                                   2.10
         Maximum Room Height (m) =                          2.70
         Minimum Room Height (m) =                          2.70
         Floor Elevation (m) =                              0.000
         Absolute X Position (m) =                          0.000
         Absolute Y Position (m) =                          2.600
         Room 2 has a flat ceiling.
         Shape Factor (Af/H^2) =                            11.9

         Wall Surface is plasterboard
         Wall Density (kg/m3) =                             810.0
         Wall Conductivity (W/m.K) =                        0.160
         Wall Specific Heat (J/kg.K) =                      900
         Wall Emissivity =                                  0.88
         Wall Thickness (mm) =                              13.0
         SQROOT Thermal Inertia (J.m-2.s-1/2.K-1) =         342

         Ceiling Surface is plasterboard
         Ceiling Density (kg/m3) =                          810.0
         Ceiling Conductivity (W/m.K) =                     0.160
         Ceiling Specific Heat (J/kg.K) =                   900
         Ceiling Emissivity =                               0.88
         Ceiling Thickness (mm) =                           13.0
         SQROOT Thermal Inertia (J.m-2.s-1/2.K-1) =         342

         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
         SQROOT Thermal Inertia (J.m-2.s-1/2.K-1) =         1558

Room 3 : Child Area
         Room Length (m) =                                  17.60
         Room Width (m) =                                   11.10
         Maximum Room Height (m) =                          2.70
         Minimum Room Height (m) =                          2.70
         Floor Elevation (m) =                              0.000
         Absolute X Position (m) =                          0.000
         Absolute Y Position (m) =                          4.700
         Room 3 has a flat ceiling.
         Shape Factor (Af/H^2) =                            26.8

         Wall Surface is plasterboard
         Wall Density (kg/m3) =                             810.0
         Wall Conductivity (W/m.K) =                        0.160
         Wall Specific Heat (J/kg.K) =                      900
         Wall Emissivity =                                  0.88
         Wall Thickness (mm) =                              13.0
         SQROOT Thermal Inertia (J.m-2.s-1/2.K-1) =         342

         Ceiling Surface is plasterboard
         Ceiling Density (kg/m3) =                          810.0
         Ceiling Conductivity (W/m.K) =                     0.160
         Ceiling Specific Heat (J/kg.K) =                   900
         Ceiling Emissivity =                               0.88
         Ceiling Thickness (mm) =                           13.0
         SQROOT Thermal Inertia (J.m-2.s-1/2.K-1) =         342

         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
         SQROOT Thermal Inertia (J.m-2.s-1/2.K-1) =         1558

====================================================================
Wall Vents
====================================================================
Vent  1 : RM1 Leak
                   From room 1 to 4
                   Front face of room 1
                   Offset (m) =                             0.800
                   Vent Width (m) =                         0.017
                   Vent Height (m) =                        2.700
                   Vent Sill Height (m) =                   0.000
                   Vent Soffit Height (m) =                 2.700
                   Opening Time (sec) =                     0
                   Closing Time (sec) =                     0
                   Discharge Coefficient (-) =              1.000

Vent  2 : RM2 Leak
                   From room 2 to 4
                   Rear  face of room 2
                   Offset (m) =                             0.800
                   Vent Width (m) =                         0.087
                   Vent Height (m) =                        2.700
                   Vent Sill Height (m) =                   0.000
                   Vent Soffit Height (m) =                 2.700
                   Opening Time (sec) =                     0
                   Closing Time (sec) =                     0
                   Discharge Coefficient (-) =              1.000
```

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

```
Vent   3 : Door - RM1-RM2
                   From room 1 to 2
                   Rear  face of room 1
                   Offset (m) =                          0.100
                   Vent Width (m) =                      0.800
                   Vent Height (m) =                     2.100
                   Vent Sill Height (m) =                0.000
                   Vent Soffit Height (m) =              2.100
                   Opening Time (sec) =                  0
                   Closing Time (sec) =                  0
                   Discharge Coefficient (-) =           0.680

Vent   4 : Final Exit - RM2
                   From room 2 to 4
                   Rear  face of room 2
                   Offset (m) =                          18.000
                   Vent Width (m) =                      0.900
                   Vent Height (m) =                     2.100
                   Vent Sill Height (m) =                0.000
                   Vent Soffit Height (m) =              2.100
                   Opening Time (sec) =                  120
                   Closing Time (sec) =                  600
                   Discharge Coefficient (-) =           0.680

Vent   5 : RM3 Leak
                   From room 3 to 4
                   Rear  face of room 3
                   Offset (m) =                          0.800
                   Vent Width (m) =                      0.058
                   Vent Height (m) =                     2.700
                   Vent Sill Height (m) =                0.000
                   Vent Soffit Height (m) =              2.700
                   Opening Time (sec) =                  0
                   Closing Time (sec) =                  0
                   Discharge Coefficient (-) =           1.000

Vent   6 : Door - RM2-RM3
                   From room 2 to 3
                   Rear  face of room 2
                   Offset (m) =                          3.000
                   Vent Width (m) =                      1.600
                   Vent Height (m) =                     2.100
                   Vent Sill Height (m) =                0.000
                   Vent Soffit Height (m) =              2.100
                   Opening Time (sec) =                  0
                   Closing Time (sec) =                  0
                   Discharge Coefficient (-) =           0.680

====================================================================
Ceiling/Floor Vents
====================================================================
====================================================================
Ambient Conditions
====================================================================
Interior Temp (C) =                                      24.0
Exterior Temp (C) =                                      15.0
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)                                        1000
1. Room                                                  2
2. Start Time (sec)                                      0
2. End Time (sec)                                        0
2. Room                                                  0
3. Start Time (sec)                                      0
3. End Time (sec)                                        0
```

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

```
3. Room                                                  0
====================================================================
Sprinkler / Detector Parameters
====================================================================
         Ceiling Jet model used is NIST JET.
         Sprinkler System Reliability                    1.000
         Sprinkler Probability of Suppression            0.000
         Sprinkler Cooling Coefficient                   1.000

         Sprinkler ID                                    1
         Room                                            1
         Response Time Index (m.s)^1/2 =                 50
         Sprinkler C-Factor (m/s)^1/2 =                  0.65
         Water Spray Density (mm/min) =                  4.20
         Radial Distance (m) =                           3.250
         Distance below ceiling (m) =                    0.025
         Actuation Temperature (deg C) =                 68.0

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

         Smoke Detector ID                               1
         Room                                            1
         Radial Distance from Plume (m) =                7.00
         Distance below Ceiling (m) =                    0.025
         Smoke Optical Density for Alarm (1/m)           0.097
         Detector Characteristic Length Number (m) =     15.00
         Detector response is based on OD outside the detector chamber.

====================================================================
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
Stoichiometric air/fuel ratio                            0.0

Burning objects are manually positioned in room.
Enhanced burning submodel is                             OFF

Burning Object No 1
description
              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
              Location, X-coordinate (m) =               3.000
              Location, Y-coordinate (m) =               1.300
              Fire Location (for entrainment) =          CENTRE
              Plume behaviour is                         UNDISTURBED

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

Environmental & Planning
Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Postflashover Inputs

Postflashover model is OFF.

Results from Fire Simulation

0 min 00 sec (0 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	2.700	2.700	2.700	
Upper Temp (C)	24.0	24.0	24.0	
Lower Temp (C)	24.0	24.0	24.0	
Unconstrained HRR (kW)	0.0	0.0	0.0	
HRR (kW)	0.0	0.0	0.0	
Q* =	0.0000	-	-	
Visibility (m) at 2m	20+	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	Room 3	Outside
Layer (m)	2.560	2.700	2.700	
Upper Temp (C)	28.0	23.9	24.0	
Lower Temp (C)	24.0	23.9	24.0	
Unconstrained HRR (kW)	4.7	0.0	0.0	
HRR (kW)	4.7	0.0	0.0	
Q* =	0.0004	-	-	
Visibility (m) at 2m	20+	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	Room 3	Outside
Layer (m)	2.280	2.700	2.700	
Upper Temp (C)	34.9	23.9	24.0	
Lower Temp (C)	24.1	23.9	24.0	
Unconstrained HRR (kW)	18.8	0.0	0.0	
HRR (kW)	18.8	0.0	0.0	
Q* =	0.0014	-	-	
Visibility (m) at 2m	20+	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	Room 3	Outside
Layer (m)	1.938	2.694	2.700	
Upper Temp (C)	44.6	25.2	24.0	
Lower Temp (C)	24.4	23.9	24.0	
Unconstrained HRR (kW)	42.2	0.0	0.0	
HRR (kW)	42.2	0.0	0.0	
Q* =	0.0032	-	-	
Visibility (m) at 2m	2.77	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	Room 3	Outside
Layer (m)	1.624	2.638	2.700	

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Upper Temp (C)	57.6	27.7	24.0	
Lower Temp (C)	25.1	23.9	24.0	
Unconstrained HRR (kW)	75.0	0.0	0.0	
HRR (kW)	75.0	0.0	0.0	
Q* =	0.0056	-	-	
Visibility (m) at 2m	1.74	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	Room 3	Outside
Layer (m)	1.389	2.502	2.700	
Upper Temp (C)	76.1	30.4	24.0	
Lower Temp (C)	26.4	23.9	24.0	
Unconstrained HRR (kW)	117.3	0.0	0.0	
HRR (kW)	117.3	0.0	0.0	
Q* =	0.0088	-	-	
Visibility (m) at 2m	1.19	20+	20+	

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

1 min 00 sec (60 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	1.232	2.292	2.700	
Upper Temp (C)	98.4	33.7	24.0	
Lower Temp (C)	28.5	23.9	23.9	
Unconstrained HRR (kW)	168.8	0.0	0.0	
HRR (kW)	168.8	0.0	0.0	
Q* =	0.0127	-	-	
Visibility (m) at 2m	0.88	20+	20+	

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

1 min 10 sec (70 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	1.151	2.041	2.699	
Upper Temp (C)	123.5	37.7	24.2	
Lower Temp (C)	33.1	23.9	23.9	
Unconstrained HRR (kW)	229.8	0.0	0.0	
HRR (kW)	229.8	0.0	0.0	
Q* =	0.0173	-	-	
Visibility (m) at 2m	0.67	20+	20+	

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

1 min 20 sec (80 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	1.105	1.788	2.684	
Upper Temp (C)	152.2	41.9	25.7	
Lower Temp (C)	41.6	23.9	23.9	
Unconstrained HRR (kW)	300.2	0.0	0.0	
HRR (kW)	300.2	0.0	0.0	
Q* =	0.0226	-	-	
Visibility (m) at 2m	0.53	2.49	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	Room 3	Outside

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

Building Division

Invercargill City
Council
Building Consent
Authority
Approved Site Copy

```
                Layer (m)                     1.053     1.553     2.635
                Upper Temp (C)                181.7     46.5      26.8
                Lower Temp (C)                53.7      24.0      23.9
                Unconstrained HRR (kW)        379.9     0.0       0.0
                HRR (kW)                      379.9     0.0       0.0
                Q* =                          0.0286    -         -
                Visibility (m) at 2m          0.45      1.90      20+

                FED gases on egress path = 0.001
                FED thermal on egress path = 0.002

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

                Layer (m)                     1.005     1.341     2.545
                Upper Temp (C)                208.7     51.2      27.9
                Lower Temp (C)                69.2      24.2      23.9
                Unconstrained HRR (kW)        423.3     0.0       0.0
                HRR (kW)                      423.3     0.0       0.0
                Q* =                          0.0318    -         -
                Visibility (m) at 2m          0.39      1.51      20+

                FED gases on egress path = 0.001
                FED thermal on egress path = 0.004

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

                Layer (m)                     1.010     1.191     2.422
                Upper Temp (C)                221.7     55.5      28.7
                Lower Temp (C)                83.5      24.5      24.0
                Unconstrained HRR (kW)        423.3     0.0       0.0
                HRR (kW)                      423.3     0.0       0.0
                Q* =                          0.0318    -         -
                Visibility (m) at 2m          0.36      1.24      20+

                FED gases on egress path = 0.002
                FED thermal on egress path = 0.006

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

                Layer (m)                     1.007     1.086     2.280
                Upper Temp (C)                229.0     58.7      29.3
                Lower Temp (C)                91.6      25.1      24.0
                Unconstrained HRR (kW)        423.3     0.0       0.0
                HRR (kW)                      423.3     0.0       0.0
                Q* =                          0.0318    -         -
                Visibility (m) at 2m          0.34      1.06      20+

                FED gases on egress path = 0.003
                FED thermal on egress path = 0.010

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

                Layer (m)                     1.018     1.084     2.141
                Upper Temp (C)                233.4     61.2      29.7
                Lower Temp (C)                98.8      26.0      24.0
                Unconstrained HRR (kW)        423.3     0.0       0.0
                HRR (kW)                      423.3     0.0       0.0
                Q* =                          0.0318    -         -
                Visibility (m) at 2m          0.33      0.93      20+

                FED gases on egress path = 0.004
                FED thermal on egress path = 0.013

2 min           20 sec
                (140 sec)                     Room 1    Room 2    Room 3    Outside
```

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

```
                Layer (m)                     1.022     1.096     2.003
                Upper Temp (C)                237.3     63.3      30.1
                Lower Temp (C)                104.7     26.9      24.0
                Unconstrained HRR (kW)        423.3     0.0       0.0
                HRR (kW)                      423.3     0.0       0.0
                Q* =                          0.0318    -         -
                Visibility (m) at 2m          0.33      0.83      20+

                FED gases on egress path = 0.005
                FED thermal on egress path = 0.018

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

                Layer (m)                     1.023     1.109     1.873
                Upper Temp (C)                240.1     65.1      30.5
                Lower Temp (C)                109.3     27.8      24.0
                Unconstrained HRR (kW)        423.3     0.0       0.0
                HRR (kW)                      423.3     0.0       0.0
                Q* =                          0.0318    -         -
                Visibility (m) at 2m          0.33      0.76      3.42

                FED gases on egress path = 0.006
                FED thermal on egress path = 0.022

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

                Layer (m)                     1.024     1.120     1.749
                Upper Temp (C)                242.5     66.6      30.8
                Lower Temp (C)                112.8     28.6      24.0
                Unconstrained HRR (kW)        423.3     0.0       0.0
                HRR (kW)                      423.3     0.0       0.0
                Q* =                          0.0318    -         -
                Visibility (m) at 2m          0.32      0.71      3.09

                FED gases on egress path = 0.008
                FED thermal on egress path = 0.027

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

                Layer (m)                     1.025     1.129     1.633
                Upper Temp (C)                244.5     67.9      31.1
                Lower Temp (C)                115.8     29.3      24.0
                Unconstrained HRR (kW)        423.3     0.0       0.0
                HRR (kW)                      423.3     0.0       0.0
                Q* =                          0.0318    -         -
                Visibility (m) at 2m          0.32      0.66      2.82

                FED gases on egress path = 0.010
                FED thermal on egress path = 0.033

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

                Layer (m)                     1.026     1.136     1.524
                Upper Temp (C)                246.4     69.0      31.3
                Lower Temp (C)                118.3     29.9      24.1
                Unconstrained HRR (kW)        423.3     0.0       0.0
                HRR (kW)                      423.3     0.0       0.0
                Q* =                          0.0318    -         -
                Visibility (m) at 2m          0.32      0.63      2.59

                FED gases on egress path = 0.012
                FED thermal on egress path = 0.039

3 min           10 sec
```

Environmental & Planning
Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

(190 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	1.026	1.141	1.421	
Upper Temp (C)	248.1	70.0	31.6	
Lower Temp (C)	120.4	30.4	24.1	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.32	0.60	2.40	

FED gases on egress path = 0.013
FED thermal on egress path = 0.045

3 min 20 sec
(200 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	1.027	1.144	1.323	
Upper Temp (C)	249.7	70.9	31.8	
Lower Temp (C)	122.2	30.9	24.2	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.32	0.58	2.23	

FED gases on egress path = 0.016
FED thermal on egress path = 0.051

3 min 30 sec
(210 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	1.027	1.145	1.232	
Upper Temp (C)	251.2	71.6	32.0	
Lower Temp (C)	123.8	31.2	24.2	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.32	0.56	2.10	

FED gases on egress path = 0.018
FED thermal on egress path = 0.058

3 min 40 sec
(220 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	1.027	1.136	1.146	
Upper Temp (C)	252.5	72.2	32.2	
Lower Temp (C)	125.2	31.3	24.2	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.32	0.55	1.97	

FED gases on egress path = 0.020
FED thermal on egress path = 0.065

3 min 50 sec
(230 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	1.027	1.126	1.101	
Upper Temp (C)	253.9	72.7	32.6	
Lower Temp (C)	126.3	31.4	24.3	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.32	0.54	1.83	

FED gases on egress path = 0.022
FED thermal on egress path = 0.072

4 min 00 sec
(240 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	1.027	1.118	1.065	
Upper Temp (C)	255.1	73.1	32.9	
Lower Temp (C)	127.4	31.6	24.3	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.32	0.53	1.70	

FED gases on egress path = 0.024
FED thermal on egress path = 0.079

4 min 10 sec
(250 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	1.026	1.111	1.030	
Upper Temp (C)	256.3	73.5	33.3	
Lower Temp (C)	128.6	31.8	24.4	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.33	0.52	1.59	

FED gases on egress path = 0.027
FED thermal on egress path = 0.086

4 min 20 sec
(260 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	1.026	1.105	0.996	
Upper Temp (C)	257.5	73.9	33.5	
Lower Temp (C)	129.8	32.1	24.5	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.33	0.51	1.50	

FED gases on egress path = 0.029
FED thermal on egress path = 0.094

4 min 30 sec
(270 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	1.026	1.099	0.964	
Upper Temp (C)	258.6	74.2	33.8	
Lower Temp (C)	131.1	32.4	24.5	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.33	0.51	1.42	

FED gases on egress path = 0.032
FED thermal on egress path = 0.101

4 min 40 sec
(280 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	1.025	1.094	0.932	
Upper Temp (C)	259.7	74.5	34.0	
Lower Temp (C)	132.5	32.8	24.6	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.33	0.50	1.35	

FED gases on egress path = 0.034
FED thermal on egress path = 0.109

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

Building Division

Invercargill City
Council
Building Consent
Authority
Approved Site Copy

4 min 50 sec (290 sec)

(290 sec)	Room 1	Room 2	Room 3	Outside
Layer (m)	1.025	1.088	0.902	
Upper Temp (C)	260.8	74.7	34.2	
Lower Temp (C)	133.9	33.2	24.7	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.33	0.50	1.29	

FED gases on egress path = 0.037
FED thermal on egress path = 0.117

5 min 00 sec (300 sec)

(300 sec)	Room 1	Room 2	Room 3	Outside
Layer (m)	1.025	1.083	0.872	
Upper Temp (C)	261.8	75.0	34.4	
Lower Temp (C)	135.4	33.5	24.8	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.33	0.50	1.23	

FED gases on egress path = 0.039
FED thermal on egress path = 0.124

5 min 10 sec (310 sec)

(310 sec)	Room 1	Room 2	Room 3	Outside
Layer (m)	1.024	1.078	0.844	
Upper Temp (C)	262.8	75.3	34.6	
Lower Temp (C)	136.9	33.9	25.0	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.33	0.50	1.18	

FED gases on egress path = 0.042
FED thermal on egress path = 0.132

5 min 20 sec (320 sec)

(320 sec)	Room 1	Room 2	Room 3	Outside
Layer (m)	1.024	1.073	0.816	
Upper Temp (C)	263.9	75.5	34.8	
Lower Temp (C)	138.4	34.3	25.1	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.33	0.49	1.14	

FED gases on egress path = 0.044
FED thermal on egress path = 0.140

5 min 30 sec (330 sec)

(330 sec)	Room 1	Room 2	Room 3	Outside
Layer (m)	1.024	1.068	0.789	
Upper Temp (C)	264.9	75.8	34.9	
Lower Temp (C)	139.9	34.7	25.2	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.33	0.49	1.10	

FED gases on egress path = 0.047

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

FED thermal on egress path = 0.149

5 min 40 sec (340 sec)

(340 sec)	Room 1	Room 2	Room 3	Outside
Layer (m)	1.023	1.063	0.763	
Upper Temp (C)	265.8	76.0	35.1	
Lower Temp (C)	141.4	35.1	25.3	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.33	0.49	1.06	

FED gases on egress path = 0.050
FED thermal on egress path = 0.157

5 min 50 sec (350 sec)

(350 sec)	Room 1	Room 2	Room 3	Outside
Layer (m)	1.023	1.058	0.738	
Upper Temp (C)	266.8	76.3	35.2	
Lower Temp (C)	142.9	35.5	25.5	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.33	0.49	1.03	

FED gases on egress path = 0.052
FED thermal on egress path = 0.165

6 min 00 sec (360 sec)

(360 sec)	Room 1	Room 2	Room 3	Outside
Layer (m)	1.023	1.054	0.714	
Upper Temp (C)	267.7	76.5	35.4	
Lower Temp (C)	144.4	35.9	25.6	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.33	0.49	1.00	

FED gases on egress path = 0.055
FED thermal on egress path = 0.174

6 min 10 sec (370 sec)

(370 sec)	Room 1	Room 2	Room 3	Outside
Layer (m)	1.022	1.049	0.690	
Upper Temp (C)	268.7	76.7	35.5	
Lower Temp (C)	145.8	36.2	25.8	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.33	0.49	0.97	

FED gases on egress path = 0.058
FED thermal on egress path = 0.182

6 min 20 sec (380 sec)

(380 sec)	Room 1	Room 2	Room 3	Outside
Layer (m)	1.022	1.045	0.667	
Upper Temp (C)	269.6	76.9	35.6	
Lower Temp (C)	147.2	36.6	25.9	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.32	0.48	0.94	

Environmental & Planning
Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City
Council
Building Consent
Authority
Approved Site Copy

FED gases on egress path = 0.061
FED thermal on egress path = 0.191

6 min 30 sec
(390 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	1.022	1.040	0.645	
Upper Temp (C)	270.5	77.0	35.7	
Lower Temp (C)	148.7	37.0	26.1	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.32	0.48	0.92	

FED gases on egress path = 0.063
FED thermal on egress path = 0.199

6 min 40 sec
(400 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	1.022	1.036	0.624	
Upper Temp (C)	271.3	77.0	35.9	
Lower Temp (C)	150.0	37.3	26.2	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.32	0.48	0.90	

FED gases on egress path = 0.066
FED thermal on egress path = 0.208

6 min 50 sec
(410 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	1.022	1.031	0.604	
Upper Temp (C)	272.2	77.0	36.0	
Lower Temp (C)	151.3	37.6	26.4	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.32	0.48	0.88	

FED gases on egress path = 0.069
FED thermal on egress path = 0.217

7 min 00 sec
(420 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	1.021	1.025	0.584	
Upper Temp (C)	273.0	77.0	36.2	
Lower Temp (C)	152.6	37.9	26.6	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.32	0.48	0.86	

FED gases on egress path = 0.072
FED thermal on egress path = 0.225

7 min 10 sec
(430 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	1.021	1.023	0.565	
Upper Temp (C)	273.8	77.2	36.3	
Lower Temp (C)	153.8	38.2	26.7	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.32	0.48	0.84	

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

FED gases on egress path = 0.075
FED thermal on egress path = 0.234

7 min 20 sec
(440 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	1.021	1.024	0.546	
Upper Temp (C)	274.6	77.4	36.4	
Lower Temp (C)	154.9	38.5	26.9	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.32	0.47	0.82	

FED gases on egress path = 0.078
FED thermal on egress path = 0.243

7 min 30 sec
(450 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	1.021	1.022	0.529	
Upper Temp (C)	275.4	77.6	36.5	
Lower Temp (C)	155.9	38.8	27.1	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.32	0.47	0.81	

FED gases on egress path = 0.081
FED thermal on egress path = 0.252

7 min 40 sec
(460 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	1.021	1.021	0.512	
Upper Temp (C)	276.1	77.8	36.6	
Lower Temp (C)	156.9	39.0	27.3	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.32	0.47	0.79	

FED gases on egress path = 0.083
FED thermal on egress path = 0.260

7 min 50 sec
(470 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	1.021	1.024	0.496	
Upper Temp (C)	276.8	78.2	36.7	
Lower Temp (C)	157.8	39.3	27.4	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.32	0.46	0.78	

FED gases on egress path = 0.086
FED thermal on egress path = 0.270

8 min 00 sec
(480 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	1.022	1.026	0.481	
Upper Temp (C)	276.8	78.5	36.8	
Lower Temp (C)	158.6	39.5	27.6	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.32	0.46	0.76	

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

FED gases on egress path = 0.090
FED thermal on egress path = 0.279

8 min 10 sec (490 sec)

(490 sec)	Room 1	Room 2	Room 3	Outside
Layer (m)	1.021	1.021	0.466	
Upper Temp (C)	276.9	78.7	36.9	
Lower Temp (C)	159.4	39.7	27.8	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.32	0.46	0.75	

FED gases on egress path = 0.093
FED thermal on egress path = 0.288

8 min 20 sec (500 sec)

(500 sec)	Room 1	Room 2	Room 3	Outside
Layer (m)	1.021	1.025	0.452	
Upper Temp (C)	277.0	79.2	37.0	
Lower Temp (C)	160.1	40.0	27.9	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.32	0.46	0.74	

FED gases on egress path = 0.096
FED thermal on egress path = 0.297

8 min 30 sec (510 sec)

(510 sec)	Room 1	Room 2	Room 3	Outside
Layer (m)	1.021	1.025	0.438	
Upper Temp (C)	277.2	79.5	37.1	
Lower Temp (C)	160.8	40.2	28.1	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.32	0.45	0.72	

FED gases on egress path = 0.099
FED thermal on egress path = 0.307

8 min 40 sec (520 sec)

(520 sec)	Room 1	Room 2	Room 3	Outside
Layer (m)	1.021	1.021	0.425	
Upper Temp (C)	277.0	79.8	37.3	
Lower Temp (C)	161.5	40.4	28.2	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.32	0.45	0.71	

FED gases on egress path = 0.102
FED thermal on egress path = 0.317

8 min 50 sec (530 sec)

(530 sec)	Room 1	Room 2	Room 3	Outside
Layer (m)	1.020	1.021	0.412	
Upper Temp (C)	277.1	80.1	37.4	
Lower Temp (C)	162.2	40.7	28.4	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.32	0.45	0.70	

FED gases on egress path = 0.105
FED thermal on egress path = 0.327

9 min 00 sec (540 sec)

(540 sec)	Room 1	Room 2	Room 3	Outside
Layer (m)	1.020	1.024	0.400	
Upper Temp (C)	277.2	80.5	37.5	
Lower Temp (C)	162.9	40.9	28.5	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.32	0.45	0.69	

FED gases on egress path = 0.108
FED thermal on egress path = 0.336

9 min 10 sec (550 sec)

(550 sec)	Room 1	Room 2	Room 3	Outside
Layer (m)	1.019	1.020	0.389	
Upper Temp (C)	277.5	80.7	37.6	
Lower Temp (C)	163.6	41.1	28.7	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.32	0.45	0.68	

FED gases on egress path = 0.112
FED thermal on egress path = 0.347

9 min 20 sec (560 sec)

(560 sec)	Room 1	Room 2	Room 3	Outside
Layer (m)	1.019	1.023	0.377	
Upper Temp (C)	278.0	81.0	37.7	
Lower Temp (C)	164.4	41.3	28.8	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.32	0.44	0.67	

FED gases on egress path = 0.115
FED thermal on egress path = 0.357

9 min 30 sec (570 sec)

