



THE FULL SPECTRUM
OF DEVELOPMENTS

0410 659 795
admin@allspecap.com

STATEMENT OF ENVIRONMENTAL EFFECTS

**Proposed Office & Shop to replace
existing and Service Station upgrade**

9807 New England Highway,
Glen Innes NSW 2370

13th March 2019

ALLSPEC

58 Fitzroy Street
Tumut NSW 2720

Phone: +61 410 659 795
Email: admin@allspecap.com

CONTENTS

1	INTRODUCTION.....	4
1.1	Location.....	4
1.2	Clients Details.....	5
1.3	Description of Proposal.....	5
1.4	Surrounding Land use	6
2	PROPOSED DEVELOPMENT	6
2.1	Operation	6
2.2	Site Design.....	6
2.3	Fuel Deliveries.....	6
2.4	Above Ground Fuel Tank.....	7
2.5	Holding Tank	7
2.6	Signage	8
2.7	Storm Water Management.....	8
3	ASSESSMENT OF ENVIRONMENTAL EFFECTS	8
3.1	Environmental Planning Instruments	9
3.2	Glen Innes Severn Council Local Environment Plan 2012.....	9
3.2.1	Land Use Zones	9
3.2.2	Land Use Table	9
3.2.3	Flood Planning.....	10
3.2.4	Bushfire Prone Land.....	11
3.2.5	Drinking Water Catchments.....	11
3.2.6	Essential Services	12
3.3	State Environmental Planning Policy (Infrastructure 2007)	12
3.3.1	State Environmental Planning Policy No. 64 – Advertising and Signage	13
3.3.2	State Environmental Planning Policy No 33—Hazardous and Offensive Development 15	
3.4	Glen Innes Severn Council Development Control Plan 2014.....	17
3.4.1	Chapter 6 – Development in Commercial & Industrial Areas.....	17
3.4.2	Chapter 7 – Access and Parking.....	20
3.5	Other Relevant Planning Matters:	23
4	CONCLUSION.....	24
5	Preliminary Hazard Analysis:.....	25

Tables

Table 1-1: Location and Property Description	4
Table 1-2: Clients Details.....	5

Figures

Figure 1-1 Location Map of Lot C DP 348764 (image taken from Google Maps)	4
Figure 2-1 Aerial view of Lot C DP 348764 (image taken from Six Maps).....	5
Figure 3-1 B6 Land Zoning of Lot C DP 348764 (image taken from Planning Portal)	9
Figure 3-2 Flood Prone Area surrounding Lot C DP 348764 (image taken from Planning Portal).....	10
Figure 3-3 Bushfire Land surrounding Lot C DP 348764 (image taken from Planning Portal).....	10
Figure 3-4 Drinking Water Catchment surrounding Lot C DP 348764.....	11

1 INTRODUCTION

In accordance with Division 1 of the Environmental Planning and Assessment Regulation 2000, a development application (DA) must be accompanied by a Statement of Environmental Effects. This document has been prepared by Allspec and Partners for Lot C DP348764. The document identifies the main environmental effects identified for the DA submission of proposed office and shop to replace existing at Glen Rest Tourist Park, 9807 New England Highway, Glen Innes NSW.

1.1 Location

The proposed development site is in the town of Glen Innes. Glen Innes is a town on the Northern Tablelands, in the New England region of New South Wales, Australia. It is the centre of the Glen Innes Severn Shire Council. The town is located at the intersection of the New England Highway and the Gwydir Highway. At the 2016 census, Glen Innes had a population of 6,155. The development site is situated on the New England Highway.

Table 1-1: Location and Property Description

LOCATION AND PROPERTY DESCRIPTION			
Unit No:	House No:	Street:	Suburb:
NA	9807	New England Highway	Glen Innes
Lot and DP or SP:			Post Code:
Lot C DP 348764			2370



Figure 1-1 Location Map of Lot C DP 348764 (image taken from Google Maps)

1.2 Clients Details

Table 1-2 below provides the clients details. The (DA) submission has been submitted on behalf of the client by Allspec and Partners: 58 Fitzroy Street, Tumut NSW 2720. (Phone: +61 410 659 795).

Table 1-2: Clients Details

CLIENTS DETAILS	
Name or Company: Xpress Fuels	
Address: P.O Box 807 Ingleburn, NSW	Post Code: 1890
Phone: 0416 340 340	
Email: Mark@xpressgroup.com.au	

1.3 Description of Proposal

The subject site is located on the New England Highway. It has an established caravan park and service station. The existing office building is between the fuel dispenser canopy and amenities block. It has a floor area of approx. 13.6m² and is approx. 450mm below the pavement height of the fuel canopy. The proposed development is to replace this section with a larger building of approx. 38m² with a finished floor height approx. 100mm above the existing pavement height.

The service station will be upgraded and rebranded, with new fuel dispensers and an additional above ground diesel tank.

An aerial photo of the subject site is shown in **Figure 2** below.



Figure 2-1 Aerial view of Lot C DP 348764 (image taken from Six Maps)

1.4 Surrounding Land use

The surrounding land uses are predominately mixed-use business/residential and rural properties.

2 PROPOSED DEVELOPMENT

The proposed development will involve the following:

- Demolition of the existing office building
- Construction of a new office/shop building
- Upgrade/rebrand of the fuel facilities

Redevelopment of the site will comprise the following but not be limited by:

- Earthworks and Site Preparation;
- Installation of an above ground diesel storage tank
- Replacement of the existing fuel and diesel dispensers
- Installation of a second fuel dispenser under the canopy
- Installation of bunding around the fuel dispenser canopy
- Installation of a 5000L below ground holding tank for run-off and spills from the bunded area
- Further testing of the existing underground fuel tanks and pipework and replacement if found inadequate. There are three existing tanks, a 27600L ULP tank and a 10000L diesel tank (located between the forecourt canopy and the New England Highway property boundary), and a 4500 PULP (located near the diesel bowser).
- Installation of an illuminated pylon sign

A full set of plans including the proposed additional work can be viewed at the end of this report along with any other information to support this statement of environmental effects.

2.1 Operation

The service station will continue to provide a range of fuel products, including but not limited to ULP, premium and diesel. The service station will operate 7 days per week between the hours of 6am and 10pm and will be staffed by at least one person during opening hours. There will be no provision for 24hr fuel purchases at this stage.

2.2 Site Design

The proposed office and shop will be in the same location as the existing building but will extend further north and east. It will be built against the existing amenities building and extend to the steel columns supporting the canopy.

2.3 Fuel Deliveries

Fuel deliveries will be made by heavy rigid vehicle, up to three or four times per week depending on requirements, generally outside of peak times. The fuel refilling points will remain in their current location between the fuel canopy and the New England Highway property boundary. The new above ground diesel tank will be direct filled.

There is adequate room within the development site for the delivery tankers to manoeuvre into and out of the site in a forward direction, entering and exiting from two driveways on the New England Highway. At no time is there a need to reverse a tanker.

2.4 Existing Fuel Tanks & Lines

The UPSS Precision Testing Report 1807241 prepared by Neo Consulting identifies that the existing fuel tanks and lines failed integrity testing. As per recommendations in the report, the fuel tanks will

be retested in isolation. If they do not pass they will be repaired if possible (replacement of leaking foot valves) or replaced if necessary. All fuel suction lines will be replaced given their age and current condition. The system will then be rechecked prior to commissioning.

2.5 Above Ground Fuel Tank

Installation of a new 38,000L tank is proposed, as located on the proposed site plan. Its specifications have been provided with the Development Application. A new underground diesel line would be installed to connect it with the bowsers.

The tank would be self-bunded and satisfy the following Australian Standards:

- AS 1692-2006 Steel Tanks for Flammable and Combustible Liquids
- AS 1657-1992 Fixed Platforms, Walkways, Stairways and Ladders - Design, construction and installation
- AS 1940-2004 The Storage and Handling of Flammable and Combustible Liquid

2.6 Holding Tank

Bunding and pits will be provided to the fuel canopy area to ensure any stormwater discharging from this area is directed into the proposed 5000L holding tank, as located on the proposed site plan. This tank will have an alarm installed which will be triggered at 75% full. A licenced contractor will then be engaged to remove the contents to an appropriate disposal site. The tank will be checked every six months (after winter) to ensure that the alarm is operating correctly.

Operation Control under Spill Conditions

Minor fuel spills will be managed by the staff members on duty using local spill kits to Control, Contain and Clean Up any spillages. The Spill kits will be strategically located next to the fuel bowsers and will be checked weekly and replenished as required.

Major Spills

These spills are very infrequent on service station sites, but from a risk perspective must be able to be accommodated. The holding tank will hold the major spills if any and it will be disposed of by the licensed contractor. Should a major spill occur it would activate the Service Station Emergency Procedure to call Fire Brigade and evacuate.

2.7 Signage

The proposed signage will consist of statutory service station signage and individual franchise signage. A 6m high pylon sign is proposed near the New England Highway property boundary and brand signage will be placed off the canopy. The new signage will be modernised and illuminated at night while the service station is open.

A proportion of the sign will be designated to statutory required pricing signage, as required under *Division 3 Fuel price signs* of the *Fair-Trading Regulation 2012*, which states as follows:

10 Product information standards

The product information standard for prescribed fuel supplied to retail customers at a petrol station is that information in relation to the types of prescribed fuel so supplied at the petrol station must be displayed in accordance with the requirements of clauses 11 and 12.

11 Product information standards

(1) The price of prescribed fuel supplied to retail customers at the petrol station must be displayed at the petrol station on one or more signs that are so positioned and lit that any price and other matter that the signs display will be readily seen by motorists approaching the petrol station at any time that the petrol station is open for business for the supply of prescribed fuel.

(2) All signs at the petrol station (including signs required by subclause (1)) that display information in relation to the price of prescribed fuel supplied to retail customers at the petrol station may display only the normal price of the prescribed fuel and no other price for that fuel.

2.8 Storm Water Management

The roof water from the proposed new building will be connected to the existing stormwater system and is not expected to significantly increase the volume of stormwater.

3 ASSESSMENT OF ENVIRONMENTAL EFFECTS

The following is an assessment of the proposed development in accordance with the relevant matters for consideration listed under Division 4.3 of the EP&A Act 1979. Division 4.3 (4.15) of the EP&A Act states the following;

4.15 Evaluation

In determining a development application, a consent authority is to take into consideration such of the following matters as are of relevance to the development the subject of the development application:

(a) the provisions of:

(i) any environmental planning instrument, and

(ii) any proposed instrument that is or has been the subject of public consultation under this Act and has been notified to the consent authority (unless the Planning Secretary has notified the consent authority that the making of the proposed instrument has been deferred indefinitely or has not been approved), and

(iii) any development control plan, and

(iiia) any planning agreement that has been entered under section 7.4, or any draft planning agreement that a developer has offered to enter under section 7.4, and

(iv) the regulations (to the extent that they prescribe matters for the purposes of this paragraph),

that apply to the land to which the development application relates,

(b) the likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality,

(c) the suitability of the site for the development,

(d) any submissions made in accordance with this Act or the regulations,

(e) the public interest.

3.1 Environmental Planning Instruments

The following Environmental Planning instruments apply to the subject site because of the proposed redevelopment:

- ✓ Glen Innes Severn Council Local Environmental Plan 2012;
- ✓ State Environmental Planning Policy (Infrastructure 2007);
- ✓ State Environmental Planning Policy no.64 Advertising and Signage; and
- ✓ Glen Innes Severn Council Development Control Plan 2014

3.2 Glen Innes Severn Council Local Environment Plan 2012

The main Environmental Planning Instrument (EPI) which applies to the subject site is the Glen Innes Local Environment Plan (LEP) 2012. The following sections undertake an assessment of the relevant provisions.

3.2.1 Land Use Zones



Figure 3-1 B6 Land Zoning of Lot C DP 348764 (image taken from Planning Portal)

The subject site is currently zoned B6-Enterprise Corridor. Under B6-Enterprise Corridor zoning a Caravan park is prohibited but a Service Station is not. As prior approval would have been granted for the site to operate a Caravan park and Service Station and the proposed development will not change that use, Allspec believes the use should be permitted to continue.

3.2.2 Land Use Table

The Land use table of Glen Innes Severn Council LEP 2012 states as follows in relation to B6-Enterprise Corridor zone:

1-Objectives of zone

- To promote businesses along main roads to encourage a mix of compatible uses.
- To provide a range of employment uses (including business, office, retail and light industrial uses).
- To maintain the economic strength of centres by limiting retailing activity.
- To provide for residential uses, but only as part of a mixed-use development.

2-Permitted without consent

Environmental protection works; Flood mitigation works

3-Permitted with consent

Agricultural produce industries; Business premises; Community facilities; Garden centres; general industries; Hardware and building supplies; Hotel or motel accommodation; Landscaping material supplies; Light industries; Liquid fuel depots; Neighbourhood shops; Passenger transport facilities; Plant nurseries; Restaurants or cafes; Roads; Rural supplies; Shop top housing; Take away food and drink premises; Timber yards; Vehicle sales or hire premises; Warehouse or distribution centres; Any other development not specified in item 2 or 4

4-Prohibited

Agriculture; Air transport facilities; Airstrips; Animal boarding or training establishments; Bed and breakfast accommodation; Boat launching ramps; Boat sheds; Camping grounds; Caravan parks; Cemeteries; Centre-based child care facilities; Charter and tourism boating facilities; Commercial premises; Correctional centres; Eco-tourist facilities; Environmental facilities; Extractive industries; Farm buildings; Farm stay accommodation; Forestry; Heavy industrial storage establishments; Helipads; Home-based child care; Home businesses; Home occupations; Home occupations (sex services); Industries; Jetties; Marinas; Mooring pens; Moorings; Open cut mining; Recreation areas; Registered clubs; Residential accommodation; Respite day care centres; Restricted premises; Rural industries; Services apartments; Storage premises; Waste disposal facilities; Wharf or boating facilities

The premises currently operate as a caravan park and service station. The proposed development is intended to improve the amenity and appearance of the site, and will not change the existing use.

3.2.3 Flood Planning

The objective of *Clause 7.1 Flood Planning* is to (a) minimise the flood risk to life and property associated with the use of land; (b) to allow development on land that is compatible with the land's flood hazard, taking into account projected changes as a result of climate change; and (c) to avoid significant adverse impacts on flood behaviour and the environment.

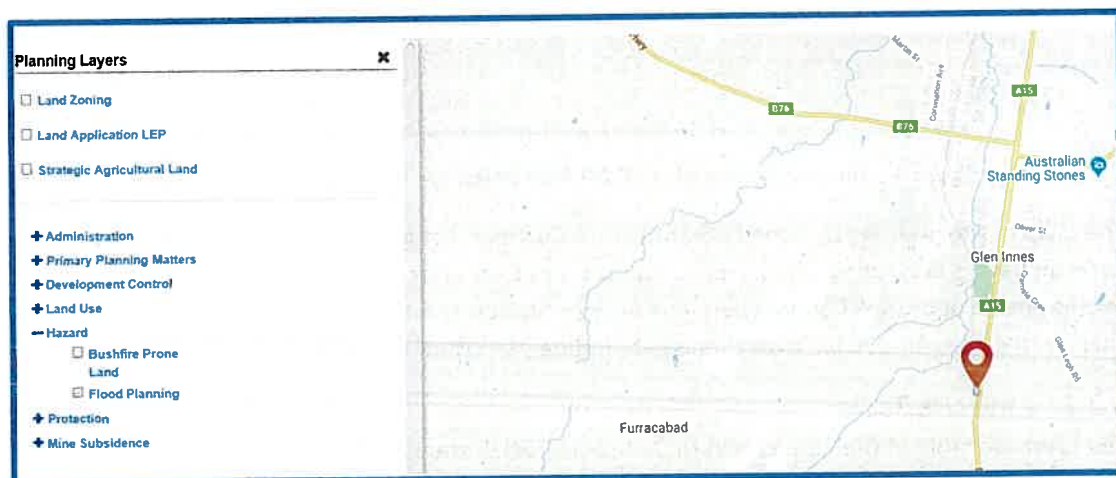


Figure 3-2 Flood planning area surrounding Lot C DP 348764 (image taken from Planning Portal)

The subject site is not located within the flood planning area and the redevelopment of the subject site will not affect the flood planning area of the Glen Innes Severn Council LEP 2012.

3.2.4 Bushfire Prone Land

The subject site is not located on bushfire prone land.

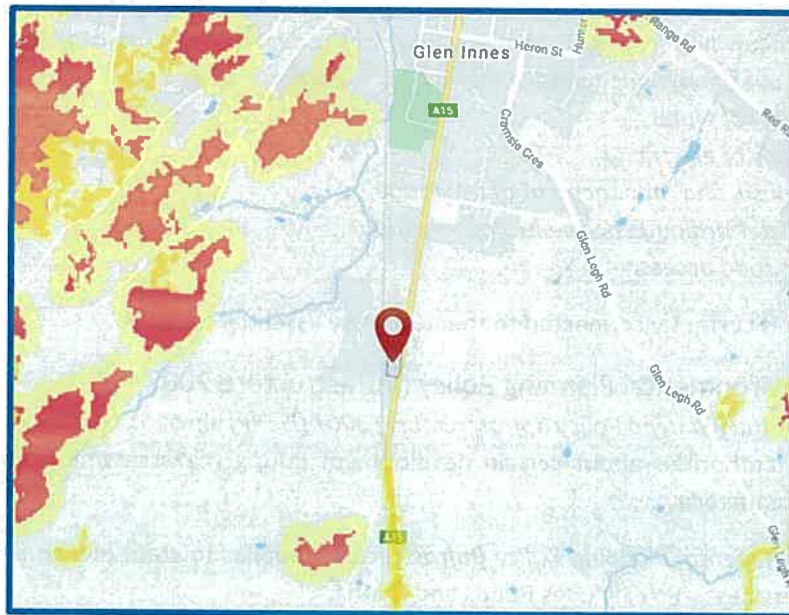


Figure 3-3 Bush Fire Prone Land Map (image taken from Planning Portal)

3.2.5 Drinking Water Catchments

The objective of *Clause 7.2 Drinking Water Catchments* is to protect drinking water catchments by minimising the adverse impacts of development on the quantity of water entering drinking water storages.

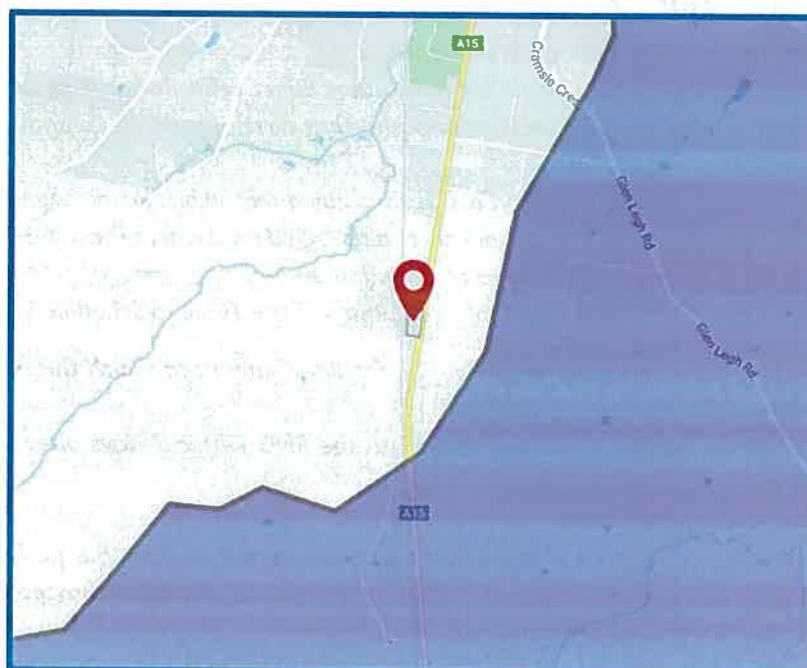


Figure 3-4 Drinking Water Catchment Map (image taken from Planning Portal)

The subject site is not located within the Drinking Water Catchment area.

3.2.6 Essential Services

The objective of *Clause 7.3 Essential Services* states the following:

Development consent must not be granted to development unless the consent authority is satisfied that any of the following services that are essential for the development are available or that adequate arrangements have been made to make them available when required:

- (a) The supply of water,*
- (b) The supply of electricity*
- (c) The disposal and management of sewerage,*
- (d) Stormwater drainage or on-site conservation,*
- (e) Suitable road access.*

The subject site is currently connected to the necessary essential services.

3.3 State Environmental Planning Policy (Infrastructure 2007)

State Environmental Planning Policy (Infrastructure) 2007 (ISEPP) aims to provide for consultation with relevant public authorities about certain development during the assessment process or prior to development commencing.

The *State Environmental Planning Policy (Infrastructure)* applies to state owned land to be used for the supply of services which includes Roads and Traffic.

Clause 104 Traffic-generating development of the Infrastructure SEPP states:

(1) This clause applies to development specified in Column 1 of the Table to Schedule 3 that involves:

- (a) new premises of the relevant size or capacity, or*
- (b) an enlargement or extension of existing premises, being an alteration or addition of the relevant size or capacity.*

*(2) In this clause, **relevant size or capacity** means:*

- (a) in relation to development on a site that has direct vehicular or pedestrian access to any road—the size or capacity specified opposite that development in Column 2 of the Table to Schedule 3, or*
- (b) in relation to development on a site that has direct vehicular or pedestrian access to a classified road or to a road that connects to a classified road where the access (measured along the alignment of the connecting road) is within 90m of the connection—the size or capacity specified opposite that development in Column 3 of the Table to Schedule 3.*

(3) Before determining a development application for development to which this clause applies, the consent authority must:

- (a) give written notice of the application to the RMS within 7 days after the application is made, and*
- (b) take into consideration:*
 - (i) any submission that the RMS provides in response to that notice within 21 days after the notice was given (unless, before the 21 days have passed, the RMS advises that it will not be making a submission), and*
 - (ii) the accessibility of the site concerned, including:*
 - (A) the efficiency of movement of people and freight to and from the site and the extent of multi-purpose trips, and*
 - (B) the potential to minimise the need for travel by car and to maximise movement of freight in containers or bulk freight by rail, and*

(iii) any potential traffic safety, road congestion or parking implications of the development.

(4) The consent authority must give the RMS a copy of the determination of the application within 7 days after the determination is made.

Service stations are included in the list at *Schedule 3 Traffic generating development to be referred to the RMS* of the Infrastructure SEPP and are subject to *Clause 104* if the capacity of the service station (including service stations which have retail outlets) is 200 or more motor vehicles with access to any road or service stations of any capacity which are accessible from a classified road as identified in the *Roads and Maritime Services Schedule of Classified Roads and State & Regional Roads*.

The subject site has existing vehicular access and egress to the New England Highway and no changes are proposed as part of the development. As the premises currently operates as a caravan park and service station it should be noted that the traffic currently generated at the subject site is accommodated safely within the road network. No additional load on the infrastructure is expected.

3.3.1 State Environmental Planning Policy No. 64 – Advertising and Signage

State Environmental Planning Policy No. 64 – Advertising and Signage (SEPP 64) aims to ensure that signage is compatible with the desired amenity and visual character of an area, provides effective communication in suitable locations and is of high quality design and finish.

SEPP 64 was amended in August 2007 to permit and regulate advertisements on road and railway corridors and provide appropriate design and safety controls for these advertisements. Complementing the provisions of SEPP 64 is the *Transport Corridor Outdoor Advertising and Signage Guidelines* (DP&I July 2007) which outlines the best practice for the planning and design of outdoor advertisements in transport corridors such as along or adjacent to classified roads, transit ways, railway corridors and rail overpasses.

The proposal includes two types of signage:

1. Price pylon sign located just inside the Eastern boundary fronting the New England Highway;
2. Business identification signage attached to the canopy fascia. The signage attached to the canopy fascia can be defined as “business identification signs” under SEPP 64.

The business identification signs identify the name and logo of the business within the building and proposed as part of the service station, and as such are defined as a ‘business identification sign’ under SEPP 64 which states:

Business identification sign means a sign:

(a) that indicates:

(i) the name of the person, and

(ii) the business carried on by the person, at the premises or place at which the sign is displayed,
and

(b) that may include the address of the premises or place and a logo or other symbol that identifies the business, but that does not include any advertising relating to a person who does not carry on business at the premises or place.

The Relevant objectives of SEPP 64 are:

(1) This Policy aims:

- (a) to ensure that signage (including advertising):
 - (i) is compatible with the desired amenity and visual character of an area, and
 - (ii) provides effective communication in suitable locations, and
 - (iii) is of high quality design and finish, and
- (b) to regulate signage (but not content) under Part 4 of the Act, and
- (c) to provide time-limited consents for the display of certain advertisements, and
- (d) to regulate the display of advertisements in transport corridors, and
- (e) to ensure that public benefits may be derived from advertising in and adjacent to transport corridors.

(2) This Policy does not regulate the content of signage and does not require consent for a change in the content of signage.

The SEPP no. 64 Signage and advertising does not apply to the following:

Reg 9 This Part applies to all signage to which this Policy applies, other than the following:

- (a) business identification signs,
- (b) building identification signs,
- (c) signage that, or the display of which, is exempt development under an environmental planning instrument that applies to it,
- (d) signage on vehicles.

The proposed signage is consistent with the objectives of SEPP 64, and will effectively communicate the business name for the subject site and will have a high-quality design and finish. The signage will be integrated with the building façade and will be compatible with the desired character and amenity of the locality.

Clause 8 Granting of consent to signage of State Environmental Planning Policy No. 64 – Advertising and Signage (SEPP 64) states as follows:

8 Granting of consent to signage

A consent authority must not grant development consent to an application to display signage unless the consent authority is satisfied:

- (a) that the signage is consistent with the objectives of this Policy as set out in clause 3 (1) (a), and
- (b) that the signage satisfies the assessment criteria specified in Schedule 1.

Clause 8 requires all signage be consistent with the objectives of the SEPP and satisfy the assessment criteria in **Schedule 1**. The proposed signage is consistent with the objectives of SEPP 64 as:

- ➔ Effectively communicates regarding the purpose and nature of the proposed business; and
- ➔ Is of high quality design and finish.

The signage satisfies the criteria of Schedule 1 as outlined in **Table 1** below.

Assessment Criteria	Response
Character of the Area	The proposed signage including Pylon sign and Canopy Fascia signage will be consistent with expectations for business identification signage. It will be of a compatible scale to the existing built form and signage in the locality. The color of the signage will be subdued and integrated with the building, being sympathetic in tone and intensity with existing development along the New England Highway.
Special Areas	The proposed Signage does not intrude into the surrounding area and will not detract from the amenity or visual quality of any environmentally

	sensitive areas, heritage areas, natural or other conservation areas, open space area, waterways, rural landscapes, or residential areas.
Views and Vistas	The proposed signage is integrated appropriately into the overall design and as such, will not obscure or compromise any important views, will not dominate the skyline or reduce the quality of vistas, and the proposal respects the viewing rights of other residents and is integrated appropriately into the design.
Site and Building	The signage is designed as an integral part of the proposed development, with individual signs incorporated into architectural elements, such as canopy fascia signage. The proposed signage respects the features of the proposed service station building, ensuring that the functionality and safety of the service station is not compromised by the signage layout and design.
Associated devices and logos with advertisements and advertising structures	Refer to plans submitted with the development application for proposed signage.
Illumination	The proposed illumination will not result in any unacceptable glare and will not be bright enough to affect safety of pedestrians, vehicles or aircraft. The proposed illumination will not detract from the amenity of any residence on the subject site or in the vicinity of the subject site. All illumination has been designed in accordance with Australian Standards and a detail providing the LUX levels has been provided with the development application.
Safety	The proposed signage will not obscure traffic signals or sightlines, and will not pose a significant risk for traffic safety for roads, pedestrians or cyclists.

3.3.2 State Environmental Planning Policy No 33—Hazardous and Offensive Development

This Policy aims:

- a) to amend the definitions of hazardous and offensive industries where used in environmental planning instruments, and
- b) to render ineffective a provision of any environmental planning instrument that prohibits development for the purpose of a storage facility on the ground that the facility is hazardous or offensive if it is not a hazardous or offensive storage establishment as defined in this Policy, and
- c) to require development consent for hazardous or offensive development proposed to be carried out in the Western Division, and
- d) to ensure that in determining whether a development is a hazardous or offensive industry, any measures proposed to be employed to reduce the impact of the development are taken into account, and
- e) to ensure that in considering any application to carry out potentially hazardous or offensive development, the consent authority has sufficient information to assess whether the development is hazardous or offensive and to impose conditions to reduce or minimize any adverse impact, and

f) to require the advertising of applications to carry out any such development

According to the clause 4

hazardous industry means a development for the purposes of an industry which, when the development is in operation and when all measures proposed to reduce or minimize its impact on the locality have been employed (including, for example, measures to isolate the development from existing or likely future development on other land in the locality), would pose a significant risk in relation to the locality:

- (a) to human health, life or property, or
- (b) to the biophysical environment.

According to the clause 13 Matters for consideration by consent authorities

In determining an application to carry out development to which this Part applies, the consent authority must consider (in addition to any other matters specified in the Act or in an environmental planning instrument applying to the development):

- (a) current circulars or guidelines published by the Department of Planning relating to hazardous or offensive development, and
- (b) whether any public authority should be consulted concerning any environmental and land use safety requirements with which the development should comply, and
- (c) in the case of development for the purpose of a potentially hazardous industry—a preliminary hazard analysis prepared by or on behalf of the applicant, and
- (d) any feasible alternatives to the carrying out of the development and the reasons for choosing the development the subject of the application (including any feasible alternatives for the location of the development and the reasons for choosing the location the subject of the application), and
- (e) any likely future use of the land surrounding the development.

According to the **Circular PS 11-008 ISSUED on 23rd Feb 2011** by the department of planning with the title “**Planning and Assessment Guidelines for Hazardous Industry**” it stated that

For development proposals categorized as ‘potentially hazardous industry’ the policy requires applicants to prepare a preliminary hazard analysis (PHA) to estimate the risk to people, property and the environment at the proposed location. This must be taken into account by the consent authority. Should such risk exceed nominated acceptability criteria, the development is classified as ‘hazardous industry’, which would not be permissible within most industrial zones in NSW.

It further states;

The assessment processes

The Department has developed an integrated assessment process for development proposals, which are potentially hazardous. The process typically requires:

- a preliminary hazard analysis to support the development application by demonstrating that risk levels do not preclude approval
- a hazard and operability study, fire safety study, emergency plan and an updated hazard analysis undertaken during the design phase of the project
- a construction safety study to ensure facility safety during construction and commissioning, particularly when there is interaction with existing operations
- implementation of a safety management system to give safety assurance during ongoing operation and
- regular independent hazard audits to verify the integrity of the safety systems and that the facility is being operated in accordance with its hazards-related conditions of consent.

The above ground fuel storage tank will be manufactured to meet or exceed current industry standards, specifically

- AS 1692-2006 Steel Tanks for Flammable and Combustible Liquids
- AS 1657-1992 Fixed Platforms, Walkways, Stairways and Ladders - Design, construction and installation
- AS 1940-2004 The Storage and Handling of Flammable and Combustible Liquid

The proposed above-ground fuel storage tank will be self-bunded and would be installed by the qualified persons. The specifications of the tanks have been attached in the appendix of the report. A preliminary hazard analysis report can be seen in section 5 of this report.