(570 sec)	Room 1	Room 2	Room 3	Outside
Layer (m)	1.019	1.021	0.367	
Upper Temp (C)	278.5	81.2	37.8	
Lower Temp (C)	165.1	41.5	28.9	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.32	0.44	0.66	

FED gases on egress path = 0.118
FED thermal on egress path = 0.367

9 min 40 sec (580 sec)

(580 sec)	Room 1	Room 2	Room 3	Outside
Layer (m)	1.018	1.021	0.357	
Upper Temp (C)	279.0	81.5	37.9	
Lower Temp (C)	165.8	41.7	29.1	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

	Room 1	Room 2	Room 3	Outside
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.32	0.44	0.65	

FED gases on egress path = 0.122
FED thermal on egress path = 0.378

9 min 50 sec (590 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	1.018	1.020	0.347	
Upper Temp (C)	279.5	81.6	38.0	
Lower Temp (C)	166.5	41.9	29.2	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.32	0.44	0.64	

FED gases on egress path = 0.125
FED thermal on egress path = 0.388

10 min 00 sec (600 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	1.018	1.019	0.337	
Upper Temp (C)	280.0	81.8	38.0	
Lower Temp (C)	167.2	42.1	29.3	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.32	0.44	0.63	

FED gases on egress path = 0.128
FED thermal on egress path = 0.399

10 min 10 sec (610 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	1.010	0.997	0.326	
Upper Temp (C)	280.7	83.9	38.2	
Lower Temp (C)	167.9	43.6	29.4	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.32	0.42	0.63	

FED gases on egress path = 0.132
FED thermal on egress path = 0.410

10 min 20 sec (620 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	1.004	0.977	0.316	
Upper Temp (C)	281.8	85.5	38.4	
Lower Temp (C)	169.7	45.0	29.5	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.32	0.40	0.62	

FED gases on egress path = 0.135
FED thermal on egress path = 0.422

10 min 30 sec (630 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	1.003	0.960	0.306	
Upper Temp (C)	282.9	86.5	38.6	
Lower Temp (C)	172.3	46.3	29.7	
Unconstrained HRR (kW)	423.3	0.0	0.0	

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

	Room 1	Room 2	Room 3	Outside
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.32	0.39	0.61	

FED gases on egress path = 0.139
FED thermal on egress path = 0.434

10 min 40 sec (640 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	1.005	0.944	0.296	
Upper Temp (C)	283.9	87.1	38.8	
Lower Temp (C)	175.3	47.3	29.8	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.31	0.38	0.60	

FED gases on egress path = 0.143
FED thermal on egress path = 0.447

10 min 50 sec (650 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	1.005	0.928	0.287	
Upper Temp (C)	284.8	87.6	39.1	
Lower Temp (C)	178.1	48.2	29.9	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.31	0.37	0.59	

FED gases on egress path = 0.147
FED thermal on egress path = 0.461

11 min 00 sec (660 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	1.002	0.914	0.278	
Upper Temp (C)	285.7	87.9	39.3	
Lower Temp (C)	180.4	49.0	30.1	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.31	0.36	0.58	

FED gases on egress path = 0.152
FED thermal on egress path = 0.474

11 min 10 sec (670 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	0.998	0.900	0.270	
Upper Temp (C)	286.4	88.2	39.5	
Lower Temp (C)	182.3	49.6	30.2	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.31	0.36	0.57	

FED gases on egress path = 0.156
FED thermal on egress path = 0.488

11 min 20 sec (680 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	0.992	0.886	0.263	
Upper Temp (C)	287.0	88.5	39.7	
Lower Temp (C)	184.1	50.2	30.4	

Environmental & Planning
Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318			
Visibility (m) at 2m	0.31	0.35	0.56	

FED gases on egress path = 0.160
FED thermal on egress path = 0.502

11 min 30 sec (690 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	0.987	0.872	0.255	
Upper Temp (C)	287.5	88.7	40.0	
Lower Temp (C)	185.7	50.7	30.5	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.31	0.34	0.55	

FED gases on egress path = 0.165
FED thermal on egress path = 0.515

11 min 40 sec (700 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	0.980	0.858	0.248	
Upper Temp (C)	288.0	88.8	40.2	
Lower Temp (C)	187.2	51.1	30.7	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.30	0.34	0.54	

FED gases on egress path = 0.170
FED thermal on egress path = 0.529

11 min 50 sec (710 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	0.973	0.845	0.242	
Upper Temp (C)	288.4	89.0	40.4	
Lower Temp (C)	188.7	51.5	30.8	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.30	0.33	0.53	

FED gases on egress path = 0.175
FED thermal on egress path = 0.544

12 min 00 sec (720 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	0.966	0.832	0.236	
Upper Temp (C)	288.9	89.1	40.5	
Lower Temp (C)	190.1	51.9	31.0	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.30	0.33	0.52	

FED gases on egress path = 0.180
FED thermal on egress path = 0.558

12 min 10 sec (730 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	0.959	0.820	0.230	
Upper Temp (C)	289.3	89.3	40.7	

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Lower Temp (C)	191.5	52.2	31.1	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.30	0.33	0.51	

FED gases on egress path = 0.185
FED thermal on egress path = 0.572

12 min 20 sec (740 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	0.952	0.808	0.225	
Upper Temp (C)	289.6	89.4	40.9	
Lower Temp (C)	192.8	52.5	31.3	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.30	0.32	0.50	

FED gases on egress path = 0.190
FED thermal on egress path = 0.586

12 min 30 sec (750 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	0.944	0.796	0.220	
Upper Temp (C)	290.0	89.5	41.1	
Lower Temp (C)	194.1	52.9	31.4	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.29	0.32	0.49	

FED gases on egress path = 0.195
FED thermal on egress path = 0.601

12 min 40 sec (760 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	0.937	0.784	0.215	
Upper Temp (C)	290.3	89.6	41.2	
Lower Temp (C)	195.4	53.2	31.6	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.29	0.31	0.48	

FED gases on egress path = 0.201
FED thermal on egress path = 0.615

12 min 50 sec (770 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	0.929	0.773	0.210	
Upper Temp (C)	290.7	89.8	41.4	
Lower Temp (C)	196.7	53.4	31.7	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.29	0.31	0.48	

FED gases on egress path = 0.206
FED thermal on egress path = 0.630

13 min 00 sec (780 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	0.922	0.762	0.206	

Environmental & Planning
Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Upper Temp (C)	291.0	89.9	41.5	
Lower Temp (C)	197.9	53.7	31.8	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.29	0.31	0.47	

FED gases on egress path = 0.212
FED thermal on egress path = 0.644

13 min 10 sec (790 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	0.915	0.752	0.202	
Upper Temp (C)	291.3	90.0	41.7	
Lower Temp (C)	199.1	54.0	32.0	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.29	0.30	0.46	

FED gases on egress path = 0.218
FED thermal on egress path = 0.659

13 min 20 sec (800 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	0.907	0.742	0.199	
Upper Temp (C)	291.6	90.1	41.8	
Lower Temp (C)	200.3	54.2	32.1	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.28	0.30	0.45	

FED gases on egress path = 0.224
FED thermal on egress path = 0.674

13 min 30 sec (810 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	0.900	0.732	0.195	
Upper Temp (C)	291.9	90.2	42.0	
Lower Temp (C)	201.4	54.5	32.2	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.28	0.30	0.45	

FED gases on egress path = 0.230
FED thermal on egress path = 0.689

13 min 40 sec (820 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	0.893	0.723	0.192	
Upper Temp (C)	292.2	90.3	42.1	
Lower Temp (C)	202.5	54.7	32.4	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.28	0.30	0.44	

FED gases on egress path = 0.236
FED thermal on egress path = 0.703

13 min 50 sec (830 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	0.887	0.714	0.189	
Upper Temp (C)	292.5	90.5	42.2	
Lower Temp (C)	203.6	55.0	32.5	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.28	0.29	0.43	

FED gases on egress path = 0.242
FED thermal on egress path = 0.718

14 min 00 sec (840 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	0.880	0.705	0.186	
Upper Temp (C)	292.7	90.6	42.4	
Lower Temp (C)	204.6	55.2	32.6	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.28	0.29	0.43	

FED gases on egress path = 0.248
FED thermal on egress path = 0.733

14 min 10 sec (850 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	0.874	0.697	0.183	
Upper Temp (C)	293.0	90.7	42.5	
Lower Temp (C)	205.6	55.4	32.7	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.27	0.29	0.42	

FED gases on egress path = 0.255
FED thermal on egress path = 0.748

14 min 20 sec (860 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	0.811	0.692	0.182	
Upper Temp (C)	303.3	90.7	42.6	
Lower Temp (C)	168.4	55.6	32.8	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.28	0.29	0.41	

FED gases on egress path = 0.261
FED thermal on egress path = 0.763

14 min 30 sec (870 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	0.803	0.690	0.181	
Upper Temp (C)	302.3	90.9	42.7	
Lower Temp (C)	156.2	55.8	32.9	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.27	0.28	0.41	

FED gases on egress path = 0.268
FED thermal on egress path = 0.779

14 min 40 sec (880 sec)

	Room 1	Room 2	Room 3	Outside

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

	Room 1	Room 2	Room 3	Outside
Layer (m)	0.803	0.688	0.179	
Upper Temp (C)	301.2	91.1	42.8	
Lower Temp (C)	154.1	56.0	33.0	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.27	0.28	0.40	

FED gases on egress path = 0.275
FED thermal on egress path = 0.794

14 min 50 sec (890 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	0.803	0.687	0.177	
Upper Temp (C)	300.9	91.2	42.9	
Lower Temp (C)	153.7	56.2	33.1	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.26	0.28	0.40	

FED gases on egress path = 0.281
FED thermal on egress path = 0.809

15 min 00 sec (900 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	0.802	0.685	0.175	
Upper Temp (C)	300.9	91.4	43.0	
Lower Temp (C)	153.8	56.4	33.2	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.26	0.27	0.39	

FED gases on egress path = 0.288
FED thermal on egress path = 0.825

15 min 10 sec (910 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	0.800	0.683	0.173	
Upper Temp (C)	301.0	91.5	43.1	
Lower Temp (C)	154.0	56.5	33.3	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.26	0.27	0.39	

FED gases on egress path = 0.296
FED thermal on egress path = 0.840

15 min 20 sec (920 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	0.799	0.681	0.172	
Upper Temp (C)	301.1	91.6	43.2	
Lower Temp (C)	154.3	56.7	33.4	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.26	0.27	0.38	

FED gases on egress path = 0.303
FED thermal on egress path = 0.856

15 min 30 sec

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

(930 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	0.797	0.679	0.170	
Upper Temp (C)	301.3	91.8	43.3	
Lower Temp (C)	154.6	56.9	33.5	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.26	0.27	0.37	

FED gases on egress path = 0.310
FED thermal on egress path = 0.871

15 min 40 sec (940 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	0.796	0.678	0.169	
Upper Temp (C)	301.5	91.9	43.4	
Lower Temp (C)	154.9	57.0	33.6	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.25	0.26	0.37	

FED gases on egress path = 0.318
FED thermal on egress path = 0.887

15 min 50 sec (950 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	0.795	0.676	0.168	
Upper Temp (C)	301.7	92.0	43.5	
Lower Temp (C)	155.3	57.2	33.7	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.25	0.26	0.36	

FED gases on egress path = 0.325
FED thermal on egress path = 0.903

16 min 00 sec (960 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	0.793	0.674	0.167	
Upper Temp (C)	301.9	92.1	43.6	
Lower Temp (C)	155.6	57.3	33.8	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.25	0.26	0.36	

FED gases on egress path = 0.333
FED thermal on egress path = 0.919

16 min 10 sec (970 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	0.792	0.672	0.166	
Upper Temp (C)	302.2	92.3	43.7	
Lower Temp (C)	156.0	57.5	33.9	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.25	0.26	0.36	

FED gases on egress path = 0.341
FED thermal on egress path = 0.935

Environmental & Planning
Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

16 min 20 sec (980 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	0.791	0.670	0.165	
Upper Temp (C)	302.4	92.4	43.8	
Lower Temp (C)	156.3	57.6	34.0	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.25	0.26	0.35	

FED gases on egress path = 0.349
FED thermal on egress path = 0.951

16 min 30 sec (990 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	0.789	0.669	0.164	
Upper Temp (C)	302.6	92.5	43.9	
Lower Temp (C)	156.7	57.8	34.0	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.25	0.25	0.35	

FED gases on egress path = 0.357
FED thermal on egress path = 0.967

16 min 40 sec (1000 sec)

	Room 1	Room 2	Room 3	Outside
Layer (m)	0.788	0.667	0.163	
Upper Temp (C)	302.8	92.6	44.0	
Lower Temp (C)	157.0	57.9	34.1	
Unconstrained HRR (kW)	423.3	0.0	0.0	
HRR (kW)	423.3	0.0	0.0	
Q* =	0.0318	-	-	
Visibility (m) at 2m	0.25	0.25	0.34	

FED gases on egress path = 0.365
FED thermal on egress path = 0.983

==
Event Log
==
FED(CO) Exceeded 0.3 at 917.0 Seconds.
FED(thermal) Exceeded 0.3 at 503.0 Seconds.
FED(thermal) Exceeded 0.3 at 503.0 Seconds.
Simulation Finished.
Sprinkler Effectiveness 1
600 sec. Vent 2-4-2 closed by user.
120 sec. Vent 2-4-2 opened by user.
Fire HRR is controlled by sprinkler
95 Sec. Sprinkler 1 responded.
29 sec. Visibility at 2m above floor reduced to 10 m in room 1
30 sec. Smoke detector 1 operates in room 1
0 sec. Item 1 description ignited.
Iteration 1

==
Computer Run-Time = 10.4 seconds.
==

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

Building Division

Invercargill City
Council
Building Consent
Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER

2019/1381

C.4 ASET for Robustness Check RC1

Robustness Check RC1 utilise Challenging Fire CF1 with the failure of the smoke exhaust system. The fire is subject to (quick response) sprinkler control.

Table 23 - Sprinkler Activation time for CF1

(Quick Response) Sprinkler activation in FDS (s)	Sprinkler activation modelled for HRR control (s)
265	265

The graph below shows the comparison between the HRR output of the FDS burner modelled in RC1 against that specified in C/VM2 ($0.0469t^2$).

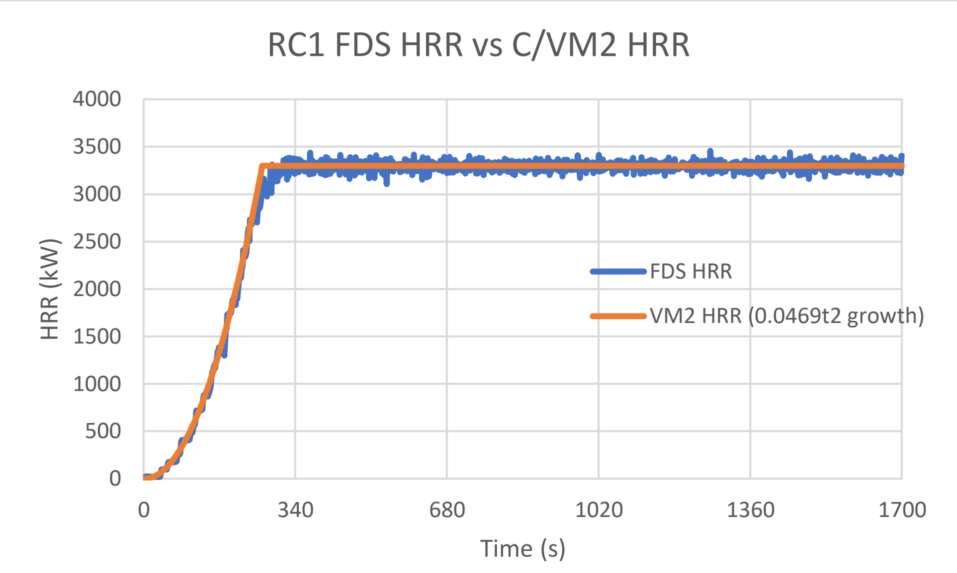


Figure 26 - RC1 FDS HRR v.s. VM2 HRR

C.4.1 RC1 ASET Summary

Tenability was assessed by FEDco slice files located 2m above each floor. The table below showed the tenability for each floor. As agreed in the Zone 1 FEB, only FEDco will be assessed.

Table 24 - RC1 ASET

Floor Level	Location	Time @ FED_{CO} = 0.3 (s)	ASET (s)
GF	Retail	>1700	>1700
	SW Entry to Mall	>1700	
	Main Entry (Esk St)	>1700	
	SE Exit to Tay St	>1700	
L1	Retail	1610	1610
	Entry to Carpark	1644	1644
	Entry to Stair 3	1686	1686

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Floor Level	Location	Time @ FED_{CO} = 0.3 (s)	ASET (s)
	Entry to Stair 4	1615	1615

The images below showed FDS Smokeview FEDco slice file at 2 metres above each level.

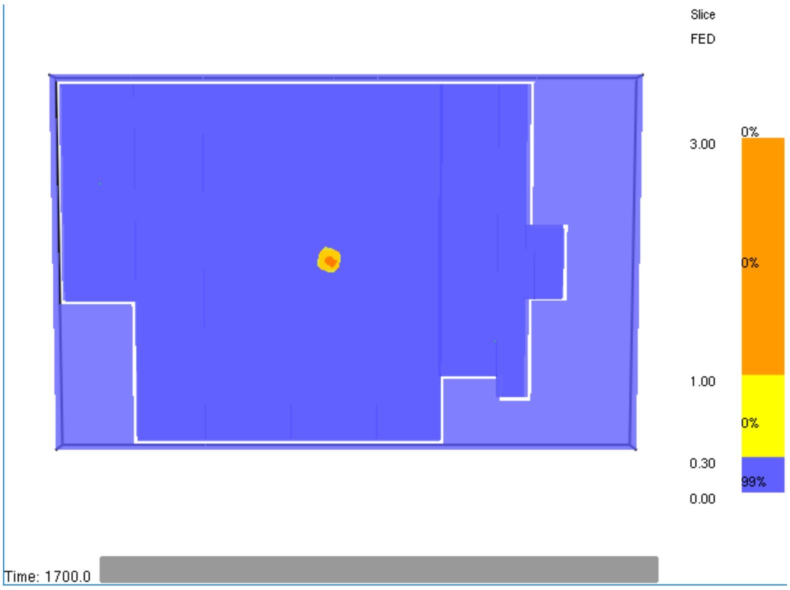


Figure 27 - RC1 FEDco slice file at 2.0 m above Ground Floor Anchor at 1700 s

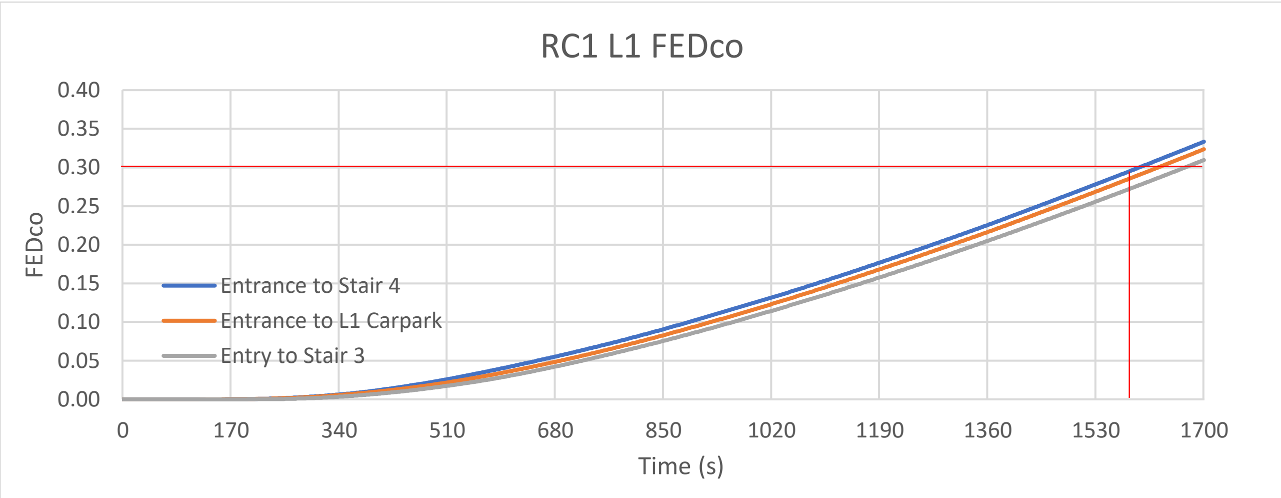


Figure 28 - RC1 FEDco measured at 2.0 m above Level 1 floor at main exits

Environmental & Planning Services I.C.C.
Document Received

17 Dec 2019

Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

C.4.2 RC1 ASET vs RSET Assessment

Table 25 - RC1 ASET vs RSET Summary

Floor Level	Location[1]	ASET (s)	RSET[1] (s)		ASET > RSET
			Base Case	Non-Base Case	
GF	GF Anchor	>1700	212	202	Yes
	N Circulation[2]	>1700	-	534	Yes
L1	L1 Anchor	1610	285	351	Yes
	Entry to Carpark	1644	285	287	Yes
	L1 Stair 3 Landing[3]	1686	281	273	Yes
	L1 Anchor-S BoH[4]	1615	285	243	Yes
	L0 Stair 3 Landing[5]	1610	298	290	Yes
	L0 Stair 4 Landing[6]	1644	270	276	Yes
	Corridor[7]	>1700	-	1540	Yes
L2	Childcare Centre	>1700	786		Yes

Rev B
Rev B
Rev B

Explanatory Notes:

1) Location is the space represented as nodes in EvacuatioNZ.

2) 'N Circulation' is the node that corresponds to the space precede the final exit from the Zone 2 ground floor mall space and is taken as the node where the last person leaves GF Anchor.

3) 'L1 Stair 3 Landing' is the node that corresponds to the lobby space before entering into Stair 3 which indicates the queuing clear time preceding stair 3.

4) 'L1 Anchor-S BoH' is the node that corresponds to the lobby space before entering into Stair 4 which indicate the queuing clear time preceding stair 4.

5) 'L0 Stair3 Landing' is the node that corresponds to the space precede the final exit from Stair 3 (i.e. time to clear L1 Anchor north stairwell) which is shared by the occupants from L2 Childcare space.

6) 'L0 Stair4 Landing' is the node that corresponds to the space precede the final exit from Stair 4 (i.e. time to clear L1 Anchor south stairwell).

7) 'Corridor' is the node that corresponds to the space precede the final exit from Zone 3 Carpark building.

As shown above in Table 25, ASET is greater than RSET for all locations.

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Appendix D Smoke Barrier (Upper Layer Temperature) Assessment

The following details the assessment of the smoke barrier located between the Anchor building and the adjacent mall/carpark building.

The worst-case scenario is Challenging Fire 2 where the fire is located near the mall opening on the ground floor. The temperature is monitored near the Zone 1 Anchor west elevation.

Table 26 - CF1, CF2 and RC1 Upper Layer Temperature

Challenging Fire	Floor Level	Upper Layer Temperature (°C)
CF1	GF (between Anchor and Mall)	<50
	L1 (between Anchor and Carpark)	<50
CF2	GF (between Anchor and Mall)	<117
	L1 (between Anchor and Carpark)	<30
RC1	GF (between Anchor and Mall)	<40
	L1 (between Anchor and Carpark)	<80

The slice files below in Figure 29, Figure 30 and Figure 31 showed the upper layer temperature against time for CF1, CF2 and RC1.

As shown in Table 26 above and the figures below, the temperature between the ground floor anchor and mall smoke barrier are less than 200°C for the duration of the model run (1700 seconds) for all three scenarios. Thus, it is reasonable to assume the smoke barrier between anchor and mall would remain in place for the duration of the RSET. The temperature between the level 1 anchor and level 1 carpark are also less than 200°C for the duration of the model run for all three scenarios and is reasonable to assume the smoke barrier between level 1 anchor and carpark would remain in place for the duration of the RSET.

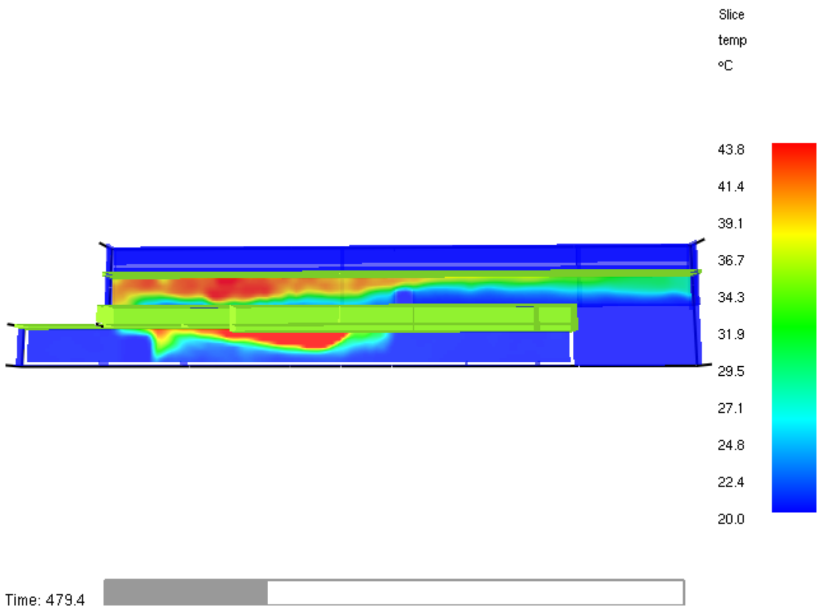


Figure 29 - CF1 Temperature slice file adjacent the west wall at 479 s(worst case)

Environmental & Planning Services I.C.C. Document Received

17 Dec 2019

Building Division

Invercargill City Council Building Consent Authority Approved Site Copy

Approved For Issue 27/02/2020

BUILDING CONSENT NUMBER

2019/1381

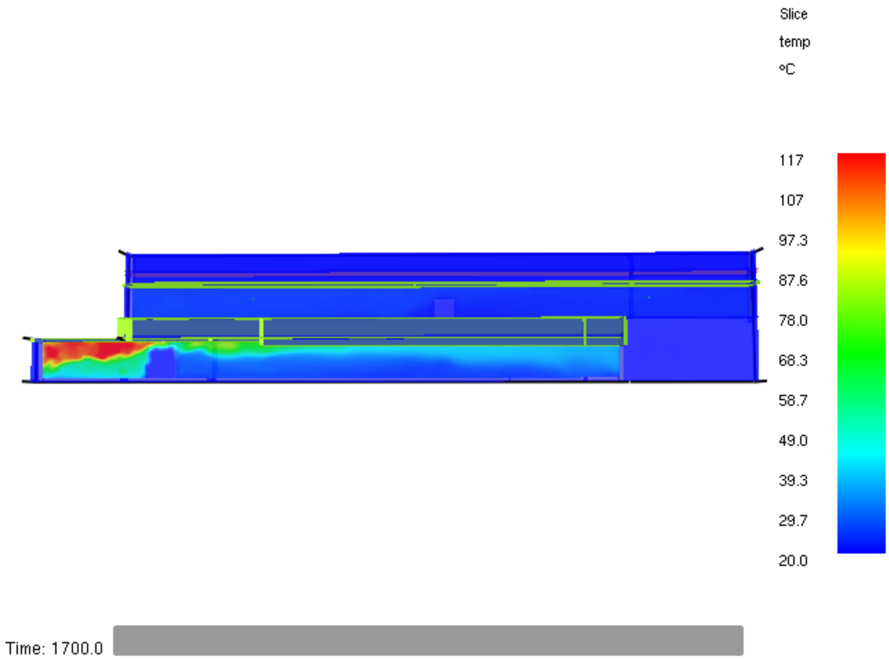


Figure 30 - CF2 Temperature slice file adjacent the west wall at 1700 sec

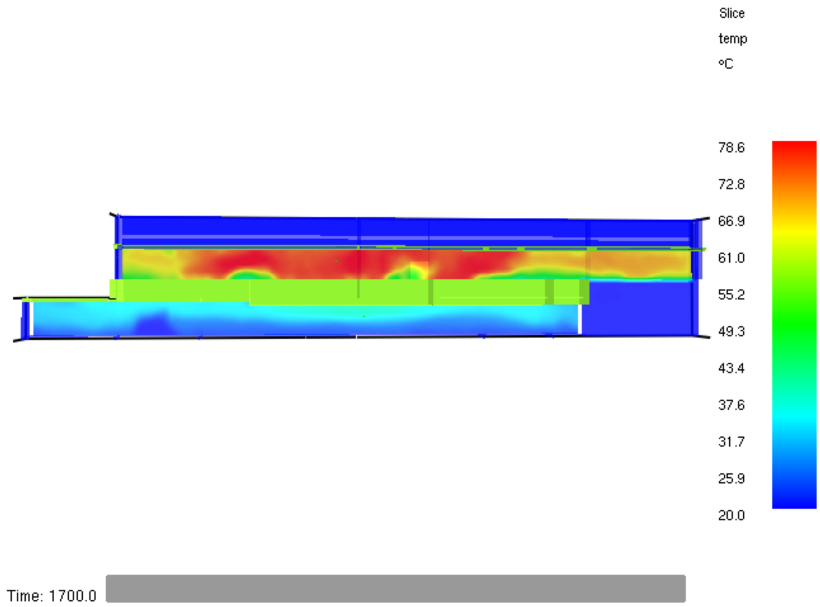


Figure 31 - RC1 Temperature slice file adjacent the west wall at 1700 sec

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Appendix E Correspondence

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Project:	HWCP Invercargill CBD Development	**Design Stage:**	FEB Peer Review
Document:	**Zone 1 (Anchor) Fire Engineering Brief**		**Rev A dated 24 June 2019**
Company:		**Reviewer (s):**	MacDonald Barnett / Michael Dunn

No.	**Item**	**Review Comments Date: 26/06/2019**	**Response Comments Date: 04/07/2019**
1)	BOH Areas Anchor tenant	• The fire design is based on a Class A sprinkler water supply and on this basis there is no requirement for HS fire spread to neighbouring property to be considered. Under C/VM2 this imposes a storage height limit of 3 metres. • How is storage to be managed in the BOH areas of the anchor tenant, or is a fire separation between BOH and retail areas to be provided?	The design for the BOH areas is still under discussion with the proposed tenant. If the storage height exceeds the 3 m limit, fire separation will be provided between the BOH and retail areas. Any such firewall will be 60 min rated. **Date 1-8-2019 MacDonald Barnett** Peer review FEB query closed out
2)	Fire Resistance	• Confirm that Clause 2.5 will be addressed in respect to evaluating fire resistance of the enclosed egress stairs and fire separation between the childcare centre and the remainder of the development.	The fire resistance rating for the anchor stairwells will be assessed either by using burnout calculation or 3 times the RSET as per Clause 2.5. **Date 1-8-2019 MacDonald Barnett** Peer review FEB query closed out

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

Building Division

Invercargill City
Council
Building Consent
Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

No.	Item	Review Comments Date: 26/06/2019	Response Comments Date: 04/07/2019
3)	Challenging Fire 3	• We consider that the zone model with fire modelled in the kitchen should have the adjacent area being modelled as an equivalent area of the adjoining corridor / linkway and not half the entire floor area. Given the building is sprinkler protected it is reasonable to assume that the partitions will remain in place. • Under C/VM2 we believe it is reasonable to model adjacent room /s with the doors open as per C/VM2 2.2.1e.	Noted. The zone model for the childcare will include the kitchen (room of fire origin), central corridor and potentially one more room with tenability measured in the central corridor. Doors connecting these rooms will be modelled as open. We do not fundamentally agree this is necessary under C/VM2 as they will be unrated barriers and therefore no criteria apply to their performance. We are modelling as requested simply to enable us to progress. **Date 1-8-2019 MacDonald Barnett** Peer review FEB query closed out

Environmental & Planning
Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

END OF REVIEW COMMENTS

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Paul Richards
Fire and Emergency New Zealand
Phone: 03 372 8613
Email:
paul.richards@fireandemergency.nz

Amy Chao
Holmes Fire LP
By Email

23 July 2019

Dear Amy,

Re: Fire Engineering Brief for HWCP Invercargill CBD Development (Our Reference: FEB 13041- Rev 1)

Status: Ongoing

Thank you for the additional information provided on the above project. Fire and Emergency understands that the project involves the redevelopment of a whole city block bounded by Tay Street, Dee Street, Kelvin Street and Esk Street.

The complex will consist of two levels of retail and dining tenancies, a multi-level carpark building and an office tower which may form a separate stage. The existing Kelvin hotel on this block is not part of this development, however the existing Readings cinema complex will be connected to the development. With regards to development staging, the complex has been subdivided into multiple zones, namely:

- Zone 1 The anchor tenancy space and the rooftop childcare center
- Zone 2 The ground and first floor mall area
- Zone 3 The carparking building

The complex is intended to operate on an all-out evacuation scheme however smoke detection may operate on a double knock arrangement before alarm activation.

The master FEB is unusual in that it covers only those aspects that are intended to apply to the entire complex. It is effectively a master document and additional FEB documentation is intended to be issued as the project develops.

The Zone 3 FEB covers design aspects (such as design fire locations) that are applicable to the carpark building. The Zone 1 FEB covers design aspects of the anchor tenancy. These documents are intended to be read in conjunction with the Zone 0 FEB.

The FEB report proposes to use C/VM2 to demonstrate that the fire design for the building will meet the performance requirements of the New Zealand Building Code. This letter outlines the Fire and Emergency position as a stakeholder in the building design process.

Environmental & Planning
Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Referenced Information

Item	Title	Date	Revision
Emails	Preliminary meeting and email discussion on fire fighting facilities and requirements for complex	19 October 2018 to 8 May 2019	-
FEB	HWCP Invercargill CBD Development Master Fire Engineering Brief	19 May 2019	A
Meetings and meeting minutes	Two weekly meetings on design progress	Commenced 23 May 2019	-
Peer review correspondence	Fire Peer Review of FEB – HWCP Invercargill CBD Development, Edendale	30 May 2019	-
FEB response	HWCP Invercargill CBD Development Master Fire Engineering Brief response	13 June 2019	-
FEB	HWCP Invercargill CBD Development Zone 3 (Carpark) Fire Engineering Brief	14 June 2019	A
FEB	HWCP Invercargill CBD Development Zone 1 (Anchor tenancy) Fire Engineering Brief	24 June 2019	A
FEB response	HWCP Invercargill CBD Development Master Fire Engineering Brief response	4 July 2019	-

The comments from the peer reviewer are noted and concurred with. Fire and Emergency has reviewed the FEB documentation identified above and offers additional comments in the attached list:

To avoid unnecessary iterations of the FEB process, Fire and Emergency welcomes discussion on any of the above items, however a written response is required for our records. While we recommend that the final revision of the FEB includes all stakeholder comments, the impact of the items identified above are not considered sufficient to warrant a revision of the FEB documentation on their own. However, should additional items be identified by other stakeholders then it is recommended that the FEB be revised to address all issues.

Our review of the information provided has focused on the requirements of C/VM2 and is intended to provide guidance to reduce the consent risks associated with undertaking verification method design. No assessment against the requirements of the acceptable solutions has been undertaken. Also, please note that this advice does not imply a technical verification of the information provided.

If you have any questions related to the above, please do not hesitate to contact me.

Sincerely,

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER

2019/1381

Paul Richards
Fire Engineering Unit

cc:

Steve McCarthy	Steve.mccarthy@icc.govt.nz
Fire and Emergency Engineering Unit	Engineers@fireandemergency.nz
Mike Dunn	miked@macbar.co.nz
Murray Milne-Maresca	Murray.Milne-Maresca@fireandemergency.nz

Attached: FEB comments register

Environmental & Planning Services I.C.C. Document Received
17 Dec 2019
Building Division

Invercargill City Council Building Consent Authority Approved Site Copy

Approved For Issue 27/02/2020

BUILDING CONSENT NUMBER 2019/1381

FEB Comments Register – FENZ ref: FEB 13041		Designers Reference: 136249	
Item	**Fire and Emergency NZ Comment**	**Designers Response**	**Close Out Date**
Building Code Items The following items have been identified as they directly relate to compliance with the Building Code			
Master FEB Comments			
1.1	**4 June 2019 – Project staging** While we acknowledge and support the proposed approach of this FEB we note that some subtleties of the design may only become apparent once more information is available. While the following comments have been made on the basis of the information provided, please note that in specific instances these decisions may have to be revised once greater detail is available. One example of this is the proposal for a medium fire in the carpark zone. While this may be appropriate for the carpark use, it may not be appropriate for the proposed community use of the top floor.	***Note only***	4 June 2019
1.2	**4 June 2019 – Double knock smoke detection** For those areas with smoke detection, please clarify how the proposed double knock detection will be incorporated into the modelling. In addition please clarify how this will work in the event of rooms small enough to have only a single detector.	**13.06.2019** Double knock detection is yet to be confirmed. If double knock system is proposed, the configuration of detectors, noting only one may be present in a space, will be presented in a sketch format in detailed zone FEB for mutual understanding before we proceed.	21 June 2019
1.3	**4 June 2019 – FLED** The FLED drawings indicate that back of house storage areas are to have a FLED of either 400 or 800MJ/m2. Please justify why the storage<3m FLED of 1200MJ/m2 given in C/VM2 Table 2.2 is not proposed to be used.	**13.06.2019** We will address the storage<3m FLED of 1200 MJ/m^2 in the detailed zone FEB. At this stage we believe this is limited to major anchor tenancies only. A Time equivalence sensitivity of retail areas having 10% 1200MJ/m^2 will also be considered.	21 June 2019
1.4	**4 June 2019 – Proposed k_b factor** As discussed in the meeting, please justify the value of 0.065 for the spaces immediately below the carpark given that this floor slab will be insulated for thermal reasons.	**13.06.2019** For the space below the carpark (mall area), we are proposing to do a weighted average FLED and K_b factor. The void between ground floor mall area and the intermediate floor will be considered as a horizontal vent for the purpose of calculation time equivalence for the ground floor space only. Details will be included in the appropriate detailed Zone FEB.	21 June 2019
1.5	**4 June 2019 – Use of B-risk** The proposal to use Q* and shape factor to assess the suitability of B-Risk is noted and concurred with. However be aware that other guidance such as aspect ratio and the 'rules' over the configuration of virtual rooms may also impact on the model set-up and therefore suitability of this tool.	**13.06.2019** If and when B-Risk is proposed, this will be detailed in the zone FEB in sketch format taking into consideration of other guidance not mentioned in the master FEB such as aspect ratio and virtual rooms configuration.	21 June 2019

Environmental & Planning Services I.C.C. Document Received
17 Dec 2019
Building Division

Invercargill City Council Building Consent Authority Approved Site Copy

Approved For Issue 27/02/2020

BUILDING CONSENT NUMBER 2019/1381

FEB Comments Register – FENZ ref: FEB 13041		Designers Reference: 136249	
Item	**Fire and Emergency NZ Comment**	**Designers Response**	**Close Out Date**
1.6	**4 June 2019 – FDS grid resolution** Proposed grid resolution (0.25m near field to 1m far field) noted. Recommended that details to be provided in subsequent zone FEB documents once these developed. Given that D* has not been supported by NIST since November 2015 reference to D* should no longer be relied on to justify an appropriate resolution. A review of the FDS user guide suggests that either a grid resolution study or the use new parameters such as MTR or Wavelet Error Measure (WEM) may be more appropriate.	**13.06.2019** Noted. We are proposing to do grid resolution study to one scenario. Detailed of the grid resolution study will be included in each zone FEB.	21 June 2019
1.7	**4 June 2019 – Factors influencing challenging fire locations** In other mall projects around the country we have observed a number of parameters that impact on the choice of design fire locations. We recommend consideration of these when determining the challenging fire locations particularly for the zone 2 mall FEB. a. Ceiling height within the mall and retail shops b. Width and number of openings into the mall (particularly applicable for corner tenancies). c. Controls or restrictions on the downstand (if any) between the tenancy and the mall concourse. d. The potential of openings between floors within tenancies. e. Proximity to voids connecting to the upper level of retail/dining spaces. While the details of these is unlikely to be available at this time the intention is to highlight the concern and support the future challenging fire locations. We also recommend that the details of these assumptions be clearly documented so that future retail fit-outs may be compared against these design assumptions. This will help confirm if a proposed fit-out lies within the original building assumptions or if additional modelling is required to support that fit-out.	**13.06.2019** Noted. Details of assumptions will be documented in each zone FEB.	21 June 2019
1.8	**4 June 2019 - Modelling of doors** The FEB currently proposes to model external doors as 50% open for the duration of the simulation. While this is appropriate during occupant egress, please justify in accordance with C/VM2 2.2.1(d). Are these doors designed to open for makeup air purposes?	**13.06.2019** Noted. Details of external doors will be clarified in each zone FEB. In general, if the doors are designed to auto open, it applies only to those doors.	21 June 2019
1.9	**4 June 2019 – Smoke control initiation** The FEB currently proposes to model mechanical smoke control with a delay time of 0 seconds and a ramp up time of 30 seconds. We note that the 30 second verification time in C/VM2 is based on the alarm verification and equipment response time requirements of NZS 4512 clauses 204.6 and 204.7. Please discuss the suitability of the times proposed.	**13.06.2019** If the double knock system is proposed, a delay time of 0 seconds is considered reasonable. If a double knock system is not proposed within the building, we will be considering a delay time of 15 seconds. In respect to exhaust fan ramp up times, this is to be detailed in the zone FEB for the appropriate buildings (Zone 1 - Anchor and Zone 2-mall).	21 June 2019

Environmental & Planning Services I.C.C. Document Received
17 Dec 2019
Building Division
Invercargill City Council Building Consent Authority Approved Site Copy
Approved For Issue 27/02/2020
BUILDING CONSENT NUMBER 2019/1381

FEB Comments Register – FENZ ref: FEB 13041		Designers Reference: 136249	
Item	**Fire and Emergency NZ Comment**	**Designers Response**	**Close Out Date**
Zone 3 (Carpark) FEB			
1.10	**3 July 2019 - HS scenario** The zone 3 FEB is ambiguous in that Table 1 indicates that two water supplies for the sprinkler system is being provided whereas section 4.1 indicates that the secondary water supply is no certain. We note that the master FEB was more certain on the two water supplies. Is this a design change? As this impacts on the HS scenario, please clarify.	**04.07.2019** At this stage, dual water supplies is still the proposed design. If the design changes, we will update the assessment on HS scenario.	15 July 2019
1.11	**3 July 2019 - Future retail** We note no consideration of this space at this time. Is this being considered or is this intended to be considered should this occur in the future? Given the floor area of the carpark we recommend consideration of the occupant loads using the stairs and the potential for the occupant load to exceed 1000 people within this zone.	**04.07.2019** Future retail will be considered in the future when this is confirmed. Comments regarding the stairwell noted. We will address this point when the design has confirmed. It is proposed to address the occupant load within the stairwell on a case by case basis as the occupant load within any stairwell is dependant on the location of the fire and the alternative available egress provided to the occupant load. If a challenging fire arise where it forces the occupant load within a certain stairwell to exceed 1000 people, we will assess tenability within the stairwell.	15 July 2019
1.12	**3 July 2019 - Occupant load from other zones** While it is not expected to have a large impact on the results please confirm that for CF2 and CF3, the egress of occupants from zone 1 will be considered., particularly as they will essentially all use the same stair.	**04.07.2019** Yes, the egress of occupants from zone 1 will be considered as per Section 9 of the FEB where we talk about non-base case RSET which includes occupants from Zone 1 and Zone 2. Please also refer to Appendix A updated sketches on egress distributions (page 24-29).	15 July 2019
Zone 1 (Anchor Tenant) FEB			
1.13	**3 July 2019 – Level 1 offices** Does the current layout of the level 1 offices trigger the requirement for a challenging fire scenario in this space? Particularly with regards to the 25m dead end limitation. Please discuss.	**04.07.2019** The office layer is still under design. If the final design reaches the 25 m dead end limitation, challenging fire scenarios will be looked into for the office.	15 July 2019
1.14	**3 July 2019 – Stair fire rating** We note that the stairs in the anchor tenant are provided with different fire ratings. Please clarify the logic of this.	**04.07.2019** The design has changed since the issue of the FEB. We will update the stair fire rating in accordance to the burnout calculation in the fire engineering verification document.	15 July 2019
1.15	**3 July 2019 – CF3** While we take the point that the internal partitions within the childcare centre is unrated, Fire and Emergency questions the appropriateness of modelling the 'supplementary compartment' as a single room. We recommend consideration of three rooms, the kitchen (room of fire origin), one representing the central corridor and the other representing the balance of the smoke reservoir. If tenability is measured in the central corridor, this would provide a reasonable representation of this portion of the building.	**04.07.2019** Noted. The zone model for the childcare will include the kitchen (room of fire origin), central corridor and potentially one more room with tenability measured in the central corridor. Doors connecting these rooms will be modelled as open. We do not fundamentally agree this is necessary under C/VM2 as they will be unrated barriers and therefore no criteria apply to their performance. We are modelling as requested simply to enable us to progress.	15 July 2019

Environmental & Planning Services I.C.C. Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

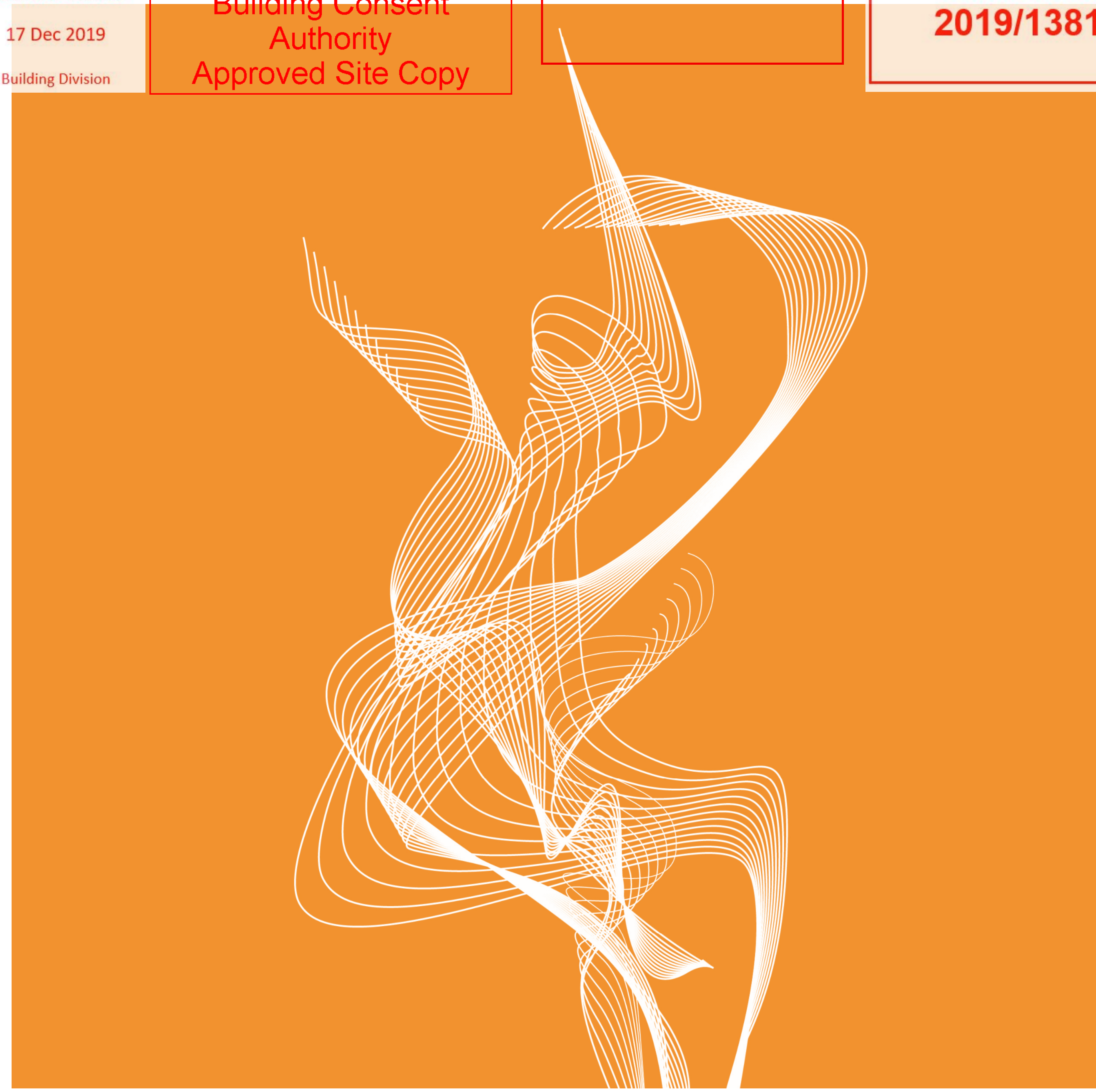
FEB Comments Register – FENZ ref: FEB 13041		Designers Reference: 136249	
Item	**Fire and Emergency NZ Comment**	**Designers Response**	**Close Out Date**
Building Consent Items The following items are considered to be detailed design elements that are considered to be required as part of the consent stage documentation. They have been identified at this stage to avoid delays during consenting.			
2.1	**4 June 2019 – Cause and Effect Matrix** Given the expected building complexity, we recommend that a cause and effect matrix be included in the consent documentation to ensure that the system operates as intended (e.g. smoke extract fans – particularly if zoned and make-up air supplied.	**13.06.2019** A cause and effect matrix will be included in the consent documentation for the appropriate zone.	21 June 2019
2.2			
Compliance with Other Relevant Legislation The following items have been identified to address issues with legislation other than the Building Code.			
3.1			
Other Issues The following recommendations have been made solely as advice for good risk management and are intended for discussion only. They are not required to be addressed to demonstrate compliance with the Building Code or other applicable legislation.			
4.1			

Environmental & Planning
Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City
Council
Building Consent
Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381



Zone 1 – D.S. ANCHOR & Childcare Centre
HWCP Invercargill CBD Development

HWCP Management Ltd

Fire Engineering Strategy

Holmes Fire

Version B
25 September 2019
136249.FES01b.docx

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Holmes Fire
Level 2, 254 Montreal Street
Christchurch Central
PO Box 6718
Christchurch 8442
holmesfire.com

Issue Authorisation

Project: Zone 1 – D.S. ANCHOR & Childcare Centre, HWCP Invercargill CBD Development

Project No. 136249

Version	Date	Status	Prepared	Reviewed
A	03 May 2019	Preliminary Issue	ACC	DXM
B	23 September 2019	For Approval	ACC/DXM	DXM

Version	Extent of Revision

This report caters specifically for the requirements for this project and this client. No warranty is intended or implied for use by any third party and no responsibility is undertaken to any third party for any material contained herein. This report is produced and signed solely on behalf of Holmes Fire and no liability whatsoever accrues to the authors.

The building owner must be aware that the Fire Engineering Strategy described in this report may be alternative solutions to those given by the MBIE Acceptable Solutions or Verification Methods.

New Zealand Building Regulations do not impose specific requirements on a building owner to protect their own property. Consideration of protection of the building owner's property is not included in this design beyond the extent which arises from compliance with the Building Code, unless this has been specifically requested. Accordingly, in the event of a fire, it is possible that the property loss could be significant.

It is assumed that the details of these documents are read and understood. Holmes Fire should be contacted if there are any queries regarding interpretation or meaning of the content. Holmes Fire takes no responsibility for the misinterpretation by others.

Submission of this Fire Engineering Strategy document for Building Consent Authority approval implies full understanding and acceptance of the above.

Written By:

Amy Chao

Written/Reviewed by:

Darin Millar

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Contents

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

INTRODUCTION

The purpose of this report is to determine the minimum fire safety precautions required within the proposed D.S. Anchor & Childcare Centre in HWCP Invercargill CBD Development to demonstrate compliance with Section 17 of the New Zealand Building Act 2004 with respect to the fire regulations.

This is a legal requirement whereby it must be shown that after the completion of works, the objectives of clauses of the New Zealand Building Code relating to means of escape from fire, protection of other property, and structural and fire rating behaviour are satisfied.

This Fire Engineering Strategy report includes a performance based Scope of Works advising of fire safety issues affecting architecture, building services and structure in accordance with the requirements of the New Zealand Building Code. This Fire Engineering Strategy must be read in conjunction with the accompanying fire safety sketches which are marked up on drawings prepared by other consultants.

This is not a 'For Construction' document, but a performance document that is intended to be used by the Architect and other consultants in implementing their detailed designs and preparing their working drawings and specifications. The consultants whose documentation is required to incorporate the requirements of this Fire Engineering Strategy are expected to have read this report, understood the implications as it affects their scope of work, and incorporated the relevant fire requirements into their drawings, specifications, and other construction documents.

SUPPORTING DOCUMENTS

This Fire Engineering Strategy document is one of a suite of documents prepared by the fire engineer:

- Fire Engineering Brief (FEB)
- Fire Engineering Verification (FEV)
- Fire Engineering Strategy (FES) – this document
- Fire Engineering Sketches (ref latest version of FSK sketches).
- Document transmittal

The Fire Engineering Brief outlines what the design intends to achieve, the factors that affect the design solution, and the design methodology and acceptance criteria that are used to verify that the design objectives are met. The FEB does not detail the final design solution.

The Fire Engineering Verification document contains the calculations and engineering background to the fire safety design – the verification showing how the design solution meets the acceptance criteria.

The Fire Engineering Strategy document outlines the fire safety solution for the proposed works and describes the design solution and specific fire safety requirements necessary to achieve the design objectives.

The Fire Engineering sketches (prepared by Holmes Fire) are to be read in conjunction with the Fire Engineering Strategy.

Environmental & Planning
Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

EXTENT OF WORK

This Fire Engineering Strategy covered in this C/VM2 design is the construction of the Zone 1 of HWCP Invercargill CBD development, Invercargill.

The overall development comprises of numerous zones to achieve the completed development. In broad terms the zones are:

- Zone 0 = Overall development consideration.
- Zone 1 = D.S Anchor and Childcare Centre
- Zone 2 = Mall
- Zone 3 = Carpark

Zone 1 is a three-storey structure consisting of a large anchor tenancy occupying the majority of the ground and level 1 space. In the centre of the ground floor are two escalators that lead from the ground floor to level one which creates an open void. Level one is therefore considered as an intermediate floor rather than fully fire separated first floor. Small retail tenancies unrelated to the Anchor, are accessed directly from Esk St.

Level two is proposed to be a childcare centre that is accessed via the adjacent Zone 3 Carpark.

This Fire Engineering Strategy is for the base building design to the extent of proposed works as identified by the Architectural plans used as backgrounds to the Fire Strategy drawings. As a result, all the interactions with Zone2 and 3 are not part of this fire engineering strategy. For greater understanding of the interaction of the Zones and how we demonstrate compliance with NZBC, refer to the Compliance Design Features Report (CDFR). In broad principles, the following is being asked for Building Consent for Zone 1:

- Ground floor and Level one design except for ceilings in the Anchor tenancy area. Without the ceilings, which have been considered in the Fire Engineering analysis, then the specified systems will not be installed to the ceilings but transferred to the separate application for the tenancy fitout.
- Level 2 design except for the outdoor space sun shades, kitchen fitout or associated extract, floor or window coverings. These works are not transferred as their presence and compliance can be addressed independently via a separate building consent application once the works originate.