3.4 Glen Innes Severn Council Development Control Plan 2014

3.4.1 Chapter 6 – Development in Commercial & Industrial Areas

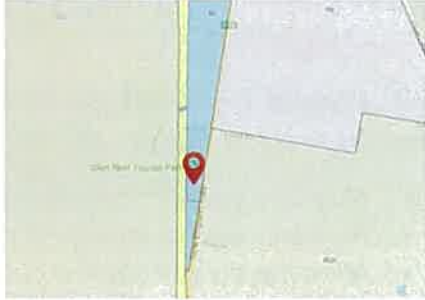
Objective : *This chapter is intended to achieve the following:*

- *To reinforce the role of the town centre (B2 zone) as the main focus for retail and commercial activity within Glen Innes*
- *To provide guidelines for elements, such as the external appearance of buildings and landscaping, which contribute towards appropriate streetscape character*
- *To ensure that the design of developments provides ease of access for pedestrians, including people with disabilities*
- *To ensure that business and industrial development is served by the necessary physical infrastructure, including reticulated water supply and sewerage drainage systems*
- *To ensure that adequate vehicular access and parking is provided so as to protect the safety of other road users*

Controls:

Control	Requirement	Proposed
Change of Use	Lodgement of a development application	Development application has been lodged
Access for persons with disabilities	<ul style="list-style-type: none"> - Adequate provision to be made to enable persons with disabilities to gain access to the development and to the land on which the development is proposed to be carried out - The development is to comply with the relevant Australian Standard for access for disabled persons applying at the time the development application is lodged 	<ul style="list-style-type: none"> - The existing building is not suitable for disability access with the shop floor level below the canopy ground level and stairs between. The proposed building has been designed with a 100mm level difference (for weather-proofing) with an integrated disability step to the threshold of the entrance doors and step ramp as shown on the plans provided with the application. - The internal layout of the proposed building complies with the circulation requirements of AS1428.1 as indicated on the proposed floor plan.

		<ul style="list-style-type: none"> - It is acknowledged that the floor levels between the new shop and existing tea room have a difference of 450mm. Due to space restrictions access will be via a small flight of stairs. These stairs will be compliant with AS1428.1 as indicated on the plans. An exemption is sought from this room requiring to be accessible with the following justification: <ul style="list-style-type: none"> - There is not enough space to provide a ramp for access. - The tea room area is not required to be accessed by patrons, only staff members. - The premises is a small business operated by the owners and family, without a need to hire employees. Therefore, the inability for mobility impaired employees to access the tea room would not be a cause of discrimination. - For safety reasons, it is preferred to provide internal access to the tea room (and amenities) rather than having to access them externally, having to pass through the fuel dispenser area).
Height	Max. 8.5m from the natural ground level to the top of the ridge	<ul style="list-style-type: none"> - Existing canopy height is approx. 4.8m. Proposed building roof height is 3.4m
On-site facilities	<ul style="list-style-type: none"> - Onsite facilities for garbage bin and recycling storage and service meters are designed to be physically convenient, visually attractive and require minimal maintenance - Garbage and recycling bin storage is not to be located at the street frontage - Where collection is not on the street frontage, adequate loading and turning areas for service vehicles is to be provided within the development - Adequate provision is to be made for the storage and handling of solid wastes generated by the development. The storage area is 	<ul style="list-style-type: none"> - A waste and recycling bin area is proposed at the side of the amenities building as located on the proposed site plan, with easy access from the shop (through the tea room). Existing horizontal timber slats screen the area from view from the road - There is adequate space for waste collection due to the existing layout - An area for storage of construction materials and solid waste has been provided on the proposed site plan, screened from view by existing trees/landscaping. This

	<p>to be enclosed and the material stored is to be screened from public view</p> <ul style="list-style-type: none"> - Provision is to be made for the installation and maintenance of Liquid Trade Waste facilities where required 	<p>area will be enclosed by temporary fencing if required</p> <ul style="list-style-type: none"> - NA. Holding tank is proposed for the handling of contaminated water and possible fuel and/or oil spills
<p>Development on land adjoining R1 General Residential Zone</p>	<p>Business or industrial development on land adjoining a residential zone should not have a significant adverse impact on the amenity of the residential areas in the vicinity. Applications will be required to address the following:</p> <ul style="list-style-type: none"> - Noise associated with the amount of traffic generated by the development - The type of traffic generated by the development (cars, delivery vehicles etc) - Location of car parking and loading/unloading areas - Hours of operation - Headlight glare from vehicles within the site - Odour - Nuisance caused by illumination of the development for advertising and/or security reasons - Visual impact associated with the setback of the development from the common property boundary and the design and scale of the development. Possible adverse impacts on the locality, including the above factors, should be considered when choosing the site and designing the development 	<p>The subject site does not adjoin R1 zone. Properties to the north and south are zoned B6 and to the east and west RU1.</p> 
<p>Energy Efficiency</p>	<p>Opportunities may exist to design layouts for a development which minimise winter heat loss and make use of solar energy. This may be achieved by:</p> <ul style="list-style-type: none"> - Locating main office and/or retail areas on the north side of the building. Storage areas, toilets and other rooms requiring minimum climate control could 	<ul style="list-style-type: none"> - Building design for energy efficiency was restricted due to existing site layout, however glazing has been provided to the north to capture sun and eastern glazing is shielded by the canopy. - A section J report has been provided by Energyraters to maximise opportunity for energy efficiency and to ensure

	<p>be located away from the north side</p> <ul style="list-style-type: none"> - Walls set back sufficiently from the north site boundaries to enable winter solar access to the main north facing areas - Buildings to incorporate window shading devices, such as eaves, verandahs and blinds, to reduce exposure from hot summer sun, especially on the western side of the building - Landscaping that incorporates good solar design principles 	compliance with the BCA requirements
--	--	--------------------------------------

3.4.2 Chapter 7 – Access and Parking

Objective : To ensure that new development:

- Maintains or improves traffic safety and management
- Provides adequate provision for access and parking for people with disabilities
- Minimises the visual impact of on-site parking and
- Provides for the ongoing maintenance of on-site car parking and manoeuvring areas

Controls:

Control	Requirement	Proposed
Vehicular Crossover & Driveway Width	<ul style="list-style-type: none"> - Footway crossings shall generally be constructed from concrete - Internal driveways and crossovers associated with a multi dwelling housing development shall have a minimum clear trafficable width of 5.5 metres - All existing vehicular crossings not utilised by the development will generally be required to be removed, and the area restored to match the adjoining section of kerb and footpath, prior to occupation or use of the development <p><u>Design Requirements</u></p> <ul style="list-style-type: none"> - Driveways, manoeuvring areas and parking areas are generally to be designed in accordance with the provisions of AS2890.1 Parking Facilities: Off-Street Parking 	<ul style="list-style-type: none"> - Any crossings are existing - NA. Development is not a multi housing development - The site has two existing vehicular crossovers, both required with the proposed development - Driveways are existing. No alteration or new driveways are proposed

	<ul style="list-style-type: none"> - Long straight driveways are to be avoided - All vehicles must enter and leave the site in a forward direction - The location of visitor parking facilities should be evident from the street so that their use is encouraged - The location of resident and visitor parking shall be behind the building line - One car parking space per unit is to be enclosed and form part of the unit entitlement should the development be strata subdivided - All driveways, parking areas and vehicular turning areas are to be constructed with a base course of adequate depth to suit design traffic and are to be sealed from the kerbline with either bitumen, asphaltic concrete or interlocking pavers. Full details should be indicated on the plans submitted with the development application - Each resident car parking space is to have minimum dimensions of 6m x 3m. Other parking spaces are to have minimum dimensions of 5.5m x 2.6m. Car parking spaces are to be adequately delineated and maintained at all times 	<ul style="list-style-type: none"> - Driveways are existing - The existing driveway layout provides for vehicles enter and exit the site in a forward direction - NA. Visitor parking not applicable to the proposed development - NA. Resident parking not applicable to the proposed development - NA. The proposed development does not include units - All existing driveways and parking areas are currently sealed with bitumen and has proven to be adequate quality for the current and therefore intended use - Three 6m x 2.6m parking spaces are proposed for the development, as located on the proposed site plan
Parking	<ul style="list-style-type: none"> - Car-parking spaces are to be provided on the same lot as the proposed development - Additional parking spaces required for any new development or redevelopment shall comply with the controls of this chapter and Table 7.1: Off-street Parking Rates <i>Service Station – 3 spaces per work bay plus 1 space per 30m² for convenience store = 2 spaces</i> - Accessible car parking spaces are to be provided in 	<ul style="list-style-type: none"> - The proposed parking spaces are located on the site, refer to proposed site plan for location - Two parking spaces plus an additional accessible space are proposed, as located on the proposed site plan - Marking to reserve the first space for accessible use will be provided as per AS2890.6

	<p>accordance with the Disability (Access to Premises – Buildings) Standards 2010</p> <ul style="list-style-type: none"> - Accessible car parking spaces are to be located as close as possible to the main pedestrian entrance and should have regard to the use and function of the building - Development proposals that provide less parking than required by this chapter shall be supported by a parking study - On-site parking design must meet the relevant Australian Standards (AS2890.1 and AS2890.2-2004) - All required car parking areas, driveways, turning areas and loading areas are paved in either bitumen seal coat, asphaltic or bituminous concrete, cement concrete, concrete paving blocks, or brick paving blocks - In villages & rural areas all-weather paving of driveways, turning areas, loading areas and car parking area is required. Surface materials to be at the discretion of Council’s Director of Infrastructure Services - All parking spaces shall be suitably line marked and sign-posted and be graded and drained to Council’s stormwater system - Free and interrupted access to car parking areas shall be maintained at all times - Stacked car parking is only permissible in conjunction with single dwelling houses and dual occupancies - Car parking areas are to be incorporated into the building 	<ul style="list-style-type: none"> - The front parking space will be reserved for accessible use, being the closest space to the shop entry and for ease of access without cars parked in front - The proposed development complies with the parking requirement - Proposed parking spaces exceed the 5.9m x 2.1m size required by AS2890.1, Figure 2.5 - All existing driveways and parking areas are currently sealed with bitumen - NA. The subject site is not in a village or rural area - Parking spaces will be marked as shown on the proposed site plan. Ground water run off from the spaces will flow to the existing stormwater system or adjoining landscaping - Parking has been provided in an easily accessible area - Stacked parking is not proposed - Proposed parking is along the eastern boundary as shown on the proposed site plan. Due to existing site layout parking behind the building line would not provide convenient access to
--	---	--

	or provided at, or behind, the front setback of the building	the proposed shop, and there is insufficient depth between the existing amenities and canopy for angled parking bays adjacent to the proposed building, and would also result in loss of landscaping area
--	--	---

3.5 Other Relevant Planning Matters:

3.5.1.1 Public Notification

The purpose of this notice is to establish procedures in identifying those property owners and occupiers affected by the development of land and the extent of the notification process required in the development assessment and plan making processes.

The Objectives of this plan are to:

- a) Establish an efficient and effective process for community consultation, which will minimise delays in the processing of development Applications and improve the quality of decisions;*
- b) Maintain the community's right to participate in the development assessment and plan making processes;*
- c) Foster public appreciation and understanding of the development assessment and plan making processes;*
- d) Clarify the circumstances to which a Development Application does not require notification; and*
- e) Detail the form of and requirements for public notification.*
- f) Identifies Council's approach to dispute resolution in relation to Development Applications, through conciliation.*

3.5.1.2 Section 4.15 (1)(a)(iia) Planning Agreements

There is no Planning Agreement in force relevant to this Development Application.

3.5.1.3 Section 4.15 (1)(a)(iv) Any Matter Prescribed by the regulation

There are no prescribed matters under the Environmental Planning and Assessment Regulation 2000 that are relevant to the proposed development.

3.5.1.4 Section 4.15 (1)(b) Impact on the Environment

Pursuant to Section 4.15 (1)(b) of the EP&A Act, 'the likely impacts of that development' have been considered below.

The site currently operates a caravan park and service station. The intention of the proposed development is to improve the amenity and appearance of the existing premises. As the use will continue unchanged, the proposed development is not expected to have any additional impact on the environment other than waste generated during demolition. It is envisaged that this will be recycled wherever possible with the remainder to be disposed of at authorised landfills.

4 CONCLUSION

This Statement of Environmental Effects accompanies a Development Application for proposed redevelopment of the Glen Rest Tourist Park at 9807 New England Highway, Glen Innes. The proposed works will complement the facilities already provided at the site with the construction of a larger office and shop and provision of updated fuel facilities. The assessment of environmental effects makes the following findings:

- ✓ The proposed development meets the provisions of relevant planning instruments including the SEPP (Infrastructure), SEPP 55, SEPP 64, Glen Innes Severn Council LEP 2012;
- ✓ The proposed development is compatible with the character of the locality, streetscape and surrounding land uses, and improves the amenity of the site;
- ✓ The proposed development will have a positive social and economic impact;
- ✓ The proposed development will not unreasonably impact on the amenity of neighbouring properties in relation to noise, overshadowing or privacy;
- ✓ Existing vehicle access and parking meets relevant standards;
- ✓ Traffic generated by the operations are currently accommodated safely on the road network, and the proposed redevelopment is not expected to significantly increase the amount of traffic generated at the site;
- ✓ The proposed development will generate employment during operation and construction; and
- ✓ The proposed development improves the amenity and appearance of the Glen Rest Tourist Park at 9807 New England Highway, Glen Innes.

Given the above assessment, the proposed development has planning merit and the DA can therefore be supported and granted consent by Council.

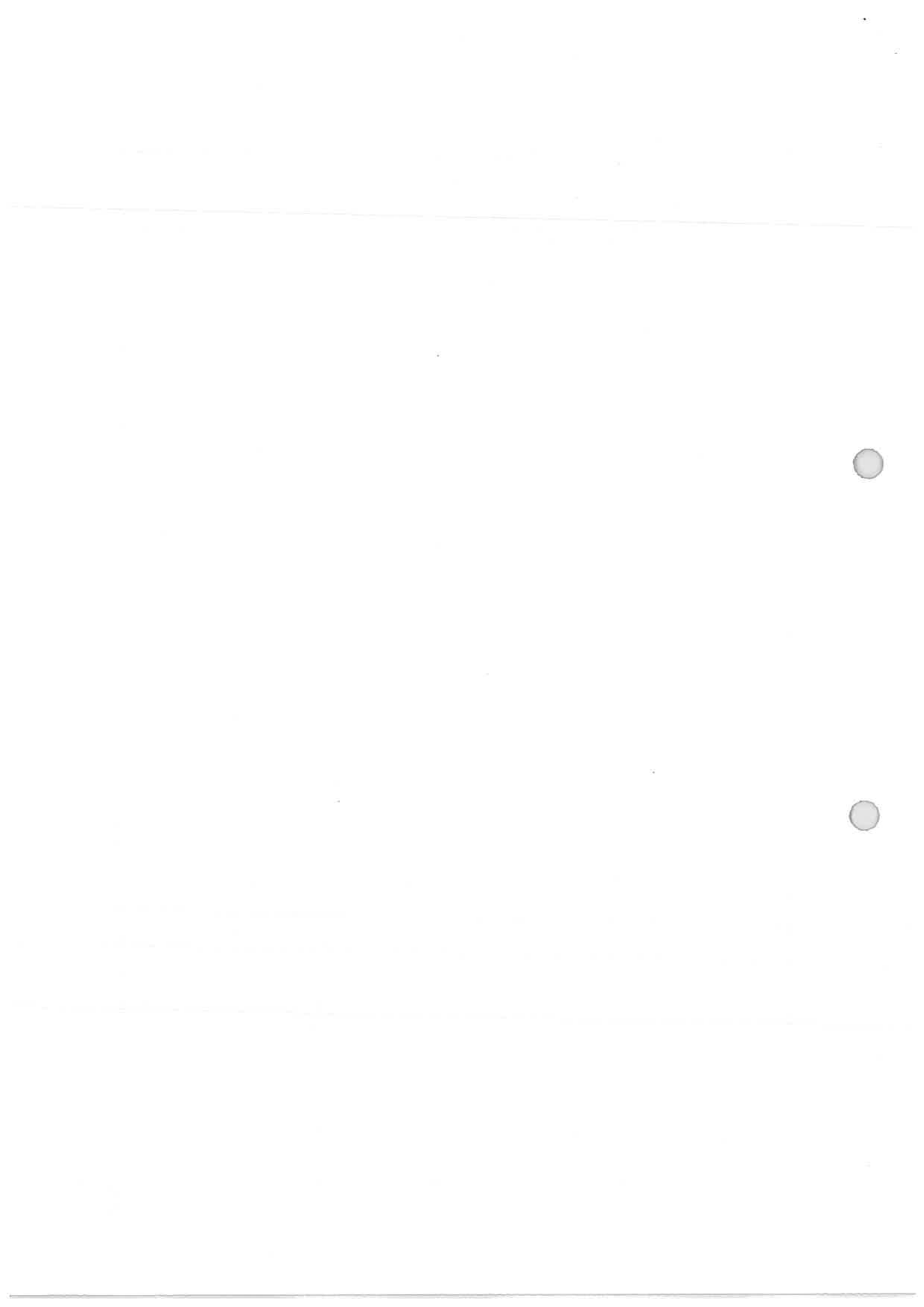
I/we declare to the best of my/our knowledge and belief that the particulars stated on this document are correct in every detail and that the information required has been supplied. I/we acknowledge that the development application may be returned to me/us if information is found to be missing or inadequate.

Name: James McMahon

Date: 20/12/18

5 Preliminary Hazard Analysis:

PHA WORKSHEET			
9807 NEW ENGLAND HWY, GLEN INNES			
Hazard / potential Accident	Cause	Major Effects	Corrective / Preventive Measures Suggested
Fuel oil spill	<ul style="list-style-type: none"> • Oil spill by customers while refilling their tanks • Oil spill by the tanker refilling the underground tanks. 	Environmental effect	<ul style="list-style-type: none"> * Concrete flooring and concrete Hump Bund around the bowsers area to stop entering that oil into ground or going into storm water. * Major Spills will be controlled with the Installation of oil and water separator to stop this to contaminate the soil or ground water. * Minor fuel spills will be managed by the staff members on duty using local spill kits to Control, Contain and Clean Up any spillages. The Spill kits will be strategically located next to the fuel bowsers and will be checked weekly and replenished as required.
Underground Tanks	Leakage of underground tanks	Environmental effect	The tanks would be self-bunded. Moreover, the tank tests would be conducted to control that on regular basis
Underground Fuel Suction Lines		Environmental effect	The Automatic Tank Gauges will be installed on the tanks for loss detection systems to automate wet stock management, environmental control and risk management across the network allowing centralised data management to optimise operational profitability.
Storm Water	Rain water contaminated with oil spills	Environmental effect	All stormwater discharging from the operational forecourt area will be drained to the 5000L holding tank.
Waste Management	Operational wastage	Environmental effect	Waste will be disposed of as per current operations.
Erosion and Sediment	Construction of site	Environmental effect	The site is predominately flat and excavation required for the development is minimal. Erosion and sediment control measures will be implemented prior to construction as required.
Potential Environmental impacts	Construction of site	Environmental effect	A construction management plan will be prepared by the company handling the construction and development of the site. It will manage potential environmental impacts of construction activities and will address the management of public pedestrian access and safety, construction vehicles, soil and water, dust, noise and waste, incorporating the SWMP
Fire	Mishandling of staff or negligence of customers	Life threatening	Staff will be trained, and the fire control system would be adopted. Safety measures signs would be posted near bowsers for the awareness of the customers.





BUILDING - LAND - GUIDANCE
THE FULL SPECTRUM OF DEVELOPMENTS

ALLSPEC & PARTNERS PTY LTD.
Shop 1, 58 Fitzroy Street
Tumut NSW 2720
Phone: (02) 6947 6761
Email: admin@allspecap.com
Website: www.allspecap.com

GENERAL SPECIFICATIONS

Proposed Office & Shop to replace
existing at:
9807 New England Highway,
GLEN INNES, NSW 2370

2nd October 2018

Allspec & Partners Pty Ltd
58 Fitzroy Street
Tumut NSW 2720
Phone: 02 6947 6761
Email: admin@allspecap.com

Table of Contents

1. Preliminaries.....	3
2. Excavations, Foundations and Footings	5
3. Concrete	5
4. Retaining Walls	7
5. Drainage and Waste Water/Sewage Treatment	7
6. Bricklaying/Masonry (BCA Part 3.3)	7
7. Carpentry (BCA Part 3.4).....	10
8. Steel Framing (Part 3.4.2 BCA)	13
9. Roofing (Tiles and Metal) (Part 3.4.1 BCA)	14
10. Internal Linings	15
11. Waterproofing	15
12. Joinery	16
13. Plumbing (National Construction Code Volume 3 – Plumbing Code of Australia (PCA)..	18
14. Electrical	19
15. Wall and Floor Tiling	20
16. Painting.....	21
Materials Schedule	22

1. Preliminaries

1.1 Scope

This Specification has been prepared for the construction of a new office and shop at the Glen Rest Tourist Park at 9807 New England Highway, Glen Innes.

The work shall be performed in accordance with:

- The approved plans;
- Any conditions of Development Consent or Complying Development Certificate;
- Conditions of the Contract of which this Specification forms part;
- The National Construction Code, Volume One and the documents (e.g. Australian Standards) adopted by the reference in the Building Code of Australia; and
- Where such work and material are not appropriately detailed by the items above, it shall be performed or installed with regard to manufacturers' guidelines and acceptable common building practices.

1.2 Definitions

Owner/s – shall also mean Proprietor/s; Principal/s, the person having the benefit of development consent or a complying development certificate

Builder/s – shall also mean contractor/s.

BCA – refers to the published editions of the National Construction Code, applicable at the date of the granting of Development Consent.

Principal Certifying Authority – shall also mean the Consent Authority; Accredited Council Certifier, Accredited Private Certifier/s.

Completion – shall mean Practical Completion.

Proprietary – shall mean an item, product, material or colour identifiable by naming the manufacturer, supplier, trade name, brand name, and reference and/or catalogue number.

Contract – shall mean the Conditions of Building Contract.

Dimensions - figure dimensions take preference over scale.

1.3 Statutory Requirements, Approvals, Fees and Inspections

All building and associated work shall comply with the relevant Acts & Regulations of Parliament and statutory requirements

1.4 Appointment of Principal Certifying Authority

In accordance with Section 6.5 of the *Environmental Planning and Assessment Act 1979*, the *Owner/s* is required to appoint the Principal Certifying Authority. The *Owner/s* is responsible for providing the *Builder* a list of mandatory critical stage inspections as required by Clause 103A of the *Environmental Planning and Assessment Regulation 2000*.

1.5 Materials

Materials shall be new, unless otherwise identified in the Schedule.

1.6 Items Supplied by Owner

Items to be supplied by the *Owner/s* shall be identified in the Addendum. Where it is agreed that additional items are to be supplied by the *Owner/s* during construction, such agreement and a description of the items shall be set out in writing to the *Builder*.

It is the responsibility of the *Owner/s* to arrange payment, for delivery and protection against damage and theft of such items. All items, unless otherwise indicated in writing by the *Owner/s* shall be new and fit for their intended purpose.

If items are not available when require, the *Owner/s* shall be obliged to make an alternative selection.

1.7 Site Access

The *Builder* has statutory responsibilities in relation to Occupational Health and Safety. In order to assist the *Builder* in maintaining a safe work site, the *Owner/s* agree to comply with any directions and instructions of the *Builder/s* concerning site access and movement on and around the site.

1.8 Site Sign

Before work commences, the *Builder* shall provide a signboard displaying the lot number, the *Builder's* name, address and license number.

The *Principal Certifying Authority (PCA)* is required to have a sign erected and maintained on the site for the duration of the project which provides their name and contact telephone number. The sign should also state that ***Unauthorised Entry to the Site is prohibited.***

Information relating to the builder and the PCA can be incorporated on a single sign.

1.9 Site Fencing and Scaffolding

Unless otherwise stated, the *Builder* shall provide site fencing to secure the site and scaffolding necessary to undertake the building work, including work undertaken by trade contractors engaged by the *Builder*.

1.10 Site Services & Amenities

Temporary Toilet Accommodation: - Not required on this site. Toilet facilities are provided in the existing amenities block. Any damage to these facilities by contractors or subcontractors shall be repaired and/or made good at the expense of the contractor.

Water Supply: - Reticulated water supply is available on the site for use during construction.

Power: - 240 volt power is available on the site for use during construction.

1.11 On Completion

The *Builder* upon completion will remove all surplus materials and construction debris from the site. The work shall be cleaned throughout.

1.12 Geotechnical Investigation

An engineer qualified to investigate the soil conditions and classify the site in the proposed building area may be engaged by either the *Builder* or the *Owner/s*. Where possible, the engineer will certify that the site will support the proposed footings, slab and building design.

Costs of such consultation will be payable by the *Owner/s* as an additional cost not allowed for/or included in the contract sum, unless otherwise specified.

1.13 Site Identification & Setting Out

The *Builder* is to visit the site and note the existing levels, site conditions and facilities. The *Builder* shall advise the *Owner/s* of any variation found at the site from the documentation or information provided.

If necessary the land shall be block and peg surveyed, and a survey certificate provided before work commences. The cost of this survey will be paid direct by the *Owner/s*.

2. Excavations, Foundations and Footings

2.1 Protection of Services

Contact Dial-Before-You-Dig NSW/ACT to identify the location of underground assets (pipe work, service lines and network installations). www.1100.com.au or phone 1100.

2.2 Environmental

2.2.1 Soil Erosion and Sediment Control

Measures shall be taken to manage the effect of Stormwater run-off to avoid erosion, sedimentation, contamination of the site, surrounding areas and drainage systems. Apply all site management requirements as specified in the Conditions of Consent.

2.2.2 Tree Protection

Protect any tree/s identified for retention on the drawings or as a Condition of Consent. Mark all trees and shrubs to be retained with visible tape or other means. Where necessary, provide physical barriers to protect marked trees and shrubs. Limit excavation within the drip-line.

The *Owner/s* shall advise the *Builder* of any vegetation protection orders related to the site.

2.3 Site Preparation

Rubbish, top soil and any vegetation within 1 metre of proposed building/s shall be cleared and removed.

2.4 Excavation

2.4.1 Scope

Excavate and backfill as required for all work shown on the drawings. The excavation and placement of fill shall be undertaken in accordance with *BCA 3.2.2*

2.4.2 Footings

Excavate trenches to Engineer's design or the approved footing design.

3. Concrete

3.1 Termite Risk Management

Termite barriers shall be installed in accordance with *AS 3660.1-2014 Termite Management* and the requirements of Glen Innes Severn Council.

Prior to the commencement of the works, the site shall be inspected for evidence of termite activity. Where termite nests are found on the site, treatment of the nests shall be carried out by a competent and qualified contractor.

3.2 Vapour Barrier

Vapour barrier installed under slab-on-ground construction shall be 0.2mm nominal thickness polyethylene film of high impact resistance and branded continuously: "*AS 2870 Concrete underlay, 0.2mm High impact resistance*".

3.3 Formwork

Quality formwork shall be used to provide shape, line, true positioning and dimension to carry all imposed loads. Brace sufficiently to prevent bowing or buckling while concrete is being poured and cured.

Where the slab edge is to be exposed for termite management, the exposed edge shall be off-the-form, smooth and without honeycomb.

3.4 Reinforcement

Steel reinforcement shall comply with *AS 3600 Reinforced Concrete Structures* and the Engineers details.

Bar chairs shall be placed to give the following clear cover:

- 40mm to unprotected ground;
- 30mm to a membrane in contact with the ground;
- 20mm to an internal surface;
- 40mm to an external surface.

3.5 Premixed Concrete

Premixed concrete shall be supplied to comply with *AS1379*.

Unless otherwise specified, concrete shall have default strength at 28 days of not less than 20Mpa (Grade N20) and have a nominal aggregate size of 20mm.

Unless otherwise specified, a default slump of 100mm will apply to residential slabs and footings.

3.6 Placement

Trenches and footings shall be dewatered and cleaned of loose and softened material prior to concrete placement.

3.7 Curing

Concrete shall be cured by covering with plastic sheeting; the application of a suitable curing compound; by keeping continually damp; or in accordance with *AS3600*.

Where adhesives to the slab surface in conjunction with floor coverings are to be used strict care should be exercised in the use and compatibility of curing compounds.

3.8 Footings and Slab on Ground

Concrete slabs and footings shall not be poured without the approval of the Engineer and/or the *Principal Certifying Authority*.

3.9 Pier and Beam Footings

Where nominated, pier and beam footings shall be constructed to the engineers' design and shall not be poured without the approval of the Engineer and/or the *Principal Certifying Authority*.

3.10 Screw in Foundations

Screw in foundations and *propriety* brand flooring systems based on composite design with pre-cast beams and in situ concrete shall be installed in accordance with the manufacturers recommendations and/or consulting Engineer.

3.11 Concrete Paths

Concrete paths shall be shown on the drawings and unless otherwise specified, shall be at least 75mm thick and if unreinforced laid in sections not more than 1800mm in length. If reinforced, the maximum length of each section shall not exceed 3000mm.

Unless otherwise specified, wood float or other non-slip finish shall be provided.

Provide falls away from the building of 1:50 for 900mm. Slope concrete up and around overflow relief gullies and set inspection openings etc. flush with the surface.

Ensure weep-holes to adjacent structure are not obstructed.

3.12 Tolerances for Concrete Floors

Shrinkage cracking can be expected in concrete floors.

Concrete floors can also be damaged by foundation movement caused by localized drying and wetting. The *Builder* is not responsible for foundation movements caused by the *Owner/s* failure to maintain drainage systems and the overwatering and misuse of watering systems to gardens located adjacent to slabs and footings.

3.12.1 Classification of Damage to Concrete Floors

Description of typical damage	Approx. crack width limit in floor	Change in offset from 3m straight edge placed over defect	Crack category
Hairline cracks. Insignificant movement of slab from level	<0.3mm	<8mm	0
Fine cracks. Slab reasonably level	<1.0mm	<10mm	1
Distinct cracks. Noticeable curve in slab or change in level	<2.0mm	<15mm	2
Wide Cracks. Obvious curvature or change in level	2mm to 4mm	15mm to 25mm	3
Gap in slab. Disturbing curvature or change in level	4mm to 10mm	>25mm	4

For further reference and Notes to Table: AS 2870, Appendix C.

4. Retaining Walls

Retaining Walls shall be constructed as identified by the approved plans of materials or *proprietary* system identified in the Schedule or otherwise specified by the *Owner/s*. *Proprietary* retaining wall systems shall be constructed to the manufacturer's requirements.

The location of retaining walls to boundaries shall be confirmed prior to construction.

5. Drainage and Waste Water/Sewage Treatment

5.1 General

l drainage work shall be carried out by a licensed drainer. Stormwater drainage shall be carried out in accordance with the BCA.

5.2 Onsite waste water treatment systems

Wastewater onsite treatment systems shall be installed in accordance with the manufacturers' requirements and the requirements of the *Local Authority*.

Following commissioning of the onsite wastewater treatment system the *Owner/s* will be responsible for the maintenance requirements of the wastewater system provided.

6. Bricklaying/Masonry

6.1 Masonry Units

Masonry units are to be as selected and as identified in the Schedule. Masonry units produced from clay, concrete and calcium silicate shall comply with AS/NZS 4455.

Masonry units exposed to salt attack shall comply with the durability requirements of AS 3700.

Autoclaved Aerated Concrete (AAC) blocks shall be selected and installed to the manufacturer's specification.

6.2 Workmanship

Masonry construction shall comply with AS 4773.1. Set out masonry as shown on the drawings, build to gauge to suit masonry units, maintain chosen bond with full mortar joints to a nominal 10mm.

Mortar joints shall be finished to the type nominated in the Schedule. Where the Schedule nominates raked joints, the rake must not extend into reveals and sills beyond the line of the storm moulds.

The cleaning of masonry should take place as work progresses and upon completion in a manner so that the work is not damaged. Pressure cleaning and acid wash should not be carried out without the prior approval of the *Builder*.

Where masonry is to be pressure cleaned, the following restrictions shall apply:

- a- Maximum pressure shall be 7000 kpa;
- b- Use a wide fan spray nozzle of 150 to 200;
- c- Nozzle shall be no closer to the work than 300mm.

6.3 Mortar

Mortar mixes shall comply with AS 3700.

Mortar shall consist of a mixture of cement, sand and water, with the addition of lime and admixtures. Where water thickener is used, it shall be cellulose-based product, suited for its application according to the manufacturers' and suppliers' directions.

Mortar for reinforced masonry shall be of mortar class either M3 or M4.

6.4 Cavities and Weepholes

In brick veneer construction, the minimum cavity width shall be 25mm, measured clear of any conduit, insulation or services placed within the cavity. In cavity masonry walls, the minimum cavity width shall be 35mm, measured clear of any conduit, insulation or services placed within the cavity.

Mortar droppings should be removed from wall ties and cavity flashings progressively during construction and upon completion of the work.

Weepholes shall be created by open perpend, free of mortar and other materials, at centres not exceeding 1200mm centres and in accordance with the relevant Australian Standard.

6.5 Wall Ties

Wall ties are to be manufactured in accordance with AS/NZS 2699 and installed to AS 4773.1.

Wall ties shall suit the exposure conditions of the site. Ties shall be spaced at a maximum of 600mm apart in both directions and at 300mm around openings and edges of brickwork, at bearer level where a timber floor is provided and control joints.

Wall ties are to be built in as work progresses, and to a minimum of 50mm into the mortar joint, with the other end secured to the frame with approved galvanized fixings. (Note:- Clouts are not acceptable for fixing brick ties). Ties shall be installed in a manner that prevents moisture travelling along their length to the inner leaf.

6.6 Lintels

Brick work over openings may be supported by steel lintel, reinforced masonry lintel or reinforced concrete member complying with AS 3600.

Where steel lintels are used over openings, they shall be hot dip galvanized mild steel angles or flat bars complying with AS 4100, AS/NZS 4600.

For lintels with a clear span of 1m or more, each end of the lintel is to have a minimum bearing length of 150mm. For shorter spans the minimum end bearing is to be 100mm.

Not less than three (3) courses of brick must be used above steel lintels and brickwork shall not overhang the lintel by more than 25mm. Prop lintels until mortar has reached its design strength. Props should be no more than 1.2 metres apart. The long leg of angle lintels must be vertical.

6.7 Damp Proof Courses (DPC) and Flashings

Flashings and damp-proof membrane shall be manufactured to AS/NZS 2904 and built in as work proceeds. Flashings shall be flexible material compatible with the adjacent materials to prevent electrolytic action.

Install damp-proof courses in all masonry walls between 150mm and 250mm from finished ground level and to the full width of the wall. Step damp-proof course on loping ground to maintain the height above ground level.

At timber floors, install not higher than the bottom of the floor bearers. Damp course material shall be run in long lengths, lapping a minimum of 150mm at joins and to the full width of courses at all intersections. Flashing extending the full width of the masonry course may also be used as a DPC.

6.7.1 Cavity Flashing

Sill and Head Flashings shall be installed in accordance with figure 3.3.4.5 of Part 3.3.4 BCA.

Stepped flashings shall be installed in accordance with figure 3.3.4.6 of Part 3.3.4 BCA.

Flashings at roof and wall junctions shall be installed in accordance with figure 3.3.4.6 Part 3.3.4 BCA.

6.8 Access & Sub-Floor Ventilation

Sub-floor ventilation shall be provided in accordance with Part 3.4.1 BCA.

Provide cross ventilation to the space between the ground and the underside of the timber floor by installing brick or proprietary brand vents to external walls enclosing the space.

The air-flow through the vents must be unobstructed and where external walls are of cavity brick construction, internal openings shall be provided adjacent to the vent. Openings will also be provided to internal sub-floor walls to ensure cross-ventilation.

Provide access to sub-floor area where identified on the plans or as instructed, opening/s to be approximately 600mm wide unless otherwise specified.

6.9 Clearances

In masonry veneer construction generally leave the following clearances between window frames and brick sills and the roof structure and masonry veneer:

- 5mm at sills of lower or single storey buildings;
- 8mm at roof overhangs of single storey buildings;
- 10mm at sills to two storey buildings;
- 12mm at roof overhangs of two storey buildings.

Clearances should be increased to accommodate expected timber shrinkage e.g. unseasoned hardwood.

6.10 Tolerances in Masonry Construction

Masonry work is not considered defective if it is within the following tolerances:

Item	Structural Tolerances	Non-Structural Facework Tolerance
Horizontal position of any masonry element specified or shown in a plan at its base or at each storey	+15mm	+15mm
Relative displacement between load bearing walls in adjacent storeys intended to be in vertical alignment.	+10mm	+10mm
Maximum deviation from plumb within a story from a vertical line through the base of the member	The lesser of +10mm per 3m of height or 0.05 times the thickness of the leaf.	+10mm
Maximum deviation from plumb in the total height of the building (from the base)	+25mm	+25mm
Maximum or horizontal or vertical deviation of a surface from a plane surface (bow) in any 2m length.	+5mm	+3mm
Deviation (step) of any exposed brick surface from any adjacent exposed brick surface. The bow provision above also applies	Not applicable	2mm
Deviation of bed joint from horizontal, or from the level specified or shown in elevation	+10mm in any 10m length, +15mm in total	+10mm in any 10m length, +15mm in total
Deviation from specified thickness of bed joint	+3mm	+3mm
Minimum perpend thickness	5mm	5mm
Deviations from specified thickness of perpend.	+10mm max.	+ 5mm average
Maximum difference in perpend thickness in any wall.	No limit	8mm
Deviation from specified width of cavity.	+15mm	+15mm

For further reference: Table 11.1 AS 3700.

Efflorescence is a crystalline deposit of salts that forms on or near the surface of concrete, masonry and cementitious products. All masonry materials can be susceptible to efflorescence and often occurs during or after construction. Efflorescence is particularly affected by temperature, humidity and wind and is a common occurrence in winter. Primary efflorescence will decrease over the passage of time and is not considered a defect.

7. Carpentry

7.1 Timber Generally

All timber used shall be of the durability and stress grade specified and/or comply with the provisions of AS 1720 and AS 1684. All structural timber used will be of a durability class appropriate to the expected service life and exposure conditions. All structural timber used will be stamped or otherwise identified in respect of stress grade. Sizes of timber to be the nominal size mentioned with allowable tolerances as provided by the relevant supplement of AS 1684. Scantlings to be in long lengths, accurately cut and fitted and securely fixed.

7.2 Engineered Timber Products

Fabricated glue-laminated timber beams are to conform as to AS 1328. Fabricated I-beams, laminated veneer lumber beams are to be designed in accordance with AS 1720.1.

7.3 Handling and Storage

Timber and timber products delivered to the site shall be stored at least 50mm off the ground, stored level, evenly supported, well ventilated and protected from the rain and sun. Pre-fabricated trusses should be handed in a vertical position to avoid distortion and overstressing of the timber and connecting plates. Where pre-fabricated roof trusses are required to be handled horizontally, provide intermediate support. Do not site repair damaged trusses and report them to the truss fabricator immediately to avoid delays in rectification.

7.4 Corrosion Protection

All connectors, fixing plates, brackets and general fixings and related components shall suit exposure level and be compatible to avoid galvanic or electro-chemical action.

7.5 Floor Framing

All floors not specified to be concrete are to be framed at the level shown. Floor structure sizes and spacing are to be in accordance with *AS 1684* or otherwise specified by a Practising Structural Engineer. Bearers, joists and plates shall be laid true and level.

7.5.1 Bearers and Joists

Span and spacing of timber bearers and joists is to conform to *AS 1684* series of Standards in conjunction with supporting supplements relevant to the applicable wind classification and stress grade.

7.5.2 Blocking

Where the depth of floor joists is equal to or exceeds 4 times their width, herringbone strutting or solid blocking must be provided between the outer pairs of joists at not more than 1.8m centres, or continuous trimming joists can be provided to the ends of joists above external bearers or wall plates.

Trimmers or solid blocking may be 25mm less in depth than the joists and solid blocking shall be a minimum thickness of 25mm.

7.6 Flooring

7.6.1 Strip flooring

Timber species and size should be selected by the *Owner/s*. Flooring is to be clear finished and shall not be laid until the building is weather tight. Check supplier certificate for species, grade size and moisture content prior to laying.

Where machine nailing is to be used, ensure boards are in contact with the joist as this type of nailing cannot be relied upon to pull board down to joist.

All fitted floors require a 12mm expansion gap between the floor boards and any internal or external wall structures.

7.6.2 Plywood Structural Flooring

Structural plywood must be manufactured in accordance with *AS/NZS 2269* and sheets stamped with the manufacturer's name or trademark.

Sheets shall be installed in accordance with *AS 1684*. Plywood face grain must run at right angles to the joists and shall be continuous over at least two spans. Where possible, panel ends shall be staggered.

7.6.3 Particleboard Flooring

Particleboard flooring shall be laid and fixed in accordance with *AS 1860.2*

Sheets shall span not less than two floor joist spacing's. Square edges and ends of sheets shall be butted over joists and trimmers.

7.7 Wall Framing

Wall frame timber, sizes and spacing shall be in accordance with *AS 1684* or as specified by a practicing structural engineer.

7.8 Wall Sarking

Provide wall sarking as noted on the drawings and/or noted in the Schedule.

Provide vapour permeable sarking under cladding material that does not provide a permanent weather proof seal (such as unpainted fibre cement, sawn weatherboards).

Fix sarking on the outside of the studs from the bottom plate (lapped over flashing if any) up to at least the level of the underside of the fascia. Allow a gap at the top plate for wall ventilation.

7.9 Timber Stairs

Timber stairs are to be designed and constructed to riser, going and balustrade dimensions and comply with Part 3.9 BCA.

7.10 Roof Framing

Roof trusses shall be fabricated in accordance with designs prepared by the truss manufacturer or a practicing structural engineer and AS 1720.1.

Conventional roof frame timber, sizes and spacing shall be in accordance with AS 1684 or as specified by a practicing structural engineer.

7.11 Roof Bracing

Provide roof bracing in accordance with truss manufacturers' detail and Section 8 of AS 1684.

7.12 Access to Roof Space

Where the space between the roof and ceiling exceed 900mm in height, trim as required between roof trusses for a manhole, line the opening and provide a suitable cover.

7.13 Verandah Posts

Verandah posts unless otherwise specified shall be a minimum of 100mm x 100mm or as required by AS 1684, checked at the top plate and secured to the floor structure. Where fixed to concrete the base of the verandah posts shall be supported by galvanised shoes, stirrups or similar supports.

7.14 Eaves Soffit

Where overhang is less than 600mm support linings on 45mm x 32mm soffit bearers at not more than 450mm centres. Where overhang is between 600mm and not more than 1500mm support soffit linings on 70mm x 35mm soffit bearers at not more than 450mm centres.

7.15 Cross Ventilation

Ventilate the roof space at the ridge, gable and/or eaves to effectively cross ventilate the whole of the roof space.

7.16 Tolerances

7.16.1 Timber Shrinkage

Timber shrinkage shall be no more than 3% for seasoned timber and no more than 10% for unseasoned timber.

7.16.2 Vertical and Horizontal Deviation of Frames and Posts

Wall frames and posts (timber/steel) must not deviate from plumb by more than 4mm within any 2m of height, measured from the underside of the bottom plate and the base of the post.

Frames shall not deviate from the horizontal plane by more than 4mm within any 2m length of wall.

7.16.3 Floors

Timber is a natural product that responds to changes in weather conditions. The overall movement and rate of movement varies depending upon the timber species and cutting pattern on individual boards. Gaps between individual tongue and grooved boards can be expected at the floor accommodates seasonal changes.

Exposure to sunlight, cooling and heating appliances is likely to cause localized shrinkage of timber that cannot be allowed for at the time of construction.

Except for gaps occurring due to exposure to sunlight and heating and cooling appliances and the like, gaps up to 2mm between adjacent boards that extend for more than 1m is acceptable and not considered a defect.

Timber strip flooring to be supplied to a seasoned moisture content of 10-15%.

Some finishes of feature floors have the potential to bond board edges together at the tongue and groove joint. With seasonal moisture changes in the floor this bonding or 'gluing effect' may produce a pattern across the floor where there are four or five boards followed by a large gap. In some instances the bonded joint is of sufficient strength that board may split. It is therefore recommended that finishes and finish systems are used that do not promote gluing.

7.17 Hot Water Storage Tank Support

Where solar water heaters incorporating a roof storage tank are installed, ensure additional loading has been incorporated into the roof design.

8. Steel Framing

8.1 General

Steel framing shall be designed and constructed to either:

- a) *AS 4100 – Steel Structures*
- b) *AS/NZS 4600 – Cold-formed steel structures*
- c) *NASH – Residential and low-rise steel framing – Part 1 Design criteria.*

The frame is to be assembled with fixings as be the design, or in accordance with the manufacturer's recommendations.

8.2 Corrosion Protection

The steel frame must be protected from corrosion.

Hole cutting or cutting of members should be done in a way which does not leave swarf. Compatible materials and fixings to be used to avoid galvanic or electro-chemical action. Direct contact with CCA Treated timber is to be avoided. For slab on ground, use damp-proof course under wall frame bottom plates, to prevent corrosion.

The frame is to be permanently earthed.

Channels should be clean of any swarf and mortar droppings.

Electrical wiring, water pipes and other services passing through the frame are to be isolated from it by rubber grommets or other suitable material.

9. Roofing (Tiles and Metal)

9.1 General

All roof cladding shall comply with one or more of the following documents relevant to the work;

- a) AS 2049 – Roof tiles
- b) AS 20250 – Installation of roof tiles
- c) AS 1562.1 – Design and installation of sheet roof and wall cladding – Metal
- d) AS/NZS4256 Pts 1,2,3 and 5; and AS/NZS 1562.3 Plastic sheet roofing.

Ensure appropriate fall prevention requirements are installed prior to the commencement of roofing work.

9.2 Roof Tiles

Provide roof tiles as shown on the drawings. Roof tiles shall be of a colour, profile and material noted in the Schedule or as selected by the *Owner/s*.

Roof tiles shall be fixed in accordance with the *BCA* and referenced Standard and the nominated design wind speed for the project.

Leave 10 tiles at site for future use.

9.3 Metal Roofing

Provide metal roofing as shown on the drawings. Metal roofing shall be of a profile and colour as provided in the Schedule or as selected by the *Owner/s*. Metal roofing and accessories shall be installed to the manufacturer's recommendations.

Metal roofing must be corrosion resistant. Where different metals are used they must be compatible.

Use only sealants recommended by the manufacturer of the sheet material to be joined.

9.4 Battens

Roof battens may be of timber or steel.

Timber battens shall be sized and installed in accordance with *AS 1684.2* and *AS 1684.3*. Where battens are joined in a run, they shall be butt jointed at the centre of the truss or rafter.

Metal battens shall be corrosion resistant and fixed to the manufacturer's recommendations. Metal battens are to be joined over trusses with a minimum lap of 40mm. Advice should be obtained from the manufacturer on the use of metal battens in high corrosive areas.

9.5 Sarking

Reflective foil sarking shall comply with *AS 4200.1* and be installed in accordance with *AS 4200.2*.

Sarking shall be provided for all roofs where the design wind classification is greater than N3. The requirement for sarking will be influenced by roof pitch, length of rafter and bushfire prone areas.

For tiled roofs at a slope below 20°, provide sarking and anti-ponding board at the eaves.

Where a gutter discharges onto a tile roof through a spreader, irrespective of the roof slope, sark the roof from the point of discharge over a width of 1800mm down to the gutter. Where one section of roof fully discharges onto a lower section, fully sark the lower section.

Fix sarking over rafters/trusses to ensure the discharge of water without ponding into the eaves gutter. Secure sarking at the top edge of the fascia and dress down 25mm into the gutter.

Extend sarking over the bead of valley gutters and turn up neatly along valley. Keep folded joints clear of valleys.

Where tiles abut a wall, turn the sarking neatly up behind flashing a minimum of 50mm.

9.6 Roof Flashings

Flashings shall be installed in accordance with part 3.5.1.3 of the *BCA*.

Lead flashings must not be used with aluminium or zincalume roofing or rainwater plumbing, or anywhere where water supply is by rainwater storage.

9.7 Gutters and Downpipes Part 3.4.2 BCA

Gutters and downpipes shall be designed and installed in accordance with Part 3.5.2 of the *BCA*.

Where high front gutters are installed, attention is required to prevent overflow back into the roof or building.

10. Internal Linings

10.1 Walls

Walls shall be fixed in accordance with the manufacturer's recommendations. Provide recessed edge gypsum plasterboards of 10mm thickness to all internal walls, except as required for wet areas, or other type of paneling as indicated in the Schedule and/or plans.

10.2 Wet area linings

Wet area linings shall be of water resistant material for full wall height.

10.3 Ceiling linings

Ceiling linings shall be 13mm gypsum plasterboard or 10mm high-density plasterboard.

The junction of walls and ceilings shall be set as required. Fix suitable cornice as identified in the Schedule or selected by *Owner/s*, neatly mitred and set at all angles.

Provide back-blocking where three (3) or more consecutive recess joints are present in ceilings.

10.4 Tolerances

Industry standards have established six (6) levels of acceptable finish for gypsum plasterboard. Unless otherwise specified, a Level 4 finish shall apply to all gypsum plasterboard surfaces.

10.4.1 Level 4 finish

Typical finish for domestic construction. It is used where smooth textured finishes and satin/flat/low sheen paints are used and illuminated by non-critical lighting. Gloss and semi-gloss paint finishes are generally not suitable over a Level 4 finish.

Tape to be embedded in joint compound and two separate coats of jointing compound to be applied and finished over joints angles and fasteners.

In critical lighting conditions, surface imperfections may still be apparent in a Level 4 finish.

Critical lighting is defined as natural or artificial light projected across a surface at a low incidence angle.

Non-critical lighting occurs when the light that strikes the surface is diffused and not parallel to that surface.

10.4.2 Level 5 Finish

A Level 5 finish is for use in areas of severe or critical lighting and gloss or semi-gloss is used or sheer critical lighting conditions occur on flat or low sheen paints.

Level 5 finish is identical to Level 4 finish except for the addition of a skim coat; or finish coat toweled or sprayed with airless equipment over the entire surface to achieve a smooth finish.

11. Waterproofing

11.1 General

From the drawings, identify the areas to be waterproofed.

Waterproofing to internal wet areas and balconies over habitable areas shall be in accordance with *AS3740-1994* and installed as per the manufacturers' specifications.

Improved waterproofing outcomes can be achieved by installing waterproofing to internal wet areas by following the Master Builders Association of NSW, *Guide to Internal Wet Area Waterproofing*.

Improved waterproofing outcomes can be achieved by installing waterproofing to external balconies by following the Master Builders Association of NSW, *Guide to External Waterproofing: Balcony Decks*.

11.2 Waterproofing System Selection

The waterproofing system should be selected according to the project requirements and the manufacturers' specification, taking account of product suitability, and compatibility with surface materials.

11.3 Compatibility of Materials

The waterproofer is to ensure component to component compatibility.

11.4 Flood Testing

On completion and after the membrane has fully cured, floor waste outlets should be sealed, and the area flooded with water to test for water leaks.

The height of the water should be 5mm below the overflow levels of the waterstops.

11.5 Protection

Membrane area shall be protected by barriers or signage until the membrane is fully cured.

12. Joinery

12.1 Generally

All fixing out timber to be seasoned and free from defects which might affect appearance or durability. All timbers are to be D.A.R. accurately cut and securely fixed. Mouldings and trimmings are to be properly mitred or scribed. All surfaces must be free of machine marks and ready for painting. External joinery to be inherently durable and primed prior to fixing.

12.2 Door Frames

Door frames shall be solid rebated frames, packed plumb and true and fixed securely to door opening studs or masonry. Metal door frames shall be installed to manufacturers' recommendations.

12.3 Doors

External doors are to be solid core or framed and glazed as specified in the Schedule or selected by the *Owner/s*, and not less than 2040 x 820 x 40mm thick. Front and rear external doors shall be hung with three 88mm (min) butt hinges of suitable finish and durability. Where external doors are sheeted with plywood only waterproof plywood is to be used. Top and bottom door edges are to be painted or similarly sealed prior to hanging.

Internal doors shall be not less than 35mm thick at widths and swing direction as shown on the drawings. Door type shall be as indicated in the Schedule or selected by the *Owner/s*.

All doors shall be fitted with suitable furniture as indicated in the Schedule or selected by the *Owner/s*.

12.4 Windows

Aluminium and timber windows shall be manufactured and installed in accordance with AS 2047. Windows are to be supplied with Performance Label attached confirming compliance with AS 2047.

Windows shall be protected from mortar droppings.

Window flashings – Refer to 6.7 “Damp Proof Courses (DPC) and Flashings”.

12.5 Glazing

All glazing shall comply with AS 1288. Glazing shall meet the BASIX commitments where identified on the drawings or in the drawing block.

12.6 Storm Moulds

Provide storm moulds to external doors and windows and other openings.

12.7 Architraves

Provide architraves to all window, door and other openings where necessary and of a type, finish and size as identified in the Schedule or as selected by the *Owner/s*.

12.8 Skirtings

Provide skirtings where required of a type, finish and size as identified in the Schedule or as selected by the *Owner/s*.

Note: Where skirtings are to be fixed over tiled floors, the skirting shall not be fixed down hard on the tile so as to strict the movement joint.

12.9 Kitchen Cupboards

Provide kitchen cupboards as included on the drawings and/or included in the Schedule.

Kitchen cupboards and bench tops shall be fabricated from water resistant materials.

12.10 Linen/Storage Cupboards

If shown, to be constructed as detailed on the drawings using material specified in the Schedule or selected by the *Owner/s*.

12.11 Tolerances

12.11.1 Joints in Internal Fixings

All mitre joints, butt joints and junctions of architraves, skirtings and mouldings shall be filled and sanded flush. Gaps whether filled or otherwise shall not exceed 1mm. After the first 12 months following handover and within the statutory warranty period, gaps exceeding 2mm are not acceptable.

12.11.2 Bench Tops

12.11.2.1 Laminate

Scratches that cannot be seen from a normal viewing position, that is at a distance of 600mm, viewed in non-critical light are considered acceptable. Notable scratches or chips should be reported on walk-through or within 10 days after occupation. Non-critical light means the light that strikes the surface is diffused and is not glancing or parallel to the surface.

12.11.2.2 Natural Stone or Manufactured Stone

In natural stone, variations in colour, veining pattern and blemishes are acceptable if within the samples selected. In slabs with obvious veining, the slabs shall be installed with the vein trend running in the same direction unless otherwise specified.

Natural stone products supplied with a sealer coating will require resealing periodically.

Natural stone products should not be subjected to excessive weight, stress and extreme temperatures. Small areas at the front and rear of sinks, cook tops and the like should not be subjected to excessive weight stress.

Scratches that cannot be seen from a normal viewing position, that is at a distance of 600mm, viewed in non-critical light are considered acceptable. Notable scratches or chips should be reported on walk-through or within 10 days after occupation. Non-critical light means the light that strikes the surface is diffused and is not glancing or parallel to the surface.

13.Plumbing (National Construction Code Volume 3 – Plumbing Code of Australia (PCA)

13.1General

All plumbing work is to be in accordance with the PCA and comply with the requirements of the Plumbing and Drainage Regulator or Local Authority.

All plumbing and drainage works must be carried out by a licensed plumber and drainer.

Ensure all inspections are carried out and certificates issued, including a Certificate of Compliance upon final inspection.

13.2 Water Service

Unless otherwise specified, copper tubing shall be used for all internal plumbing work.

Where Polyethylene or similar approved piping products are specified, pipes and fittings are to be used and installed to the manufacturers' recommendations.

Taps and tap sets are to be selected by the owner.

13.3 Hot Water Service

An approved water heater is to be installed in accordance with the manufacturers' instructions and located to ensure ease of maintenance.

The selection of hot water service shall comply with the BASIX commitments provided for water heating in the BASIX Certificate.

Where a solar system is specified, the solar collectors shall be positioned as identified on the drawings. Where storage tanks are located to the roof, the roof design will account for point loading.

13.4 Stormwater Drainage

Guttering shall be designed and installed in accordance with Part 3.5 *BCA* and *AS 3500*.

Locate downpipes as shown on the drawings. The number, size and location of downpipes shall be in accordance with *AS 3500*.

Stormwater pipes are to be a minimum of 90mm in diameter of UPVC material, and where not feeding rainwater tanks, shall drain to the street gutter or alternative retention device constructed to approval of the Regulator or Local Authority.

13.5 Sanitary Plumbing and Drainage

Sanitary plumbing and drainage shall be undertaken in accordance with the *PCA* and the requirements of the Regulator or Local Authority.

Sanitary plumbing and drainage work shall be undertaken by an appropriately licensed person.

13.6 Gas

All gas-fitting work is to be installed and connected in accordance with the supply authorities' requirements.

Gas plumbing shall be provided as detailed on the plans and to all fixtures requiring gas service from the point of supply.

Test all pipe work before concealment and securely fix pipe work to prevent movement.

In-ground gas lines shall be identified with plastic warning tape 300mm above and for the full length of the line while backfilling.

14. Electrical

14.1 General

All electrical work shall be undertaken by a licensed electrician and in accordance with *AS/NZS 3000*.

A *Certificate of Compliance Electrical Work* shall be provided at the completion of the electrical work.

Confirm the position of the meter box. Single-phase power is to be provided unless otherwise specified or noted in the Schedule.

Install all lights, power outlets and electrical fixtures as nominated by the *Owner/s*.

14.2 Smoke Alarms

Smoke alarms shall be installed in accordance with the *BCA* and comply with *AS 3786*.

Photo-electric smoke alarms should be the preferred type for installation in the path of travel between sleeping areas and exits.

14.3 Solar PV

Installations must be compliant with *AS/NZS 5033* and *AS 3000*.

PV modules shall be compliant with *IEC/EN61730* and either *IEC/EN61215* or *IEC/EN61646*.

Grid connect inverters shall be compliant with *AS 4777*.

Solar panels are to be installed by either the licensed builder or licensed electrician. All electrical wiring and connections of the solar PV system must be undertaken by an appropriately licensed electrician.

Meters are to be installed by an Authorised Service Provider.

Where the location of PV modules is not shown on the plan, it will be the responsibility of the accredited installer to undertake an onsite assessment and identify the precise location for the modules. The assessment is to identify any overshadowing or other influences which may affect the operation of the installation.

A *Certificate of Compliance* for electrical installation work is to be issued upon completion and commissioning of the work.

15. Wall and Floor Tiling

15.1 General

Provide wall and floor tiles as indicated on the drawings and/or specified by the *Owner/s*.

15.2 Surface Preparation

All tiling substrates shall be dry and free of dust, debris and deposits.

Very smooth trowel finishes on slabs; with slabs inadequately cured, releasing agent and curing compounds can lead to tile adhesion problems. Care should be taken where there is paint overspray on floors adjacent to walls.

The preparation of smooth trowel floors and floors which are contaminated should be undertaken in consultation with the builder, tiler and adhesive supplier and/or manufacturer.

Adhesive manufacturers' recommendations on surface preparation should be followed.

15.3 Compatibility

Ensure tile adhesives are compatible with the waterproofing membranes used. Waterproofing membranes to be properly cured prior to tile laying.

Tile adhesives, primers and related products must be compatible. The use of mixed brand products is not recommended.

Selections of tile adhesives in wet areas are to be made in consultation with the builder, floor tiler and adhesive supplier and/or manufacturer.

15.4 Movement Joints

Movement joints are to be provided in accordance with AS 3958.1 to:

- Separate the tiled elements from fixed elements such as walls and columns;
- Over movement joints in the substrate; and
- In large tiled areas, immediate movement joints at evenly spaced location at approximately 4.5 metres.

15.5 Falls in Wet Areas

Grade floor tiles to floor wastes and elsewhere as required.

The recommended ratio of fall within a shower is between 1:60 and 1:80.

The recommended ratio of fall in other wet areas is between 1:80 and 1:100.

15.6 Tolerances

15.6.1 Australian Standard AS 3958.1 “Guide to the installation of ceramic tiles”.

The installation of ceramic tiles is covered by Australian Standard AS 3958.1. This Standard is not referenced by the BCA and this Specification places no obligation that work and material must comply with the Standard.

15.6.2 Floor and wall tiles supplied by the owner

Faults and imperfections in tiles are the responsibility of the owner.

Installer is to discard any cracked or pitted tiles. The installer is responsible for defects related to poor workmanship.

Installer is responsible for the selection of adhesives and grouts and is not obliged to accept materials supplied by the owner.

16. Painting

16.1 General

All paint and related products such as primers, sealers and fillers shall be compatible, suitable for purpose and used in accordance with the manufacturers' recommendations and the manufacturers' safety data sheets.

16.2 Colour Selection

Unless specified elsewhere, colours are to be selected by the *Owner/s*.

16.3 Preparation

All surfaces shall be prepared to the manufacturers' product recommendations. Final preparation shall be the responsibility of the painter/applicator.

16.4 Spraying

Spray application to plasterboard is to be “backrolled”.

If floor surfaces are to be tiled, ensure floor surface is protected from overspray.

16.5 Completion

The contractor shall remove empty paint tins and associated waste from site and is to ensure the clean-up of equipment does not contaminate the site.

Where removed for painting, all fittings, door furniture, switch plates and the like are to be refixed or re-installed.

Paint splashes, runs and drips are preferable to be removed during the course of the work, or removed and repaired upon completion.

16.6 Tolerances

16.6.1 Quality Inspections

Paint finish inspections shall be undertaken in well-lit, natural or artificial light conditions, comparable to final anticipated light conditions. Inspections shall occur at a distance from the painted surface of 1.5 to 2 metres.