To augment the ability for Zone 1 to be granted a Building Consent, the CDFR clearly identifies that the intended occupancy at the completion of the Zone 1 Building Consent works is zero occupants, During the analytical fire design (the Verification) for Zone 1 it has been demonstrated that once additional works as identified in current Zones 3 and future Zone 2 are undertaken, that the Zone 1 can be occupied.

WORK BY OTHERS

Access Routes

Escape route widths specified in this fire engineering strategy are the minimum widths for fire safety only, and may not specifically address requirements for access for people with disabilities. Other escape routes features that are not related to fire safety - and hence not specified in this Fire Engineering Strategy - may be required for compliance with Clauses D1 of the New Zealand Building Code.

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Visibility in Escape Routes

The design of systems to achieve compliance with F6 of the NZBC is outside the scope of this report. Any comments in the Fire Engineering documentation for visibility in escape routes are for purposes of assisting the designers responsible for F6 compliance.

The design of systems to provide artificial lighting to escape routes (both internal and external parts) in compliance with G8 of the NZBC is outside the scope of this report. To assist, the fire strategy identifies the intended escape routes.

Wayfinding/Signage

The design of exit signage for compliance with F8.3.3 a) of the NZBC is outside the scope of this report. Any comments in the Fire Engineering documentation for exit signage positioning are for purposes of assisting the designers responsible for F8.3.3 a) compliance.

Structure

Defining the period of fire resistance and fire severity in consideration of C6.2 b, c, and d of the NZBC is addressed by this fire strategy. Identification of the structural systems and its need for structural stability to achieve the performance requirements is to be provided by others. The methodology to achieve the performance is to be provided by others.

Any load bearing walls identified by the structural engineers for the purposes of compliance with C6 have not been annotated onto the fire strategy sketches.

HSNO

This Fire Engineering Strategy does not specifically consider requirements for Hazardous Substances and New Organisms (HSNO). Therefore, clause C5.7 c) of the NZBC is not addressed by this report.

Other

Details and approval of the Evacuation Scheme, are to be provided by others.

DESIGN APPROACH

Parameters

The following key parameters form the basis of this design. These parameters have been verified by the appropriate parties:

1. No unit title or similar other boundary arrangements exist or are proposed [Client].
2. There are no Memorandum of Encumbrances or similar that exist or proposed which relate to fire. [Client]
3. The Building Importance Level is not IL4 or IL5.
4. The fire design is based around a building wide evacuation strategy. The philosophy is further explained in the FES Zone 0 Discussion.
5. There will be immediate evacuation upon detector activation – no double knock or pre-investigation period is considered.
6. No storage in excess of 3m height is to occur. [Anchor tenant]
7. There are no air ducts which include combustible materials, passing through exitways.
8. The activities (including potential storage and associated Fire Load Energy Density as appropriate) for the various areas of the building are as follows:

Environmental & Planning
Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City
Council
Building Consent
Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

- Ground Floor – 800MJ/m^2
- Level one – 800 MJ/m^2
- Level two (Early childhood centre) – 800 MJ/m^2

9. There is no solid fuel, gas burning, and oil fired appliances and open fires, proposed in the works.
10. There are no specific spaces for which the sprinkler system is not permitted to be installed as defined by other disciplines.
11. No upper/subfloor concealed spaces shall be used as an air-handling plenum.
12. At this stage there is no ventilation system that services multiple firecells and therefore in duct detection is not required.

Philosophy

To demonstrate compliance with the relevant fire safety clauses of the Building Code, the following Compliance Documents have been adopted as the design basis:

- C/VM2 – Verification Method: Framework for Fire Safety Design, Amendment 5, 24 November 2017.

FIRE AND EMERGENCY NEW ZEALAND (FENZ)

In accordance with section 46(1) of the Building Act 2004 some kinds of applications for Building Consent must be provided to Fire and Emergency New Zealand for review.

The proposed fire engineering design solution contained herein;

- establishes compliance in accordance with the provisions of an applicable compliance document to the extent required by the Building Act, and

Therefore, under the Gazette we believe this application need not to be forwarded to Fire and Emergency New Zealand for review. HOWEVER – as this project includes a unique CDFR, we encourage this application to be sent to FENZ for consideration. FENZ have been intimately involved in this development and therefore the process should be relatively straight forward.

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

SCOPE OF WORKS

We believe that the proposed work will be in compliance with the objectives of the New Zealand Building Code clauses C1 to C6 Protection from Fire, to the extent required by the Building Act, based on implementation of the following Scope of Works. This is required to be read in conjunction with the Fire Safety sketches.

The Scope of Works below lists the fire safety precautions needed for compliance with the fire safety requirements of the Building Code.

1 FIRE DETECTION, WARNING AND SUPPRESSION SYSTEMS

1.1 Alarm / Detection Systems Requirements

1.1.1 A new supplementary smoke detection alarm system is required to be installed to the full area (including detectors for Electromagnetic Hold Open Devices) as indicated on the Fire Strategy sketches, in accordance with NZS 4512:2010.

> *To be addressed in other applications shall be:*
>
> - *The ground floor and level one smoke detectors, when the ceilings are installed.*
> - *The ground floor and level one manual call points once the fitout of the space is designed.*
> - *The positions of the Fire Control Room (FCR), Sprinkler Valve Room (SVR), all associated infrastructure to make the alarm/detection system functional - being the fire alarm and indicator panels (FAP & FIP)*

1.1.2 In order to provide signal for the release of electromagnetic hold open devices, the relevant detectors shall be within 1.5 m in plan, on both sides of the door.

1.1.3 At the request of the Anchor tenant, a communication cable is to be installed linking the FAP to the tenants security panel in their security office. This is not a specific NZBC item but a request by the tenant.

1.2 Electromagnetic Hold Open Devices

1.2.1 Automatic Hold Open Devices including associated detection devices shall be provided at locations as identified in the fire strategy sketches. They are to be installed to BS 7273.4:2007, or EN 1155:1997.

1.3 Sprinkler System Requirements

1.3.1 A new Type 6 automatic fire sprinkler system is required to be installed throughout the Zone 1 (including external transformer area) in accordance with NZS 4541:2013 with the amendments outlined in Appendix B of C/AS1 to C/AS/6.

> *To be addressed in other applications shall be:*
>
> - *The ground floor and Level one sprinkler system where ceilings are installed (retail space).*
> - *The positions of the Fire Control Room (FCR), Sprinkler Valve Room (SVR), all associated FENZ inlets (FSI & FHI)*

Environmental & Planning Services I.C.C. Document Received

17 Dec 2019

Building Division

Invercargill City Council Building Consent Authority Approved Site Copy

Approved For Issue 27/02/2020

BUILDING CONSENT NUMBER

2019/1381

- *The class A water supply infrastructure (tank and pumps)*

Specifics that are ancillary to NZBC requirements, for information only:

- The sprinkler system for the Zone will have a single isolation valve for all three levels.
- The extent of recessed concealed heads, with white caps is part of a tenant requirement.
- The sprinkler system design will need to cater for the intended use/storage of the tenants.
- There may be no coverage to the Esk street canopy as no external combustible content is expected.
- The rear loading dock canopy shall be provided with sprinklers with a hazard classification equating to the higher of either the sprinkler standard or the largest design density inside the tenancy.
- The expectation of final ceilings extent is important, otherwise the sprinkler head type in a ceiling void could be more than that actually required.

1.3.2 The sprinklers are to have the following operational characteristics in the designated locations:

- Unless noted below all sprinklers are to be quick response (RTI ≤ 50), with an activation temperature (T_{act}) of 68 °C. Any concealed heads must also meet these parameters.
- External sprinklers to cover areas such as the transformer and loading canopies provide sprinklers with standard response and T_{act} being 68 °C.
- Higher rated heads as dicytated by the standard due to the ambient environment.

To be addressed in other applications shall be:

- *The ground floor and Level one sprinkler system where ceilings are installed (retail space) with the characteristics noted above.*

1.4 Alerting Requirements – Alarm Sounder

1.4.1 A new fire alarm sounder system shall be installed throughout Zone 1 in accordance with NZS 4512:2010.

To be addressed in other applications shall be:

- *The ground floor and level one sounders, when the ceilings are installed.*
- *All associated infrastructure to make the alarm/detection system functional - being the fire alarm panel (FAP)*

1.4.2 Provide a Remote Display Unit, or similar, to the Level 3 Childcare facility. The objective of the unit is to easily identify the area of fire original so that the Evacuation Managers of the Childcare facility are more informed than they would be from purely an evacuation alarm. The details of the information is to be developed as part of the Evacuation Scheme design for the tenancy, which will be by others. This feature is considered for facilitating an Evacuation Scheme, it is not considered critical for the NZBC compliance.

To be addressed in other applications shall be:

- *All associated infrastructure to make the RDU functional - being the fire alarm panels (FAP)*

Environmental & Planning Services I.C.C. Document Received
17 Dec 2019
Building Division

Invercargill City Council Building Consent Authority Approved Site Copy

Approved For Issue 27/02/2020

BUILDING CONSENT NUMBER
2019/1381

1.4.3 The functional alerting operation associated with the fire alarm system shall be as identified on the fire strategy sketch Z0 FS 100.

> *To be addressed in other applications shall be:*
>
> - *All associated infrastructure to make the interfaces functional - being the fire alarm panel (FAP)*

1.5 Fire Alarm System Interface Requirements

1.5.1 Functional interface expectations associated with the fire alarm system shall be as identified on the fire strategy sketch Z0 FS 100.

> *To be addressed in other applications shall be:*
>
> - *All associated infrastructure to make the interfaces functional - being the fire alarm panel (FAP)*

1.6 Hydrants

1.6.1 A new internal charged fire hydrant riser is required to be installed as identified on the Fire Safety Strategy drawings in accordance with NZS 4510:2008.

> *To be addressed in other applications shall be:*
>
> - *The positions of the Fire Control Room (FCR), Sprinkler Valve Room (SVR), all associated FENZ inlets (FSI & FHI)*

1.7 Hand Operated Firefighting Equipment

1.7.1 Portable hand operated extinguishers to NZS 4503:2005, are to be provided in the Zone 1 Anchor tenancy to the extent agreed wih the Anchor tenant, but not in excess of the requirements of the standard. These items are not a functional requirement of the New Zealand Building Code.

> *To be addressed in other applications shall be:*
>
> - *The positions of the extinguishers and their type/size .*

2 FIRE AND SMOKE CONTROL SYSTEMS

2.1 Mechanical Smoke Exhaust System

2.1.1 Mechanical smoke extract is required as indicated in the fire strategy sketches to achieve 40m³/s of smoke extract from the space. The system components and controls are to be designed and installed in accordance with AS/NZS 1668.1:2015 and AS 1670.1:2015.

Environmental & Planning Services I.C.C. Document Received

17 Dec 2019

Building Division

Invercargill City Council Building Consent Authority Approved Site Copy

Approved For Issue 27/02/2020

BUILDING CONSENT NUMBER 2019/1381

2.1.2 Make up air is to be provided as shown on the fire strategy sketches. The system components and controls are to be designed and installed in accordance with AS/NZS 1668.1:2015 and AS 1670.1:2015.

To be addressed in other applications shall be:

- *The associated inlet air continuation from the ground floor once the Zone 2 works are imposed. Technically compliance is currently achieved as the neighbouring space is the Zone 3 ground floor area which is open, has no perimeter enclosures.*

2.1.3 A fire fans control panel is required to be design and installed in accordance with AS 1670.1:2015. The FFCP shall be located in the Fire Control room.

To be addressed in other applications shall be:

- *The positions of the Fire Control Room (FCR) and therefore the resulting FFCP.*

2.1.4 Functional interface expectations associated with the fire alarm system shall be as identified on the fire strategy sketch Z0 FS 100.

To be addressed in other applications shall be:

- *All associated infrastructure to make the interfaces functional - being the fire alarm panel (FAP)*

3 ESCAPE ROUTE REQUIREMENTS

3.1 Dimensions

3.1.1 Horizontal escape routes are to have minimum clear widths not less than those outlined in the following table, unless specifically identified otherwise in the fire safety sketches:

Table 1: Horizontal escape route widths

Location	Min. Clear Width[1] [mm]	Min. Clear Door Width Into/Within [mm]
Horizontal egress routes in open path travel with less than 50 people – not an accessible route	700	600
Horizontal egress routes in open path travel with greater than 50 people – not an accessible route	850	760
Horizontal egress routes in open path travel – accessible route	1200	760
Horizontal egress route within an Exitway	1000	875
All entrance doors into an exitway stair	N/A	1600

1. Allowable minor obstructions to the widths noted are as defined by D1/AS1.

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

> *To be addressed in other applications shall be:*
>
> - *All means of escape continuation through the Zone 2 area.*

3.1.2 Vertical escape routes are to have minimum clear widths not less than those outlined in the following table, unless specifically identified otherwise in the fire safety sketches:

Table 2: Vertical escape route width

Location	Min. Clear Width[1] [mm]	Min. Clear Door Width Into/Within [mm]
Vertical egress routes in open path travel with less than 50 people – not an Exitway or an accessible route	850	600
Vertical egress routes in open path travel with greater than 50 people – not an Exitway or an accessible route	1000	760
Vertical egress routes in open path travel – accessible routes.	1100	760
Vertical egress routes within an Exitway	1800	1600

1. Allowable minor obstructions to the widths noted are as defined by D1/AS1.

3.1.3 The clear height of escape routes shall be no less than 2100 mm across the full width (except for isolated ceiling fittings less than 200 mm in diameter, which may project downwards to reduce this clearance by no more than 100 mm).

3.1.4 All doors on escape routes shall have a clear height of no less than 1955 mm for the required width of the opening, open onto a level floor area on both sides of the door, and where side hinged shall open no less than 90° and the door swing shall not reduce the width of any escape route.

3.1.5 Clear widths of doors shall be measured taking into account the door frame and the width of the door. Door hardware is not permitted to intrude into this minimum clear width of a doorway. Measurement method for escape route width and clear door width shall be as indicated in the figure below.

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

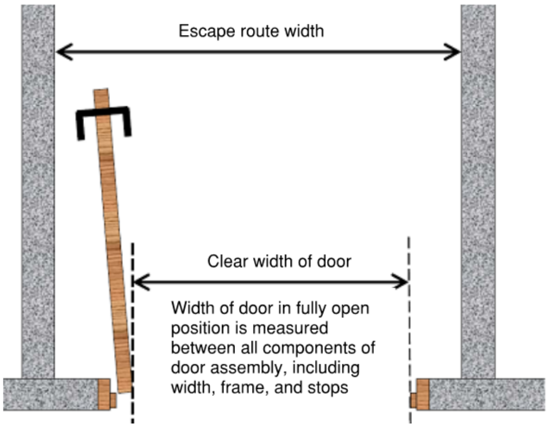


Figure 1 Method of door opening measurements

3.2 General

3.2.1 Vision panels are to be provided to the doors as noted on the fire strategy sketches.

3.2.2 For means of escape provisions, all manually operated doors on escape routes shall have door handles complying with D1/AS1 and door opening forces that do not exceed 67 N to release the latch, 133 N to set the door in motion, and 67 N to open the door to the minimum required width.

3.2.3 Automatic sliding doors on escape routes required on malfunction or power failure to automatically slide open and remain open in an emergency. Integration with this related to the smoke control system and the various hours of trade is identified in the fire alarm interface matrix.

3.2.4 Painting on floors keep clear adopting yellow hatching in accordance with AS 1319:1994 Table A1 to the areas as indicated on the Fire Strategy sketches.

To be addressed in other applications shall be:

- *Paving surfaces so that the application of the painting can be done.*

3.3 Locking Devices/Security

3.3.1 All locking devices on doors on escape routes until reaching the defined place of safety shall be clearly visible, located where such a device would normally be expected, designed to be easily operated without a key or other implement and allow the door to open in a normal manner.

3.3.2 All electronic locking devices on doors on escape routes shall either act under free handle or be fitted with a push button or switch that is fail safe (i.e. independent of any BMS or Security System). The operation must be such that it releases the lock and allows the door to be opened.

3.3.3 Crash bars (Panic Bar Door Hardware - PBDH) are required to doors on escape routes as identified in the fire strategy sketches. The following is proposed for some doors which are noted as having PBDH:

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

- The doors only have push plates – no lever action or PBDH units.
- The doors will be interfaced with the fire alarm system such that if fire alarm is activated during operating hours the doors release any latching.
- In out of hours operations, the doors will not auto release on fire alarm.
- The doors will be fitted with a break glass door release function (addresses any out of hours functionality).
- All doors will be fitted with a manual call point adjacent the break glass alarm – so for what ever reason if occupants are choosing to evacuate and no fire alarm has initiated, then they can release the doors via either manual call point of the door break glass.

3.3.4 If the above is not adopted, then for the PBDH, the associated actuating portion shall consist of a horizontal bar that is not less than half the width of the escape route door leaf and be located between 800 mm and 1200 mm above the floor. The horizontal force is not to exceed 67 N and the door lock is to release allowing the door to swing freely. Doors identified as requiring PBDH but which are auto doors, are deemed to meet this provision.

4 LIGHTING AND SIGNAGE

4.1.1 A new emergency lighting system is required to be installed throughout Zone 1 including associated external escape routes to a safe place, to the extent and in accordance with F6.

To be addressed in other applications shall be:

- *The ground floor and level one coverage, when the ceilings are installed.*
- *Coverage in the neighbouring Zone 2 space.*

4.1.2 A new emergency exit signage system is required to be installed throughout Zone 1 and associated external escape routes to a safe place, in accordance with F8.

To be addressed in other applications shall be:

- *The complete ground floor and level one coverage, when the ceilings are installed.*
- *Coverage in the neighbouring Zone 2 space.*

4.1.3 A specific “Clever evac” exit sign system is to be adopted for the Level two Childcare centre such that “no exit” is identified as per the fire alarm interface matrix.

4.1.4 Signage for the fire related safety features is required to be installed throughout the Zone 1 in accordance with F8.

4.1.5 Wherever deemed practical, it is recommended that fire rated or smoke rated wall separations are to be marked within ceiling voids, where no ceilings and aesthetically deemed acceptable in non ceiling areas, with a visible annotation stating “Fire wall (xx)/xx/xx sm, all penetrations to be fire stopped.” Where xx is the period of fire or smoke rated from the fire strategy sketches. This is over and above the NZBC requirements.

Environmental & Planning Services I.C.C. Document Received

17 Dec 2019

Building Division

Invercargill City Council Building Consent Authority Approved Site Copy

Approved For Issue 27/02/2020

BUILDING CONSENT NUMBER 2019/1381

5 CONTROL OF INTERNAL HAZARDS INCLUDING SURFACE FINISH REQUIREMENTS

5.1.1 Throughout the Zone 1 internal surface finishes shall meet the following early fire hazard indices limitations (when tested to ISO 9705:1993 as per C/VM2 Clause A1.2, or ISO 5660:2002 as per C/VM2 Clause A1.3). Refer to Clause 5.1.2 for exceptions.

Table 3: Group Number limitations

Building Elements	Location	Maximum Material Group
Ceilings and walls	Exitways (stairwells)	2
Ceilings	Crowd spaces	2
Walls	Crowd spaces	3
Ceilings and walls	All other occupied spaces (offices/store)	3
HVAC ducts	Internal surfaces	2
	External surfaces	3
Acoustic treatment and pipe insulation	Within air handling plenum	3

5.1.2 Note surface finish controls do not apply to:

- Small areas of non-conforming product within a space with a total aggregate surface area not more than 5.0 m^2.
- Electrical switches, outlets, cover plates and similar small discontinuous areas.
- Pipes and cables used to distribute power or services.
- Handrails and general decorative trim of any material such as architraves, skirtings and window components including reveals, provided these do not exceed 5% of the surface area of the wall or ceiling to which it is attached.
- Damp-proof courses, seals, caulking, flashings, thermal breaks and ground moisture barriers.
- Timber joinery and structural timber building elements constructed from solid wood, glulam or laminated veneer lumber. This includes heavy timber columns, beams, portals and shear walls not more than 3.0 m wide, but does not include exposed timber panels or permanent formwork on the underside of floor/ceiling systems.
- Individual doorsets.
- Continuous areas of permanently installed openable wall partitions not more than 3.0 m high and having a surface area of not more than 25% of the divided room floor area or 5.0 m^2, whichever is less.

To be addressed in other applications shall be:

- *The ground floor and part level one compliance because a stahlton floor system if exposed in the public area would not achieve GN2, but once the ceiling installed compliance achieved.*

5.1.3 The correlation of wall and ceiling surface finishes derived from Australian or European classifications to the Group Number requirements of NZBC Clause 3.4(a) can, without the need for further testing, be taken as described in the following.

Environmental & Planning Services I.C.C. Document Received
17 Dec 2019
Building Division

Invercargill City Council Building Consent Authority Approved Site Copy

Approved For Issue 27/02/2020

BUILDING CONSENT NUMBER 2019/1381

Table 4: Australian or European correlations

Group Number to NZBC Clause C3.4(a) using ISO 9705:2003	Australian Group Number to NCC Specification C1.10 Clause 4 using AS ISO 9705:2003	European Classification to EN 13501-1:2007+A1:2009
1S	Group 1, and a smoke growth rate index not more than 100	Class A1, A2 or B and smoke production rating s1 or s2
1	Group 1	Class A1, A2 or B
2S	Group 2, and a smoke growth rate index not more than 100	Class C and smoke production rating s1 or s2
2	Group 2	Class C
3	Group 3	Class D

5.1.4 Any foamed plastic building materials or exposed combustible insulating materials forming part of a wall, ceiling or roof system are required to have a completed system (foamed plastic and/or foamed plastic plus a surface lining) meeting the above maximum material group number as applicable for the location of this building material. In addition, the foamed plastic is to meet the flame propagation criteria as specified in latest versions of AS 1366. It is strongly recommended that foamed plastic materials are not used wherever practical.

5.1.5 Throughout the Zone 1, flooring shall meet the following critical radiant flux limitations (when tested to ISO 9239-1:2010).

Table 5: Critical flux limitations for flooring.

Area of Building	Minimum Critical Radiant Flux [kW/m^2]
Exitways (stairwells)	2.2
All other spaces	1.2

5.1.6 Throughout the Zone 1, any suspended flexible fabrics shall have a Flammability Index of no greater than 12 (when tested to AS 1530.2).

5.1.7 Throughout the Zone 1, any flexible fabrics used as underlay to roofing or exterior cladding that is exposed to view, shall have a flammability index of no greater than 5 (when tested to NZS/AS 1530.2:1993).

5.1.8 Throughout the Zone 1, downlights are required to be designed and installed to C/AS1 to C/AS6 Part 7 and the manufacturer's requirements or alternatively, downlights can be considered to have achieved compliance with C2.2 if compliance is demonstrated using the Electrical (Safety) Regulations and subject to a condition of consent.

5.1.9 At the completion of the installation of the lighting, in particular downlights, shall be achieved by a Declaration of Conformity by a Registered Electrician.

Environmental & Planning Services I.C.C. Document Received

17 Dec 2019

Building Division

Invercargill City Council Building Consent Authority Approved Site Copy

Approved For Issue 27/02/2020

BUILDING CONSENT NUMBER

2019/1381

6 FIRE AND SMOKE SEPARATIONS

6.1 Internal Passive Fire and Smoke Separations

6.1.1 Throughout the Zone 1, bounding construction (walls and floors) shall achieve a fire resistance rating as noted on the fire strategy plans.

6.1.2 The nominated internal and external fire ratings need not have the insulation rating applied.

6.1.3 Firecells are as indicated in the fire strategy sketches. The firecells are generally described as:

- Childcare Centre on the second floor;
- Each of the exitway stairs;
- Lift shafts as noted
- Remainder of the Zone 1

The ground and Level 1 including their interaction with Zone2 and Zone 3 is essentially one firecell except as noted above. Openings at floor slabs in Zone 1 for the reticulation is to be kept to a minimum, effectively treated as a smoke barrier around the service.

6.1.1 The vertical risers being the stairs and lift shaft as indicated on the fire strategy drawings, are required to be enclosed with two-way fire rated constructions that achieve a FRR of no less than that identified in the fire strategy sketches as a vertical shaft.

6.1.2 Vertical fire separations are required to be continuous from the ground or floor slab below, to either:

- the underside of the fire rated floor slab above, or
- the fire rated ceiling above, or
- underside of the roofing material.

6.1.3 The horizontal fire separations which separate firecells, are required to extend to the inside face of the external cladding.

6.1.4 The fire separations for the purposes of floors which do not divide firecells shall have a structural stability rating of 30min . Openings between floors for the escalators are expected – other openings are to be addressed as per above even though Ground and Level one is one firecell. As an example, large openings around service penetrations may be filled with intubatt/rockwool material to act as a suitable barrier.

6.1.5 Assemblies of construction to achieve the fire resistance rating performance must be tested in accordance with AS 1530.4:2005, or NZS/BS 476:1987 Parts 21 and 22, or EN 1363 Part 1:1999.

6.1.6 The fire rated glazing required is limited to those associated with the fire doors.

6.1.7 Throughout the Zone 1, smoke separation as indicated in the fire strategy sketches shall achieve the performance with the construction/materials meeting the following:

1. Be a smoke barrier complying with BS EN 12101 Part 1:2005, or
2. Consist of rigid building elements capable of resisting without collapse:
   a. a horizontal pressure of 0.1 kPa applied from either side, and
   b. self-weight plus the intended vertically applied live loads; and

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

3. Form an imperforate barrier to the spread of smoke, and
4. Be constructed of non-combustible materials or achieve a fire resistance rating of (10)/10/- sm, except that non-fire resisting glazing may be used if it is toughened or laminated safety glass.
5. It is acknowledged that duct openings may be present in a smoke barrier – in these circumstances they are to be considered as a fire barrier to achieve a -/10/- rating.
6. As an example, large openings around service penetrations may be filled with intubatt/rockwool material to act as a suitable barrier.

6.2 Fire/Smoke Doors, Panels and Hatches

6.2.1 All doors within fire separations (excluding lift landing doors) are required to be certified fire rated door-sets complying with NZS 4520:2010 that achieve a FRR of no less than -/xx/-, where xx is the fire resistance rating of the separation the door is to be installed within.

Fire doors are to include self-closers and smoke seals to the top and both side edges of the door leaf or the door frame (and in the latter option, where the door is multi-leave smoke seals are also to be provided at the meeting stile).

6.2.2 The fire doors may have vision panels of no greater than 65,000 mm^2 using non-insulated glass.

6.2.3 Lift landing doors within fire separations are required to achieve an FRR of no less than -/XX/- or as noted on the fire strategy sketches with the explicit note that they need only achieve integrity rating. The doors shall be certified as a one-way fire rating from the landing side to the shaft.

6.2.4 Any access panels or hatches within fire separations are required to be certified to AS 1530.4:2005 to achieve an FRR of no less than -/xx/xx.

6.2.5 All doors (except lift doors) within fire separations are required to be fitted with door closers and smoke seals to the top and vertical edges.