Materials Schedule

Exterior

	Type	Selection	Notes
Floor	Steel bearers & joists on steel stumps with particleboard flooring	Stramit 'C' section 19mm pb flooring	Joists @ 450 centres
Wall Frame	H2 timber		
Roof Frame	H2 timber rafters. Steel roof battens		
Roof Cladding	Trimdeck profile suitable for 4° pitch		
Wall Cladding	Alucobond		
Fascia	Colorbond		
Gutter	Colorbond		
Downpipes	PVC		
Eave Lining	Fibre cement		
Windows	Aluminium		
External Doors	Glass & aluminium		
Sarking	R1.0 roofing blanket R0.3 wall wrap		
Roof Insulation	R3.5 batts		
Wall Insulation	R2.5 batts		
Floor Insulation	R2.0	CSR Optimo or similar	

Interior

	Type	Selection	Notes
Wall Linings	10mm plasterboard		
Ceiling Linings	10mm plasterboard on aluminium furring channels		Furring channels @ 450mm centres
Cornices	90mm coved		
Internal Doors	Pocket cavity slide unit with flush finish timber door	To be selected	
Architraves	Timber	To be selected	
Skirtings	Timber	To be selected	
Joinery	Sales area - Laminate cabinets & benchtop. Shop - Laminate shelving. Kitchen - existing	To be selected	
Hot water System	Existing		
Floor Coverings	Laminate timber planks	To be selected	
Heating/Cooling	Split system AC		

Level 2, 111-113 Hume Street
Wodonga VIC 3690
(02) 6024 1022
admin@energyraters.com.au



BCA 2016 – Section J1 to J8

Compliance Summary & Report

Report Number	9114/16
Date	3 October 2018
Project Name	Alts & Adds to Service Station
Address	9807 New England Highway Glen Innes NSW 2370
Building Class	6
Climate Zone	6
Documentation	Allspec – drawing set no. 18079, rev. 3, dated 15/11/2018
Prepared by	Peter Chalker – VIC/BDAV/16/1731

BCA SECTION J — ENERGY EFFICIENCY “DTS” COMPLIANCE SUMMARY					
JOB DESCRIPTION			BUILD’G CLASS	CLIMATE ZONE	DATE
Proposed Alts & Adds to Service Station 9807 New England Highway, Glen Innes NSW 2370			6	6	03/10/2018
REF.	BCA CLAUSE	REQUIREMENTS SUMMARY	COMPLIANCE EXISTING	COMPLIANCE NEW	
J1	BUILDING FABRIC		PASS		
1.3	Roof and ceiling construction	Metal cladding: R1.1 foil-faced blanket Ceilings: R3.0 bulk insulation	n/a*	PASS	
	Adj. for loss of ceiling insulation			n/a	
1.4	Roof lights			n/a	
1.5	Walls – external	Lightweight cladding: Vapor permeable sarking + R2.5 batts		PASS	
	Walls – internal (to amenities)	Stud frame: R1.5 batts		PASS	
1.6	Floors	Suspended timber, open: R2.0 batts		PASS	
J2	GLAZING		PASS		
2.4	Glazing AFRC default glazing	External: Single glazed, clear • Aluminium frame, Group A, ALM-002-01 <i>U-Value SHGC</i> 6.7 0.70			
J3	BUILDING SEALING		PASS		
3.2	Chimneys and flues		n/a*	n/a	
3.3	Roof lights			n/a	
3.4	Windows and doors	Must be fitted with air infiltration seals		PASS	
	Entrances			n/a	
3.5	Exhaust fans			n/a	
3.6	Construction of roofs, walls and floors	Must be sealed to minimise air leakage, with close fitting linings		PASS	
3.7	Evaporative coolers	Must be fitted with a self-closing damper		PASS	
J5	AIR-CONDITIONING AND VENTILATION SYSTEMS		See report		
5.2g	Time switch	A/C systems >10kW must be fitted with a time switch	n/a*	TBC by builder	
J6	ARTIFICIAL LIGHTING AND POWER		See report		
6.2	Artificial lighting	Maximum total illumination power: 1279 watts (new works)	n/a*	TBC by builder	
6.3	Interior lighting & power control			n/a	
6.5	Perimeter lighting	Must be controlled by a daylight sensor or time switch		TBC by builder	
J7	HEATED WATER SUPPLY AND SWIMMING POOL AND SPA POOL PLANT		See report		
J8	FACILITIES FOR ENERGY MONITORING		See report		
<p>* – New works less than 50% volume of existing: Existing building does not require assessment (ref. NSW EP&A Regulation 94) For guidance on RBS discretion, see <i>Additional Information and Remarks</i> <i>See following report for compliance details and calculations</i></p>					

BCA SECTION J — ENERGY EFFICIENCY “DTS” COMPLIANCE REPORT

REF	BCA CLAUSE	PROPOSED BUILDING
J1	BUILDING FABRIC	
1.1	Application of Part	<i>Refer to attached Building Envelope at Annex A</i>
	Applies to the building elements forming the conditioned envelope	<p>The building envelope for the purpose of Section J includes walls, floor and roof areas highlighted in the attached floor plan</p> <p>Where applicable, existing building has been assessed in accord with <i>ABCB protocols for Class 2-9 buildings and NSW EP&A Regulation 94</i></p>
1.2	Thermal construction – general	
	<p>Where required, insulation must comply with AS/NZS 4859.1 and be installed so that it—</p> <ul style="list-style-type: none"> • abuts or overlaps adjoining insulation other than at supporting members such as studs, noggings, joists, furring channels and the like where the insulation must butt against the member, • forms a continuous barrier with ceilings, walls, bulkheads, floors or the like that inherently contribute to the thermal barrier, and • does not affect the safe or effective operation of a service or fitting <p>Where required, reflective insulation must be installed with—</p> <ul style="list-style-type: none"> • the necessary airspace to achieve the required R-Value between a reflective side of the reflective insulation and a building lining or cladding, • the reflective insulation closely fitted against any penetration, door or window opening, • the reflective insulation adequately supported by framing members, and • each adjoining sheet of roll membrane being overlapped not less than 50mm, or taped together <p>Where required, bulk insulation must be installed so that—</p> <ul style="list-style-type: none"> • it maintains its position and thickness, other than where it crosses roof battens, water pipes, electrical cabling or the like, and • in a ceiling, where there is no bulk insulation or reflective insulation in the wall beneath, it overlaps the wall by not less than 50mm 	
1.3a	Roof and ceiling construction	
	Roof and ceiling construction must achieve a minimum total R-Value of 3.2 downwards	<p>Metal-clad roof, 4° pitch – R1.1 foil-faced blanket under roof with R3.0 bulk insulation to ceiling will achieve a total system R-Value >3.2 downwards</p> <p><u>Notes:</u></p> <ul style="list-style-type: none"> ▪ Not applicable to existing roof or ceilings – at RBS discretion (see NSW EP&A Regulation 94) ▪ Thermal break – n/a
1.3c	Adjustment for loss of ceiling insulation	n/a – Surface mounted lighting only
1.4	Roof lights	n/a
1.5a	Walls – external	
	<p>External walls that are part of the envelope must achieve a minimum total R-Value of 2.8</p> <p><u>Note:</u> Minimum R-Value can be reduced, as follows—</p> <ul style="list-style-type: none"> • A wall with min. surface density of 220kg/m², by 0.5; and • A wall that is— <ul style="list-style-type: none"> ○ facing the south orientation, by 0.5; or ○ shaded with a projection angle of— <ul style="list-style-type: none"> ▪ 30° to 60°, by 0.5; or ▪ more than 60°, by 1.0; or • Where there is limited space for insulation and glazing satisfies energy index Option B, to 1.4 	<p>Lightweight cladding – Vapour permeable sarking with R2.5 bulk insulation will achieve a total system R-Value >2.8</p> <p><u>Notes:</u></p> <ul style="list-style-type: none"> ▪ Not applicable to existing external walls – at RBS discretion (see NSW EP&A Regulation 94) ▪ Thermal break – n/a ▪ All above wall constructions are considered to have a cavity to suit the insulation system with an internal lining. The system must be installed to the manufacturer’s specifications
1.5b	Walls – internal	
	<p>Internal walls that are part of the envelope must achieve a minimum total R-Value of 1.8</p> <p><u>Note:</u> For a non-conditioned space with max. ventilation of 1.5 air changes per hour, minimum R-Value can be reduced to 1.0</p>	<p>Stud frame – R1.5 bulk insulation will achieve a total system R-Value >1.8</p>
1.6	Floors	
	<p>Enclosed suspended floors must achieve a minimum total R-Value of 1.0 downwards</p> <p>Unenclosed suspended floors must achieve a minimum total R-Value of 2.0 downwards</p>	<p>Suspended timber floor, open – R2.0 bulk insulation will achieve a total system R-Value >2.0 downwards</p>

J2	GLAZING
<i>Refer to attached BCA Glazing Calculations at Annex C</i>	
<p>Notes:</p> <ul style="list-style-type: none"> ▪ Not applicable to existing glazing – at RBS discretion (see NSW EP&A Regulation 94) ▪ Only applicable to glazing in conditioned space (or adjacent non-conditioned areas where required by Table J1.5b) ▪ Tolerances for glazing values used in the BCA Glazing Calculator are— <ul style="list-style-type: none"> ▪ U-value: must be less than or equal ▪ SHGC: must be within +/- 10% 	
J3	BUILDING SEALING
3.1 Application of part	
<p>Buildings mechanically conditioned are to be sealed</p> <p>Excludes—</p> <ul style="list-style-type: none"> • where there is sufficient pressurisation to prevent infiltration, or • parts of buildings that cannot be fully enclosed 	The conditioned envelope is to be sealed
3.2 Chimneys and flues	n/a
3.3 Roof lights	n/a
3.4 Windows and doors	
<p>Doors and windows leading into a conditioned space must be sealed</p> <p>Excludes windows complying with AS2047, fire/smoke doors, and roller shutters</p>	All doors leading into conditioned space to have air infiltration seals; and all windows sealed as per manufacturers standards
3.4d Entrances	n/a – Conditioned space less than 50m ²
3.5 Exhaust fans	n/a – Exhaust fans in non-conditioned space
3.6 Construction of roofs, walls and floors	
Building fabric must be constructed to minimise air leakage	Internal lining systems to be close fitting and gaps to be sealed
3.7 Evaporative coolers	
Evaporative coolers must be fitted with self-closing damper when serving a heated space, habitable room or public place	If fitted, must have self-closing damper
J4	<i>This section has been left blank in the BCA</i>
J5	AIR-CONDITIONING AND VENTILATION SYSTEMS
5.2a Air-conditioning systems – Control	
<p>A/c systems must—</p> <ul style="list-style-type: none"> • be capable of being deactivated and close any return air dampers when the part of the building served is unoccupied, and • have a variable speed fan <p>A/c systems serving more than one zone/area with different heating and cooling needs must—</p> <ul style="list-style-type: none"> • thermostatically control the temperature of each zone/area, • not control the temperature by mixing actively heated air with actively cooled air, and • limit reheating to not more than 7.5K at the supply air rate for the space served <p>A/c systems >35kW capacity must have an outdoor economy cycle</p>	
5.2b Air-conditioning systems – Fans	
<p>Non-ducted a/c systems <1000L/s supply air capacity: Not applicable</p> <p>Other a/c systems: Maximum fan motor power to be determined in accord with Specification J5.2a (by mechanical engineer/contractor)</p>	
5.2c Air-conditioning systems – Pumps	
A/c systems circulating water at >2L/s must have a variable speed pump and maximum power to be determined in accord with Table J5.2 (by mechanical engineer/contractor)	

J5	AIR-CONDITIONING AND VENTILATION SYSTEMS (cont.)	
5.2d	Air-conditioning systems – Insulation	
	Supply and return air ductwork to an a/c system must be insulated and sealed in accord with Specification J5.2b	Where installed, new ductwork is to be insulated as follows— <ul style="list-style-type: none"> • Within a conditioned space: R1.2 min • Exposed to direct sunlight: R3.0 min • All other locations: R2.0 min
	Piping, vessels, heat exchangers and tanks, other than in a packaged system complying with MEPS, to have insulation determined in accord with Specification J5.2c (by mechanical engineer/contractor)	
5.2e	Air-conditioning systems – Space heating	
	A heater used for air-conditioning must comply with Specification J5.2d (see <i>Additional Information and Remarks</i>)	
5.2f	Air-conditioning systems – Energy efficiency ratios	
	Packaged a/c systems <65kW capacity: Must comply with Minimum Energy Performance Standards (MEPS) Other a/c systems: Energy efficiency ratios to be determined in accord with Specification J5.2e (by mechanical engineer/contractor)	
5.2g	Air-conditioning systems – Time switches	
	A/c or heating systems >10kW: Must have a time switch complying with Specification J6.3 (see <i>Additional Information and Remarks</i>)	
5.3	Mechanical ventilation systems	
	Mechanical ventilation systems, other than those in an a/c system covered above, to have compliance determined in accord with J5.3 (by mechanical engineer/contractor)	
5.4	Miscellaneous exhaust systems	
	Miscellaneous exhaust systems with an air flow rate >1000 L/s: Must have variable speed fan and stop controls	
J6	ARTIFICIAL LIGHTING AND POWER	
6.2b	Artificial lighting	<i>Refer to attached Internal Lighting Calculations at Annex C</i>
	The total design illumination power load must not exceed the sum of the allowances of each area or space, in accord with Table J6.2a, b	
6.3a-c	Interior lighting and power control	
	Lighting must— <ul style="list-style-type: none"> • be individually operated by a switch or other control device located so the lighting can be seen from the switch position, and • must not operate an area greater than 250m² 	
6.3d	Whole building control	n/a – Building less than 250m ²
6.3e	Artificial lighting in natural lighting zones	n/a – Building less than 250m ²
6.4	Interior decorative and display lighting	
	Interior decorative and display lighting must be separately switched, and where lighting exceeds 1kW, be controlled by a time switch complying with Specification J6.3 (see <i>Additional Information and Remarks</i>)	
6.5	Artificial lighting around the perimeter of a building	
	Perimeter lighting must, in accord with Specification J6 — <ul style="list-style-type: none"> • be controlled by a daylight sensor or time switch; • if total perimeter lighting exceeds 100W, have an average light source efficacy of at least 60 Lumens/W, or be controlled by a motion sensor; and • if used for decorative purposes (such as facade or signage lighting), have a separate time switch 	
6.6	Boiling and chilled water storage units	
	Power supply to boiling and chilled water storage units must be controlled by a time switch complying with Specification J6.3 (see <i>Additional Information and Remarks</i>)	
J7	HEATED WATER SUPPLY AND SWIMMING POOL AND SPA POOL PLANT	
7.2	Hot water supply	
	A heated water system for food preparation and sanitary purposes must be designed and installed in accord with NCC Vol. 3: PCA Part B2	
7.3-7.4	Swimming / spa pool heating and pumping	n/a

J8	FACILITIES FOR ENERGY MONITORING	
8.3a	Facilities for energy monitoring in a building with floor area >500m ²	n/a
8.3b	Facilities for energy monitoring in a building with floor area >2500m ²	n/a
ADDITIONAL INFORMATION AND REMARKS		
Specification J5.2d: Space heating		
<p>A heater used for air-conditioning must be—</p> <ul style="list-style-type: none"> (a) a solar, gas, heat pump, or solid-fuel burning heater; or (b) a heater using reclaimed energy from another process; or (c) in climate zones 1 to 5, an electric heater if the annual heating energy consumption is not more than 15kWh/m²; or (d) if reticulated gas is not available at the allotment boundary— <ul style="list-style-type: none"> (i) an oil heater; or (ii) an electric heater with a capacity in accord with <i>Spec. J5.2d Table 2a</i> <p>An electric heater with a maximum capacity of 1.2kW may be used in a bathroom in a Class 3 or 9c building</p> <p>A fixed space heating appliance installed outdoors must be capable of automatic shutdown</p>		
Specification J6.3: Time switch		
<p>A time switch must be capable of switching on and off electric power at variable pre-programmed times and on variable pre-programmed days</p> <p>A time switch for internal lighting must be capable of being overridden by—</p> <ul style="list-style-type: none"> (e) a means of turning the lights on, either by— <ul style="list-style-type: none"> (iii) a manual switch or an occupant sensing device that on sensing a person's presence, overrides the time switch for a period of up to 2 hrs, after which there is no further presence detected, the time switch must resume control; or (iv) an occupant sensing device that overrides the time switch upon a person's entry and returns control to the time switch upon the person's exiting, such as a security card reader; and (f) a manual "off" switch <p>A time switch for external lighting must be capable of—</p> <ul style="list-style-type: none"> (a) limiting the period the system is switched on to between 30 min. before sunset and 30 mins. after sunrise is determined or detected including any pre-programmed period between these times; and (b) being overridden by a manual switch or a security access system for a period of up to 30 mins, after which the time switch must resume control <p>A time switch for boiling water and chilled water storage units must be capable of being overridden by a manual switch or a security access system that senses a person's presence, overrides for a period of up to 2 hrs, after which if there is no further presence detected, the time switch must resume control</p>		
Specification J6.4: Motion detector		
<p>When outside a building, a motion detector must—</p> <ul style="list-style-type: none"> (a) be capable of sensing movement such as by infra-red, ultrasonic or microwave detection or by a combination of these means, (b) be capable of detecting a person within a distance from the light equal to— <ul style="list-style-type: none"> (i) twice the mounting height; or (ii) 80% of the ground area covered by the light's beam, (c) not control more than five lights, (d) be operated in series with a photoelectric cell or astronomical time switch so that the light will not operate in daylight hours, (e) be capable of maintaining the artificial lighting when the switch is on for a maximum of 10 mins. unless it is reset, and (f) have a manual override switch which is reset after a maximum period of 4 hrs. 		
Specification J6.5: Daylight sensor and dynamic lighting control device		
<p>A daylight sensor and dynamic control device for artificial lighting must—</p> <ul style="list-style-type: none"> (a) for switching on and off— <ul style="list-style-type: none"> (i) be capable of having the switching level set point adjusted between 50 and 1000 Lux; and (ii) have a delay of more than 2 mins.; and (iii) have a differential of more than 100 Lux for a sensor controlling high pressure discharge lighting, and 50 Lux for a sensor controlling other than high pressure discharge lighting; and (b) for dimmed or stepped switching, be capable of reducing the power consumed by the controlled lighting in proportion to the incident daylight on the working plane either— <ul style="list-style-type: none"> (i) continuously down to a power consumption that is less than 50% of full power; or (ii) in no less than 4 steps down to a power consumption that is less than 50% of full power <p>Where a daylight sensor and dynamic control device has a manual override switch, the manual override switch must not be able to switch the lights permanently on or bypass the lighting controls</p>		

ADDITIONAL INFORMATION AND REMARKS (cont.)**NSW EP&A 2000 - Regulation 94: Applying BCA energy efficiency measures to existing Class 2-9 buildings**

Volume 1 Section J of the BCA contains energy efficiency measures for Class 2 to 9 buildings. The energy efficiency requirements are the same regardless of whether the building work is a new building, or alterations to an existing building.

Clause 94 of the Environmental Planning and Assessment Regulation 2000 states that “where the proposed building work, together with any other building work completed or authorised within the previous 3 years, represents more than half the total volume of the building, a consent authority is to take into consideration whether it would be appropriate to require the existing building to be brought into total or partial conformity with the BCA.”

The energy efficiency provisions have been developed on a basis of saving energy and long-term cost effectiveness for the building owner. On the same basis, when determining whether a dispensation from the energy efficiency provisions should be granted, it may be reasonable to ask “is it cost effective?”

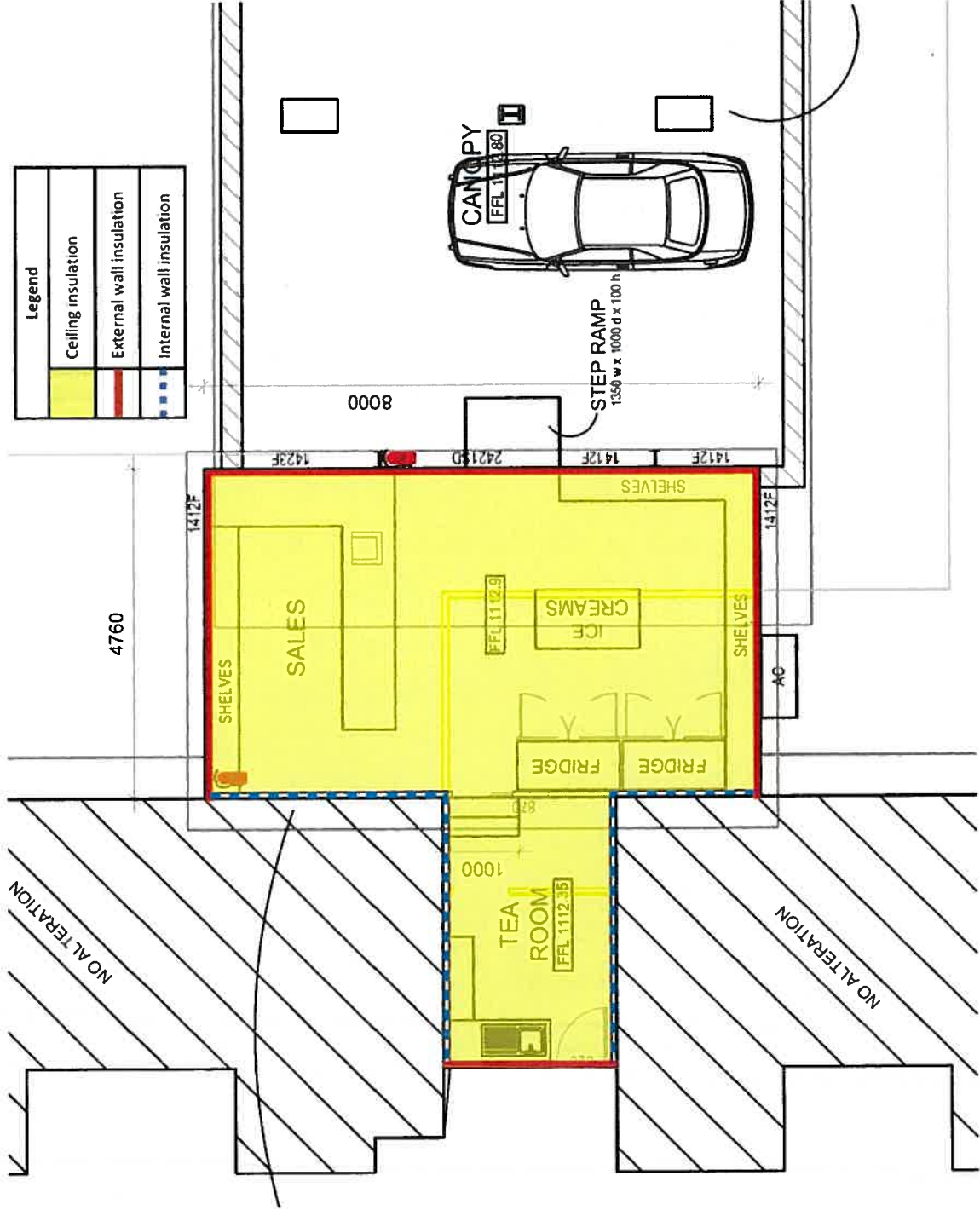
Guidance on the economic criteria used in developing the BCA energy efficiency provisions can be found in the report titled *Financial Analysis Procedure for Energy Efficiency in Buildings, Classes 2-9*, by the Atech Group (2003). This report is available from the Australian Building Codes Board website (<http://www.abcb.gov.au/>).

While the economic criteria used in this report may change, the basic principles for determining long-term cost effectiveness remain the same.

It is not possible to address all potential situations involving existing buildings; however, the basic principle is that where possible and practicable, any new building work should comply with the BCA energy efficiency provisions.

All J sections have been addressed in this report; however, it is up to the RBS to determine what should or should not be applied because of it being existing, and whether it will accomplish the intent of the BCA J Section. For further clarification, see the *ABCB Handbook: Applying energy efficiency provisions to new building work associated with existing Class 2 to 9 buildings*

BCA J1.1 - BUILDING ENVELOPE



BCA J2 – GLAZING CALCULATOR REPORT

NCC VOLUME ONE GLAZING CALCULATOR (first issued with NCC 2014)

Building name/description

Proposed Alts & Adds to Service Station - 9807 New England Highway, Glen Innes NSW 2370

Application

shop display

Climate zone

6

Storey

Facade areas

	N	NE	E	SE	S	SW	W	NW	internal
Option A	14m ²		26m ²		14m ²				
Option B									n/a

Glazing area (A) 1.68m² 11.6m² 1.68m²

Number of rows preferred in table below

6 (as currently displayed)

GLAZING ELEMENTS, ORIENTATION SECTOR, SIZE and PERFORMANCE CHARACTERISTICS										CALCULATED OUTCOMES OK (if inputs are valid)									
ID	Glazing element Description (optional)	Facing sector		Size			Performance			SHADING		Shading		Multipliers		Size		Outcomes	
		Option A facades	Option B facades	Height (m)	Width (m)	Area (m ²)	Total System U-Value (AFRC)	Total System SHGC (AFRC)	P&H or device	P (m)	H (m)	P/H	G (m)	Heating (S _H)	Cooling (S _C)	Area used (m ²)	Element share of % of allowance used		
1		N		1.40	1.20		6.7	0.70	0.600	2.250	0.27	0.85	1.00	0.95	1.68	100% of 38%			
2		E		1.40	2.30		6.7	0.70	8.000	2.900	2.76	1.50	0.67	0.58	3.22	28% of 100%			
3		E		2.40	2.10		6.7	0.70	8.000	3.900	2.05	1.50	0.67	0.58	5.04	43% of 100%			
4		E		1.40	1.20		6.7	0.70	8.000	2.900	2.76	1.50	0.67	0.58	1.68	14% of 100%			
5		E		1.40	1.20		6.7	0.70	8.000	2.900	2.76	1.50	0.67	0.58	1.68	14% of 100%			
6		S		1.40	1.20		6.7	0.70	0.600	2.250	0.27	0.85	0.98	0.97	1.68	100% of 37%			

IMPORTANT NOTICE AND DISCLAIMER IN RESPECT OF THE GLAZING CALCULATOR

The Glazing Calculator has been developed by the ABCB to assist in developing a better understanding of glazing energy efficiency parameters. While the ABCB believes that the Glazing Calculator, if used correctly, will produce accurate results, it is provided "as is" and without any representation or warranty of any kind, including that it is fit for any purpose or of merchantable quality, or functions as intended or at all. Your use of the Glazing Calculator is entirely at your own risk and the ABCB accepts no liability of any kind.

if inputs are valid



BCA J6.2(b) – INTERNAL LIGHTING CALCULATIONS

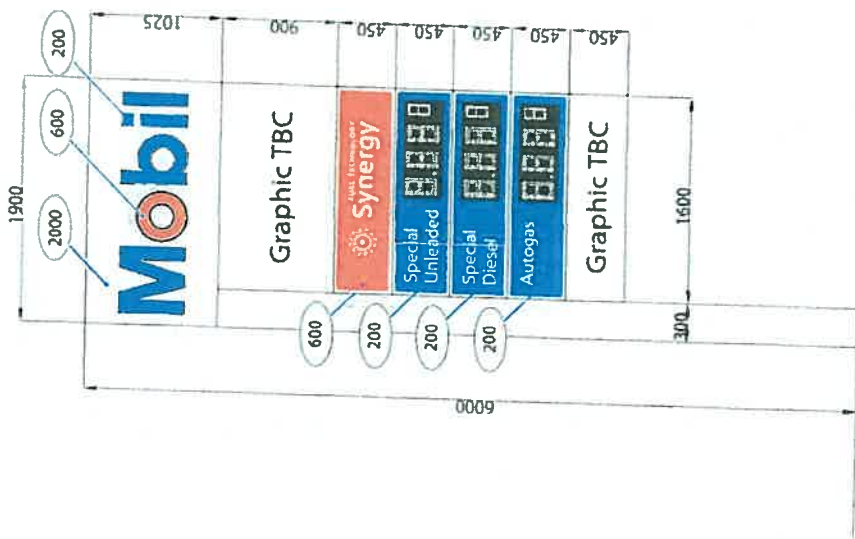
ID	Room / space	Area (m ²)	Perimeter (m)	Ceiling height (m)	Illum. power density (W/m ²)	Room aspect adjustment	Control device adjustment	Illumination power allowance (W)	Design power load (W)
1	Sales	35.77	24.78	3.00	22	0.66	n/a	1191.6	TBC
2	Tea Room	8.84	12.26	2.40	6	0.60	n/a	88.4	TBC
Whole Building - Total Design Maximum Wattage									TBC
Average wattage per m ²								28.7	
Total lighting area (m ²)								44.6	

Notes:

TBC - Actual proposed lighting to be confirmed by electrician

Total Design power load must not exceed total illumination power allowance for BCA J6.2b compliance to be achieved

- Room aspect ratio has been used to calculate illumination power density adjustment factor as per Table 6.2c
- Total design wattage includes lamp wattages, transformers, ballast and control gear
- Lighting control refers to any devices like motion detectors, etc.
- The above requirements do not apply to emergency lighting; MEPS compliant transformers, ballast and control gear; specialist processes such as in an operating theatre, fume cupboard, clean room, etc.; lighting for performances, such as theatrical or sporting; and a heater that also emits light



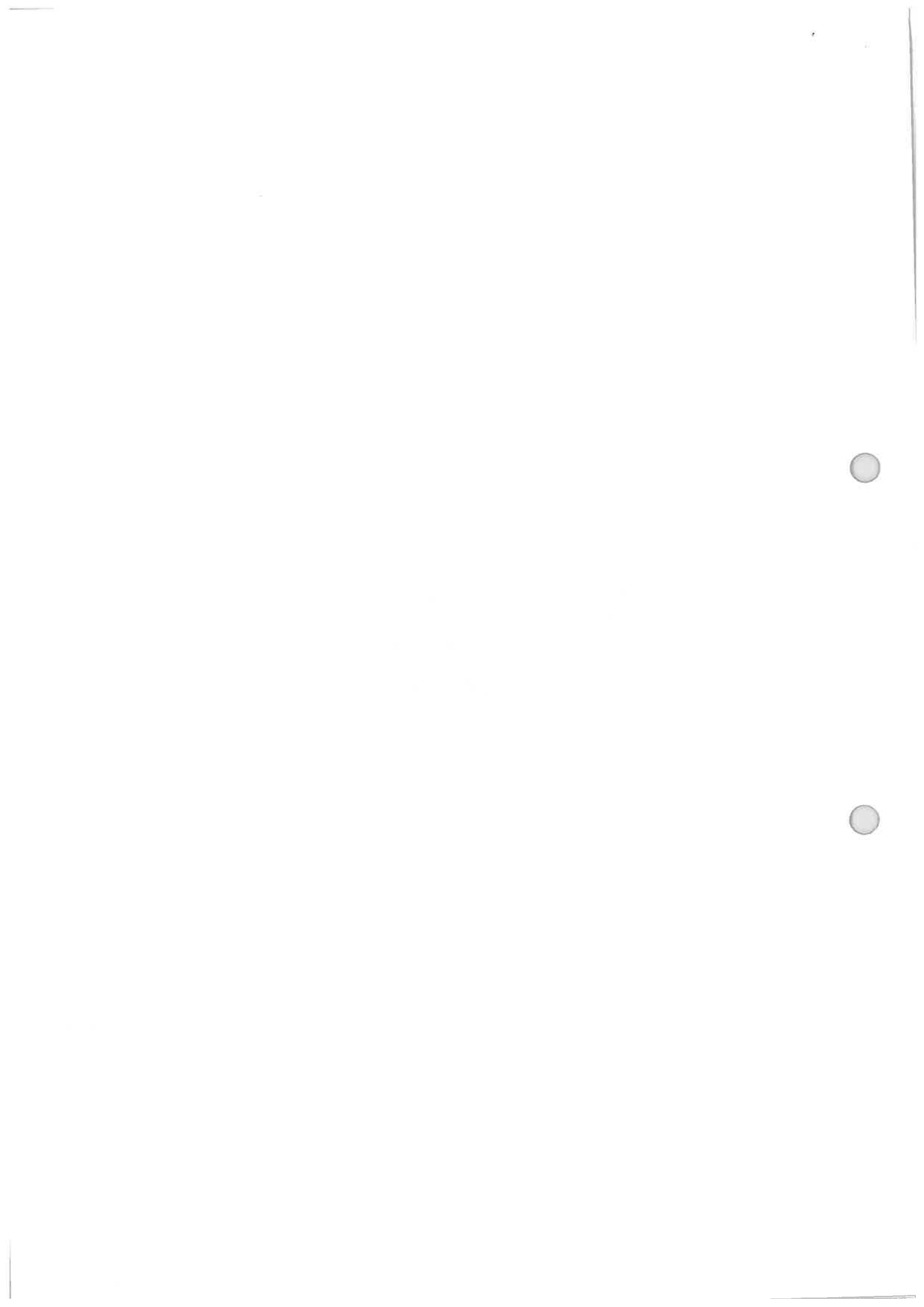
OPTION 1

PRODUCT : MID TYPE B 6M - OPTION 1 - LED LUX READING
 CUSTOMER : MOBIL AUSTRALIA
 DATE : 1/04/2017

CHECKED BY
 APPROVED BY
 GRAPHIC NO.