6.2.6 All doors in smoke separations as indicated in the fire strategy sketches shall meet the required performance with the construction/materials meeting the following:

1. Be constructed of non-combustible materials or achieve a fire resistance rating of (10)/10/- sm, except that non-fire resisting glazing may be used if it is toughened or laminated safety glass.
2. Provided with smoke seals which are in continuous contact with the mating element, and located to minimise interruption of hardware.
3. Have frames constructed of non-combustible materials such as aluminium or steel.
4. Have maximum average clearances (excluding pre-easing) of 3 mm between leaf to frame, 5 mm leaf to leaf, and 10 mm leaf to top of any floor covering.
5. Be fitted with door closers.
6. If vision panels present, then the cutout no closer than 150 mm from the leaf edges.

Environmental & Planning Services I.C.C. Document Received

17 Dec 2019

Building Division

Invercargill City Council Building Consent Authority Approved Site Copy

Approved For Issue 27/02/2020

BUILDING CONSENT NUMBER 2019/1381

6.3 Closures and Penetrations in Fire and/or Smoke Separations

6.3.1 All penetrations through fire separations (created by wires, cables, pipes, flush boxes, etc.) or any gaps, or control joints, are required to be fire stopped with systems (collars, wraps, sleeves, mastics, etc.) that are approved for the proposed use (e.g. rating, orientation, penetration type, construction type) in accordance with AS 1530.4 2005 and AS 4072.1:2005. Where fire stopping systems to AS 4072.1 :2005 are not able to be provided, it is acceptable to incorporate systems tested to BS EN 1366.3:2009, or UL 1479. Fire stopping systems are required to be installed strictly in accordance with the manufacturer's instructions.

6.3.2 Specifically note that the Level one floor is not a firecell separation and therefore sealing of penetrations is not required. However – to mitigate the paths for smoke migration any opening that is not within a riser, must be "smoke sealed" with a non combustible product.

6.3.3 Penetrations shall be supported to resist movement or collapse during fire. Supports shall not prevent normal expansion and contraction of the penetration.

6.3.4 Throughout the building, fire dampers are required to be installed where HVAC ductwork penetrates through fire separations (and smoke barriers as noted above). Dampers are to be installed in accordance with AS 1682.2:1990 and the manufacturer's instructions.

6.3.5 Each relevant services contractor will be required to submit details of the proposed fire stopping systems for review, prior to installation on site. Care should be taken to select and submit details that have been tested in the relevant wall/floor construction.

The details need to:

- identify the substrate, service and associated fully detailed solution
- solution system manufacturer/supplier
- demonstration of the certification of fire resistance rating for the complete system in accordance with a relevant standard
- test data may be required to verify performance of these systems

6.4 Structural Considerations

6.4.1 The Structural Engineer is required to identify the *primary elements* that provide support to the fire rated construction. The primary elements shall either:

1. Inherently achieve the structural adequacy, integrity, and insulation component of the fire rating as appropriate, or
2. Have applied treatment or fire protection to achieve the adequacy component of the fire rating as appropriate.

6.4.2 Primary elements are required to achieve a fire resistance rating for structural adequacy of not less than the fire rated construction elements they support. The separation elements are identified in the fire strategy sketches and in the body of the fire strategy.

6.4.3 Fire rated construction that are for protection of fire spread to other properties (i.e. external walls, internal building elements separating different titles) shall achieve structural *stability* during and post fire.

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

7 FIRE AND EMERGENCY NEW ZEALAND (FENZ)

7.1 Access

7.1.1 FENZ vehicle appliance access is required to the FENZ attendance point within the site boundary (as distinct from a location on a street frontage). The associated pavements for vehicle access situated on the property which provide vehicular access by fire appliances shall:

- The positions shall provide access to within 20 m of the firefighter access into the building and any associated inlets.
- 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
- Be trafficable in all weathers, and
- Have a minimum width of 4.0 m, and
- 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.

To be addressed in future applications shall be:

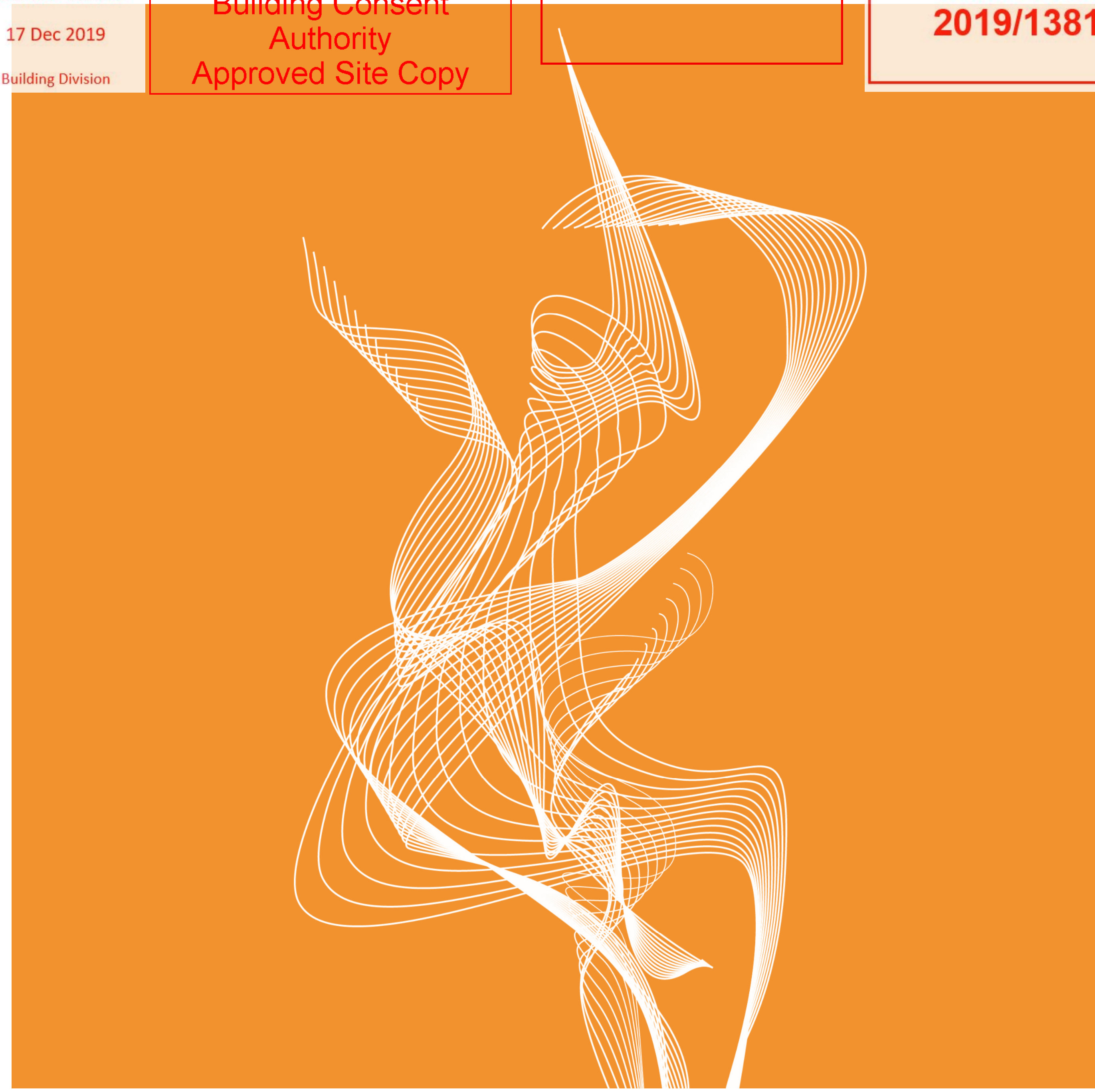
- *The positions of the Fire Control Room (FCR), Sprinkler Valve Room (SVR), all associated FENZ inlets (FSI & FHI)*
- *The positions of the Fire Control Room (FCR), Sprinkler Valve Room (SVR), all associated infrastructure to make the alarm/detection system functional - being the fire alarm and indicator panels (FAP & FIP)*

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381



Zone 1 – D.S. ANCHOR & Childcare Centre
HWCP Invercargill CBD Development

HWCP Management Ltd

Design solutions for Passive Fire Rated Systems for services

Holmes Fire

Version B
23 October 2019

Environmental & Planning
Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Issue Authorisation

Project: Zone 1 D.S Anchor and Childcare Centre, HWCP Invercargill CBD Development

Project No. 136249

Version	Date	Status	Prepared	Reviewed
A	21 October 2019	For Approval	DXM/TM	DXM
B	22 October 2019	For Approval	DXM/TM	DXM

Version	Extent of Revision
B	Minor adjustments in solutions

This document caters specifically for the requirements for this project and this client. No warranty is intended or implied for use by any third party and no responsibility is undertaken to any third party for any material contained herein. This specification is produced and signed solely on behalf of Holmes Fire and no liability whatsoever accrues to the authors.

New Zealand Building Regulations do not impose specific requirements on a building owner to protect their own property. Consideration of protection of the building owner's property is not included in this design beyond the extent which arises from compliance with the Building Code, unless this has been specifically requested. Accordingly, in the event of a fire, it is possible that the property loss within unsprinklered buildings could be significant.

It is assumed that the details of these fire safety documents are read and understood. Holmes Fire should be contacted if there are any queries regarding interpretation or meaning of the content. Holmes Fire takes no responsibility for the misinterpretation by others. Submission of this Passive Fire Protection Specification document for Building Consent implies full understanding and acceptance of the above.

This document is intended for the use of a Specialist fire stopping contractor that has been engaged by either the client or the Main contractor. If this is not the case and the passive fire protection is being attempted by the individual sub trades or the Main contractor, then thought must be given to the extra costs associated with the higher level of Engineer engagement through construction monitoring and design advice that this type of approach inevitably requires.

Regardless of whether a specialist is engaged or not (highly recommended), it is IMPORTANT that this document is read during a round table discussion with the Engineer, Main contractor and all the Sub trades prior to first fix of building services.

It is expected that the dissemination of this document to the relevant sub trades is done by the Main contractor (or client) in a timely manner, as improper sequencing can significantly affect the delivery of compliant fire stop systems.

This document is meant to be read in conjunction with the Holmes Fire report

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

GENERAL REQUIREMENTS & CLARIFICATIONS

GENERAL

A1.1 The solutions presented herein are derived from manufacturer's literature, consisting of Technical Datasheets, and/or Test Reports, and/or Appraisals by Certified Bodies. They are to form the basis of Tender and Construction as applicable.

A1.2 The solutions presented are by no means exhaustive and are not to be construed as meaning only the presented solutions should be considered compliant. However, the solutions specified in this document have been carefully chosen by looking at several criteria, and more than just price or adherence to a standard.

A1.3 Substitution of a specified solution is allowable only if site conditions make that specified system unachievable. The Sub-contractor is to state why the substitution is necessary, what solution is being proposed instead and if required provide that solutions manufacturer's literature. This includes Technical Datasheets, Fire Test Certificates and where possible Fire Test Reports. Alternatively, the Fire Protection Associations product register can be used as a source of compliant solutions. The Engineer will review the potential alternative and notify acceptance upon agreement, with the substitution triggering a revision update to this document.

A1.4 Penetrations shall be supported to resist movement or collapse during fire. Supports shall not prevent normal expansion and contraction of the penetration.

A1.5 Not withstanding the above, care should be taken to select and submit details that have been tested in the relevant wall/floor construction.

The details need to:

- identify the substrate, service and associated fully detailed solution
- solution system manufacturer/supplier
- demonstration of the certification of fire resistance rating for the complete system in accordance with a relevant standard
- test data may be required to verify performance of these systems

A1.6 If no off the shelf tested solution is available for a passive fire stop issue and an Engineering Judgement (EJ) is required then the Sub-contractor is to organise, in conjunction with a reputable manufacturer, an alternative solution. This alternative solution should come with the documents outlined in A1.3 that show that in a similar or close to situation compliance was reached. The Engineer will review the potential alternative and notify acceptance upon agreement, with the EJ triggering a revision update to this document.

CARE TO BE TAKEN

A2.1 The Sub-contractors shall take all due care to ensure that no consequential damage occurs as a result of the works being carried out in the premises. Where necessary, protective covers shall be used to protect finishes, fittings and plant equipment.

A2.2 All work areas are to be thoroughly cleaned before the application of firestop solutions. This is particularly important for sealants, as they MUST bind to the substrate that are applied to.

Environmental & Planning Services I.C.C. Document Received
17 Dec 2019
Building Division

Invercargill City Council Building Consent Authority Approved Site Copy

Approved For Issue 27/02/2020

BUILDING CONSENT NUMBER
2019/1381

INSPECTIONS, ACCEPTANCE AND FINAL COMPLETION

A3.1 The works shall be made available for inspection by the Engineer or their representative at appropriate times during the construction, to enable the Engineer or their representative to undertake a level of construction monitoring of the fire stopping systems, conducive to ascertaining whether completion of the works has been achieved and whether a PS4 Producer Statement for Construction can be issued. The construction review will entail visual inspection of fire stopping and associated quality control systems and documentation, and destructive testing of random samples of typical firestop installations. Making good following destructive testing will be done at the cost of the installer.

A3.2 Any works that have not been made available for inspection by the Engineer or do not meet the requirements of the Specification, appropriate Standards and/or legislation shall be made accessible and/or made good at no cost to the Principal.

A3.3 Upon completion the Sub-contractor shall provide a Producer Statement (Construction) stating they have installed all fire stopping in accordance with this Specification and manufacturers' instruction.

A3.4 The Producer Statement shall be issued by persons competent to attest that the fire stopping systems meet Standards and Statutory requirements and that understand the liabilities of non-conformance. They should be able to be on the local council's Producer Statement Authors list.

A3.5 In order to obtain Practical Completion the Sub-contractor shall obtain a PS4- Producer Statement (Construction) from The Engineer, who is to observe the fire stopping installations in accordance with the Standards and Statutory requirements.

A3.6 The Sub-Contractor is required to keep a record of the installation of fire stop systems. This information needs to be presented as a "Schedule of Works" as per the relevant standards guidance (AS4072.1). **Additionally, this schedule of works is to accompany a marked-up plan indicating where the firestop installations are located.** At completion of fire stopping the service the Sub-contractor is to make allowance to place an identification label adjacent to the penetration. The locating of these signs and their style is to be agreed by The Engineer prior to undertaking the works.

A3.7 Every penetration is to be photographed, and if it is a through penetration both sides of the penetration are to be photographed. These photos are to form part of the Schedule of Works. These photos are to be taken AFTER an installation label has been attached as per the requirement outlined in A3.6.

A3.8 Supply of the above certificates shall be part of the Contract requirements and final payments shall/may not be considered until ALL necessary certificates have been supplied.

SUB-CONTRACTOR RESPONSIBILITIES

A4.1 The Sub-Contractor shall coordinate with the Main contractor and other trades to ensure that their systems do not interfere with each other's fire stop solutions, particularly in areas where differing trade services are in close proximity to each other such as riser shafts or firewalls. Care needs to be taken in riser shafts and wall penetrations shared by different trade services. Minimum space constraints between services must be considered at this time.

A4.2 The Sub-contractor shall take particular care to avoid placing their services too close together or too close to another trades, so that a tested fire rated fire stopping solution may be applied.

Environmental & Planning Services I.C.C. Document Received
17 Dec 2019
Building Division

Invercargill City Council Building Consent Authority Approved Site Copy

Approved For Issue 27/02/2020

BUILDING CONSENT NUMBER
2019/1381

A4.3 The Main contractor needs to be informed of all the penetration types and is required to allocate the areas where each trade may make their penetration(s). Any services placed without the approval of the Main contractor is to be removed and relocated at no expense to the Principal. Any remedial costs will also be borne by the trade making the penetration without prior approval. Alternatively, it may be determined the fire separation can be modified to account for the service being placed in an untimely manner, however associated costs of the Engineers time, and the additional costs of the fire stopping method will be passed to the contractor at fault to pay.

A4.4 The Sub-contractor is responsible for placing their services in a manner that it can be fire stopped. For example, cable bundles, pipes and conduits must be brought through the fire separation perpendicular to the fire separation. Cable bunches must be kept less than 100 mm in diameter and at least 150mm apart. Any services run at an angle through a fire separation are to be removed and reinstated in a compliant manner and the fire separation made good at the contractor's expense.

A4.5 The Sub-contractor is not to run their service before being instructed to by the Main contractor. Any service run prior to suitable wall framing and/or linings being provided may need to be removed and reinstated once the linings and/or openings are in place at no cost to the Principal. The Engineer may determine an alternative method of fire stopping can be applied, in which case the Engineers time and any additional or associated costs of the alternative fire stopping method are required to be met by the Sub-contractor and may be retained from the contract amount for this purpose.

A4.6 Separate trades are to avoid sharing penetrations, unless prior approval is given by the Main contractor. In no instance shall any other service be run in the same opening allowed for fire dampers and sprinkler pipes. It is with note, that fire stopping solutions for penetrations containing multiple penetrations may incur greater costs (and greater penetration opening sizes) and these additional costs will be passed to the contractors concerned.

A4.7 The Sub-contractor is responsible for supporting their services on both sides of a fire separation (whether it be a floor or a wall) from the building structure. Supports shall be consistent with the relevant design standard for the services being installed (e.g. AS/NZS 3500.2 for plumbing pipes, AS/NZS 3000 for wiring, NZS 4541 for sprinkler pipes) but, with the first support either side of the penetration being within the limits stated on the fire stopping solution drawings. Wiring is required to be supported by a catenary system or cable tray system. Catenary systems (wires) are not to penetrate through a fire separation. They must terminate at the face of the separations.

DISCLAIMERS

A5.1 Acoustic Requirements

A5.1 The solutions contained herein make no reference to acoustic performance. Should walls and/or floors require a certain acoustic performance as specified on Architectural Plans and/or Specifications or by the Principal, the contractor is to notify the Engineer where this occurs along with the proposed fire stopping solution(s) to be adopted, so that acoustic performance can be investigated, and a suitable instruction issued.

A5.2 Environment

A5.2.1 The solutions contained herein are for internal environments only that are typically maintained at temperatures between -5 °C and + 70°C and with no exposure to rain and no exposure to UV.

Environmental & Planning Services I.C.C. Document Received

17 Dec 2019

Building Division

Invercargill City Council Building Consent Authority Approved Site Copy

Approved For Issue 27/02/2020

BUILDING CONSENT NUMBER

2019/1381

A5.2.2 Furthermore, Hilti CFS-C P fire collars and CFS-SL speed sleeve solutions are restricted to internal environments that do not include high humidity (e.g. not humidity class 5 in accordance with EN ISO 13788) and are not to be used where temperatures may be expected to fall below 0°C.

A5.2.3 Where systems include fire mastic, the manufacturer's instructions are to be followed with regard to temperatures to be maintained during the curing period. Typically, temperatures are to be maintained at above 8°C and full curing typically takes 1 day for every mm depth of mastic.

A5.2.4 Should fire stopping of services be in areas outside the above restrictions, the contractor is to notify the Engineer so that a suitable detail may be sourced, and a suitable instruction issued.

A5.3 Seismic

A5.3.1 The fire stopping solutions detailed herein are for low movement scenarios and do not include consideration to required clearances around services with regards to requirements of structural/services standards such as NZS 4219. It is assumed required clearances around services will be detailed within the Services Specification and/or plans. Where a solution contained herein is not able to be used for the required clearances between the services and the floor or wall, the contractor is to contact the Engineer so that a suitable detail may be issued.

A5.4 Floor Slab junctions to external walls

A5.4.1 Fire stopping solutions at the interface of floor slabs and exterior cladding and/or curtain walls are outside the scope of this Specification. Such systems are expected to have been co-ordinated between Consultants and detailed within the Architectural Specifications and/or drawings. If required, we can be engaged to undertake a review of these gaps and advise accordingly.

A5.5 Fire Dampers

A5.5.1 The nomination of a manufacturer and the installation of fire dampers is outside the scope of this Specification. However, fire separations must be viewed by Holmes as have being correctly prepared for the damper installation. New fire dampers are to be installed by the Mechanical Services contractor in accordance with AS 1682 and the manufacturer's instructions.

A5.6 Electrical flushboxes

A5.6.1 Appropriate treatment via intumescent pads or similar to the manufacturers detail shall be dealt with by the appropriate installation trade.

A5.7 Fire separation junctions

A5.6.1 Fire stopping solutions at the interface of fire separations with other elements of construction are outside the scope of this Specification. Such systems are expected to have been co-ordinated between Consultants and detailed within the Architectural Specifications and/or drawings. If required, we can be engaged to undertake a review of these gaps and advise accordingly.

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER

2019/1381

FIRE STOPPING SOLUTIONS

B1.1 Light Weight Fire Separation Walls

B1.1.1 The majority of fire stopping solutions developed and tested for use in plasterboard lined walls (timber or steel framed) are for countries that include higher fire rating requirements than New Zealand and as such incorporate wall types that achieve a 120 minute FRR and thus have 2 x 13 mm (or 2 x 12.5 mm) or 1 x 19 mm plasterboard linings on both sides of the wall.

B1.1.2 The sub-contractor is required to provide marked-up plan to the Main contractor, identifying the location they wish to penetrate the fire separation wall, and what the service is and the proposed method of fire stopping if they are responsible for it.

B1.1.3 The Main contractor, upon review of the sub-contractors marked up plans is to provide the necessary framing and linings in the areas to be penetrated.

B1.1.4 In most above ceiling instances, the Main contractor is required to provide designated areas where services are to be run. These designated areas are required to include additional framing to cut down the wall cavity area around the services. Single lined walls may require an additional layer of wall lining on the single line side (referred to as the "localised patch") to bring the wall lining thickness up to no less than 26 mm both sides of the wall. These localised patches can either be external or internal.

B1.1.5 All sheet edges of the specified wall linings must fall on framing. The localised patch must span from stud to stud and be fixed into the framing. This means any slots or cuts made in plasterboard to accommodate service penetrations must have wall framing behind them for the plasterboard to be adequately fixed, and so that the wall maintains its fire performance. Any back blocking needs to be mechanically fixed to the framing. Under no circumstances is the weight of any back blocking or framing to be carried by the plasterboard.

B1.1.6 It is preferred that any fire wall linings and localised patches are installed in the vicinity of the service penetration prior to the service being run. This requires thought around sequencing, and if it is not possible then services installed prior to the wall framing or lining must be framed around as per B1.1.5.

B1.1.7 Openings made in plasterboard walls for hydraulic and electrical/data services must be made with the appropriately sized hole saw that allows for any annular gap requirements that a fire stop system may have.

B1.1.8 For fire stopping solutions that require an opening through the wall that is framed and lined through the wall cavity, the Main contractor is required to provide the framing and the linings through the wall cavity, as well as providing the localised linings of the fire separation wall (as described above). The openings are to be fully framed and lined with the same plasterboard as the wall (e.g. wall is 13mm the opening must be 13mm, if the wall is 2 x 13mm then the opening must be trimmed with 2 x 13mm).

Ideally, services are not permitted to be run prior to the wall linings and/or trimmed opening being installed.

B1.1.9 No services are to penetrate seismic joints or deflection head joints. Service penetrations on walls with deflection heads are to be far enough away from the head to ensure that the firestop system used is in no way impacted by the action of the deflection head.

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

B1.1.10 Localised patches are to be applied as follows:

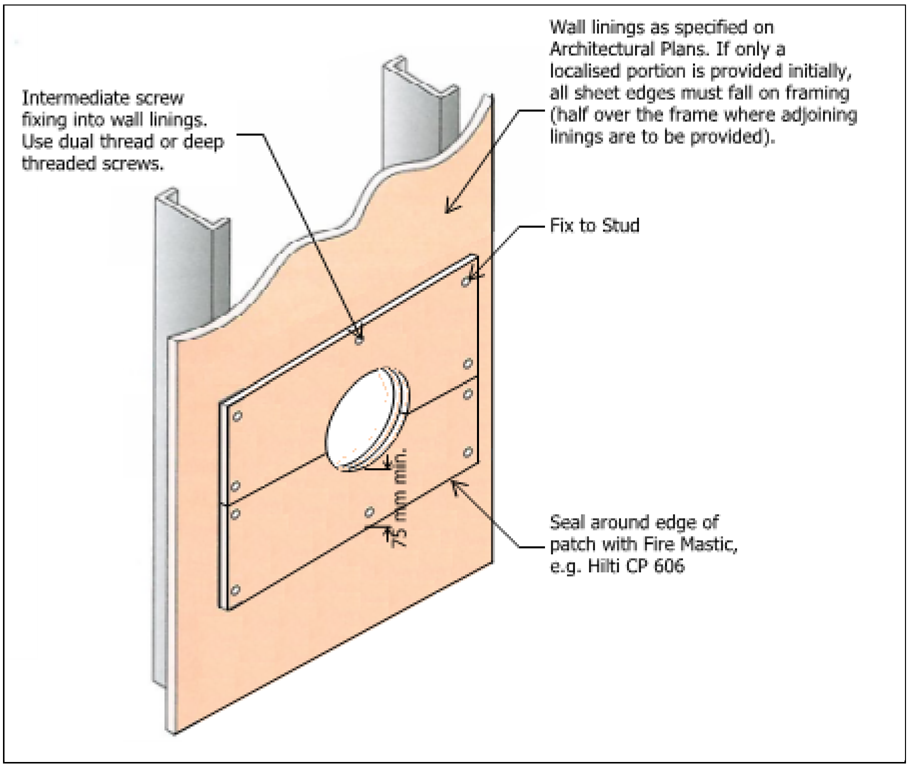


Figure 1: Patching the Services Opening.

B1.1.11 Where localised patching is to occur in areas below ceiling and open to view, the patch is required to be provided behind the finished wall layer. Additional framing is required to be fixed to the wall framing for the patch to be fixed to, as indicated in the figure below.

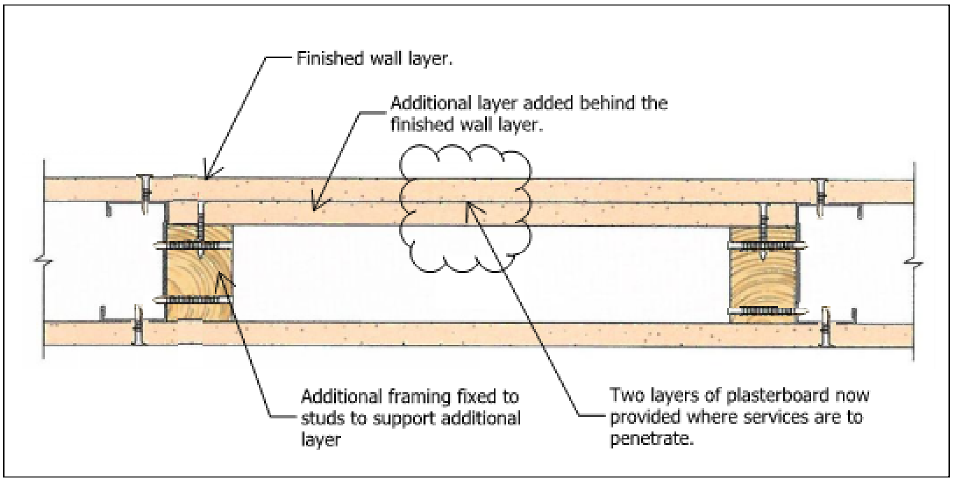


Figure 2: Provision of Additional Lining Thickness behind Finished Wall Layer.

B1.1.12 Where Fibre cement (RAB, PACBLD etc) is to be used, any penetrations must be run through solid timber framing, or they must be framed out in order to except a plasterboard patch. Where possible the fibre cement board is to be replaced with a suitable plasterboard system.

Environmental & Planning
Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

B1.1.13 All penetration through walls must have protection fitted to both sides unless specifically stipulated. Any item that cannot be treated with a system specified below, requires approval from the fire engineer prior to install.

B1.2 Light Weight Fire Separation Floor Assemblies

B1.2.1 No lightweight floors have been specified for this project.