[Signature]

EXX-AUS-PHR17-GRA-WDB-002-003



PROJECT: Mobil 6.0m Flag Sign
Monopole Sign MP[1.9x4.2x6]

LOCATION: Wind Region A&B
Terrain Category 2.5

REFERENCE: HEX017F_c Rev 0

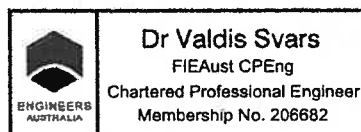
START DATE: 28-Oct-16

COMPLETED: 14-Nov-16

ENGINEER: NP

Rev No.	Date	Revision Details
0	14-Nov-16	Issued for construction

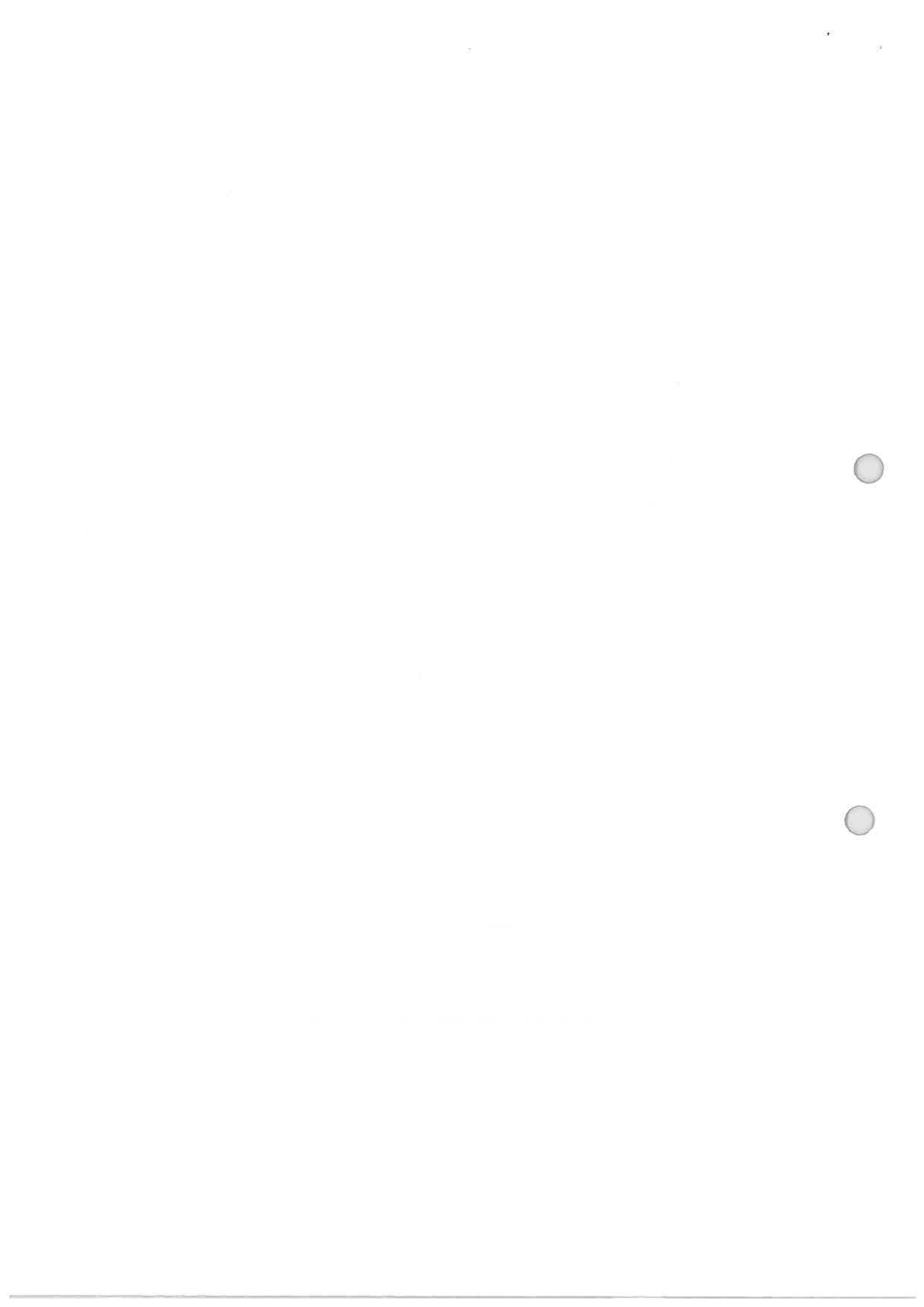
VERIFICATION & CERTIFICATION OF STRUCTURAL DESIGN DOCUMENTS




Vic: Registered Building Practitioner, Civil Engineer EC 1397.
NSW: Accredited Certifier - Structural Engineering Compliance Reg No. - BPB0398
Qld: Registered Professional Engineer of Qld. RPEQ 3414 Div: Civil.
Tas: Accredited Certifier, Civil & Structural CC40261 (Building Act 2000,Tas.)
NT: Certifying Engineer (Structural) Reg No. 47035ES

Date: 14-Nov-16

This document is the valuable property of Vistek Pty. Ltd. It contains information that is confidential and the subject of copyright, patents and other intellectual property rights. Copying, disclosing or using any part of this document is expressly prohibited without written permission from Vistek Pty. Ltd.



 Vistek engineered solutions	Mobil 6.0m Flag Sign Monopole Sign MP[1.9x4.2x6]	HEX017F_c	Rev 0
	Wind Region A&B Terrain Category 2.5	14-Nov-16	2
INTRODUCTION:			
SCOPE: Engineering design and details for freestanding monopole sign: <ol style="list-style-type: none"> 1. Design loads: <ul style="list-style-type: none"> DL Sign dead load [self weight] WL Wind load [Region & Terrain Category] EL Earthquake load [where applicable] 2. Design and detail vertical support for sign face. 3. Design and detail vertical support base, including base plate & HD-bolts 4. Footing design and details: <ul style="list-style-type: none"> Rectangular pier footing. Pad footing. 			
NB: Design assumptions: Structure to be located in Wind Region A or B. Structure designed for Terrain Category 2.5.			
Contact structural engineer if sign is located outside the above indicated areas.			
REGULATIONS & CODES:			
BCA - 2016: Building Code of Australia - 2016 AS/NZS 1170: Structural design actions. AS/NZS 1170.0 - 2002: Parts 0: General principles. AS/NZS 1170.1 - 2002: Parts 1: Permanent, imposed, and other actions. AS/NZS 1170.2 - 2011: Part 2: Wind actions. AS 1170.4 - 2007: Part 4: Earthquake actions in Australia. AS 3600 - 2009: Concrete structures. AS 4100 - 1998: Steel structures. AS/NZS 4600 - 2005: Cold-formed steel structures.			
MATERIALS:			
		fy (Mpa)	fu (MPa)
Hot Rolled	UB, UC, PFC: Grade 300 (AS/NZS 3679.1 - 2010)	300	440
	Plate: Grade 250 (AS/NZS 3679.1 - 1996)	250	410
Cold Formed	SHS: Grade C450 (AS1163 - 2009)	450	500
	RHS: Grade C450 (AS 1163 - 2009)	450	500
	CHS: Grade C350 (AS 1163 - 2009)	350	430
	CA: Cold-formed angle (Duragal)	350	400
	CC: Cold formed channels (Duragal)	400	450
	CF: Cold-formed flats (Duragal)	350	400
Bolts	Bolts (4.6/S) - [Commercial]	240	400
	Bolts (8.8/S) - [High Strength Structural]	660	830
Welds	Welding - Category: General Purpose	GP	410
Concrete:	Grade N25 [f _c @ 28 days]	25	MPa
REFERENCES:			
Duragal Easy Welding Guide. Duragal Easy Painting & Corrosion Protection Guide.			



Vistek

engineered solutions

Mobil 6.0m Flag Sign
Monopole Sign MP[1.9x4.2x6]

Wind Region A&B
Terrain Category 2.5

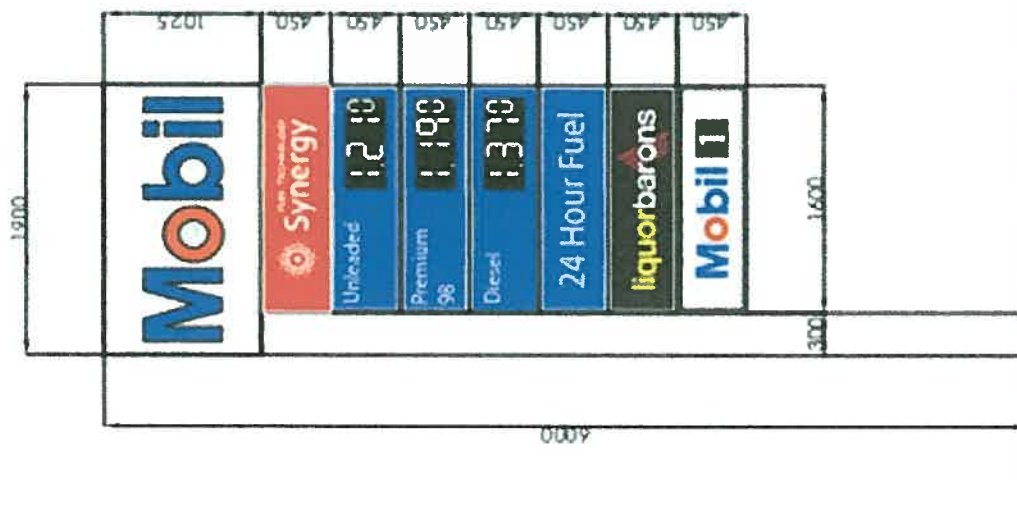
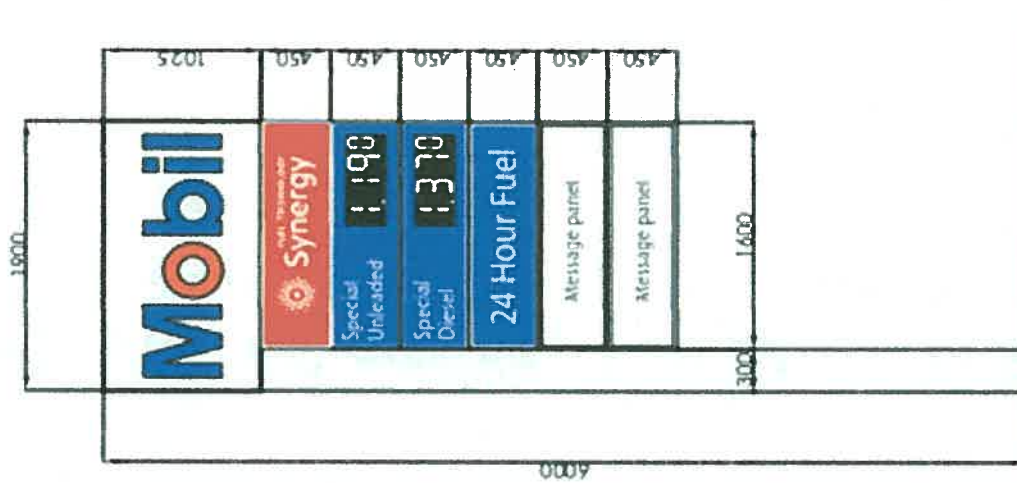
HEX017F_c

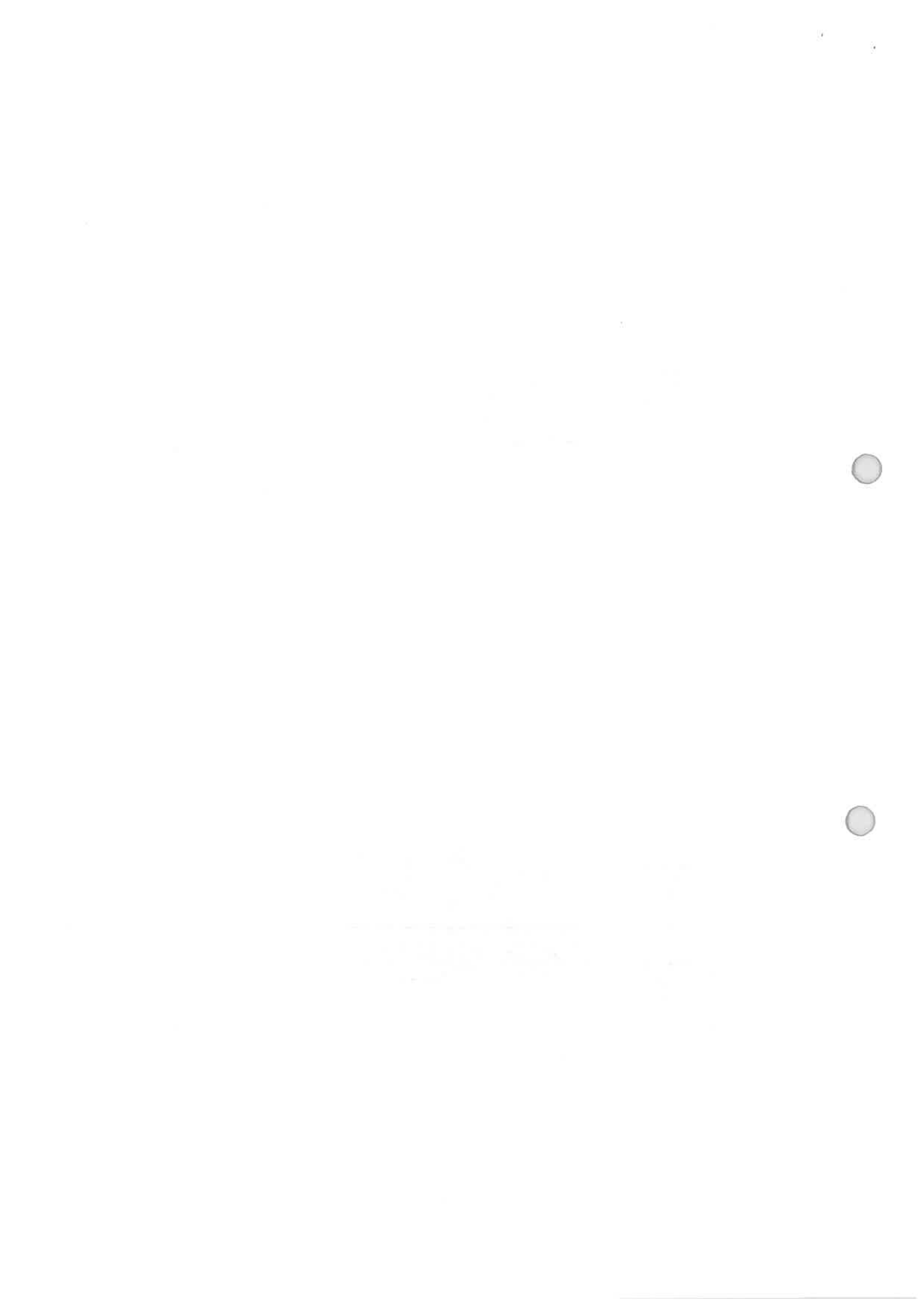
Rev 0

14-Nov-16

3

DIAGRAM 1: SIGN DIMENSIONS





Vistek

engineered solutions

Mobil 6.0m Flag Sign
Monopole Sign MP[1.9x4.2x6]

Wind Region A&B
Terrain Category 2.5

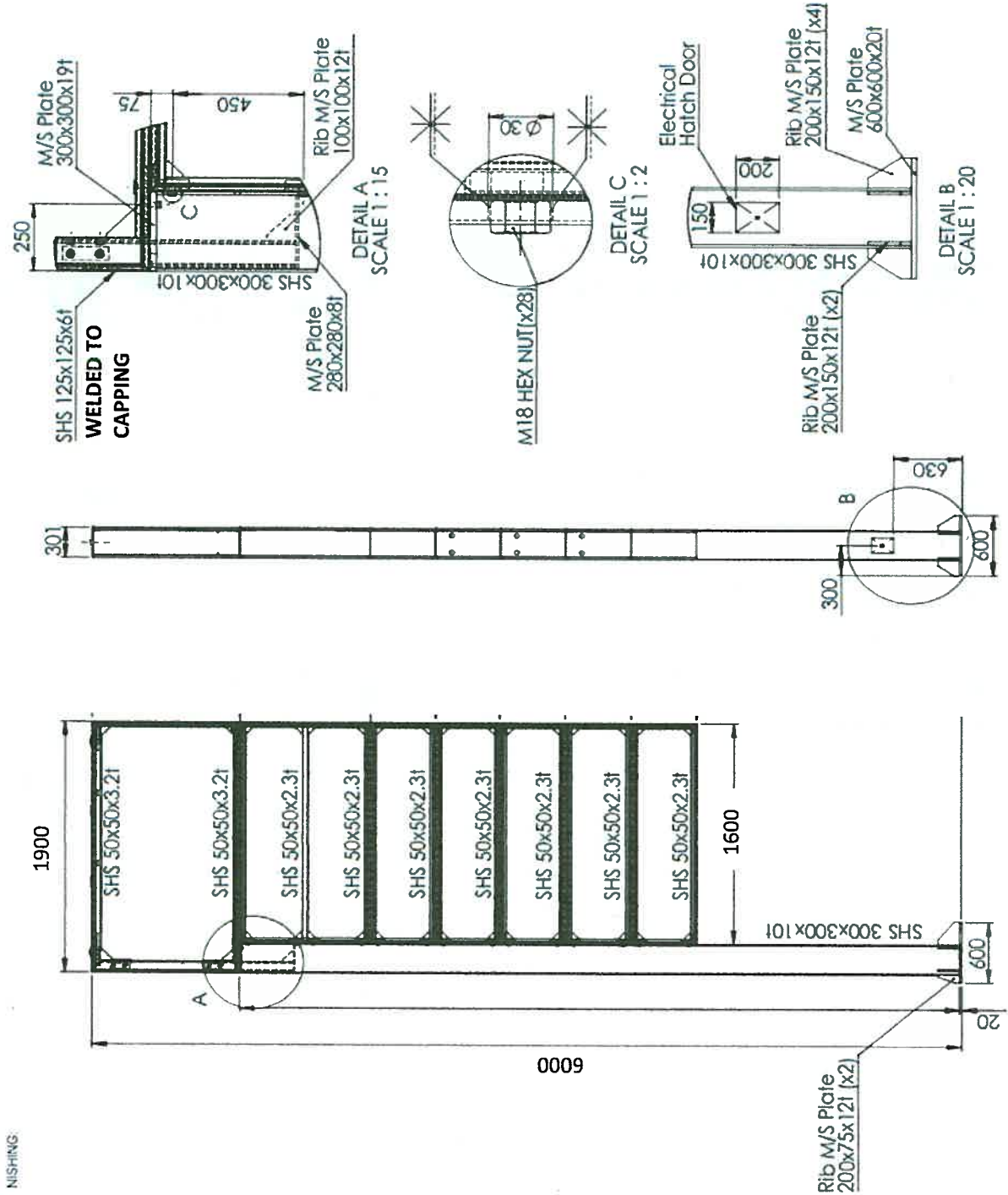
HEX017F_c

Rev 0

14-Nov-16

4

DIAGRAM 2: SIGN LAYOUT





Vistek

engineered solutions

Mobil 6.0m Flag Sign
 Monopole Sign MP[1.9x4.2x6]
 Wind Region A&B
 Terrain Category 2.5

HEX017F_c

Rev 0

14-Nov-16

5

SECTION PROPERTIES:

Units:

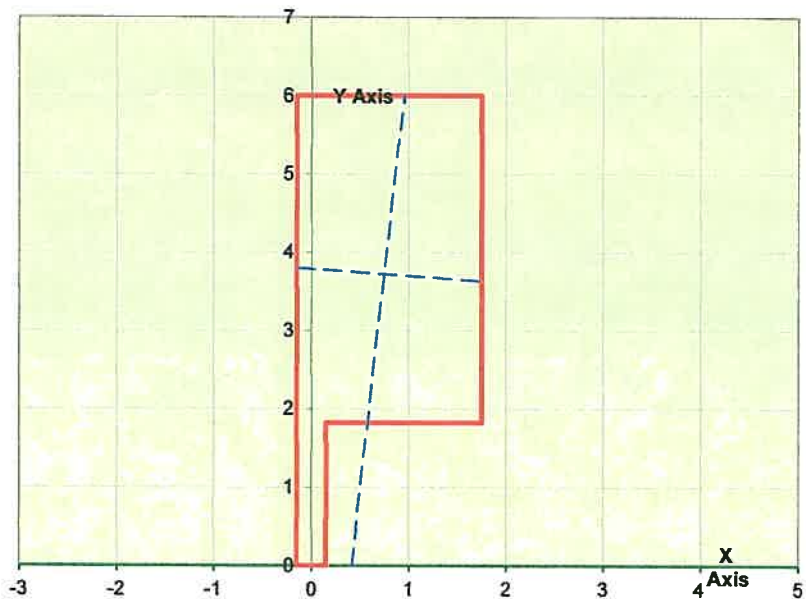
Nodes Coordinates		
	x	y
1	0.000	0.000
2	-0.150	0.000
3	-0.150	6.000
4	1.750	6.000
5	1.750	1.825
6	0.150	1.825
7	0.150	0.000
8	0.000	0.000
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29		
30		
31		
32		
33		
34		
35		
36		
37		
38		

Section properties about axes parallel to reference axes with origin at section centroid


A =	8.48 m ²	W =	1.9 m
P =	15.8 m	H =	6 m
x _c =	0.748 m	S _x ^{top} =	7.14 m ³
y _c =	3.719 m	S _x ^{bot} =	4.38 m ³
I _x =	16.28 m ⁴	S _y ^{right} =	3.03 m ³
I _y =	2.72 m ⁴	S _y ^{left} =	2.71 m ³
I _{xy} =	1.23 m ⁴		

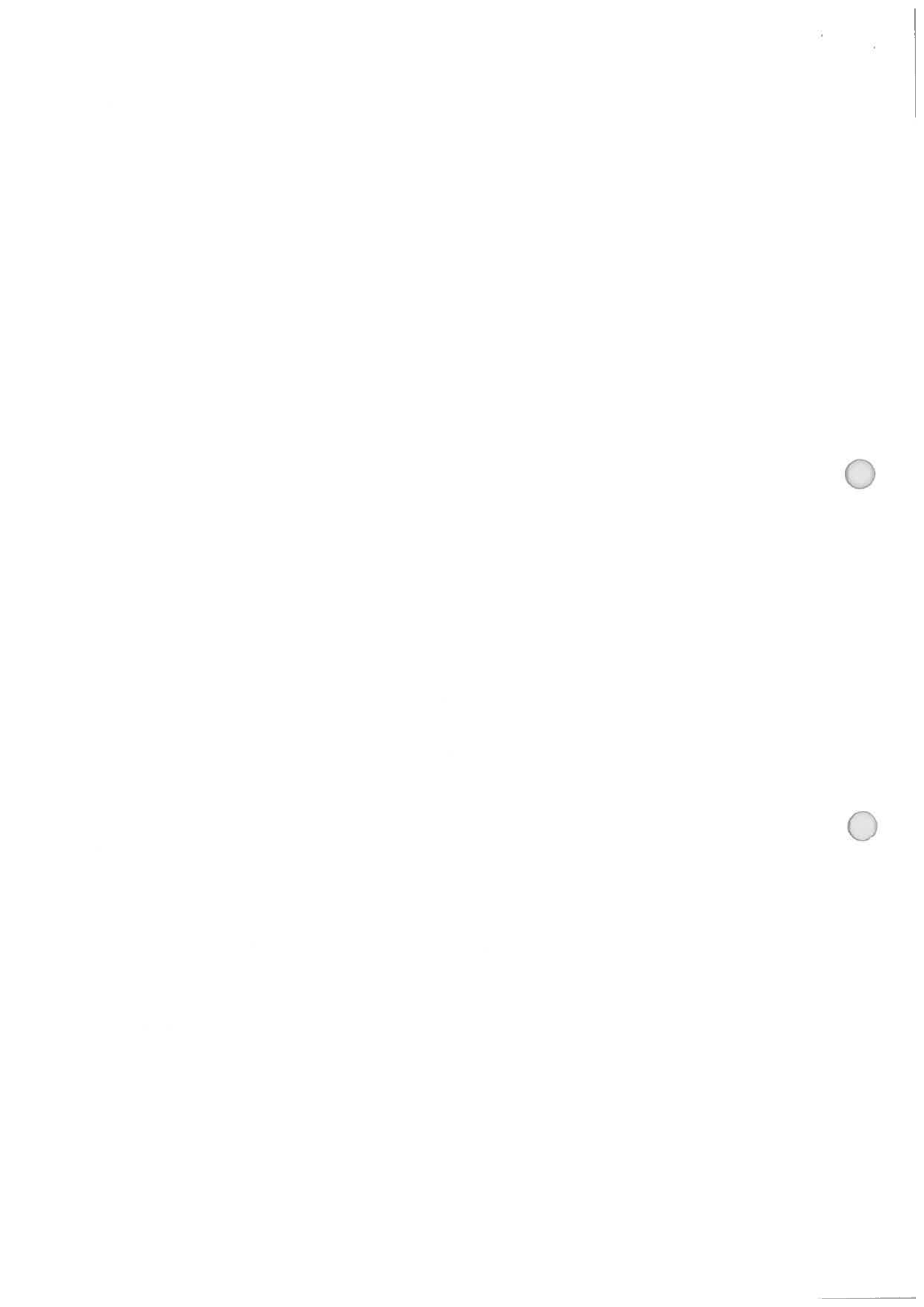
Section properties about principal axes

θ _p =	-5.14 deg	S _{xp} ^{top} =	6.94 m ³
I _{xp} =	16.39 m ⁴	S _{xp} ^{bot} =	4.33 m ³
I _{yp} =	2.61 m ⁴	S _{yp} ^{right} =	2.37 m ³
I _p =	19.00 m ⁴	S _{yp} ^{left} =	2.23 m ³





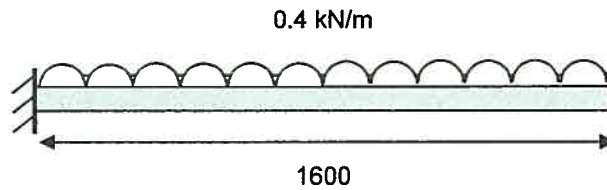
 engineered solutions		Mobil 6.0m Flag Sign Monopole Sign MP[1.9x4.2x6]	HEX017F_c	Rev 0
		Wind Region A&B Terrain Category 2.5	14-Nov-16	6
SIGN DIMENSIONS & WIND PRESSURE:				
Item	Param	Detail / Formula	Value	Units
Site	REG	Region	B	***
	TC	Terrain Category	2.5	***
Geometry	R	Average Recurrence Interval	250	***
	V_R	Regional wind speed for R	49	m/s
	A_s	Area of sign face	8.48	m ²
	x_c	CoA from CL of LH support	0.75	m
	y_c	CoA above datum (top of footing)	3.72	m
	b	Average width of sign face	1.90	m
	c	Height of sign face	4.20	m
	h	Total height of sign above datum	6.00	m
	h_d	Height of datum above NGL (z = 0)	0.00	m
	z	Height above NGL (rounded up)	6	m
	Ratios	b/c	Width / Height	0.45
	c/h	Sign height ratio	0.70	***
Coeff.	C_p	Wind pressure coefficient	1.30	***
Eccen.	e	Wind load eccentricity	0.38	m
Terrain	M_z	Terrain & height multiplier	0.88	***
Pressure	p_z	Pressure at ht z	1.12	kPa
STR	p_d	Strength design pressure	1.45	kPa
SRV	p_s	Serviceability design pressure	0.92	kPa
STR	W_s	Wind load on sign face	12.28	kN
	M_s	Moment due wind load	45.66	kNm
	M_z	Torsion due wind load	13.85	kNm
SRV	W_{sv}	Total wind load on sign face	7.78	kN
	M_{sv}	Total wind moment	28.92	kNm
	M_{zsv}	Total wind torsion	8.78	kNm
Section:	$f_y=275\text{MPa}$	300 x 300 x 10.0 SHS		***
	ϕM_{sx}	Section moment capacity	266	kNm
	ϕV_{vx}	Section shear capacity	2193	kN
	ϕM_z	Section torsion capacity	233	
	I_x	Second Mnt of Area	155	$\times 10^6 \text{mm}^4$
	J	Torsion constant	250	$\times 10^6 \text{mm}^4$
	E	Elastic modulus	200.0E+3	MPa
	G	Shear modulus	80.0E+3	MPa
STR	η_m	$M_s / \phi M_{sx}$	0.17	≤ 1 OK
	η_v	$V_{max} / \phi V_{vx}$	0.01	≤ 1 OK
	η_z	$M_z / \phi M_z$	0.06	≤ 1 OK
	UC	Unity check	0.15	≤ 1 OK
SRV	Δ_v	Deflection @ top of support	8	mm
	Δ_θ	Deflection @ top of flag due to rotation	10	mm
	Δ_z	Total Deflection	18	mm
	η_Δ	Height / Deflection ratio	329	≥ 50 OK



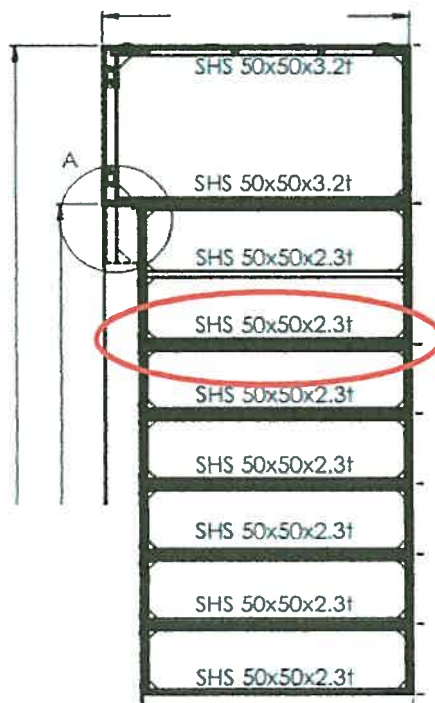
Vistek engineered solutions	Mobil 6.0m Flag Sign Monopole Sign MP[1.9x4.2x6]	HEX017F_c	Rev 0
	Wind Region A&B Terrain Category 2.5	14-Nov-16	7

RAIL SUPPORT MEMBERS:

Section	Parameter	Detail / Description	Value	Units
Loads	P_1	Point load	0.00	kN
	w_1	Distributed load	0.43	kN/m
	L	Length of member	1.60	m



STR	M_{max}	Moment on member	0.56	kNm
	V_{max}	Shear on member	0.69	kN
Section:	$f_y=275\text{MPa}$	50 x 50 x 2.3		***
	ϕM_{bx}	Member moment capacity	1.7	kNm
	ϕV_{vx}	Section shear capacity	30	kN
	I_x	Second moment of area	0.167	$\times 10^6 \text{ mm}^4$
STR	η_m	$M_{max} / \phi M_{bx}$	0.34	≤ 1 OK
	η_v	$V_{max} / \phi V_{vx}$	0.02	≤ 1 OK
	UC	Unity check	0.26	≤ 1 OK
SRV	Δ	Deflection @ end	7.1	mm
	η_Δ	Span / Deflection ratio	225	≥ 40 OK

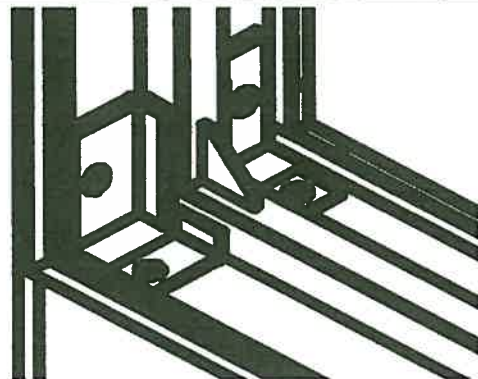
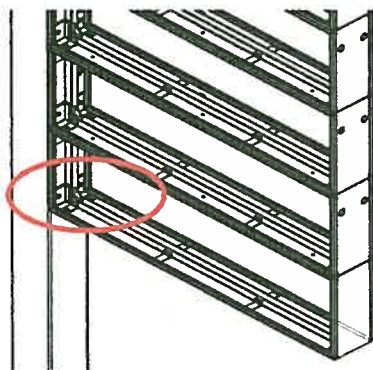




Vistek engineered solutions	Mobil 6.0m Flag Sign Monopole Sign MP[1.9x4.2x6]	HEX017F_c	Rev 0
	Wind Region A&B Terrain Category 2.5	14-Nov-16	8