B1.3 Concrete Floors

B1.3.1 For hydraulic penetrations trade it is expected for the Main contractor wil will inform of the approach that will be adopted for the site, being either the provision of Cast-In Collars or the provision of Retro-Fit collars and/or pipe wraps.

B1.3.2 Where Retro-Fit solutions are specified the Sub-contractor is to tender the supply and install of the appropriately sized retro-fit collar and/or pipe wrap. Wraps are not permitted to be provided to the shower or floor waste gullies. These are to fire stopped with fire collars only. Wraps may be used on basin and toilet wastes.

B1.3.3 With retro-fit solutions, it is the responsibility of the Sub-contractor to provide the correct sized core hole in the slab for the collar or wrap (wrap for toilet and basin wastes only). The sub-contractor is also to select the appropriate method accounting for the proximity of any structural element such as ribs or columns.

B1.3.4 Where collars are proposed to be used by the Sub-contractor for a penetration type that could have been protected with a pipe wrap and there is a clash with the ribs, preventing the application of a collar, the additional cost of the required bulkhead and any additional collars is to be borne by the sub-contractor.

B1.3.5 It is the responsibility of the applicable Sub-contractors to provide the correct sized core hole, or where applicable the correct sized conduit through the wall, taking note of the size of the services and the requirements of the fire stopping solution that is to be adopted. Typically, services are to occupy no greater than 60% of the opening. If conduit is cast into the wall this conduit counts to the percentage loading of the services.

B1.4 Concrete Walls

B1.4.1 It is the responsibility of the Sub-contractors to provide the correct sized core hole, or where applicable the correct sized conduit through the wall, taking note of the size of the services and the requirements of the fire stopping solution that is to be adopted. Typically, services are to occupy no greater than 60% of the opening. If conduit is cast into the wall this conduit counts to the percentage loading of the services.

B1.4.2 Where the wrong sized core hole or conduit is placed, the cost of additional required core holes and any rework of services is to be borne by the contractor at fault.

B1.4.3 All sub-contractors are to price for penetrating concrete walls and the required fire stopping. Should during works different sub-contractors negotiate between themselves to share a core hole, provided it can readily still be fire stopped to the methods contained herein, the savings are to be passed onto the Principal.

B1.4.4 No cables or plastic pipes are to be run through openings formed for sprinkler pipes or fire dampers.

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

B1.4.5 Any penetration through walls must have protection fitted to both sides unless specifically stipulated. Any item that cannot be treated with a system specified below, requires approval from the fire engineer prior to install.

B1.5 Stahlton Floor

B1.6.1 Where plastic pipes penetrate through floors, All Proof drop in fire collars are preferred. Where retro-fit options are specified the sub-contractor is to tender the supply and install of the appropriately sized retro-fit collar and under packing if required (i.e Intubatt, steel plate and rockwool etc). For shower or floor waste gullies only the All Proof system can be used.

B1.6.2 It is the responsibility of the sub-contractor to provide the correct sized core drilled hole in the slab for the service. The Sub-contractor is also to select a method appropriate for accounting for the proximity of any structural element such as ribs or columns.

B1.6.3 It is the responsibility of the applicable sub-contractor to provide the correct sized core drilled hole, or where applicable the correct sized conduit through the floor, taking note of the size of the services and the requirements of the fire stopping solution that is to be adopted. Typically services are to occupy no greater than 60% of the opening. If conduit is cast into the floor this conduit counts to the percentage loading of the services. If in doubt about loading percentages being met, then core another hole.

B1.6.4 If any cable tray/large cable group is to penetrate the slab, specific form work may be required in the floor system to create a specific opening which can be appropriately fire stopped (the slab may be required to be a full section 150mm thick).

B1.6.5 Suitable spacing between penetrations must be provided to allow fire stop devices/systems to be installed as per manufacturers specifications. If services are installed without the correct spacing then this would be treated as an alternative solution, and any costs associated with providing more information or an engineering judgement would be undertaken at the expense of the sub-contractor.

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

Building Division

Invercargill City
Council
Building Consent
Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER

2019/1381

SPECIFIC FIRE RATING SOLUTIONS

Overview

The following scope of services penetrating through fire separations that divide firecells are provided as identification that a solution is available to address the service and maintain compliance with the performance requirement of the fire separation.

Based on the services supplied information, the following represents product solutions for the individual service penetrations that have been identified

Service	Substrate	Material	Indicative sizes	Solution	Doc
Cables for fire alarm	Concrete wall	Cable	4<Ø<15mm	Hilti CFS-IS (CP611A)	CWE01
Metal pipe sprinkler and hydrant	Concrete wall	Steel	40<Ø<165mm	Hilti CFS-S ACR (CP606) Or Firetherm Intumastic	CWP01
Electrical cable trays (120min wall)	Plasterboard wall	Galvanised Steel with XLPE/PVC cabling attached	600mm width horizontally	Hilti CFS-F FX (CP660 – 150mm min. thickness)	Hilti approval document or Ryanfire V32

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Service	Substrate	Material	Indicative sizes	Solution	Doc
Electrical cable duct (vertical duct riser from transformer to Childcare DB – Grid 1.C-1.D/1.6-1.7)	Concrete Inter floor structure	High impact uPVC conduit c/w XLPE/PVC cabling	Ø 100m	HiltiCP660 Or Hilti CFS-B and CFS-P BA Or RyanFire Intusleeve, intumastic and Mineral Fibre Backing 64kg 100mm thick	Hilti approval document Or RyanFire V40
Electrical Cable trays (horizontal)	Level 1 reserve / stair lobby smoke separated area	Galvanised Steel with XLPE/PVC cabling attached	200 – 600mm	Not through fire/smoke separation no fire stopping req.	
Mechanical & Electrical services cables (cables serving electrical services within stairs)	Concrete wall	TPS cable	1.5mm2<Ø<25mm2	Hilti CFS-IS (CP611A)	CWE01
Security and Telecommunications cables (cables serving electrical services within stairs)	Concrete wall	PVC multicore and/or LSZH optical fibre	Ø<1.5mm2	Hilti CFS-IS (CP611A)	CWE01

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Service	Substrate	Material	Indicative sizes	Solution	Doc
Mechanical & Electrical services cables – Cable conduit	Concrete inter floor structure?	High impact uPVC conduit c/w TPS cable?	16mm2<Ø<150mm2	Hilti CFS-IS (CP611A) (upto 32mm) Hilti Collar For >32mm All Proof Drop In Collar Or Firetherm Intubatt with Ryan Fire SL Collar sealed with Intumastic or Intusleeve	CFP04 CFP05/06 Or Allproof or V22.3 or V22.5 Or V63.1
Electrical flush boxes (not part of this scope)	Fixed to fire/smoke separation walls	Metal flush boxes		Firetherm Putty Pads Or RyanFire V37.2 (acoustic tested) (not part of this scope)	V37 V37.2 (not part of this scope)

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Service	Substrate	Material	Indicative sizes	Solution	Doc
Surface mounted electrical outlets	Conduit through floor as per above.	High impact uPVC conduit c/w TPS cable Proprietary PVC mounting hardware		Hilti CFS-IS (CP611A) upto 32mm All Proof Drop In Collar Or Firetherm Intubatt with double Intustrap sealed with Intumastic or Intusleeve	CFP04
Vent pipes Foul drainage & stormwater	Concrete Floor Concrete Floor	uPVC Raupiano acoustic pipe	Ø65 - 80mm Ø 65 - 100mm	All Proof Drop In Collar Or Firetherm Intubatt with double Intustrap sealed with Intumastic or Intusleeve	Allproof manual
Water Services Pipes	Concrete floor & walls	Polyethylene	Ø32 - 40mm	All Proof Drop In Collar Or Firetherm Intubatt with Ryan Fire SL collar with Intumastic or Intusleeve	Allproof Or V22.3 or V22.5 Or V63.1

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Service	Substrate	Material	Indicative sizes	Solution	Doc
Mech condensate pipes	-	-	-	Assume none	
Mechanical refrigeration pipes	-	-	-	Assume none	
Mechanical ductwork (not part of this scope)	Gib lined stud walls	Galvanised steel	600 x 600 & 800 x 600	Holyoake fire/ smoke damper Kilargo Fire/ Smoke dampers Model dependant on size and cross sectional area…	Refer to manufacturer specifications dependant on damper type (not part of this scope)

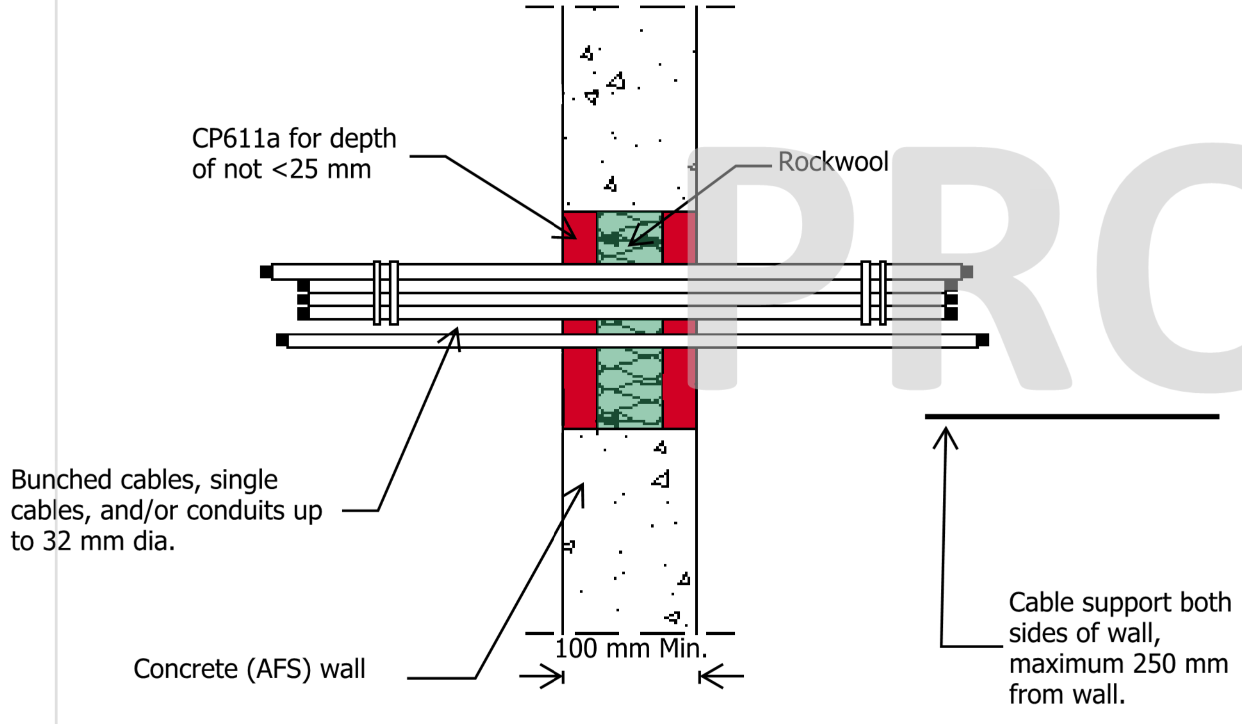
Environmental & Planning
Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

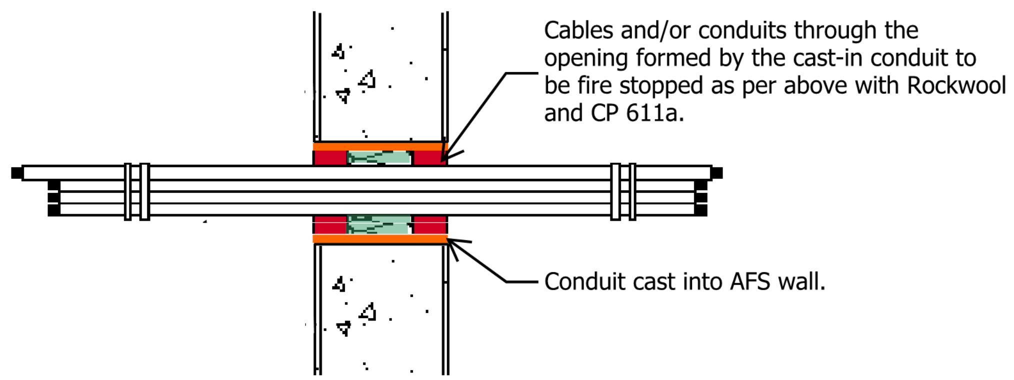
PROPERTY OF HOLMES



Section

Note:

It is acceptable for a piece of oversized Conduit to be cast into the wall. The conduit is to be trimmed flush with the AFS surface and cables run through the opening. The inside of the conduit is then to be treated as above. Noting however the 60% services limitation is to account for the plastic of the cast in conduit.



Restrictions/Notes

Solution is from EWFA Report No. RIR 27912900.1

Maximum opening size w = 150 mm and h = 150 mm, or 170 mm diameter.

Separation of services, as per the figure below.

Services are not to fill more than 60% of the opening size.

Max cable bundle size is 100 mm dia.

Max conduit size is 32 mm dia.

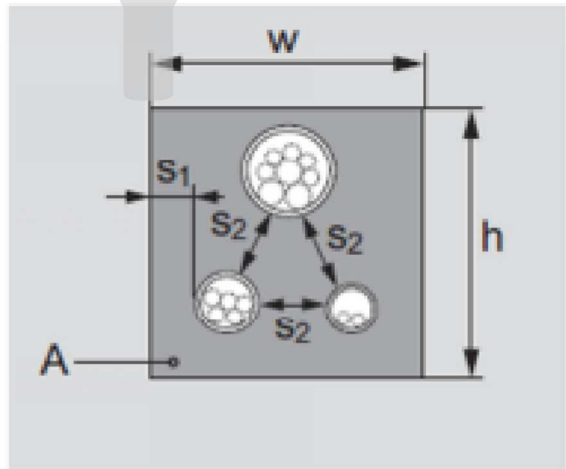
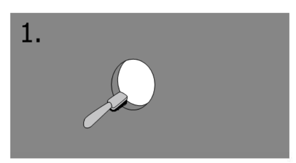


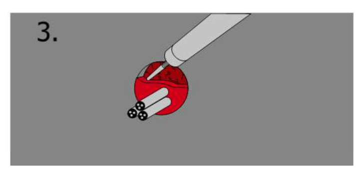
Figure 1 – Distance Requirements of Penetrations

Distance valid for installations of services in wall and floor	Minimum distance in mm
Cables to edge of seal	s1 = 0
Cable to other cables/services	s2 = 40
Tied Cable bundle to seal edge	s1 =10
Tied cable bundle to other services	s2 = 40
Small conduits/tubes to edge of seal	s1 = 10
Small conduits/tubes to other services	s2= 40
Conduits Ø > 16mm, distance between conduits to edge of seal	s1 = 10
Conduits Ø > 16mm, distance between conduits and other services	s2= 40

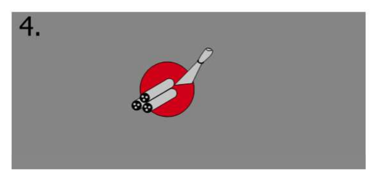


Clean opening. Surfaces to be dry and free of loose debris, dirt, oil, wax or grease.

Insert mineral wool backfilling, leave sufficient depth for application of sealant.



Fill around services with CP611a for required depth.



Where exposed to view, smooth before skin forms using water (permissible to use diluted liquid soap) and spatula. Leave completed seal undisturbed for 48 hrs.

Installation Instructions

This sketch does not constitute a complete fire engineering design or detail. Detailed construction drawings are provided by others. Best viewed in colour. Not all fire separations around ducts and shafts are shown.

Legend

Holmes

Holmes Fire LP
holmesfire.com

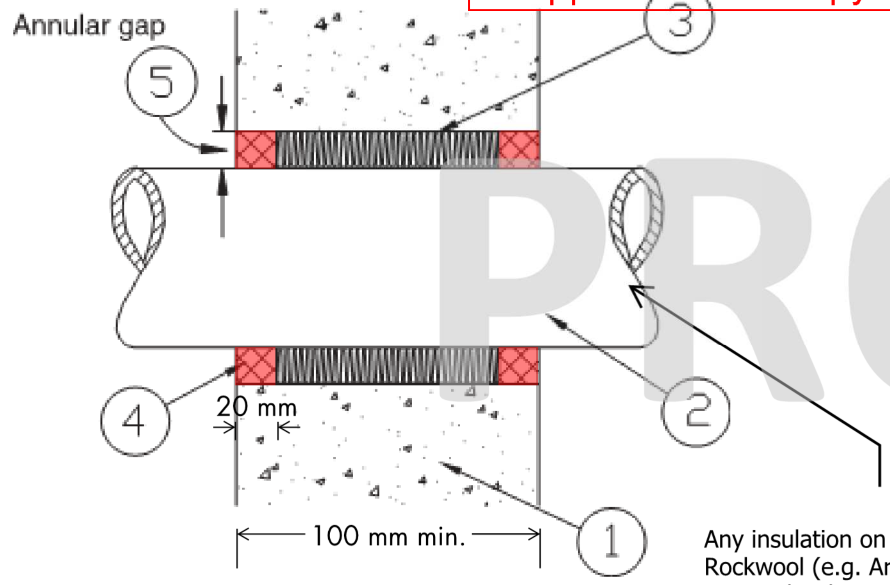
Project Title	Sketch Title	Drawn: DXM	Date: 22 / 10 / 2019	
HWCP	Cable and Conduit Penetrations through Concrete Walls Hilti CP611a Solution	Project No. 136249	Sheet No. CW-E-01	Rev A

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381



Any insulation on pipe that is not Rockwool (e.g. Armaflex) is required to be cutout so only the pipe penetrates the wall. If insulation cannot be cut out, refer to different fire stopping solution.

1 = Concrete Wall (AFS Wall)
2 = Metal Pipe up to 200 mm dia.
3 = Rockwool backfilling
4 = Hilti CP606 Sealant. Minimum Depth 20 mm.
5 = Annular Gap, 10 mm to 40 mm max.

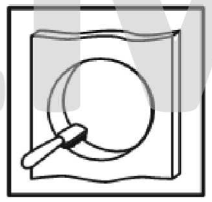
Section

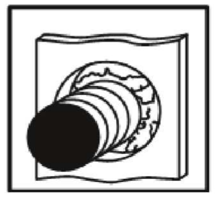
Notes:

Solution and restrictions based on Hilti ETA No. 10/0292 Report and also Hilti Australia Opinion FCO-2038.

If an insulation rating is required of the fire rated system, the metal pipe will need to be lagged with Rockwool on both sides of the penetration. Contact the Engineer for details.

PROPERTY OF HOLMES

1.

Clean opening. Surfaces to be dry and free of loose debris, dirt, oil, wax or grease.

2.

Insert pipe and provide Rockwool backfilling, leave sufficient depth for application of sealant.

3.

Fill around services with CP 606 for the required depth.

4.

For penetrations exposed to view, smooth before skin forms using water (permissible to use diluted liquid soap) and spatula. Leave completed seal undisturbed for 48 hrs.

Installation Instructions

This sketch does not constitute a complete fire engineering design or detail. Detailed construction drawings are provided by others. Best viewed in colour. Not all fire separations around ducts and shafts are shown.	Legend	Holmes Fire LP holmesfire.com	Project Title HWCP	Sketch Title Metal Pipe through Concrete Walls, Annular Gap up to 40 mm Integrity Only. Hilti CP606 Solution

Drawn: DXM	Date: 21 / 10 / 2019	
Project No.	Sheet No.	Rev
136249	CW-P-01	A

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

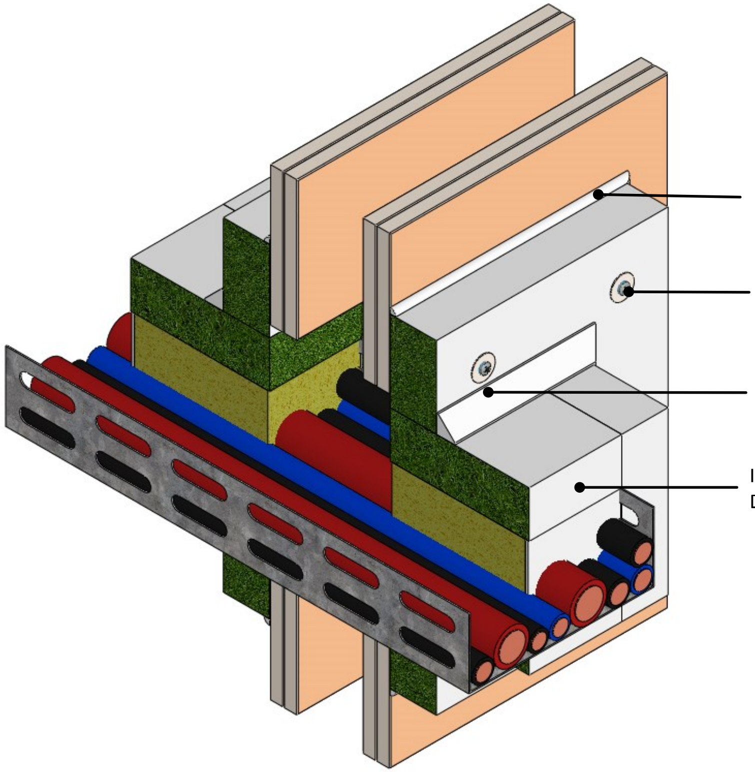
Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

INSTALLATION INSTRUCTIONS

1. ENSURE THE APERTURE IS CLEAN AND FREE OF DEBRIS AND LOOSE CEMENT. REMOVE DUST FROM SURFACES REQUIRING INSTALLATION.
2. CUT THE INTUBATT TO FORM THE BATT BOX DETAIL AROUND THE CABLE TRAY, AS PER THE BATT BOX DETAIL DRAWING V44.
3. POSITION THE BATT BOX AROUND THE PENETRATION AND POSITION THE BACK EDGE OF THE BATT BOX IN LINE WITH THE BACK SIDE OF THE PROPOSED INTUBATT FIRE SEAL.
4. CUT THE INTUBATT TO THE REQUIRED SIZE AND SHAPE, ENSURING THE INTUBATT WILL OVERLAP THE PLASTERBOARD 100MM AROUND THE OPENING..
5. CUT THE INTUBATT TO TIGHTLY FIT AROUND THE BATT BOX DETAIL.
6. CUT THE INTUBATT ACROSS THE SHORTEST DIMENSION INCORPORATING THE MIDPOINT OF THE PENETRATION, TO ENABLE THE INTUBATT TO BE FITTED ON TO THE PLASTERBOARD/MASONRY.
7. APPLY INTUMASTIC TO THE PLASTERBOARD/ MASONRY WHERE THE INTUBATT IS TO BE FITTED.
8. APPLY INTUMASTIC BRUSH GRADE TO ALL EDGES OF THE INTUBATT, ENSURING THAT AN EVEN COVERAGE IS ACHIEVED OVER THE ENTIRE EXPOSED THICKNESS OF THE INTUBATT. THIS SHOULD INCLUDE THE OUTER EDGES OF THE INTUBATT AND THE CUT ACROSS TO ALLOW INSTALLATION IN TO THE APERTURE.
9. OFFER INTUBATT UP TO PLASTERBOARD WALL AROUND THE INSTALLED BATT BOX.
10. FIX THE INTUBATT TO THE PLASTERBOARD/MASONRY USING MINIMUM 75MM LONG STEEL SCREWS AND 25MM DIAMETER STEEL WASHERS. FIXINGS SHOULD NOT EXCEED 50MM FROM ANY EDGE AND NOT EXCEED 200MM CENTRES.
11. APPLY AN INTUMASTIC FILLET APPROXIMATELY 10MM WIDE TO THE PERIMETER OF THE INTUBATT WHERE IT MEETS THE PLASTERBOARD, AND 20MM X 20MM BEAD AROUND THE BATT BOX DETAIL. ENSURE THAT ALL GAPS BETWEEN THE INTUBATT AND THE SURROUNDING EDGES ARE FULLY FILLED USING INTUMASTIC.
12. REPAIR ANY DAMAGES TO THE COATING WHICH MAY HAVE OCCURRED DURING INSTALLATION USING BRUSH OR SPRAYING APPLICATION OF INTUMASTIC.
13. REPEAT THE ABOVE TO THE OPPOSITE SIDE OF THE-WALL.



Notes

Products: INTUBATT BATT BOX DETAIL
Approval: AS 1530.4/AS 4072.1
BK: 1
Ref: 35084000
ID: **35**

Scenario: Penetration seal to cable tray.

Construction: Fire rated gypsum wall.

Fire Integrity: 120 minutes.
Insulation: 120 minutes.

Services: Cable Tray up to 500mm wide
Standard cable configuration
BSEN 1366.

Web based drawings are for example only, fire performance of any system is dependant on, but not limited to size of opening, substrate, if penetrations are passing through, type, size and number. Please refer to Ryanfire technical department for detailed and specific fire performance information.

RYANFIRE
PASSIVE FIRE PROTECTION

Client

Job Title

Drawing Title

Batt Box detail to Cable Tray in Gypsum Fire Wall

Scale	Date
NTS	July 2019
Sheet Size	Drawn By
A3	

Drawing Number	Rev
V32	2.0

Please note:
Ryanfire Products Ltd owns and has copyright in these drawings. They are to be used only for the purpose for which they were intended and supplied and are not to be sold, transferred or made available for use by a third party.

Any misuse of these drawings will result in legal proceedings.

All errors and omissions excepted - the Information contained within this drawing is believed to be correct on the date of publication, and is based upon tested and certified solutions. The policy of **RyanFire Products Ltd** is one of constant improvement. Installers must therefore ensure that they are following the latest published drawings, test evidence and instructions. Whilst **RyanFire Products Ltd** will endeavour to keep its publications up to date, the accuracy of the information contained within this drawing may be affected by pertinent changes in the law or regulatory requirements and alterations or amendments to the specification of **the manufactured** products. Terms and conditions of sale apply.