END PLATE & BOLTS

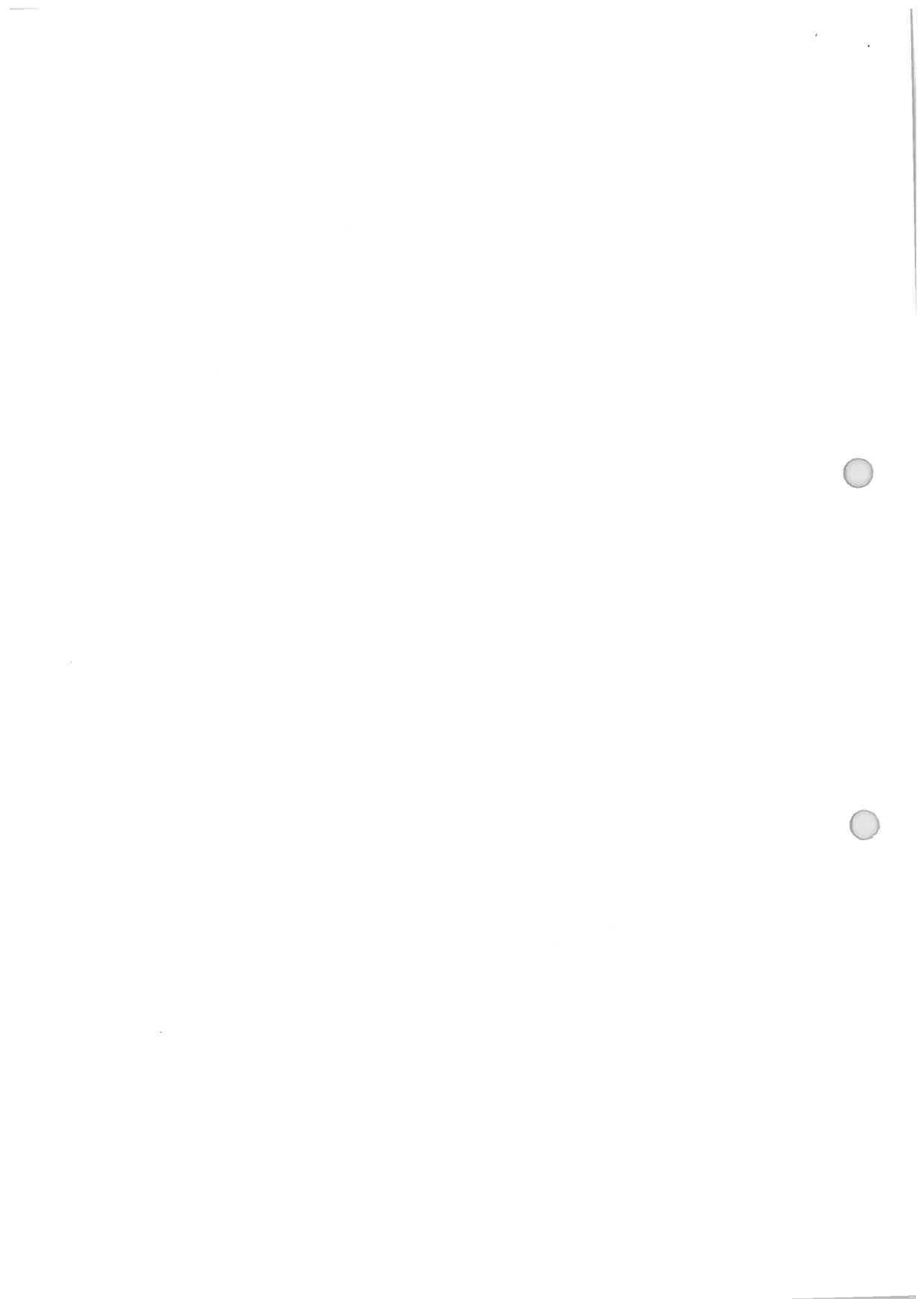
Item	Param	Detail / Formula	Value	Units
STR	W_s	Wind load on 50 x 50 x 3 member	1.39	kN
	M_s	Moment due wind load	1.11	kNm
	M_z	Torsion due wind load	0.00	kNm
Plate	f_y	Plate yield stress	250	MPa
	ϕ	Strength reduction factor	0.90	***
	ϕf_y	$\phi * f_y$	225	MPa
Section	d	Depth of section (or diam)	50	mm
	b	Width of section (or diam)	50	mm
Bolts	Spec	Grade 4.6	M16(4.6/S)	***
	ϕN_{tb}	Tensile strength	50.2	kN
	ϕV_b	Shear Strength	28.6	kN
	d_b	Bolt diameter	16	mm
	d_h	Hole diameter	18	mm
	n_{bt}	No. of bolts in tension	1	No.
	e_a	Distance CL bolt to edge of plate	60	mm
	s_o	Distance CL of bolt to face of section	75	mm
	s_g	Bolt gauge distance	0	mm
	s_p	Bolt pitch distance	100	mm
	l_b	Bolt lever arm	100	mm
	ΣN_t	Total bolt tension	11.1	kN
	ΣV	Total bolt shear	1.4	kN
	N_{tb}	Bolt tension	11.1	kN
	V_b	Bolt shear	1.4	kN
	η_t	$N_{tb} / (\kappa_r * \phi N_{tb})$	0.22	≤ 1 OK
	η_v	$V_b / \phi V_b$	0.05	≤ 1 OK
Plate No Stiffeners	L_p	Plate length (assumed)	100	mm
	B_p	Plate width (assumed)	200	mm
	κ_p	YL ratio	0.76	***
	m_p	Plate plastic mnt	0.32	kNm
	t_p	Plate thickness	12	mm
	η_m	Unity Check	0.44	≤ 1 OK
Result	Bolts	Adopt 2M16(4.6/S)		
	Plate	Adopt 12PL x 100x200 Grade 250		

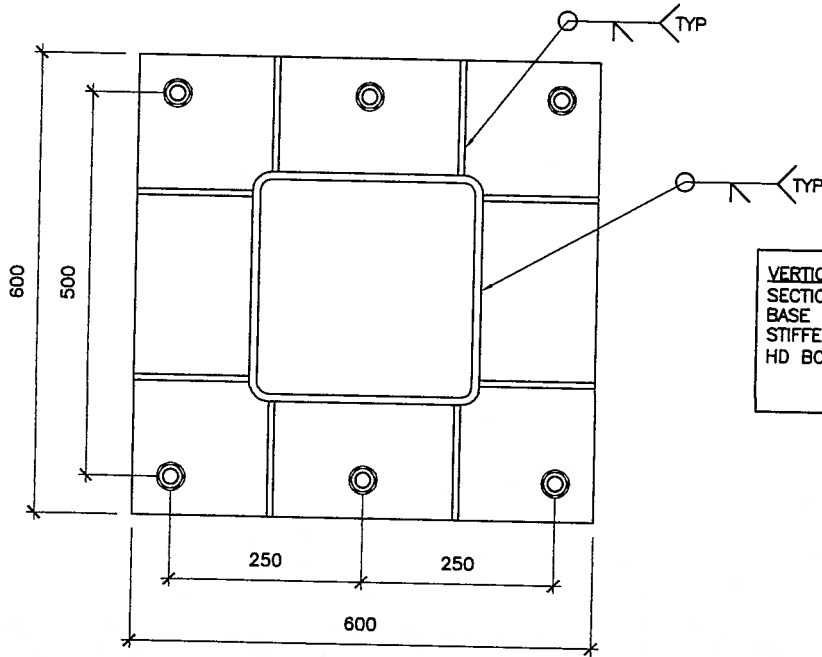




[Faint, illegible text or markings in the lower center of the page.]

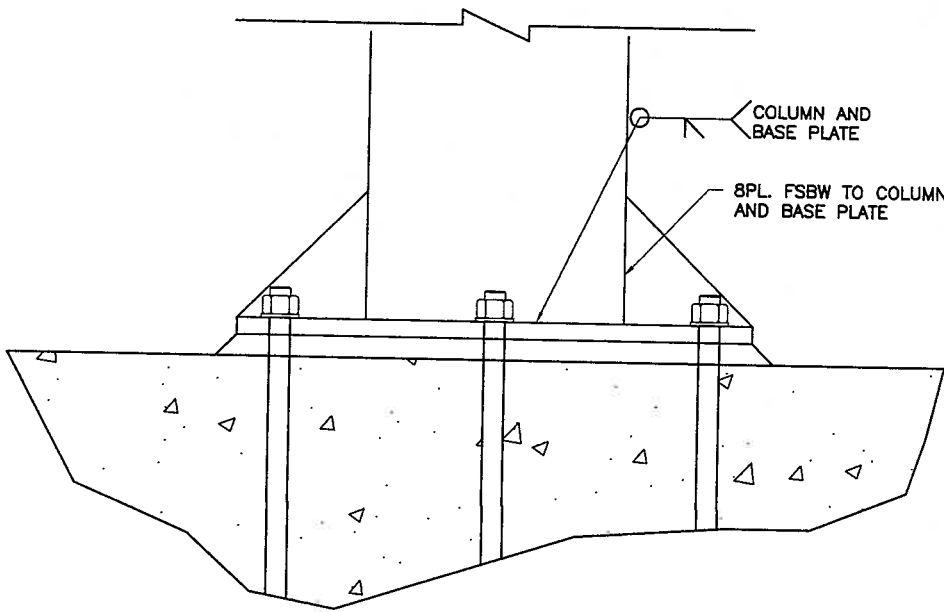
Vistek engineered solutions		Mobil 6.0m Flag Sign Monopole Sign MP[1.9x4.2x6]	HEX017F_c	Rev 0
		Wind Region A&B Terrain Category 2.5	14-Nov-16	9
VERTICAL SUPPORT BASES & HD-BOLTS				
Item	Param	Detail / Formula	Value	Units
STR	W_s	Wind load on sign face	12.28	kN
	M_s	Moment due wind load	45.66	kNm
	M_z	Torsion due wind load	13.85	kNm
Plate	f_y	Base plate yield stress	275	MPa
	ϕ	Strength reduction factor	0.90	***
Section	ϕf_y	$\phi * f_y$	247.5	MPa
	d	Depth of section (or diam)	300	mm
	b	Width of section (or diam)	300	mm
Bolts	Spec	All Thread Grade 4.6	M20(4.6/S)	***
	ϕN_{tb}	Tensile strength	78.4	kN
	ϕV_b	Shear Strength	44.6	kN
	d_b	Bolt diameter	20	mm
	d_h	Hole diameter	26	mm
	n_{bt}	No. of bolts in tension	3	No.
	e_a	Distance CL bolt to edge of plate	50	mm
	s_o	Distance CL of bolt to face of section	100	mm
	s_g	Bolt gauge distance	250	mm
	s_p	Bolt pitch distance	500	mm
	e_c	Distance bolt CL to edge of concrete	120	mm
	L_{em}	Bolt embedment for full tensile capacity	450	mm
	L_{ac}	Actual bolt embedment	500	mm
	κ_r	Reduction in tensile capacity	1.00	***
	l_b	Bolt lever arm	500	mm
	ΣN_t	Total bolt tension	91.3	kN
	ΣV	Total bolt shear	67.7	kN
	N_{tb}	Bolt tension	30.4	kN
	V_b	Bolt shear	22.6	kN
	η_t	$N_{tb} / (\kappa_r * \phi N_{tb})$	0.39	≤ 1 OK
	η_v	$V_b / \phi V_b$	0.51	≤ 1 OK
Base Plate	L_p	Base plate length	600	mm
	B_p	Base plate width	600	mm
No Stiffeners	κ_p	YL ratio	3.45	***
	m_p	Base plate plastic mnt	5.13	kNm
	t_p	Base plate thickness	20	mm
	η_m	Unity Check	0.59	≤ 1 OK
Result	Bolts	Adopt 6M20(4.6/S) Emb=500		
	Plate	Adopt 20PL x 600x600 Grade 275		





VERTICAL SECTION
 SECTION: 300x300x10.0 SHS (S275)
 BASE PLATE: 20PL.x600x600
 STIFFENER: 8PL.x150x150 TRIANGULAR
 HD BOLTS: 6 M20(4.6/S) EMB = 500mm
 6PL.x50x50 SQUARE WASHER
 GALVANSED

1 BASE PLATE
 NTS



2 BASE CONNECTION
 NTS

Vistek
 engineered solutions

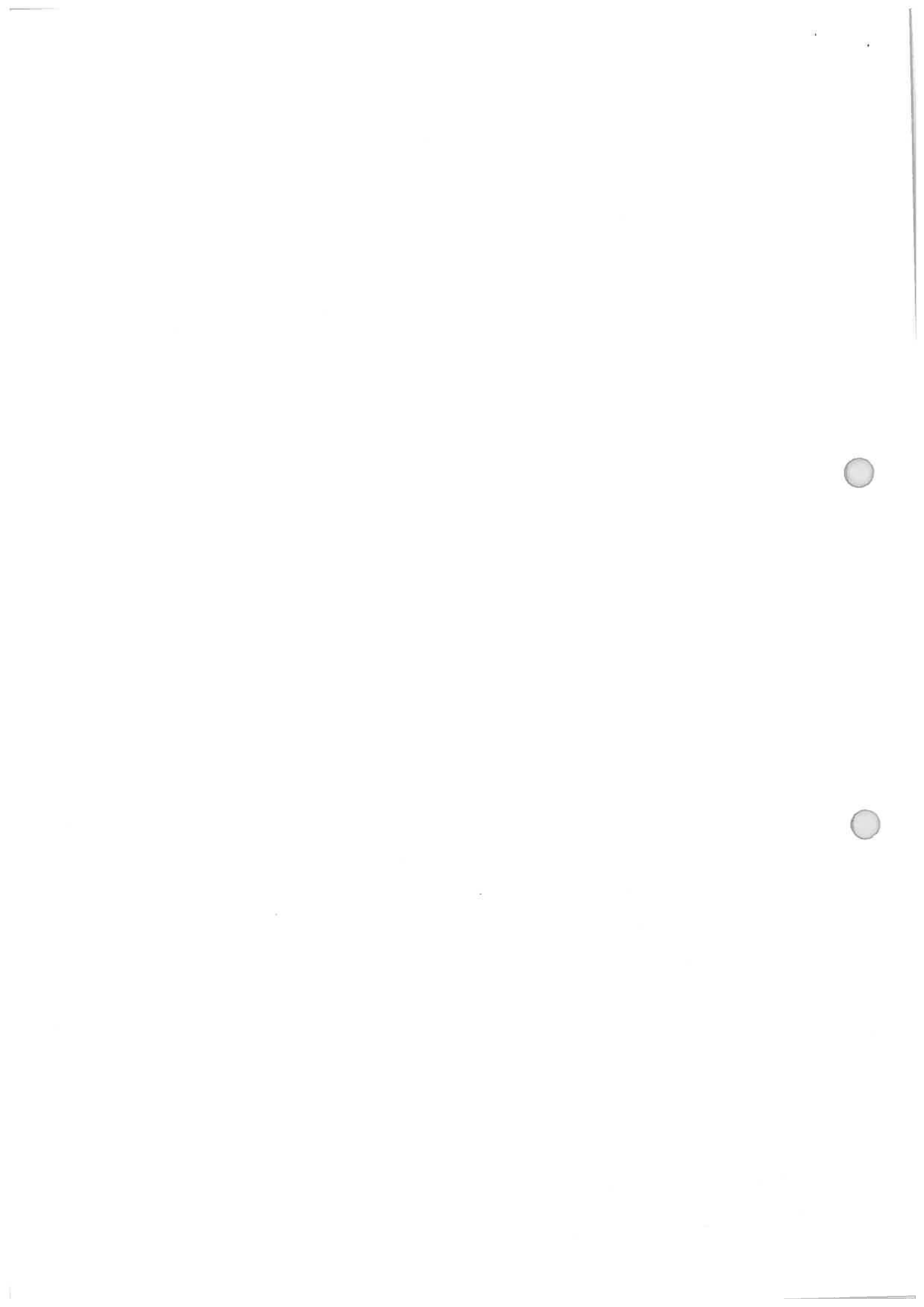
Vistek Pty Ltd (ABN: 80 122 033 626)
 SUITE 101, 8 BANK PL, MELBOURNE,
 VIC, 3000.
 T - (03) 9840 0424
 F - (03) 9840 0628
 email: info@vistek.com.au

© COPYRIGHT
 THIS DOCUMENT IS THE VALUABLE
 PROPERTY OF VISTEK PTY.LTD. IT
 CONTAINS INFORMATION THAT IS
 CONFIDENTIAL AND THE SUBJECT
 OF COPYRIGHT, PATENTS OR
 OTHER INTELLECTUAL PROPERTY
 RIGHTS. COPYING, DISCLOSING OR
 USING ANY PART OF THIS
 DOCUMENT IS EXPRESSLY
 PROHIBITED WITHOUT WRITTEN
 APPROVAL FROM VISTEK PTY.LTD.

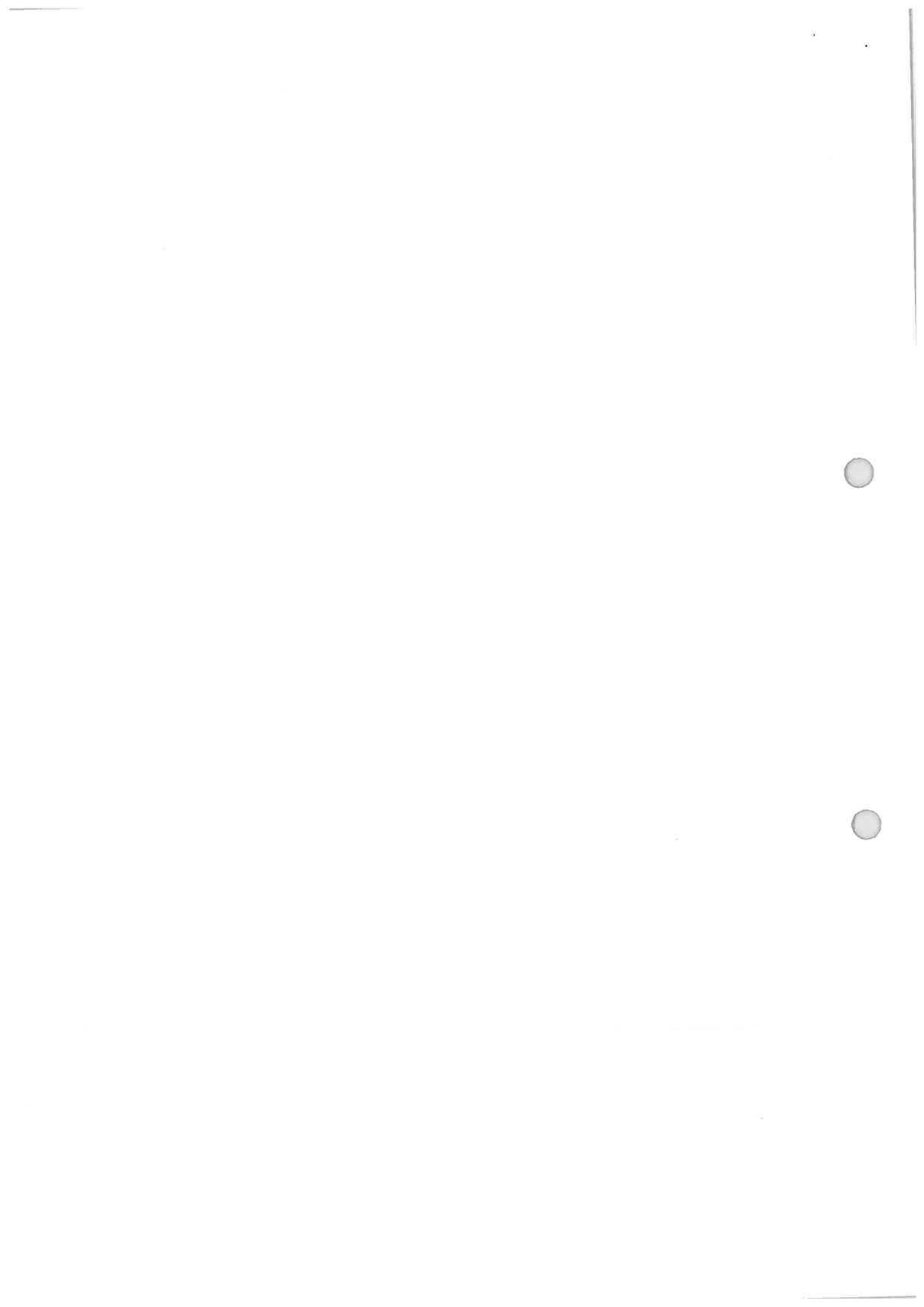
CLIENT: EVOCOM

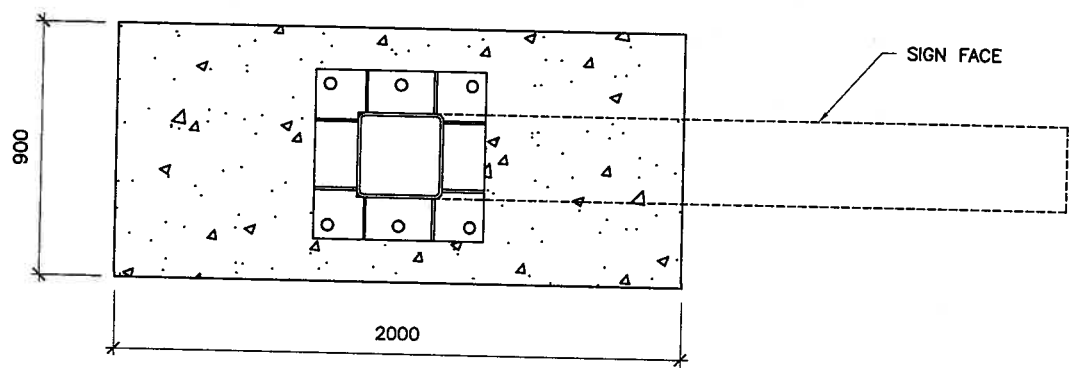
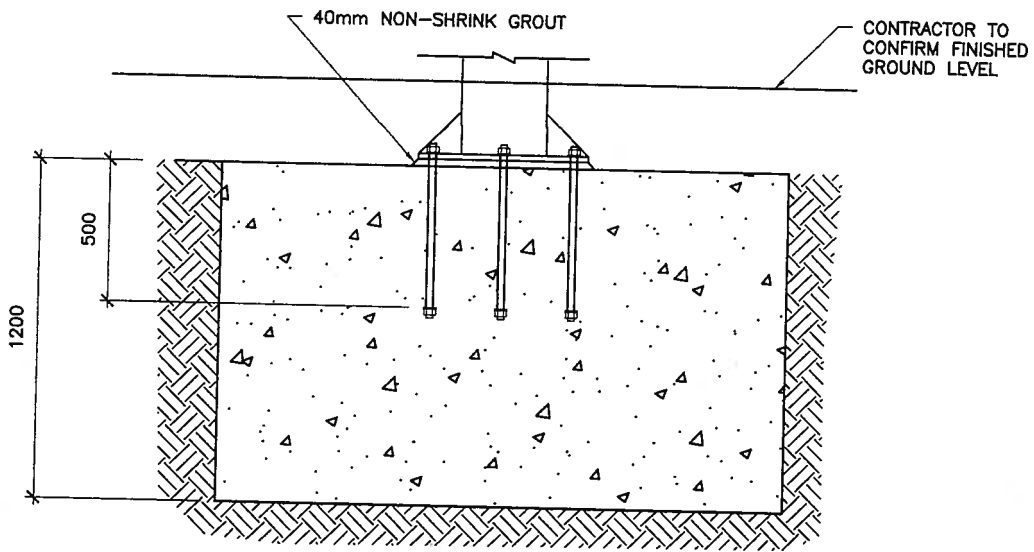
TITLE: MOBIL 6.0m FLAG SIGN
 BASE PLATE

DRAWN	NP	CHKD.	JOB NO.	DRG NO.	REV
DATE: 11/11/16		DATE:	HEX017F	S1	0



Vistek engineered solutions		Mobil 6.0m Flag Sign Monopole Sign MP[1.9x4.2x6] Wind Region A&B Terrain Category 2.5	HEX017F_c 14-Nov-16	Rev 0 11
FOOTING: RECTANGULAR PIER (UNREINFORCED CONCRETE)				
Item	Param	Detail / Formula	Value	Units
Force	W_s	Total wind load on sign face	12.28	kN
	y_c	CoA above datum (top of footing)	3.72	m
	t_s	Depth of top soil	0.20	m
Pier	B_f	Width of pier footing (parallel to sign face)	2.00	m
	L_f	Length of pier footing (perpendicular to sign face)	0.90	m
	D_f	Depth of pier footing (below NGL)	1.20	m
	y_w	Height to wind force	3.92	m
	y_f	Effective depth of pier	1.00	m
	y_t	Disn to top soil reaction	4.81	m
	y_b	Disn to bottom soil reaction	4.25	m
	y_{tb}	Disn between y_t & y_b	0.56	m
	A_f	Footing shear area	1.80	m ²
	Z_f	Footing section modulus	0.27	m ³
Soil	f_{bu}	Ultimate bearing capacity of soil	150	kPa
Concrete	f_c	Concrete Grade N(f_c) (f_c @ 28 days)	25	MPa
	ϕ	Strength reduction factor	0.60	***
	f_{ctf}	Characteristic tensile strength	3.00	MPa
Capacity	ϕM_{cf}	Moment capacity of footing	486.0	kNm
	ϕV_{cf}	Shear capacity of footing	473.7	kN
Rct Top	R_t	Top reaction of footing	106.2	kN
Rct Bot	R_b	Bottom reaction of footing	94.0	kN
	f_{brg}	Max soil bearing stress	119.5	kPa
	η_f	Unity Check = f_{brg} / f_{bu}	0.80	≤ 1 OK
	Ftg Mnt	M_f	Max moment in pier footing	48.1
Ftg Shear	V_f	Max shear force in pier footing	106.2	kN
	η_m	$M_f / \phi M_{cf}$	0.10	≤ 1 OK
	η_v	$V_f / \phi V_{cf}$	0.22	≤ 1 OK
Foundation Details				
Width of rectangular pier footing (parallel to sign face)			2000	mm
Depth of rectangular pier footing (below NGL)			1200	mm
Length of rectangular pier footing (perpendicular to sign face)			900	mm
Concrete Grade N25 (f_c @ 28 days)			25	MPa
Concrete Volume (no allowance for overcut or waste)			2.16	m ³
Reinforcement			Nil	***
Concrete shall be compacted using mechanical vibration				
Concrete shall be poured in one continuous pour				





2 PIER FOOTING
NTS

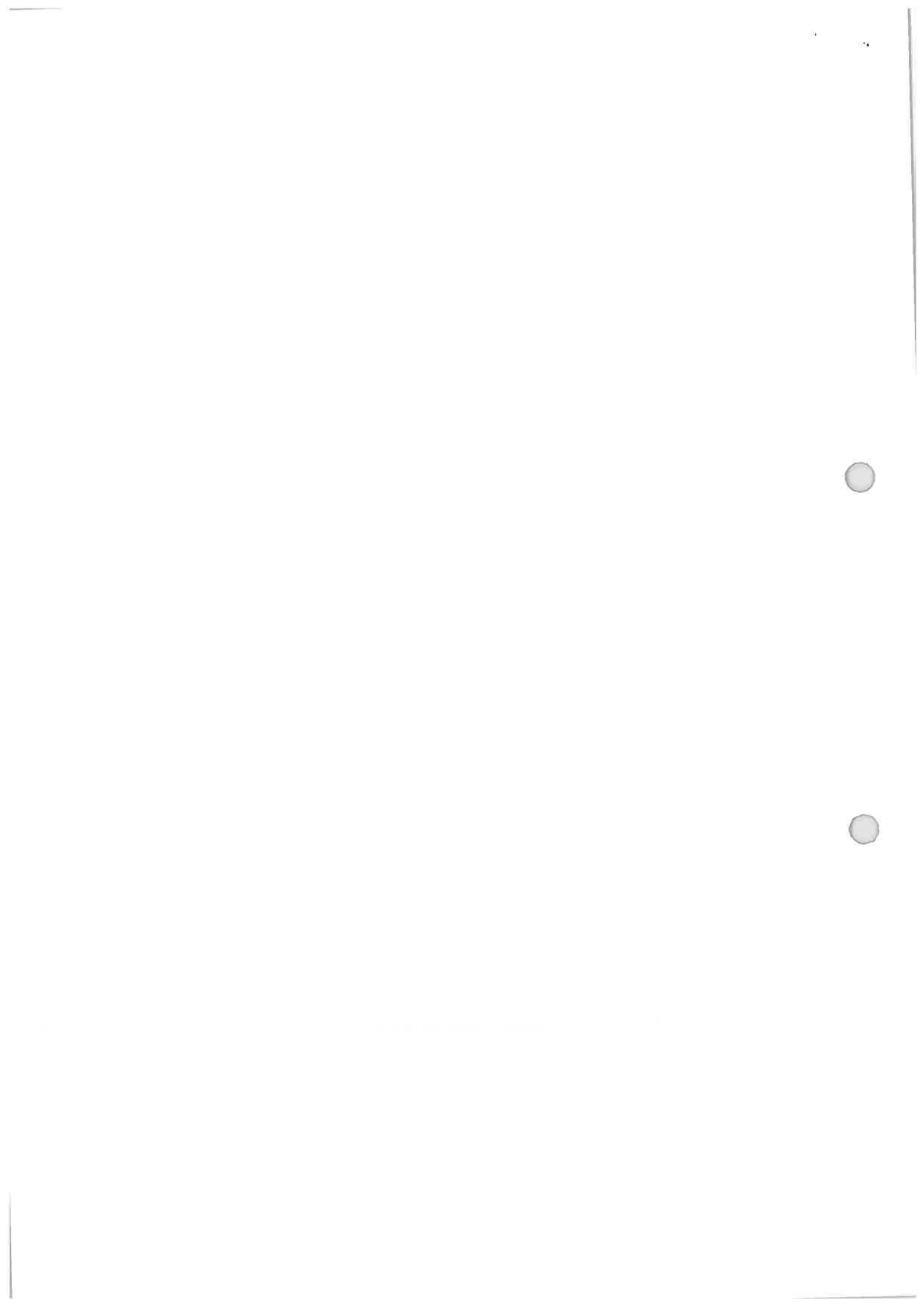
1. CONCRETE: GRADE N25
2. CONCRETE SHALL BE COMPACTED USING MECHANICAL VIBRATION.
3. CONCRETE SHALL BE POURED IN ONE CONTINUOUS POUR.
4. NOT TO BE LOCATED IN FILLED GROUND.
5. CONTRACTOR TO CONFIRM FINISHED GROUND LEVEL.
6. CONTRACTOR TO CONFIRM HD BOLT LOCATIONS ARE CONSISTENT WITH THE FINAL SIGN ARRANGEMENT.