RYANFIRE Technical Support: info@ryanfire.co.nz - Tel 09 443 0362

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

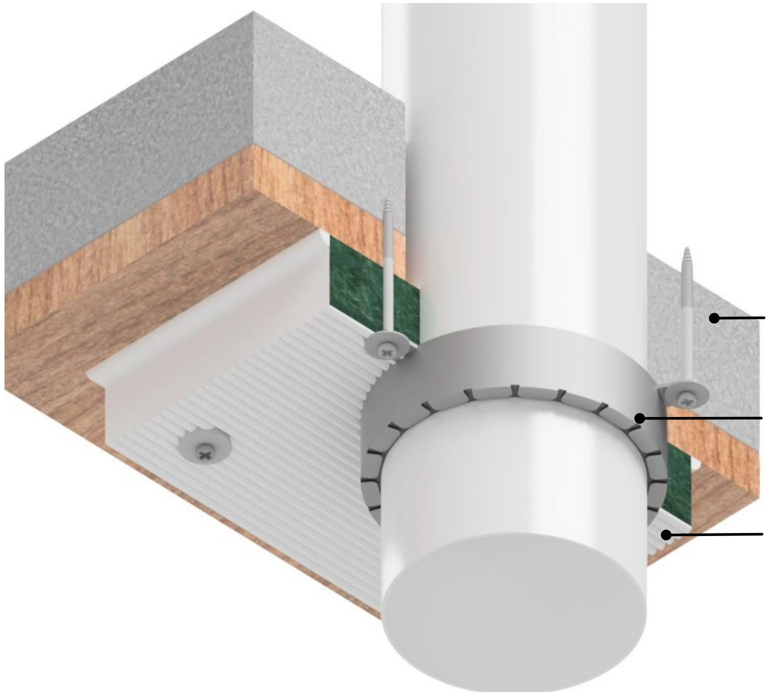
Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

INSTALLATION INSTRUCTIONS

1. ENSURE THE APERTURE IS CLEAN, FREE OF DEBRIS, LOOSE CEMENT AND DUST.
2. CUT THE INTUBATT TO THE CORRECT SIZE TO FIT TIGHTLY AROUND THE SERVICE PENETRATION AND OVERLAP THE TIMBER SARKING AROUND THE APERTURE BY 100MM.
3. APPLY INTUMASTIC (WHITE) TO THE BACK SIDE OF THE INTUBATT AND PRESS FIRMLY INTO POSITION AROUND THE PIPE.
4. SECURE THE INTUBATT TO THE UNDERSIDE OF THE TIMBER INFILL FLOOR USING 100MM LONG MILD STEEL SCREWS & 25MM WASHERS POSITIONED 50MM FROM THE EDGE OF THE INTUBATT AND NOT EXCEEDING 200MM CENTRES.
5. SELECT THE CORRECT DIAMETER RYANFIRE SL COLLAR FOR THE COMBUSTIBLE PIPE.
6. APPLY INTUMASTIC (WHITE) AROUND THE PIPE TO SMOKE SEAL THE OPENING.
7. POSITION THE RYANFIRE SL COLLAR AROUND THE PENETRATION AND FASTEN AROUND THE PIPE.
8. SLIDE THE COLLAR ALONG THE PIPE UNTIL IT IS HARD UP AGAINST THE UNDERSIDE OF THE INTUBATT.
9. FIX THE COLLAR IN PLACE USING 100MM LONG MILD STEEL SCREWS & WASHERS. ENSURE ALL FIXING POINTS ARE USED AND THE SCREWS EMBED THE SOLID CONCRETE SUBSTRATE BY MIN. 25MM.
10. APPLY INTUMASTIC BRUSH GRADE TO ALL EXPOSED INTUBATT EDGES. REPAIR ANY DAMAGE TO THE COATING THAT MAY HAVE OCCURRED DURING INSTALLATION USING BRUSH OR SPRAY APPLICATION OF INTUMASTIC.



Products:	RYANFIRE SL COLLAR
Approvals:	AS 1530.4/AS 4072.1
BK:	49 / 50
Ref:	51892400 / 51892200
ID:	Service C / B
Scenario:	Penetration seal to combustible pipe ..
Construction:	Timber infill floor (75mm concrete 25mm timber sarking).
Fire Rating:	
PVC pipe -	Integrity 60 minutes. Insulation: 60 minutes.
HDPE pipe-	Integrity 30 minutes. Insulation 15 minutes.
Services:	Up to 160mm dia. PVC pipe. Up to 160mm dia. HDPE pipe.

Web based drawings are for example only, fire performance of any system is dependant on, but not limited to size of opening, substrate, if penetrations are passing through, type, size and number. Please refer to Ryanfire technical department for detailed and specific fire performance information.

RYANFIRE PASSIVE FIRE PROTECTION

Client

Job Title

Drawing Title

Ryanfire SL Collar - Combustible Pipe through Timber Infill Floor

Scale	Date
NTS	July 2019
Sheet Size	Drawn By
A3	
Drawing Number	Rev
V22.3	2.0

Please note:
Ryanfire Products Ltd owns and has copyright in these drawings. They are to be used only for the purpose for which they were intended and supplied and are not to be sold, transferred or made available for use by a third party.

Any misuse of these drawings will result in legal proceedings.

All errors and omissions excepted - the Information contained within this drawing is believed to be correct on the date of publication, and is based upon tested and certified solutions. The policy of **RyanFire Products Ltd** is one of constant improvement. Installers must therefore ensure that they are following the latest published drawings, test evidence and instructions. Whilst **RyanFire Products Ltd** will endeavour to keep its publications up to date, the accuracy of the information contained within this drawing may be affected by pertinent changes in the law or regulatory requirements and alterations or amendments to the specification of **the manufactured** products. Terms and conditions of sale apply.

RYANFIRE Technical Support: info@ryanfire.co.nz - Tel 09 443 0362

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

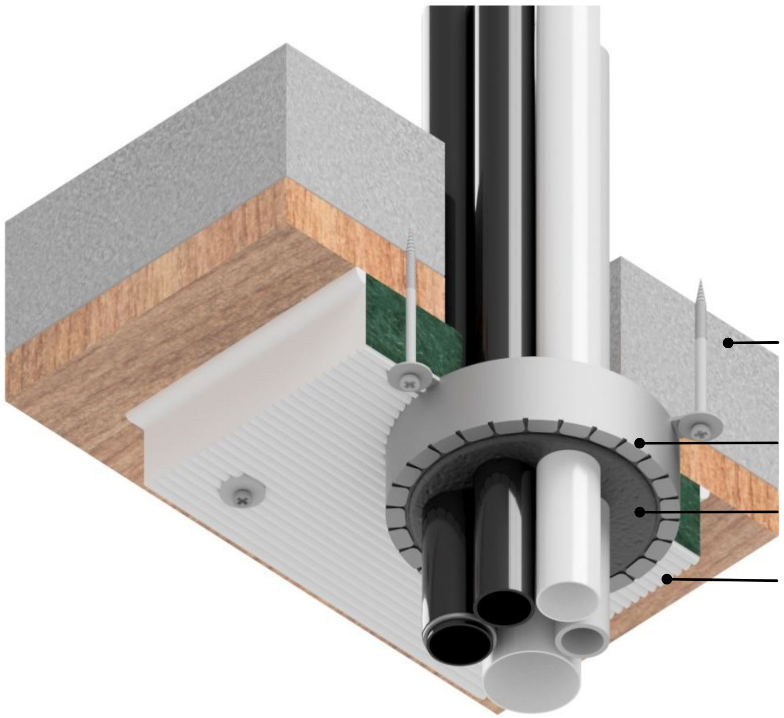
Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

INSTALLATION INSTRUCTIONS

1. ENSURE THE APERTURE IS CLEAN, FREE OF DEBRIS, LOOSE CEMENT AND DUST.
2. CUT THE INTUBATT TO THE CORRECT SIZE TO FIT TIGHTLY AROUND THE SERVICE PENETRATIONS AND OVERLAP THE TIMBER SARKING AROUND THE APERTURE BY 100MM.
3. APPLY INTUMASTIC (WHITE) TO THE BACK SIDE OF THE INTUBATT AND PRESS FIRMLY INTO POSITION AROUND THE SERVICES.
4. SECURE INTUBATT TO THE UNDERSIDE OF THE TIMBER INFILL FLOOR USING 100MM LONG MILD STEEL SCREWS & 25MM WASHERS POSITIONED 50MM FROM THE EDGE OF THE INTUBATT AND NOT EXCEEDING 200MM CENTRES.
5. SELECT THE CORRECT DIAMETER RYANFIRE SL COLLAR FOR SERVICE PENETRATIONS UP TO 160MM DIA SL COLLAR.
6. POSITION THE RYANFIRE SL COLLAR AROUND THE PENETRATION AND FASTEN INTO POSITION .
7. SLIDE THE COLLAR ALONG UP TO THE UNDERSIDE OF THE INTUBATT SEAL.
8. FIX THE COLLAR IN PLACE USING 100MM LONG MILD STEEL SCREWS & WASHERS. ENSURE ALL FIXING POINTS ARE USED AND THE SCREWS EMBED THE SOLID CONCRETE SUBSTRATE BY MIN. 25MM.
9. APPLY INTUMASTIC HP TO FILL THE ANNULAR GAP TO THE FULL DEPTH OF THE RYANFIRE SL COLLAR.
10. APPLY INTUMASTIC BRUSH GRADE TO ALL EXPOSED INTUBATT EDGES. REPAIR ANY DAMAGE TO THE COATING THAT MAY HAVE OCCURRED DURING INSTALLATION USING BRUSH OR SPRAY APPLICATION OF INTUMASTIC.



Products: RYANFIRE SL COLLAR / INTUMASTIC HP
Approvals: AS 1530.4/AS 4072.1
BK: 50
Ref: 51892200
ID: Service D
Scenario: Penetration seal to multiple combustible pipes.
Construction: Timber infill floor (75mm concrete 25mm timber sarking).
Aperture: 150mm dia.
Fire Integrity: 60 minutes.
Services: Up to 25mm dia conduit, 22mm dia. buteline pipe, 32mm rehau rautitan pipe, 32mm rehau PEX - AL pipe, 50mm PVC pipe.

Web based drawings are for example only, fire performance of any system is dependant on, but not limited too - size of opening, substrate, if penetrations are passing through, type, size and number. Please refer to Ryanfire technical department for detailed and specific fire performance information.

RYANFIRE
PASSIVE FIRE PROTECTION

Client

Job Title

Drawing Title
Multi Combustible Service Penetration Through Timber Infill

Scale	Date
NTS	July 2019
Sheet Size	Drawn By
A3	
Drawing Number	Rev
V22.5	2.0

Please note:
Ryanfire Products Ltd owns and has copyright in these drawings. They are to be used only for the purpose for which they were intended and supplied and are not to be sold, transferred or made available for use by a third party.

Any misuse of these drawings will result in legal proceedings.

All errors and omissions excepted - the Information contained within this drawing is believed to be correct on the date of publication, and is based upon tested and certified solutions. The policy of **RyanFire Products Ltd** is one of constant improvement. Installers must therefore ensure that they are following the latest published drawings, test evidence and instructions. Whilst **RyanFire Products Ltd** will endeavour to keep its publications up to date, the accuracy of the information contained within this drawing may be affected by pertinent changes in the law or regulatory requirements and alterations or amendments to the specification of **the manufactured** products. Terms and conditions of sale apply.

RYANFIRE Technical Support: info@ryanfire.co.nz - Tel 09 443 0362

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Products: CABLE TRANSIT & INTUMASTIC
Approvals: AS 1530.4/AS 4072.1
BK: 1
Ref: 35084000
ID: 38

Scenario: Floor seal to various cables passing through intusleeve cable management sleeve.

Penetrations: **Cables**

2no	type E
10no	type A1
10no	type A2
14no	3 core, twin and earth

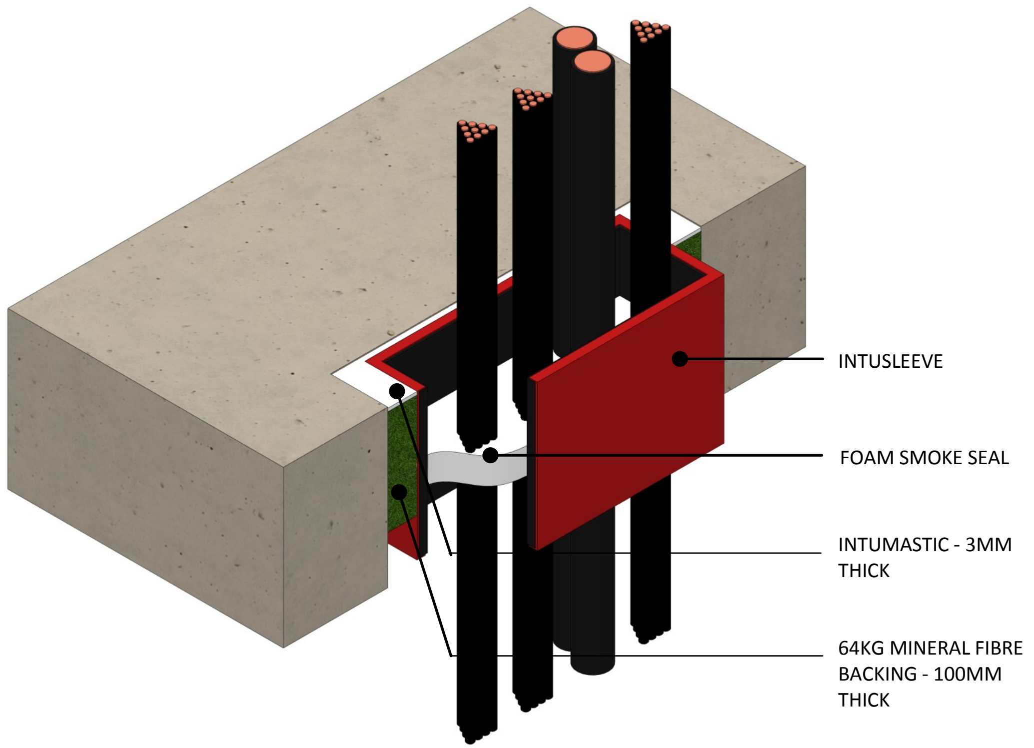
Construction: Nominal 150mm concrete floor.

Fire Integrity: 120 minutes.
Insulation: 30 minutes.

Web based drawings are for example only, fire performance of any system is dependant on, but not limited to size of opening, substrate, if penetrations are passing through, type, size and number. Please refer to Ryanfire technical department for detailed and specific fire performance information.

INSTALLATION INSTRUCTIONS

1. ENSURE THE APERTURE IS CLEAN AND FREE OF DEBRIS AND LOOSE CEMENT. REMOVE ALL DUST FROM SURFACES REQUIRING INSTALLATION.
2. SELECT THE CORRECT SIZE INTUSLEEVE.
3. FIT AROUND THE CABLES AND SECURE BY COMPRESSION FITTING THE 25MM THICK SMOKE SEAL (FOAM) TIGHTLY WITHIN THE INTUSLEEVE AND AROUND THE CABLES.
4. FIT 100MM DEPTH OF 64KG MINERAL FIBRE BETWEEN THE INTUSLEEVE AND CONCRETE FLOOR OPENING, FORMING A 3MM RECESS FROM THE TOP OF THE CONCRETE FLOOR.
5. APPLY 3MM THICKNESS OF INTUMASTIC TO THE RECESS AROUND THE INTUSLEEVE.
6. CLEAN EXCESS INTUMASTIC USING A DAMP CLOTH.



RYANFIRE
PASSIVE FIRE PROTECTION

Client

Job Title

Drawing Title
Intusleeve, Cable Management Floor Seal.

Scale	Date
NTS	July 2019
Sheet Size	Drawn By
A3	

Drawing Number	Rev
V40	2.0

Please note:
Ryanfire Products Ltd owns and has copyright in these drawings. They are to be used only for the purpose for which they were intended and supplied and are not to be sold, transferred or made available for use by a third party.

Any misuse of these drawings will result in legal proceedings.

All errors and omissions excepted - the Information contained within this drawing is believed to be correct on the date of publication, and is based upon tested and certified solutions. The policy of **RyanFire Products Ltd** is one of constant improvement. Installers must therefore ensure that they are following the latest published drawings, test evidence and instructions. Whilst **RyanFire Products Ltd** will endeavour to keep its publications up to date, the accuracy of the information contained within this drawing may be affected by pertinent changes in the law or regulatory requirements and alterations or amendments to the specification of **the manufactured** products. Terms and conditions of sale apply.

RYANFIRE Technical Support: info@ryanfire.co.nz - Tel 09 443 0362

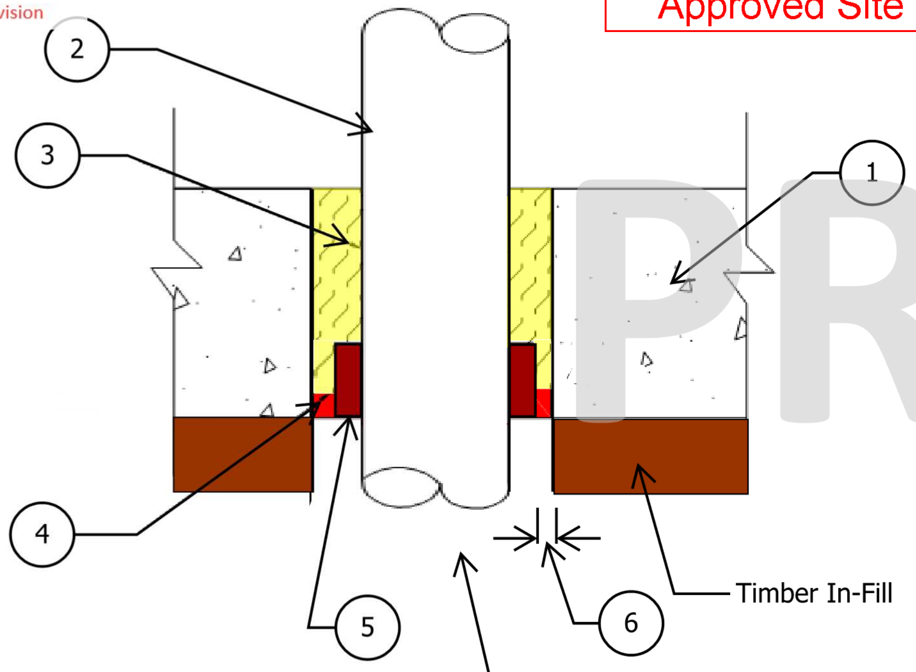
Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

PROPERTY OF HOLMES



Pipe supported both sides maximum 300 mm from floor.

Section

1 = Concrete Floor

2 = Plastic Pipe uPVC and PE 150 mm dia max.

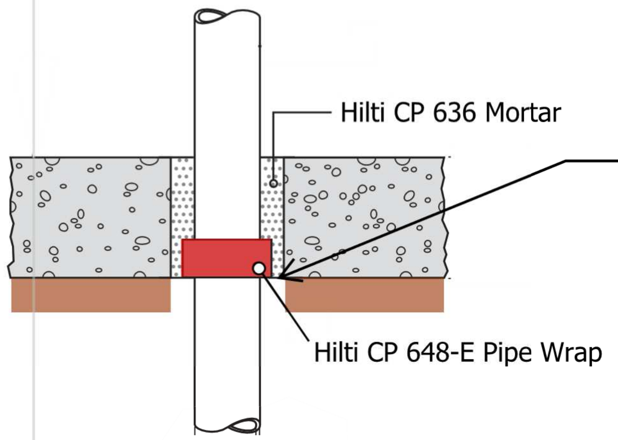
3 = Rockwool backfilling.

4 = Hilti CP606 Sealant. Minimum Depth 15 mm.

5 = Hilti CP 648-E Pipe Wrap (number of layers dependent on pipe dia. - refer Notes)

6 = Annular Gap, 10 mm max for sealing with CP 606. Refer also Below.

Alternative Back-Fill (for oversized Core Holes)



Install wrap, provide temporary shuttering to underside of the hole and pour 636 Mortar from above. Remove shuttering once cured. Pipe Wrap must be visible from below and be flush with the underside of the concrete slab/mortar backfill.

Restrictions/Notes:

System is from Hilti Australia Technical Datasheet for CP648-E which is based on Hilti Australia FCO-2301/3909. This document refers only to uPVC pipes up to 150 mm through floors. The Hilti European Technical Datasheet ETA-10/0405 documents the same system for uPVC and PE pipes up to 160 mm dia. It is therefore considered the system detailed opposite can be suitably used for PE pipes up to 150 mm dia.

Number of Layers of 648-E

Pipes up to and including 65 mm dia. only require 1 layer of CP 648.

Pipes >65 mm and to 100 mm dia. require two layers of wrap.

Pipes >100 mm and to 150 mm dia. require three layers of wrap.

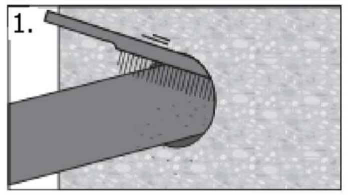
The wrap is 5 mm thick.

Core holes are to be sized appropriately, e.g:

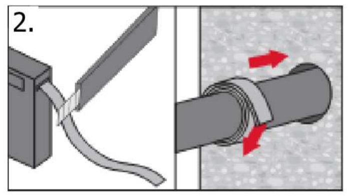
For pipes up to 65 mm dia. the core hole is to be = pipe outer dia. + 10 mm (1 layer of pipe wrap) + maximum 20 mm (CP 606 seal).

For pipes >65 mm to 100 mm dia. the core hole is to be = pipe outer dia. + 20 mm (2 layers of pipe wrap) + a maximum 20 mm (CP 606 seal).

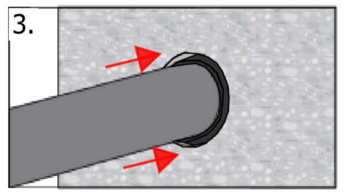
For pipes >100 mm to 150 mm dia. the core hole is to be = pipe outer dia. + 30 mm (3 layers of pipe wrap) + a maximum 20 mm (CP 606 seal).

1.


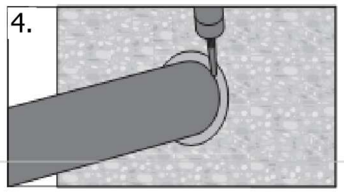
Clean opening and the pipe where the wrap is to be placed. Surfaces to be dry and free of loose debris, dirt, oil, wax or grease.

2.


Cut the wrap to length according to outer diameter of pipe and accounting for required number of layers. Wrap the wrap around the pipe the required number of times and secure with adhesive tape.

3.


Push wrap into opening until the outer edge is flush with the bottom of the concrete of the flooring system.

4.


Fill remainder of annular space between the wrap and the opening edge with CP606. Do Not cover the bottom of the wrap with mastic.

NOTE:
Multiple layers to be concentric (i.e. overlap each other) and layers need to be finished flush with the underside of the concrete.

Installation Instructions

This sketch does not constitute a complete fire engineering design or detail. Detailed construction drawings are provided by others. Best viewed in colour. Not all fire separations around ducts and shafts are shown.	Legend	Holmes Holmes Fire LP holmesfire.com	Project Title HWCP	Sketch Title Plastic Pipe (uPVC, PE) up to 150 mm Dia Penetration through Concrete Floors Hilti CP648-E Solution

Drawn: DXM	Date: 22 / 10 / 2019	
Project No.	Sheet No.	Rev
136249	CF-P-O4	A

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

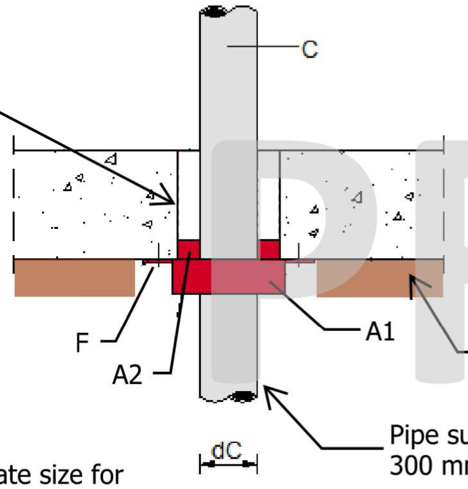
Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

PROPERTY OF HOLMES

Plastic Pipe Penetrations Through Concrete Floors



dC = Pipe Diameter. Refer Notes.

C = Pipe type. Refer Notes.

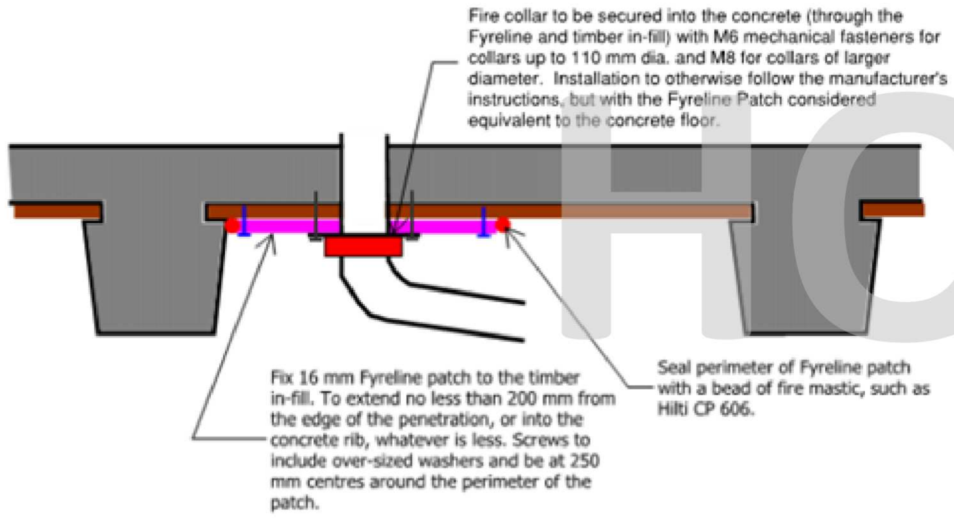
A1 = Hilti CP644 Fire Collar, of appropriate size for the pipe size fitted to underside of floor.

A2 = Hilti CP606 Fire Mastic, for depth of 10 mm min.

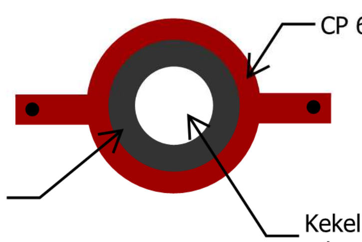
F = Fastening Hook and Anchor. Refer Installation Instructions and Notes.

Section

Alternatively - Follow Specification and Protect the Timber with Fyreline and Mount Collar to Underside of Fyreline.



Treatment of Kekelit pipes (and other plastics) < 32 mm diameter.



Notes:

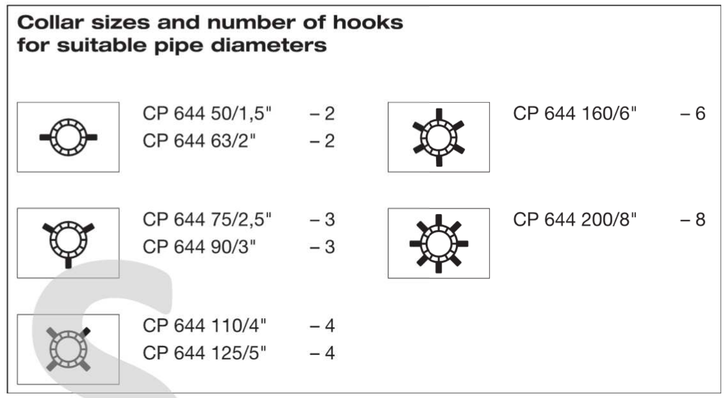
Solution is based on Hilti Australia CP 644 Technical Data Sheet referencing Report No. EWFA 27006-01.
The Aluminium Composite (e.g. Kekelit Kelox) solution is based on Technical Approval ETA No. 10/0404.

Solution is applicable for:
Raupiano Plus pipes up to 110 mm dia.,
uPVC pipes up to 150 mm dia.,
PE pipes up to 125 mm dia.
PPR pipes up to 125 mm dia.
Al - Composite up to 63 mm dia.

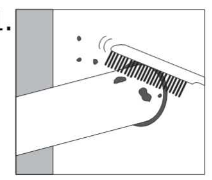
For plastic pipes less than 32 mm in diameter of the types noted above with the exception of Al-Composite, and for conduits (with or without cables) refer to the Hilti CP 611a solution. Alternatively use same detail as that opposite for Kekelit Pipes.

Collar Size Selector:

	Pipe diameter - range	Collar outside diameter	Height
CP 644 50/1.5"	32 - 51 mm	66.7 mm	22.4 mm
CP 644 63/2"	52 - 64 mm	81.7 mm	32.4 mm
CP 644 75/2.5"	65-78 mm	101.7 mm	32.4 mm
CP 644 90/3.5"	75 - 91 mm	116.7 mm	42.4 mm
CP 644 110/4"	92 - 115 mm	145.7 mm	47.4 mm
CP 644 125/5"	116 - 125 mm	166.1 mm	47.8 mm
CP 644 160/6"	126 - 170 mm	235.5 mm	48.2 mm
CP 644 200/8"	200 mm	257 mm	177.5 mm

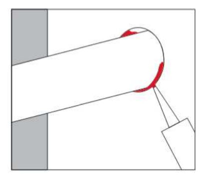


1.



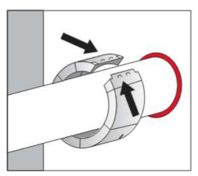
Core drill hole in concrete, diameter to be less than the outside diameter of the required collar for the pipe size. Clean opening and the pipe.

2.



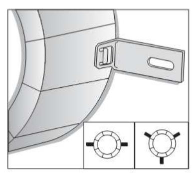
Seal annular gap with Hilti CP606 for depth of 10 mm.

3.



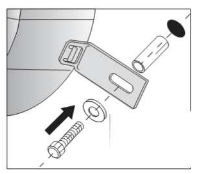
Close collar around pipe.

4.



Attach required number of fastening hooks to the steel housing, positioned as symmetrically as possible.

5.



Fasten hook to the underside of the slab with metal anchors/fasteners. Hilti HUS, DBZ, HSA minimum 6 mm dia for pipes to 110 mm dia and minimum 8 mm dia for pipes >110 mm.
Length of fixing to bed 55 to 60 mm into the concrete.

Installation Instructions

This sketch does not constitute a complete fire engineering design or detail. Detailed construction drawings are provided by others. Best viewed in colour. Not all fire separations around ducts and shafts are shown.

Legend

Holmes

Holmes Fire LP
holmesfire.com

Project Title	Sketch Title	Drawn: DXM	Date: 22 / 10 / 2019	
HWCP	Plastic Pipe Penetrations through Concrete Floors Hilti CP644 Solution	Project No. 136249	Sheet No. CF-P-05	Rev A

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

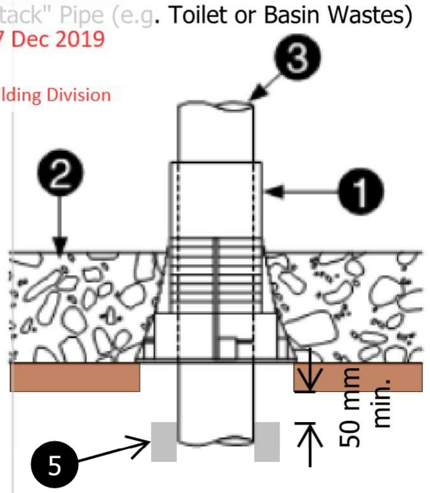
Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

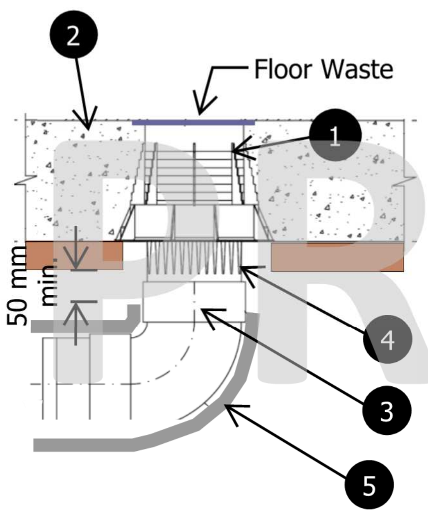
BUILDING CONSENT NUMBER
2019/1381

PROPERTY OF HOLMES

"Stack" Pipe (e.g. Toilet or Basin Wastes)



Floor Waste (e.g. Shower drain)



1 = Cast in CP 680-N collar. Refer Notes.
2 = Concrete Floor
3 = Plastic Pipe. Refer Notes
4 = RAD Device. Refer Notes
5 = Acoustic Insulation. To not extend closer than 50 mm to the underside of the timber in-fill.

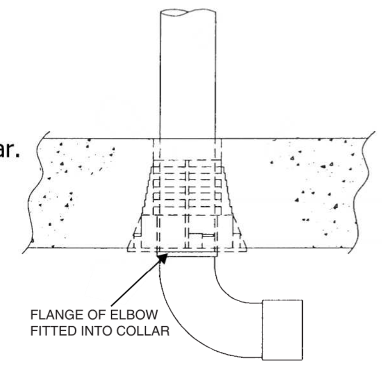
Section

Restrictions/Notes:

Solution based on CSIRO report FCO 2285/CO3975 for installation of CP 680 in an Ultra-Floor system and CSIRO report FCO-3117 for installation of CP 680 in 100 mm thick Stahlton Floor.

Solution is suitable for following Plastic Pipes:
PP to 110 mm
PP-R to 110 mm
PE to 160 mm
HDPE to 160 mm
uPVC to 150 mm

Note: For Stack Pipe Configuration and uPVC pipe and pipe fittings the elbow fitting may be in the collar.



Collar Size 75/2.5" protects pipes 32 mm to 75 mm dia.
Collar Size 110/4" protects pipes 80 mm to 110 mm dia.
Collar Size 160/6" protects pipes 125 mm to 160 mm dia.

RAD device is a separate retro-fit collar to be installed from below. Make notches in the timber in-fill to accommodate the device where it is required (for floor waste applications).

1. Use the correct size collar - refer Notes.

2. The timber deck is cut away to completely expose the metal ring at the bottom of the CP 680 N collar. The cutaway section is required to be within the following dimensions:

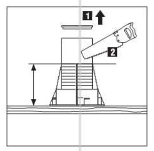
Hilti Firestop Collar Size	Minimum Hole Diameter	Maximum Hole Diameter
CP 680-75/2.5"	122	142
CP 680-110/4"	175	195
CP 680-160/6"	242	262

3. Nail the collar in place centred over the hole. Secure the top cap in place prior to concrete pour to prevent flow of concrete into the cast-in collar.

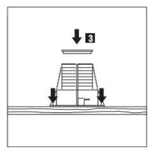
4. Pour concrete and once set remove protective cap and install pipe. Pipe may be installed from above or below.

5. Any insulation to the pipe is to be maintained 50 mm below the level of the timber in-fill

Height adjustment For Floor Wastes



1 Remove the top cap, and cut the device to the right slab thickness



2 Replace the top cap and make sure it fits correctly.

Installation Instructions

Hilti Retrofit addition CP 680 110/4" N-RAD : Installation Guidelines:

Step 1: Place to Install:

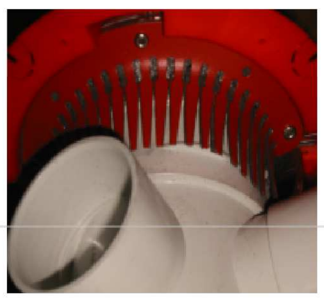
Place the RAD with the Red surface facing the bottom of the installed Hilti Fire Collar.

You only need 30mm clearance from the bottom of the slab to do this, and more space is even better.

Step 2: Rotate to Install:

Leverage the RAD so that the Red surface becomes visible from the bottom of the collar.

Even with only 30mm clearance from the bottom of the slab you can do this. With more space it is very easy to do this.



Step 3: Push to Install:

Push the RAD so that the Red surface becomes 100% visible from the bottom of the collar.

The RAD will fit tightly into the bottom of a Hilti Fire Collar, and hold in place for the screws to be inserted into the pre-drilled holes.

Step 4: Drill to Install:

Screw the RAD so that it is securely fixed into the metal ring in the bottom of the Hilti Fire Collar.

Use a Hex Head socket, and a cordless screw-gun with sufficient torque to drill the screws into the metal ring.

Step 5: Meet to Install:

Position the second half of the RAD so that it meets, but does not overlap, the first half of the RAD.

Then repeat steps 1 – 4 above.

RAD install time should be less than 2 minutes.

This sketch does not constitute a complete fire engineering design or detail. Detailed construction drawings are provided by others. Best viewed in colour. Not all fire separations around ducts and shafts are shown.

Legend

Holmes

Holmes Fire LP
holmesfire.com

Project Title
HWCP

Sketch Title
Plastic Pipes up to 160 mm Dia., Penetrations through Concrete Floors Cast in Hilti CP648-E Solution

Drawn: DXM	Date: 22 / 10 / 2019	
Project No.	Sheet No.	Rev
136249	CF-P-06	A

Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Notes

Products: INTUSIL & INTUSLEEVE
Approvals: AS 1530.4/AS 4072
BK: 4
Ref: T35319300
ID: 44

Scenario: Penetration seal to multiple service penetrations

Construction: Concrete floor 150mm

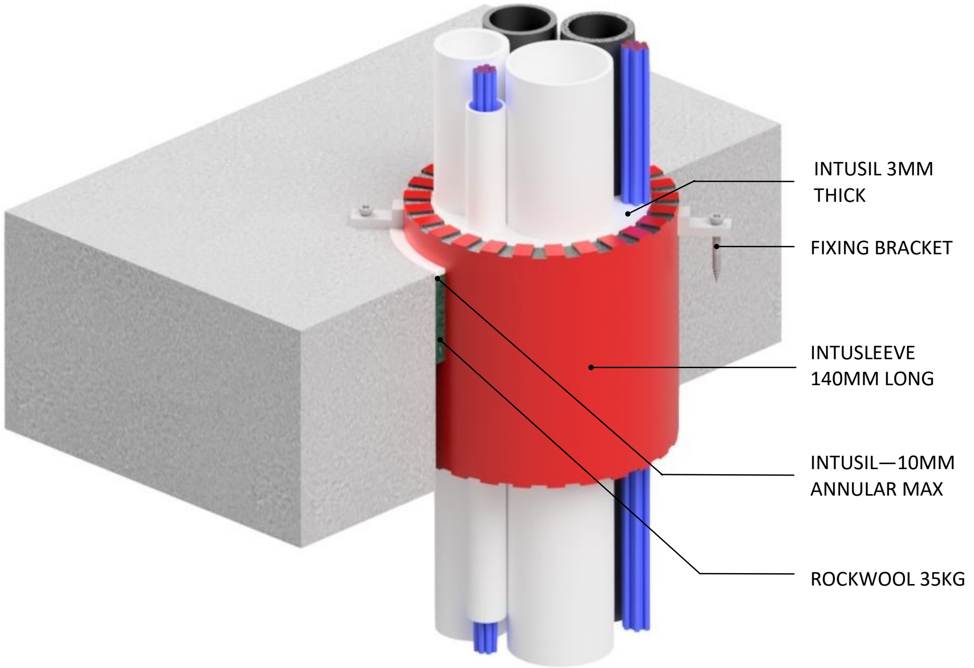
Fire Rating: Integrity: 240 minute
Insulation: 60 minute

Service Penetrations: Fibre optic cables through PVC conduit,
Fibre optic cable bundle,
Twin & Earth cable bundle,
PE Pipes, & PVC pipes

Web based drawings are for example only, fire performance of any system is dependant on, but not limited too - size of opening, substrate, if penetrations are passing through, type, size and number - please refer to Ryanfire technical department for detailed and specific fire performance information.

INSTALLATION INSTRUCTIONS

1. ENSURE THE APERTURE IS CLEAN AND FREE OF DEBRIS AND LOOSE CEMENT. REMOVE DUST FROM SURFACES REQUIRING INSTALLATION.
2. SELECT CORRECT DIAMETER INTUSLEEVE (140MM LONG) FOR SERVICE PENETRATIONS.
3. SECURE 150X20X2MM L BRACKETS TO INTUSLEEVE USING STEEL SELF TAPPING SCREWS TO SUIT INTUSLEEVE WALL THICKNESS.
4. POSITION THE INTUSLEEVE AROUND THE SERVICE PENETRATION.
5. FIX INTUSLEEVE TO TOP OF THE CONCRETE FLOOR USING SUITABLE MILD 40MM LONG STEEL FIXINGS.
6. APPLY 60MM THICK 35KG ROCKWOOL AROUND INTUSLEEVE, CREATING A 3MM DEEP RECESS FROM THE TOP OF THE CONCRETE FLOOR.
7. FILL 3MM DEEP RECESS WITH INTUSIL.
8. APPLY 3MM INTUSIL TO ANY GAPS WITHIN INTUSLEEVE.
9. CLEAN EXCESS MATERIAL AWAY USING A DAMP CLOTH.



RYANFIRE
PASSIVE FIRE PROTECTION

Client	
Job Title	
Drawing Title: **Intusleeve to Multiple Service Penetration - Concrete Floor**	
Scale: NTS	Date: Oct 2017
Sheet Size: A3	Drawn By:
Drawing Number: V63.1	Rev: 1.0

Please note:
Ryanfire Products Ltd owns and has copyright in these drawings. They are to be used only for the purpose for which they were intended and supplied and are not to be sold, transferred or made available for use by a third party.

Any misuse of these drawings will result in legal proceedings.

All errors and omissions excepted - the Information contained within this drawing is believed to be correct on the date of publication, and is based upon tested and certified solutions. The policy of **RyanFire Products Ltd** is one of constant improvement. Installers must therefore ensure that they are following the latest published drawings, test evidence and instructions. Whilst **RyanFire Products Ltd** will endeavour to keep its publications up to date, the accuracy of the information contained within this drawing may be affected by pertinent changes in the law or regulatory requirements and alterations or amendments to the specification of **the manufactured** products. Terms and conditions of sale apply.

RYANFIRE Technical Support: info@ryanfire.co.nz - Tel 09 443 0362

Environmental & Planning
Services I.C.C.
Document Received

17 Dec 2019

Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381

Products: ELECTROPAD
Approval: AS 1530.4/AS 4072.1
BK: 1
Ref: 35084000
ID: 29/30

Scenario: Electrical socket and metal back box fitted through gypsum fire wall.

Penetrations: Electrical socket metal back box.

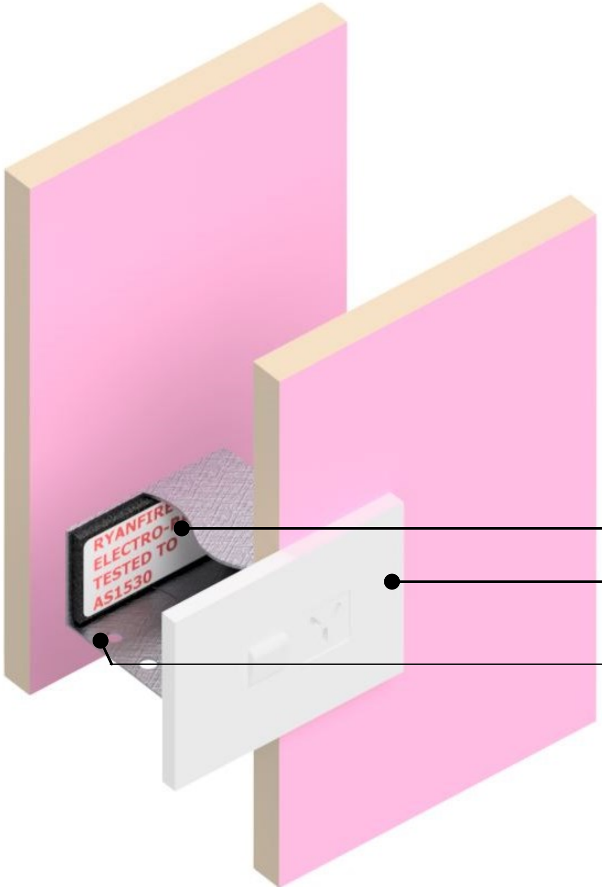
Construction: 95mm x 45mm
Softwood section studwork.
13mm fire rated plasterboard fixed to both sides of studwork.

Fire Integrity: 60 minutes.
Insulation: 60 minutes.

Web based drawings are for example only, fire performance of any system is dependant on, but not limited to size of opening, substrate, if penetrations are passing through, type, size and number. Please refer to Ryanfire technical department for detailed and specific fire performance information.

INSTALLATION INSTRUCTIONS

1. ENSURE ELECTRICAL SERVICES ARE ISOLATED PRIOR TO ANY WORKS BEING UNDERTAKEN.
2. REMOVE ELECTRICAL FACE PLATE.
3. ENSURE THE APERTURE IS CLEAN AND FREE OF DEBRIS AND LOOSE CEMENT. REMOVE ALL DUST FROM SURFACES REQUIRING INSTALLATION.
4. SELECT THE ELECTROPAD TO FIT WITHIN THE ELECTRICAL BACK BOX.
5. APPLY INTUMASTIC TO THE BACK OF THE ELECTRICAL BOX TO ENABLE THE ELECTROPAD PAD TO BE ADHERED IN PLACE. FIRMLY COMPRESS THE ELECTROPAD TO BACK OF THE ELECTRICAL BOX.
6. FILL ALL THE GAPS BETWEEN THE PLASTERBOARD OPENING AND ELECTRICAL BOX WITH INTUMASTIC.
7. REMOVE EXCESS INTUMASTIC USING A DAMP CLOTH.
8. REFIT ELECTRICAL FACE PLATE.



RYANFIRE
PASSIVE FIRE PROTECTION

Client

Job Title

Drawing Title
Electropad Gypsum Fire Wall.

Scale	Date
NTS	July 2019
Sheet Size	Drawn By
A3	
Drawing Number	Rev
V37	2.0

Please note:
Ryanfire Products Ltd owns and has copyright in these drawings. They are to be used only for the purpose for which they were intended and supplied and are not to be sold, transferred or made available for use by a third party.

Any misuse of these drawings will result in legal proceedings.

All errors and omissions excepted - the Information contained within this drawing is believed to be correct on the date of publication, and is based upon tested and certified solutions. The policy of **RyanFire Products Ltd** is one of constant improvement. Installers must therefore ensure that they are following the latest published drawings, test evidence and instructions. Whilst **RyanFire Products Ltd** will endeavour to keep its publications up to date, the accuracy of the information contained within this drawing may be affected by pertinent changes in the law or regulatory requirements and alterations or amendments to the specification of **the manufactured** products. Terms and conditions of sale apply.

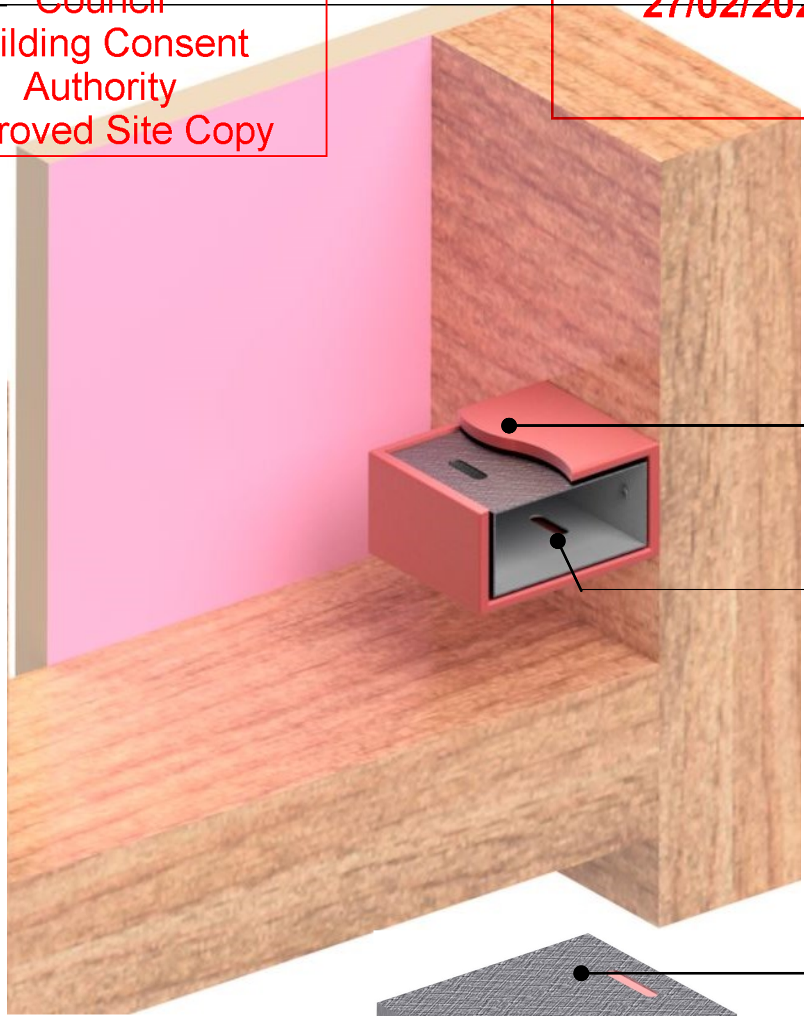
RYANFIRE Technical Support: info@ryanfire.co.nz - Tel 09 443 0362

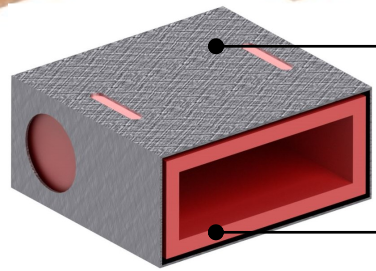
Environmental & Planning Services I.C.C.
Document Received
17 Dec 2019
Building Division

Invercargill City Council
Building Consent Authority
Approved Site Copy

Approved For Issue
27/02/2020

BUILDING CONSENT NUMBER
2019/1381





INSTALLATION INSTRUCTIONS

1. ENSURE ELECTRICAL SERVICES ARE ISOLATED PRIOR TO ANY WORKS BEING UNDERTAKEN.
2. ENSURE THE APERTURE IS CLEAN AND FREE OF DEBRIS. REMOVE ALL DUST FROM SURFACES REQUIRING INSTALLATION.
3. SELECT PUTTY PADS TO FIT AROUND ELECTRICAL BACK BOX.
4. MOULD AROUND ELECTRICAL BACK BOX TO ENSURE THE ENTIRE BOX IS ENCLOSED/SURROUNDED.
5. FIX ELECTRICAL BACK BOX INTO POSITION AS PER MANUFACTURERS INSTRUCTIONS.
6. FILL ALL GAPS BETWEEN THE PLASTERBOARD OPENING AND ELECTRICAL BOX WITH INTUMASTIC.
7. FIT ELECTRICAL FACE PLATE.

Products: RYANFIRE ACOUSTIC PUTTY PAD
Approval: AS 1530.4/AS 4072.1
BK: 46 / 51 / 52
Ref: 51028300 / 56662701 / 51892000
ID: A, B / C / D

Scenario: Electrical socket and metal back box fitted through gypsum fire wall.

Penetrations: Electrical socket metal back box.

Construction: 95mm x 55mm.
Softwood section studwork.
13mm fire rated plasterboard fixed to both sides of studwork.

Fire Integrity: 90 minutes (External Mould)
Fire Insulation: 60 minutes (External Mould)

Fire Integrity: 60 minutes (Internal Mould)
Fire Insulation: 60 minutes (Internal Mould)

Acoustic Rating: ISO 10140.2 (STC60)

Web based drawings are for example only, fire performance of any system is dependant on, but not limited to size of opening, substrate, if penetrations are passing through, type, size and number. Please refer to Ryanfire technical department for detailed and specific fire performance information.

RYANFIRE PASSIVE FIRE PROTECTION

Client

Job Title

Drawing Title
Acoustic Putty Pad Gypsum Fire Wall.

Scale	Date
NTS	July 2019
Sheet Size	Drawn By
A3	

Drawing Number	Rev
V37.2	2.0

Please note:
Ryanfire Products Ltd owns and has copyright in these drawings. They are to be used only for the purpose for which they were intended and supplied and are not to be sold, transferred or made available for use by a third party.

Any misuse of these drawings will result in legal proceedings.

All errors and omissions excepted - the Information contained within this drawing is believed to be correct on the date of publication, and is based upon tested and certified solutions. The policy of **RyanFire Products Ltd** is one of constant improvement. Installers must therefore ensure that they are following the latest published drawings, test evidence and instructions. Whilst **RyanFire Products Ltd** will endeavour to keep its publications up to date, the accuracy of the information contained within this drawing may be affected by pertinent changes in the law or regulatory requirements and alterations or amendments to the specification of **the manufactured** products. Terms and conditions of sale apply.

RYANFIRE Technical Support: info@ryanfire.co.nz - Tel 09 443 0362

Environmental & Planning Services I.C.C. Document Received

17 Dec 2019

Building Division

Invercargill City Council Building Consent Authority Approved Site Copy

Approved For Issue 27/02/2020

BUILDING CONSENT NUMBER 2019/1381

Holmes

HWCP Invercargill

stem Matrix 24-Sep-19 Z0 FS 100 v8

Activation Protocol	ALARM SIGNAL ORIGIN										
	Manual Call Point (Z1,Z2 Z3)	Smoke Detector (Z1 Anchor)	Smoke Detector (Z1 Childcare)	Smoke Detector (Z2 North)	Smoke Detector (Z2 all other)	Sprinkler Flow switch Zone 1	Sprinkler Flow switch Zone 2 (Ground or L1)	Sprinkler Flow switch Zone 3 (L1, L2 or L3 carpark)	Sprinkler Flow switch Zone 3 (L4 or L5 carpark)	Zone 1 FireFighters Control Panel Manual Switch	Zone 2 FireFighters Control Panel Manual Switch
FENZ Signalled	Y	Y	Y	Y	Y	Y	Y	Y	Y		
Fire Indicator Panel	Y	Y	Y	Y	Y	Y	Y	Y	Y		
Childcare RDU indicate origin	Y	Y	Y	Y	Y	Y	Y	Y	Y		
Building Wide Evacuation	Y	Y	Y	Y	Y	Y	Y	Y	Y		
Access control doors (mag clamp/security) release [1]	Y	Y	Y	Y	Y	Y	Y	Y	Y		
Electromechanical hold open devices	Y	Y	Y	Y	Y	Y	Y	Y	Y		
Z3 Elevators return to ground and opens	Y	Y	Y	Y	Y	Y	Y	Y	Y		
"No Exit" signage on for Childcare.				Y				Y			
Entry Traffic barrier arm stays down, Exit Traffic barrier arm open	Y	Y	Y	Y	Y	Y	Y	Y	Y		
Main Gas Solenoid	Y	Y	Y	Y	Y	Y	Y	Y	Y		
Tenancy Gas Shutoff (Foodcourt) (method of demonstrating to be considered by Cosgroves)											
HVAC shutdown (Z1 Common area Anchor)	Y	Y				Y	Y	Y	Y		
HVAC Shutdown (Z2 Common Mall Areas)	Y	Y		Y	Y	Y	Y	Y	Y		
HVAC Shutdown (Z2 Food tenancies)											
HVAC Shutdown (Z2 All tenancies)											
HVAC/Jet fan Shutdown (Z3 Carpark)	Y							Y	Y		
HVAC Shutdown (ventilation between firecells)	Y	Y	Y	Y	Y	Y	Y	Y	Y		
Z1 Anchor Smoke Extract System [3]		Y								Y	
Z2 Mall Smoke Extract System [3]				Y							Y
Z1 Auto-Doors (To Esk St & Carpark) [1, 2]	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y
Z2 Auto-Doors (To Esk St & Tay St) [1, 2]	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y
Sepatation to HWR Tower											
Separation to Reading Cinema											

Text black colour relates to works that are part of the expected works for associated building works (Z1 & Z3)

Text blue colour relates to works that are part of the future expected works (Z2)

Text red colour relates to potential future interface needs which are yet to be established.

Notes:

1. Auto-Opening of Exit Doors and Security release is only required during the hours for which either the Zone 2 or Zone 1 is in trade (e.g. when public occupancy is permitted within the building) and on activation of the manual switch at the FFCP.
2. If Smoke Extract Systems operated from the Fire Fan Control Panel (FFCP) the auto-open exit door functionality is to be interfaced with the FFCP also, to ensure that the smoke extract systems do not operate without the auto-doors opening to provide inlet/make-up air.
3. If Smoke Extract System has been triggered/ initiated in either Zone, and additional alarm signals activate, only the original smoke extract is to function.