Vistek
engineered solutions

Vistek Pty Ltd (ABN: 80 122 033 828)
SUITE 101, 8 BANK PL, MELBOURNE,
VIC, 3000.
T - (03) 9640 0424
F - (03) 9640 0828
email: info@vistek.com.au

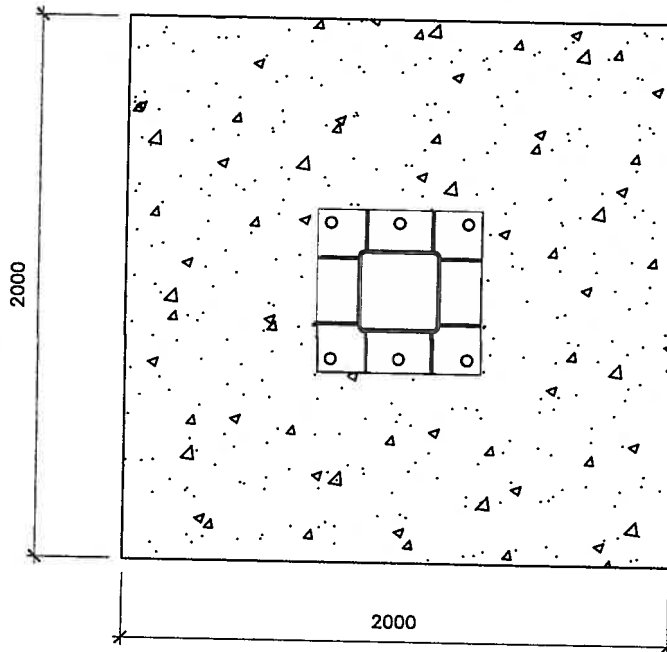
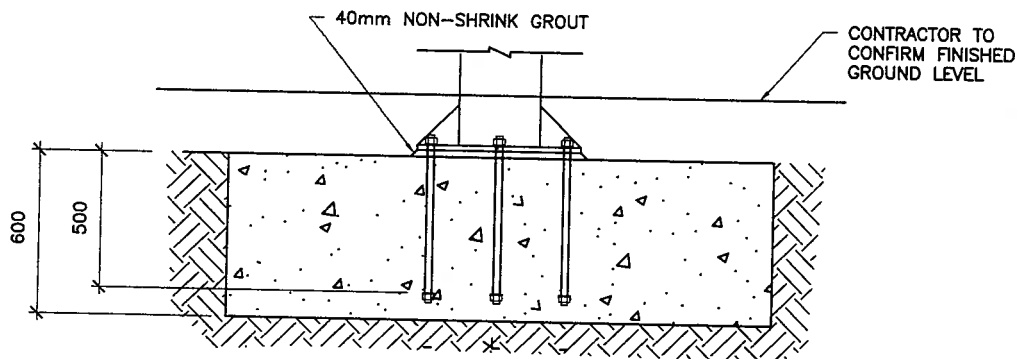
© COPYRIGHT
THIS DOCUMENT IS THE VALUABLE
PROPERTY OF VISTEK PTY.LTD. IT
CONTAINS INFORMATION THAT IS
CONFIDENTIAL AND THE SUBJECT
OF COPYRIGHT, PATENTS OR
OTHER INTELLECTUAL PROPERTY
RIGHTS. COPYING, DISCLOSING OR
USING ANY PART OF THIS
DOCUMENT IS EXPRESSLY
PROHIBITED WITHOUT WRITTEN
APPROVAL FROM VISTEK PTY.LTD.

CLIENT: EVOCOM				
TITLE: MOBIL 6.0M FLAG SIGN - REGION A&B PIER FOOTING				
DRAWN: NP	CHKD.	JOB NO.	DRG NO.	REV
DATE: 11/11/16	DATE:	HEX017A_c	S2	0



 Vistek engineered solutions	Mobil 6.0m Flag Sign Monopole Sign MP[1.9x4.2x6]		HEX017F_c	Rev 0	
	Wind Region A&B Terrain Category 2.5		14-Nov-16	13	
FOOTING: RECTANGULAR PAD (UNREINFORCED CONCRETE)					
Item	Param	Detail / Formula	Value	Units	
Forces	W_s	Total wind load on sign face	12.28	kN	
	M_s	Total wind mnt at top of footing	45.66	kNm	
Footing	B_f	Width of footing (parallel to sign face)	2.00	m	
	L_f	Length of footing (perpendicular to sign face)	2.00	m	
	D_f	Depth of footing (below NGL)	0.60	m	
	D_s	Depth of soil over footing	0.00	m	
	Concrete	f_c	Concrete Grade N(f_c) (f_c @ 28 days)	25	MPa
ϕ		Strength reduction factor	0.60	***	
$f_{ct,f}$		Characteristic tensile strength	3.00	MPa	
γ_c		Density of concrete	24.0	kN/m ³	
A_f		Shear area	1.10	m ²	
Z_f		Section modulus	0.10	m ³	
ϕM_{cf}		Moment capacity	181.5	kNm	
ϕV_{cf}		Shear capacity	289.5	kN	
Soil		f_b	Soil bearing strength	100	kPa
		f_{bu}	Ultimate soil bearing strength = $1.5 \cdot f_b$	150	kPa
	γ_s	Density of soil	16.0	kN/m ³	
	c	Characteristic cohesion of soil	50	kPa	
	ϕ	Internal angle of friction	0	deg	
	P_p	Passive resistance	115.3	kN	
	η_w	W_s / P_p	0.11	≤ 1 OK	
	Stability	G_f	Wt of pad footing	52.8	kN
G_s		Wt of soil over footing	0.0	kN	
R_t		Soil reaction	52.8	kN	
e_f		Eccen from CoG	0.86	m	
L_{sb}		Length of soil bearing	0.27	m	
f_{sb}		Soil bearing pressure	98	kPa	
η_s		f_{sb} / f_{bu}	0.65	≤ 1 OK	
Strength	M_f	Max BM in footing	32.46	kNm	
	V_f	Max SF in footing	45.66	kN	
	η_m	$M_f / \phi M_{cf}$	0.18	≤ 1 OK	
	η_v	$V_f / \phi V_{cf}$	0.16	≤ 1 OK	
Foundation Details					
Width of pad footing (parallel to sign face)			2000	mm	
Length of pad footing (perpendicular to sign face)			2000	mm	
Depth of pad footing (below NGL)			600	mm	
Concrete Grade N25 (f_c @ 28 days)			25	MPa	
Concrete Volume (no allowance for overcut or waste)			2.40	m ³	
Reinforcement			Nil	***	
Concrete shall be compacted using mechanical vibration					
Concrete shall be poured in one continuous pour					





3 PAD FOOTING
- NTS

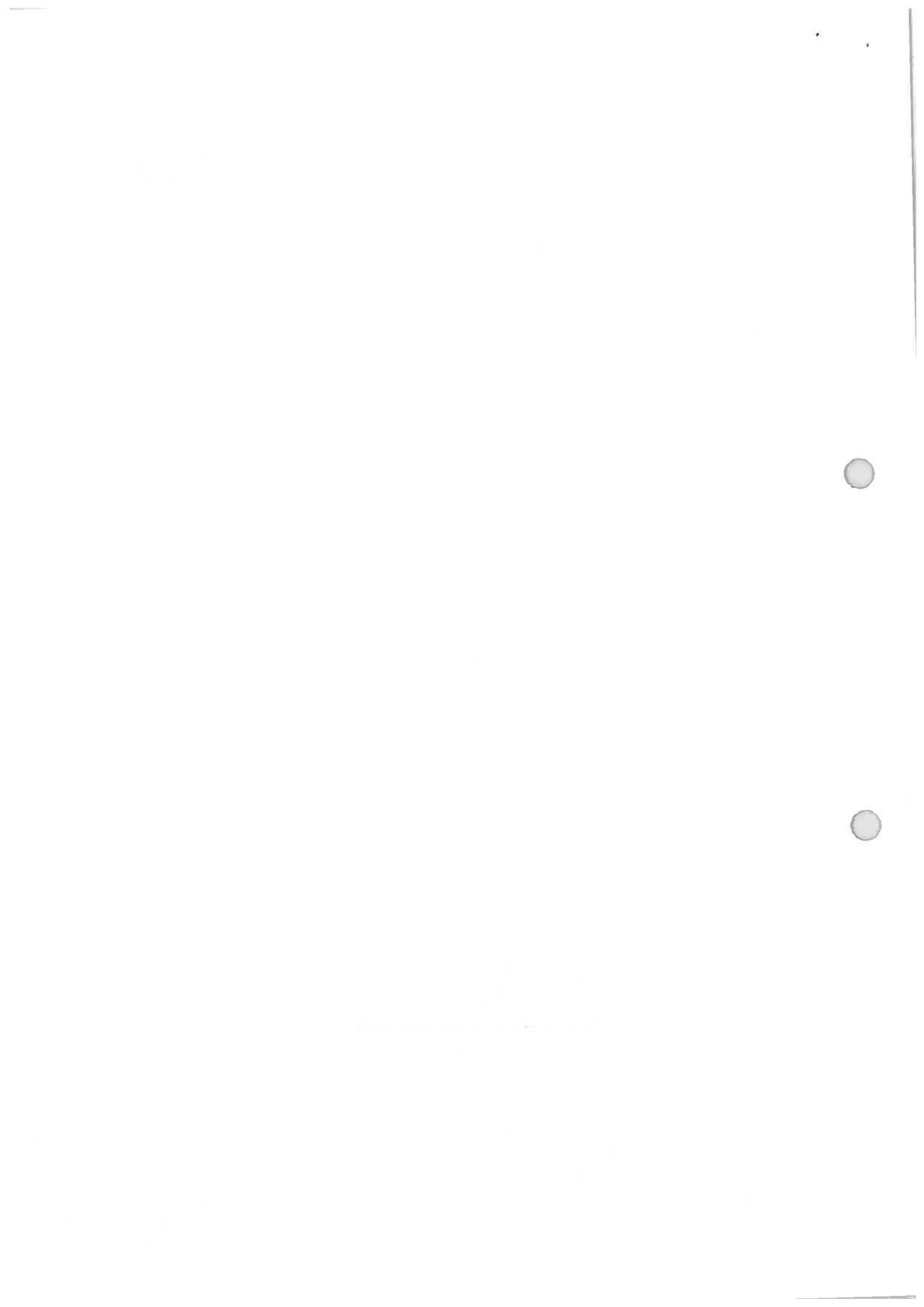
1. CONCRETE: GRADE N25
2. CONCRETE SHALL BE COMPACTED USING MECHANICAL VIBRATION.
3. CONCRETE SHALL BE POURED IN ONE CONTINUOUS POUR.
4. NOT TO BE LOCATED IN FILLED GROUND.
5. CONTRACTOR TO CONFIRM FINISHED GROUND LEVEL.
6. CONTRACTOR TO CONFIRM HD BOLT LOCATIONS ARE CONSISTENT WITH THE FINAL SIGN ARRANGEMENT.


Vistek
engineered solutions

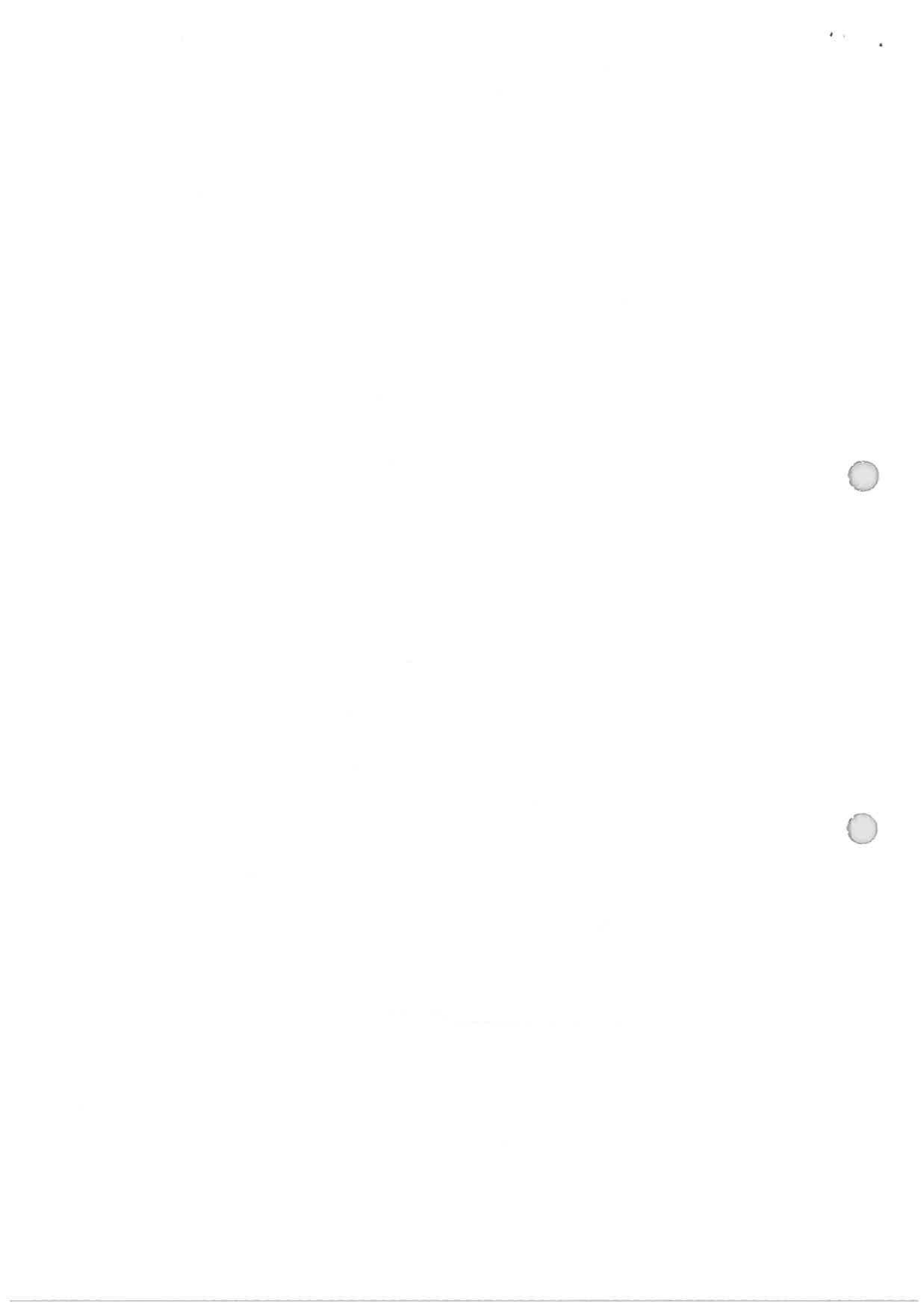
Vistek Pty Ltd (ABN: 80 122 033 828)
SUITE 101, 8 BANK PL, MELBOURNE,
VIC, 3000.
T - (03) 9640 0424
F - (03) 9640 0828
email: info@vistek.com.au

© COPYRIGHT
THIS DOCUMENT IS THE VALUABLE
PROPERTY OF VISTEK PTY.LTD. IT
CONTAINS INFORMATION THAT IS
CONFIDENTIAL AND THE SUBJECT
OF COPYRIGHT, PATENTS OR
OTHER INTELLECTUAL PROPERTY
RIGHTS. COPYING, DISCLOSING OR
USING ANY PART OF THIS
DOCUMENT IS EXPRESSLY
PROHIBITED WITHOUT WRITTEN
APPROVAL FROM VISTEK PTY.LTD.

CLIENT: EVOCOM				
TITLE: MOBIL 6.0M FLAG SIGN - REGION A&B PAD FOOTING				
DRAWN: NP	CHKD.	JOB NO.	DRS NO.	REV
DATE: 11/11/16	DATE:	HEX017A_c	S3	0



 Vistek engineered solutions	Mobil 6.0m Flag Sign Monopole Sign MP[1.9x4.2x6]	HEX017F_c	Rev 0						
	Wind Region A&B Terrain Category 2.5	14-Nov-16	15						
GENERAL NOTES:									
General:	1. All materials, fabrication and installation shall be in accordance with the BCA and relevant SAA codes (current edition including all amendments) 2. Client is responsible for all dimensions, measurements and other site information required to complete the engineering design and details.								
Steel	1. All work and materials shall be in accordance with the following: Hot-rolled steel: AS 4100 - 1998 Cold-formed steel: AS/NZS 4600 - 2005 Stainless steel: AS/NZS 4673 - 2001 2. Sections: UB, UC, PFC & Plate: Grade 300 (AS/NZS 3679.1 - 2010) RHS & SHS: Grade C450 (AS 1163 - 2009) CHS: Grade C350 (AS 1163 - 2009) Cold-formed Duragal: CA = Equal Angle, CC = Channel, CF = Flat Stainless steel Grade 304 or Grade 316 (uno). 3. Ends of all hollow sections shall be sealed with 3 mm plate.								
Aluminium:	1. All work and materials shall be in accordance with AS/NZS 1664 - 1997. 2. Structural sections: Alloy - Temper: 6060 - T5 (uno) 3. Plate: Alloy - Temper: 5005 - H34 (uno)								
Concrete:	1. All work and materials shall be in accordance with AS 3600 - 2009. 2. Concrete shall be Grade N25 (f _c = 25 MPa @ 28 days), (uno) 3. Concrete shall be compacted using mechanical vibration. 4. Minimum cover to hold-down bolts or other fitments shall be 75 mm.(uno) 5. Concrete shall be cured for 7 days before imposing any structural loads.								
Welding	1. Welding of structural steel shall be in accordance with AS/NZS 1554.1 - 2011. 2. Welding of cold - formed steel shall be in accordance with AS/NZS 1554.1 - 2004. 3. Welding of stainless steel shall be in accordance with AS/NZS 1554.6 - 1994. 4. Welding of aluminium shall be in accordance with AS/NZS 1665 - 2004 5. Welds shall be Category - GP, done by a suitably qualified welder.								
Bolts	1. Bolts shall be M16(4.6/S) galvanised (uno). 2. Stainless steel bolts shall be Grade 304 or Grade 50 (ISO)								
Screws	1. Self-Tapping (self-drilling) metal screws shall be in accordance with AS 3566 Parts 1 & 2. 2. Screw size designation shall be as follows: <table style="margin-left: 40px; width: 100%;"> <tr> <td>ST4.8 (No.10)</td> <td style="text-align: right;">Dia. = 4.8mm</td> </tr> <tr> <td>ST5.5 (No.12)</td> <td style="text-align: right;">Dia. = 5.5mm</td> </tr> <tr> <td>ST6.3 (No.14)</td> <td style="text-align: right;">Dia. = 6.3mm</td> </tr> </table> Corrosion Resistance: Class - 2 General internal use. Class - 3 General external use. Class - 4 External use in severe marine environment.			ST4.8 (No.10)	Dia. = 4.8mm	ST5.5 (No.12)	Dia. = 5.5mm	ST6.3 (No.14)	Dia. = 6.3mm
ST4.8 (No.10)	Dia. = 4.8mm								
ST5.5 (No.12)	Dia. = 5.5mm								
ST6.3 (No.14)	Dia. = 6.3mm								
VHB - Tapes	1. VHB - Tapes (Very High Bond - Tapes) shall be either 3M or Biolink. 2. VHB - Tapes shall be used to resist dynamic wind loads only. 3. Surfaces to be joined shall be prepared in accordance with manufacture's specifications and requirements. 4. VHB - Tapes shall be applied in accordance with manufacture's specifications and requirements.								
Sealant	1. All joints that are not welded and abutting surfaces should be sealed with a structural sealant.								





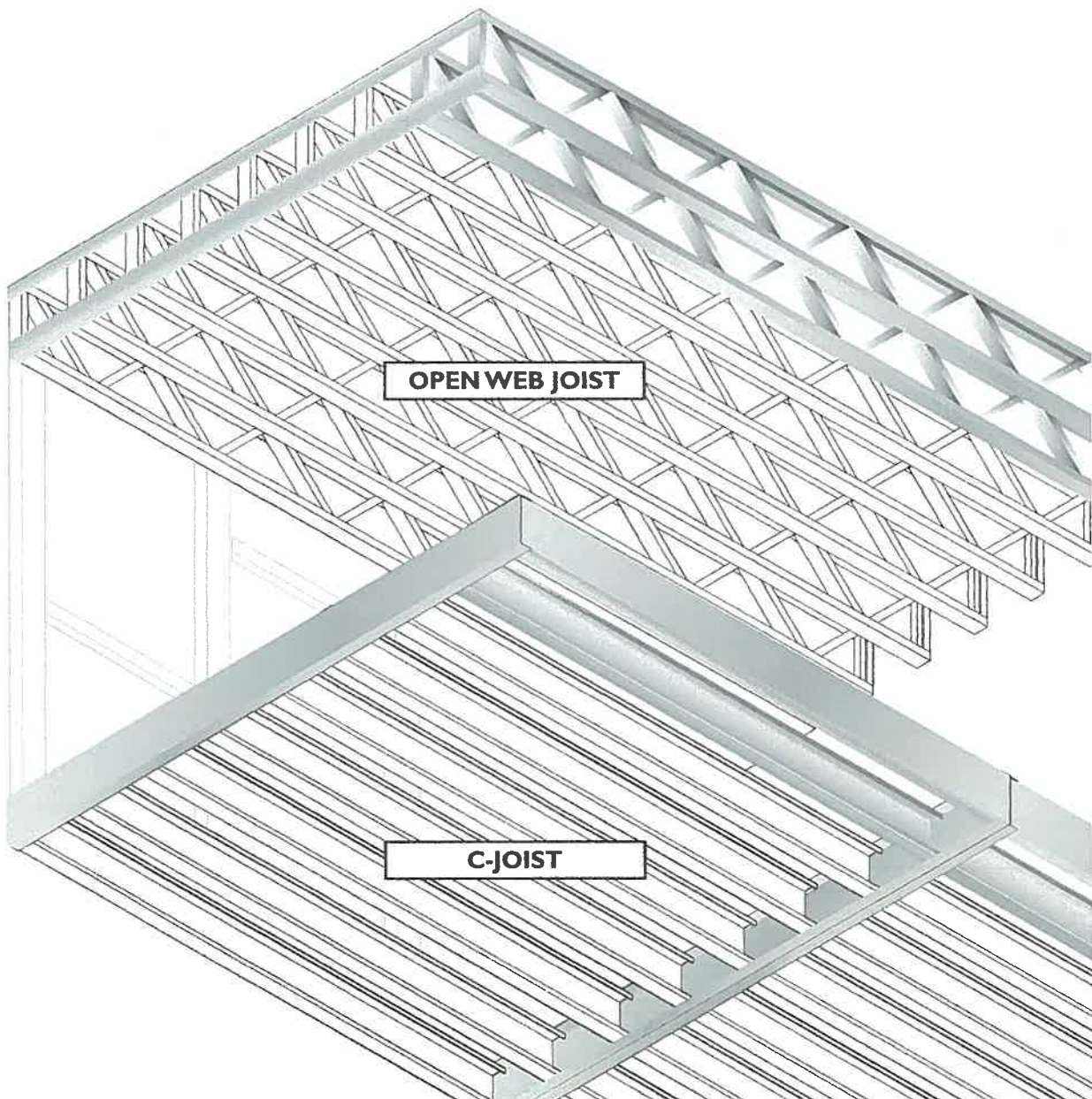
STRAMIT[®]
RESIDENTIAL FLOOR
FRAMING SYSTEM

p r o d u c t t e c h n i c a l m a n u a l



STRAMIT® RESIDENTIAL FLOOR FRAMING SYSTEM

A complete floor design solution for both ground and two storey residential construction.



IMPORTANT NOTE

The information contained within this brochure is as far as possible accurate at the date of publication, however, before application in a particular situation, Stramit Building Products (Stramit) recommends that you obtain qualified expert advice confirming the suitability of product(s) and information in question for the application proposed. While Stramit accepts its legal obligations, be aware however that to the extent permitted by law, Stramit disclaims all liability (including liability for negligence) for all loss and damage resulting from the use of the information provided in this brochure.

INTRODUCTION

The **Stramit**[®] Residential Floor Framing system is designed to address the needs of domestic house construction.

The **Stramit**[®] Residential Floor Framing system consists of two floor-framing products, C-Joist and Open Web, that can be used separately or in combination in residential construction.

A wide range of section sizes provides freedom in

designing floor joists, bearers and locations. The **Stramit**[®] Residential Floor Framing System can easily be adapted to a variety of house designs.

In addition, the **Stramit**[®] Residential Floor Framing system has extended bearer options to provide larger span design possibilities.

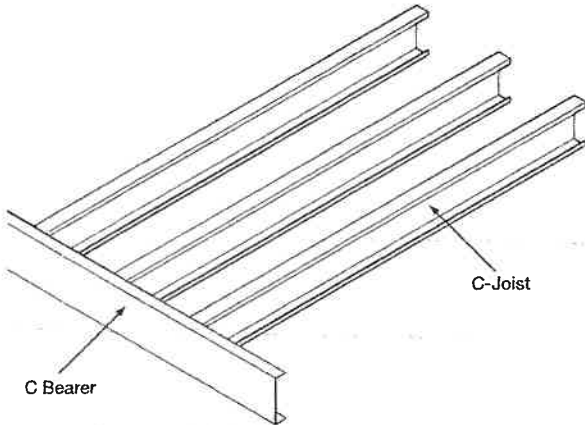
CONTENTS		PAGE	LIST OF TABLE/CHARTS		PAGE
Product			Product Data		
Features		4	Dimensions and mass		
Benefits		5	C-Joist & Bearer	table 1	20
Specifications		5	Open Web Joist	table 2	20
Design Selection			Open Web-Service provisions	table 3	20
Design Options		6	Extended Bearer	table 4	21
Load Areas		6	Durability criteria	table 5	21
Design Load Criteria		6	Design Selection Data - span & load		
Design Limitations		7	Roof load		
Structural Support Systems			C-Joist		
C-Joist - FCB3 Bracket		7	Single or Upper Level of Two Storey	table 6	22
C-Joist and Open Web - Lateral End Restraints		7	Lower Level of Two Storey	table 7	23
C-Joist and Open Web - Tie Downs		8	Non-roof load		
Installation			C-Joist - any floor level	table 8a	24
C-Joist		9		table 8b	25
Assembly		9	Open Web - any floor level	table 9	26
Fixing Techniques		9	Balcony-Verandah non roof load		
Concentrated Loads		9	C-Joist - all levels	table 10	27
Hole Cutting		10	Open Web - all levels	table 11	28
Fasteners		10	Structural Support Systems Data		
Cantilevers		10	FCB3 Brackets -		
Floor Connection		10	Load & Capacities	table 12	28
Open Web				table 13	29
Assembly		11	Lateral End Restraint	table 14-16	29
Fixing Techniques		11	Roof Batten Bracing Lengths	table 17	30
Fastening at midspan		12	Tie Downs -		
Floor Connection		12	Cyclonic Conditions	table 18	30
Extended Bearer					
Brackets and fixing - C-Joists		13			
Brackets and fixing - Open Web Joists		14			
Balcony/Verandah					
Assembly		15			
Load Considerations		15			
Slope		15			
Floor Surface Options		15			
Weather Proofing		16			
Post/Piers and Bracing Systems					
Selections		16			
Connection		17			
Bracing		17			
Procurement Details					
		18			
Additional Information					
		31			

PRODUCT Features

The **Stramit**® Residential Floor Framing System offers a choice-of-solutions to best fit your design needs.

C-Joist

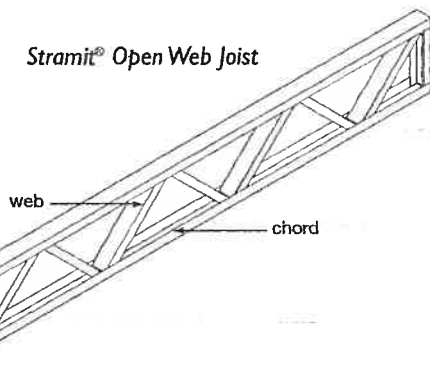
Stramit® C-Joist and Bearer



- offers spans at 450mm centres (3.2 – 6.2metres)
- extended bearer spans available up to 8 metres

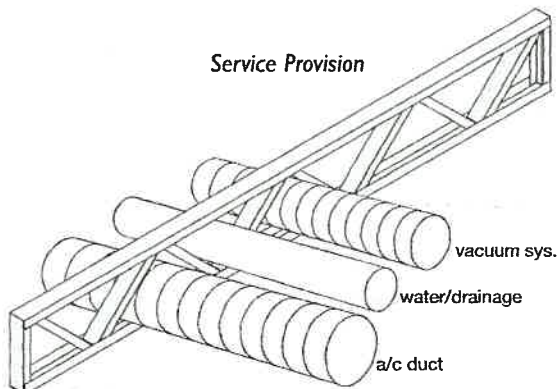
Open Web Joist

Stramit® Open Web Joist

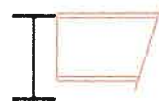


- offers spans at 450mm centres (3.2 – 7.1metres)
- with depths at 250/300/350/400 and 450mm
- extended bearer spans available up to 8 metres
- enables swift and easy service provision
- structure retains strengths at beam

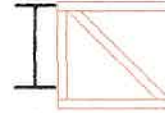
Service Provision



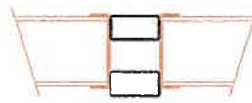
Extended Bearer Options



Stramit® C-Joist with U-beam Extended Bearer
Roof Load Area



Stramit® Open Web Joist with U-beam Extended Bearer
Roof Load Area



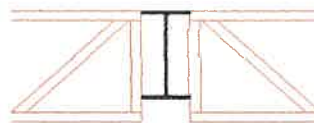
Stramit® C-Joist with paired RHS Extended Bearers - In Plane
Non-Roof Load Area



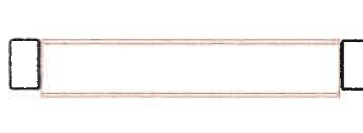
Stramit® C-Joist with single RHS Extended Bearers
Non-Roof Load Area



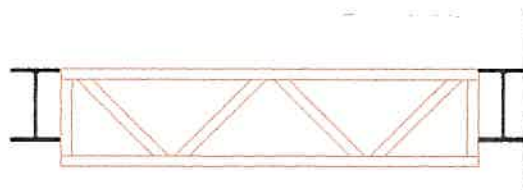
Stramit® C-Joist with U-beam Extended Bearer
Non-Roof Load Area



Stramit® Open Web Joist with U-beam Extended Bearer
Non-Roof Load Area



Stramit® C-Joist with single RHS Extended Bearer
Balcony Load Area



Stramit® Open Web Joist with U-beam Extended Bearer
Balcony Load Area

Benefits

Material

- Termite resistant
- Non combustible components
- Eliminates concerns about material quality and availability
- Lightweight and easy to install
- Ideal for flat or sloping sites

Construction Process

- Fast track construction with engineered components
- Pre-cut and prefabricated components enable speedy construction, even on sloping sites
- Total design flexibility with combination of C-Joist & Open Web Joists
- Open Web Joists ideal for continuous end supported second storey applications
- Suitable for use on standard industry pier systems

Construction Outcome

- Dimensional stability
- Achieve 'true lines' without warping
- Economical in materials and construction
- Delivers a finish without shrinkage cracks
- Swift and easy service provision through Open Web Joists
- Complements the **Stramit**[®] wall frame and roof truss systems
- Will not warp or twist and remains stable for the life of the building
- Unlike timber beams, Open Web Joists allow service provision while retaining strength of beam

Specification

Dimensions and Mass

C-Joist and Bearer	- refer to table 1
Open Web Joist	- refer to table 2
Open Web Service provision allowances	- refer to table 3
Extended Bearer	- refer to table 4

Materials

Stramit[®] C-Joist and Bearers are cold rolled formed sections manufactured from high strength steel in material thickness ranging from 1.0mm (G550 grade, 550 MPa minimum yield stress material) to 2.4mm (G450 grade, 450MPa minimum yield stress material), with Z350 zinc coating (350grams per square metre minimum coating mass) in accordance with Australian Standard AS1397.

Stramit[®] Open Web Joists are cold rolled formed sections manufactured from high strength steel in material thickness ranging from 0.6mm, 0.8mm, 1.0mm (G550 grade, 550 MPa min. yield stress material) 1.2mm (G500 grade, 500 MPa min. yield stress material) and 1.5mm (G450 grade, 450 MPa minimum yield stress material), with a zinc-aluminium alloy coating of AZ150 (150gms per sqm) as in AS1397. The sections are generally fastened with self-drilling (SD) screws.

Other **Stramit**[®] accessories, such as FCB3 brackets, extended bearer brackets, OWJ connection brackets and lateral end restraints, are made from 300 MPa steel with a minimum galvanised coating of 250 grams per square metre.

Tolerances

Stramit[®] C-Joists and Bearers are supplied with a tolerance of +0/-10mm.

Stramit[®] Open Web Joists are supplied with an overall tolerance of +0/-5mm.

Durability

Ground clearance requirements – **Stramit**[®] steel flooring is not intended for use in applications where the clearance above the ground is less than 450mm. A reduction of ground clearance in some areas may be possible subject to advice from your local Stramit Technical Services department.

Application requirements regarding location, product, finish, ventilation – refer to table 5 – Durability Criteria.

Performance

The **Stramit**[®] Residential Floor Framing System has been designed to AS3623-1993. This standard includes limits to vibration, strength and deflection. Use of these code provisions reduces the uncomfortable bounce and vibration that may be present in other systems.

The product range can be used for both single and upper storey construction. Internal bearers or joists do not support any load bearing walls. Deflections under service loads are limited to span/250 and the dominant natural frequency is limited to 8 Hertz.

DESIGN SELECTION

Design Options

Consideration of house plans is required when deciding on the floor system.

Stramit's two alternative floor joist systems provide:

- span solutions for different house designs and sites
- selection of the most suitable structural floor framework for construction requirements whether ground floor, upper level or combination, including the need for service provisions

The **Stramit**® C-Joist and Open Web systems both have the extended bearer option. Extended bearers provide design flexibility and allow for large spans to be achieved in areas such as garages, rumpus, living rooms and balconies.

Select the floor joist system that best meets your design needs.

Design Load Criteria

The Limit State Method has been used throughout this brochure. Minimum design load and load combinations are generally as per AS3623.

Load allowances

Floor live load:
1.5 kPa
3.0 kPa - for **balcony** areas.

Concentrated load

1.8kN

Dead load

Self-weight plus **partition loads**, plus weight of flooring, roof, and walls if applicable.

Static and Dynamic serviceability requirements

- Deflection, $\Delta_1 \leq L/250$
load combination: dead load + 40% live load.
- Lowest natural frequency, $\Omega \geq 8\text{Hz}$
load combination: dead load + 0.3kPa
- Deflection, $\Delta_2 \leq 2\text{mm}$
load combination: dead load.

Assumptions

Tile roof mass: 92kg/m².
Metal roof mass: 40.7kg/m².
Ceiling mass: 10.5kg/m².
Wall mass: 29.5kg/m².

balcony: an external area, one or more metres above ground.

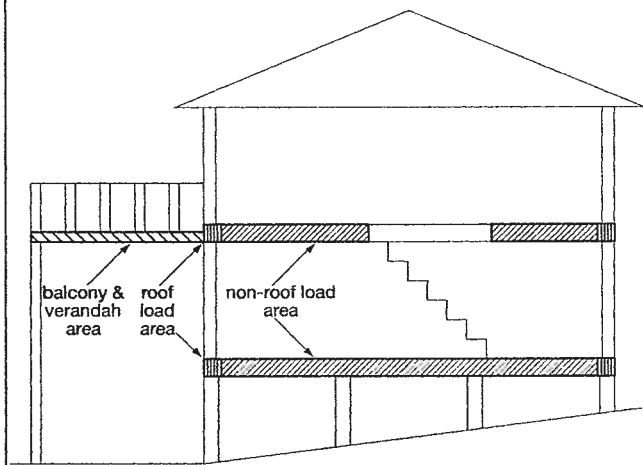
partition loads: weight of non-load bearing walls, floor underlays and floor coverings, ceilings, services through floors, are assumed to be a maximum of 0.5kPa.

Applied Standards

AS 3623-1993 Domestic metal framing.
AS/NZS 4600 Cold-formed steel structures.
AS 2670.2-1990 Evaluation of human exposure to whole-body vibration.

The design tables meet both single and continuous load span criteria

Load Areas



Roof Load Areas

These are defined as areas that support combined roof, wall and floor loads within the domestic building structure. They work as the combined load system of roof and floor areas.

Non Roof Load Areas

These are defined as any floor areas within the internal confines of a domestic building structure that supports 1.5 kPa live load, 0.5 kPa partition loading and are not supporting load bearing walls or large concentrated loads (greater than 1.8kN). Internal areas can include bearers or joists at the sides of openings (eg. stairwell)

Balcony & Verandah Areas

These are defined as floor areas that are external to the habitable building structure, and are located one or more metres above the ground.

ROOF LOAD	NON ROOF LOAD
Stramit® C-Joist & Bearer	Stramit® C-Joist & Bearer
Single or Upper Level of Two Storey table 6	Any Floor Level table 8
Lower Level of Two Storey table 7	
Stramit® Open Web Joist	Stramit® Open Web Joist
*Requires continuous support	Any Floor Level table 9

BALCONY AND VERANDAH NON ROOF LOAD
Stramit® C-Joist & Bearer
All Levels table 10
Stramit® Open Web Joist
All Levels table 11

* **Stramit**® Open Web Joist is a joist only system, it can only be used in Roof Load applications provided there is continuous support.

Design Limitations

The **Stramit**® C-Joist and Bearer and Open Web Joist System is suitable for suspended floor framing in single occupancy buildings which come within the scope of a Class 1a dwelling as defined by BCA. The building should conform to all design limitations as set out in Clause 6 of AS 4055.

Floor live load exceeding 1.5kPa (3.0kPa for balconies) requires engineering calculations

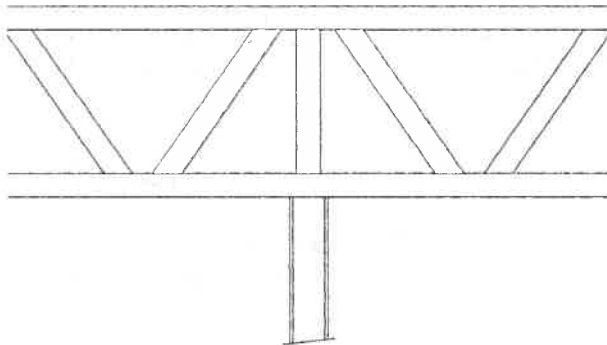
Floor concentrated load of more than 1.8kN requires engineering calculations.

May not be suitable for heavy items such as water beds, large plants or aquariums, heavy gym equipment or pianos etc. Seek engineering advice for such applications.

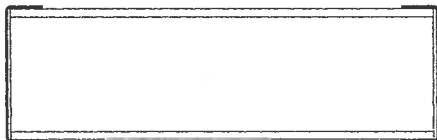
Not suitable for applications closer than 300m to the coast.

Connections between extended bearers and the structural elements of the building are the responsibility of the building designer.

Stramit® Open Web Joists when used as a continuous span require 'W' pattern bracing after each vertical web member as shown. Also when continuous spans are used a vertical member is required over each frame as shown.



Stramit® C-Joists must always be used between bearers. They are not designed for use in a joist-on-bearer configuration and must not be used in this way.



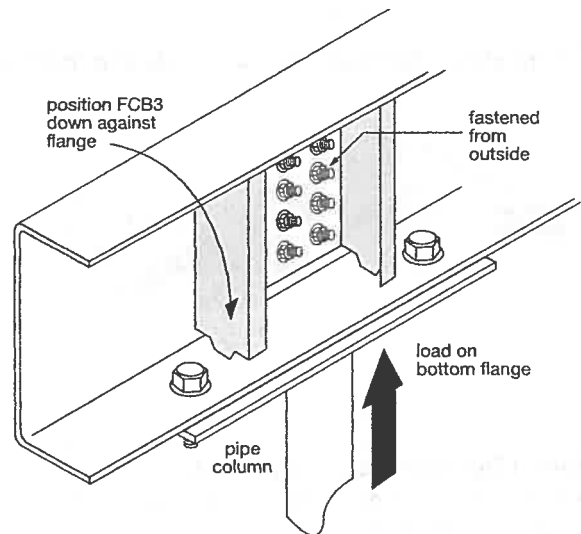
STRUCTURAL SUPPORT SYSTEMS

These are essential structural support details and must be adopted as stated.

C-Joist - FCB3 Bracket

Whenever **Stramit**® C bearers pass over a supporting wall or post, concentrated loads occur. The FCB3 bracket is used to transmit these forces into the web of the section.

Refer to table 12 and 13 for relevant FCB3 selection tables and examples in table section.



If a C-Joist coincides with the post position attach the FCB3 bracket on the closest side of the C-Joist.

C-Joist & Open Web Joists - Lateral End Restraints

Roof, wall and floor framework needs to be able to resist horizontal forces and to provide a system to transfer those forces to the foundation.

The floor system is capable of transferring loads to the structural system below, be it a wall or footing.

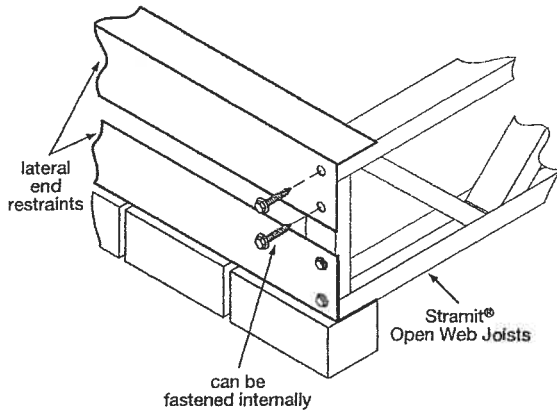
The **Stramit**® C-Joist and Bearer System has an integrated lateral restraint system. Refer to table 14 for lateral end restraint capacities.

When **Stramit**® Open Web Joists have been selected, Lateral End Restraints are required to act as a structural support to safely transfer vertical and horizontal loads to the flooring, maintaining the integrity of the building.

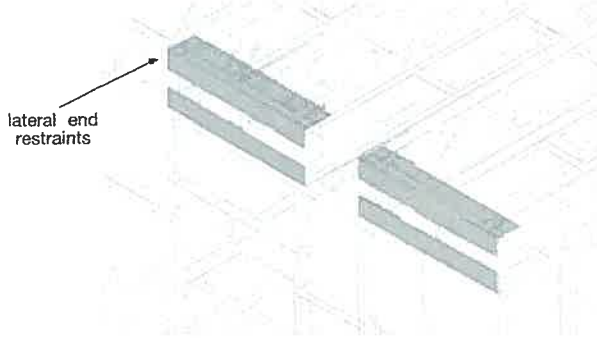
Refer to tables 15 and 16 for Open Web Joist Lateral End Restraint capacities.

Where **Stramit**® Open Web Joists are attached to extended bearers, as shown on page 14, Lateral End Restraints are not required.

Typical Application of Lateral End Restraints



Lateral End Restraint - Typical Installation Method



Lateral End Restraints are required at-

- the ends of each outer set (three or more) of joists in each floor section.
- each intermediate joist in sets of three or more.
- under every opening within the wall frame above.

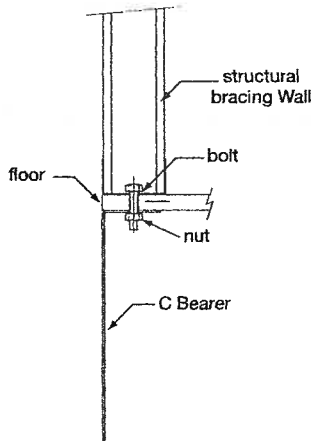
For details of racking and restraint capacity for C-joists and Open Web systems and selection of suitable Lateral End Restraint components, refer to tables 14, 15, 16 & 17.

C-Joist & Open Web Joists - Tie Downs

Structural Tie Down requirements for all domestic buildings should conform to the following connection types with the applicable fastener capacities listed.

C-Joists and Bearer

Standard Tie Down

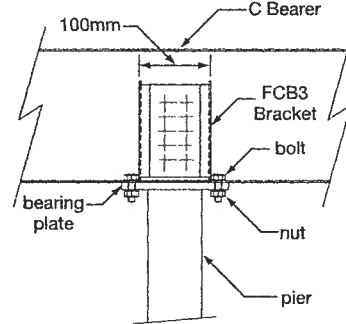


Stramit® bearers	bolts	washers	capacity: kN
1.9mm	M8, M10	standard	2.2
	M8, M10	structural	9.7
	M12	standard	4.9
	M12	structural	10.3
2.4mm	M8, M10	standard	2.8
	M8	structural	11.1
	M10	structural	12.3
	M12	standard	6.2
	M12	structural	13.0

Note: washers: standard: round commercial washers
structural: 50x80x5mm plate

• Refer to table 18 for tie downs applicable for cyclonic conditions.

Tie Down at FCB3 Connection

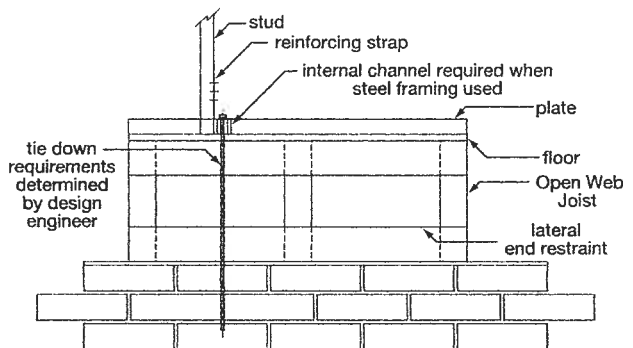


Fastener Selection

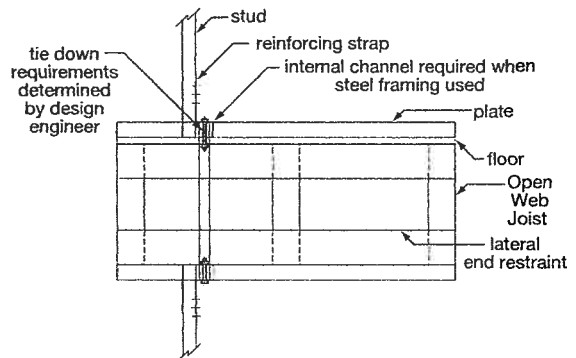
Bolt	Min. Recommended Bearing Plate Thickness	Washer	Min. Number of Screws
M8 & M10	8	Standard	6-8
M12 & M16	10	50 x 50 x 5	10
M20	12	65 x 65 x 8	12

Open Web

Typical Tie Down at lower floor



Typical Tie Down at Upper floor



INSTALLATION

STRAMIT® C-Joist System

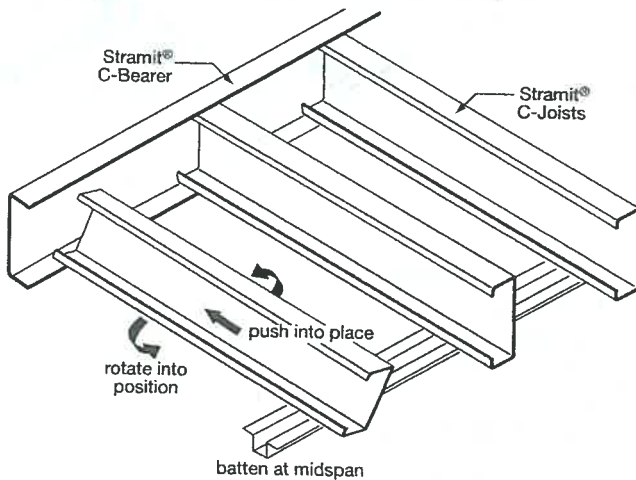
Assembly

The system uses simple installation procedures and basic tools. **Stramit®** C-Bearers are simply positioned and fixed into place, either through the section web or flange. Joists are pushed into, then rotated into place between bearers and fixed using the techniques given below.

Generally, the floor is divided into rectangular segments each containing two bearers and a series of intermediate joists. Where bearers are back to back, they are simply screwed together using two SD10Gx16mm hex head screws between each joist. If required, floor levels at different heights can be arranged by using different sized joist/bearer systems or by offsetting the height of the different floors.

Screw fix a **Stramit®** ceiling batten midspan, using two SD10Gx16mm hexagon head screws per joist to the underside of the joist prior to installing the particle board flooring. This batten helps to prevent joist roll caused by installers working above, particularly when used in longer span installations. Once the floor lining is complete, the batten may be replaced by ceiling linings if required. Ceiling linings or midspan battens will enhance the floor performance.

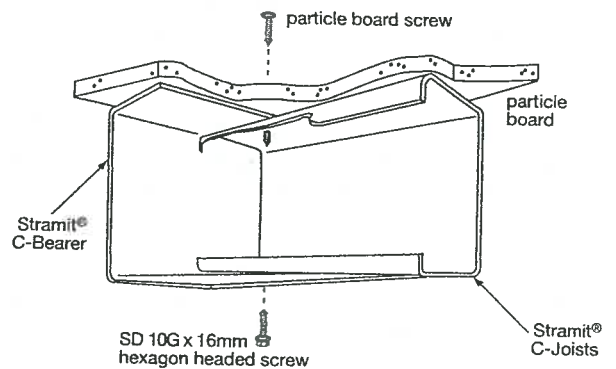
For upper level floors, Stramit recommends that ceiling battens be fixed to the underside of the **Stramit®** C-Joists. As well as simplifying height adjustment to keep ceiling sight lines even, the battens provide a path for wiring or other services to be easily installed.



Fixing Techniques

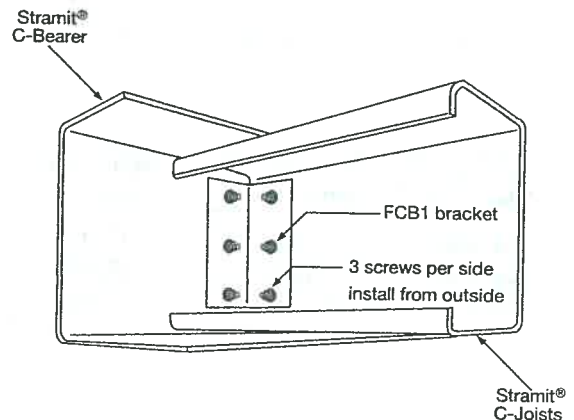
Stramit® C-Bearers are attached to the supporting structure as directed by the building designer, or using conventional methods such as bolts or metal strapping. The supporting structure may be a lower storey frame, brick piers or wall, steel or concrete posts etc, sourced from other suppliers. **Stramit®** C-Bearers may be fixed through the bottom flange or the web of the section. Standard purlin hole punching is available to reduce on-site work.

Connection Type 1



Stramit® C-Joist to **Stramit®** C-Bearer connections are usually made with easy to use self drilling screws, placed through top and bottom flanges. This connection does not require any additional brackets or bolts. The floor sheeting screw also holds the bearer and joist in position, and may replace the standard fastener. The minimum standard fastening screw size is a SD10Gx16mm. The top flange may be temporarily held in positions prior to the floor sheet installation by wafer head screw or a 4.5mm pop rivet as required.

Connection Type 2



When the bottom flange is not accessible to enable a fixing screw connection, a simple angle bracket (FCB1) is required to fix the joist to the bearer. The bracket is held by six 10Gx16mm (minimum size) screws which can be screwed from any direction although it is always preferable to fix towards the thicker material being connected. This can be achieved by initially fastening from the inside using the pilot holes, then fasten from the outside by replacing the initial screw. Please note that three screws per side are required and they should be equally spaced on the brackets.

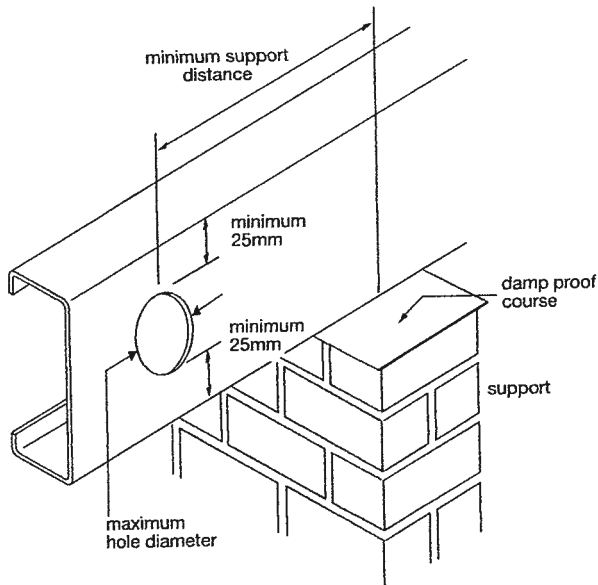
Concentrated Loads

Concentrated loads occur wherever bearers are supported. Where these situations occur the FCB3 bracket is used to transmit these forces into the web of the section. The bracket must touch the bottom flange of the bearer.

Hole Cutting

Holes may be cut into the webs of **Stramit**[®] C-Bearer and joists to allow electrical and plumbing service installations. Circular holes cut with hole saws are preferable. Holes should not be closer than 25mm to either flange nor positioned close to any support or concentrated load. Holes in **Stramit**[®] C-Bearer should be positioned centrally between **Stramit**[®] C-Joist. Minimum hole spacing along the C-Bearer/Joist is equal to 3 times the hole diameter (centre to centre).

Flanges should never be drilled or cut as this leads to loss of performance.



Stramit [®] C-Joist size	Max Hole diameter	Minimum Support distance
182mm	90mm	370mm
235mm	115mm	470mm
283mm	140mm	570mm

Fasteners

All screw fasteners must comply to Australian Standard AS3566, Class 2 - sheet flooring screws (internal use only), or Class 3 - connection screws. Generally any suitable 10G or 12G sized fasteners will connect the flooring components detailed in this brochure, sizes indicate the minimum fasteners required. The exception is where balconies are supported by main floor **Stramit**[®] C-Bearers and 14G screws are required to connect the two frames together.

Fasteners must not be positioned within 15mm of any metal edge. All particle board - or other floor sheeting - fasteners should follow the recommendations of the board manufacturer. **Stramit**[®] recommend to glue and screw all sheet floors.

Cantilevers

Cantilevered **Stramit**[®] C-Bearers are allowed when the cantilever length is limited to 10% of the adjacent span. The cantilevered **Stramit**[®] C-Bearers must be continuous and supported by FCB3 bracket over the last support.

Cantilevered **Stramit**[®] C-Joist may be applicable in some applications. Please contact Stramit for further details.

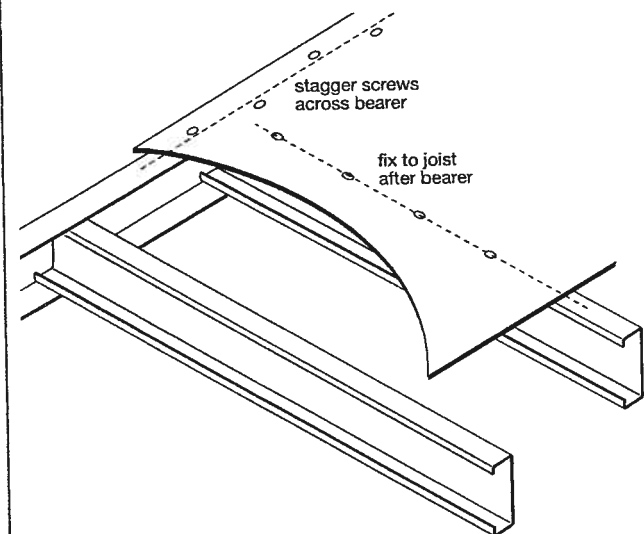
Floor Connection

Particle board or plywood structural sheet flooring in accordance with BCA is used as the floor surface, although other floor materials with similar properties (eg. Min. modulus of elasticity $E=3GPa$) can be used.

Please consult the floorboard manufacturer for details of sheet flooring, fasteners and adhesives that comply with BCA required for metal floor joist support systems.

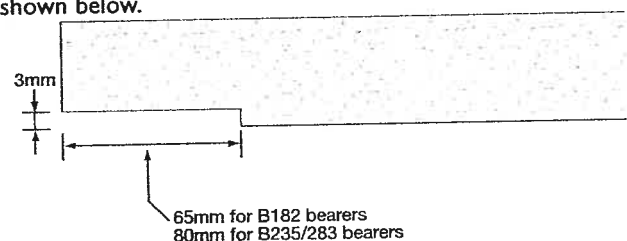
Typical particle board flooring requirements are:

Floor joist centres	Particle board		Fibrous cement	
	Thk.	Mass	Thk.	Mass
450mm	19mm	13.2kg/m ²	15mm	28.5kg/m ²



When using **Stramit**[®] C-Joist and Bearers attach the particle board to the bearers first using suitable adhesive and preferably using a staggered pattern. Fasten with SD10Gx45mm wing tipped screws. This will allow a smooth transition over the thickness step between the C-bearer and C-joist.

Alternatively, the edge of the board may be rebated as shown below.

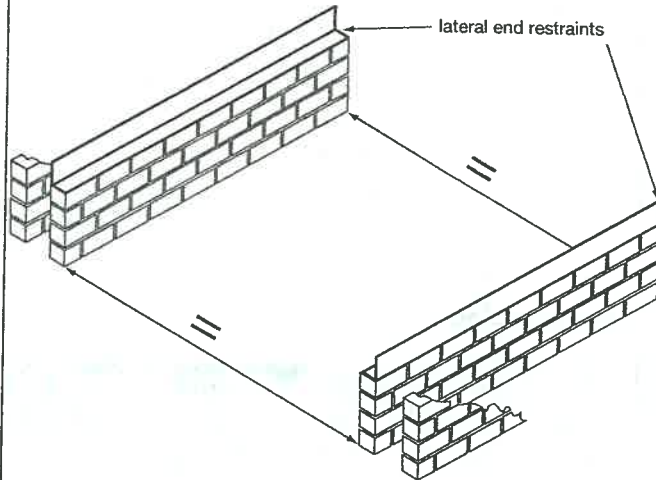


INSTALLATION

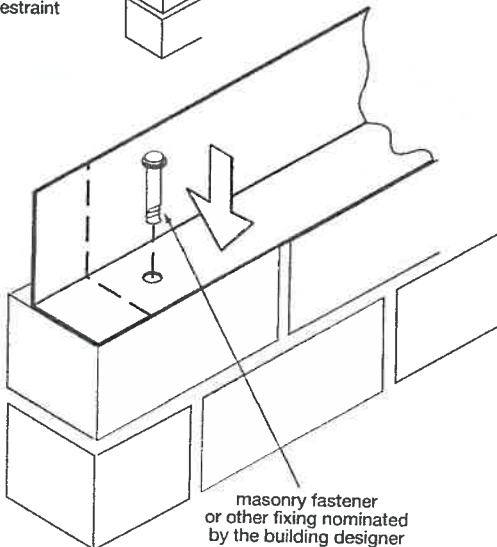
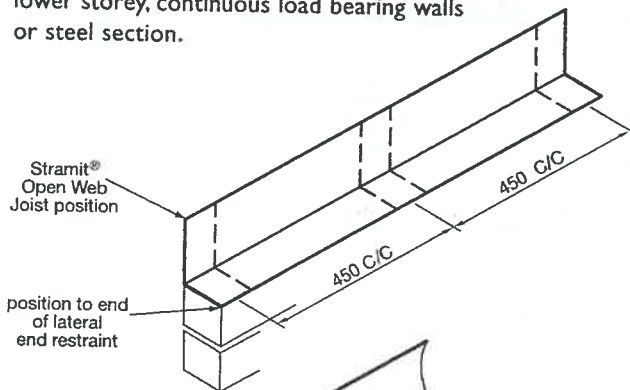
STRAMIT® Open Web Joists

Assembly

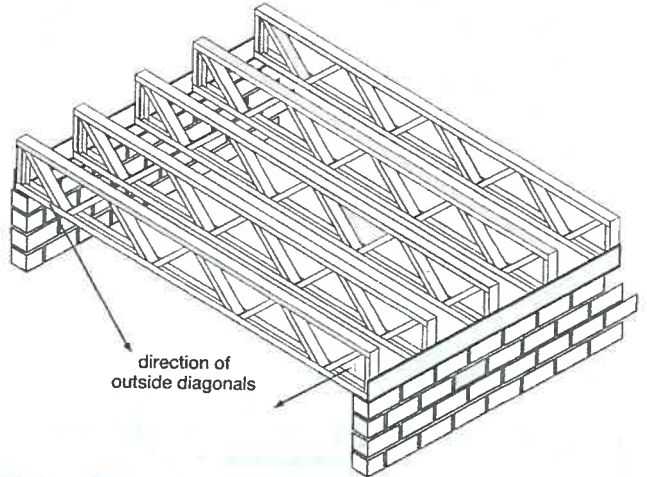
Stramit® range of Open Web Joists are installed using simple procedures and tools. Stramit® lateral end restraints are laid across the continuously supported wall ensuring that they are level and square.



Mark out the position of the Stramit® Open Web Joists centres (450mm) on the inside of the lateral end restraints. Ensure the distances are correct to accommodate the fabricated Stramit® Open Web Joists within the lateral end restraints. Fasten through the lateral end restraints to supporting structure with bolts or metal strapping. The supporting structure may be a lower storey, continuous load bearing walls or steel section.

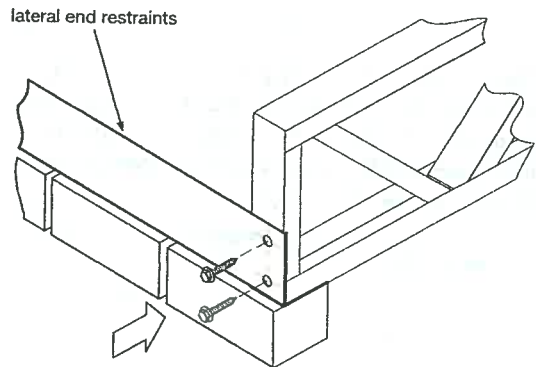


Ensure that the Stramit® Open Web Joists are square and level when positioning in marked areas. Stramit® Open Web Joists should have the outside diagonals positioned in a downward position as shown. Check that all the joists have the same web alignment to enable easy service provision. Also ensure that the vertical web ends are fully contained within the continuous support.

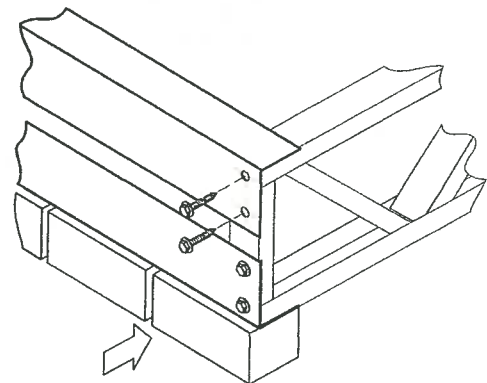


Fixing Techniques

Fasten Stramit® Open Web Joists through lateral end restraints as shown externally (or internally depending on space cavity) with SD 10G x 16mm hexagon headed screws.

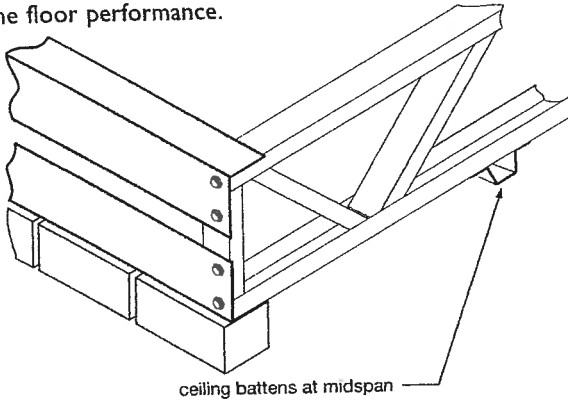


Lay the lateral end restraint on top of the Stramit® Open Web Joists as shown. Fasten as per lower lateral end restraints.



Fastening at midspan

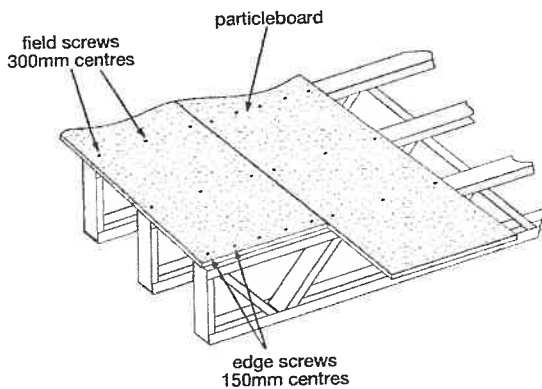
Prior to adhering flooring, screw fix a metal batten midspan, using two SD10Gx16mm hexagon head screws below the joist prior to installing the particle board flooring. Particularly when used in longer span installations, this batten helps to prevent joist roll caused by installers working above. Once the floor lining is complete, the batten may be replaced by ceiling linings if required. Ceiling linings or midspan battens will enhance the floor performance.



When connecting **Stramit**® Open Web Joists to lateral end restraints use self drilling screws, placed through the end of the lateral end restraints. This connection usually does not require any additional brackets or bolts.

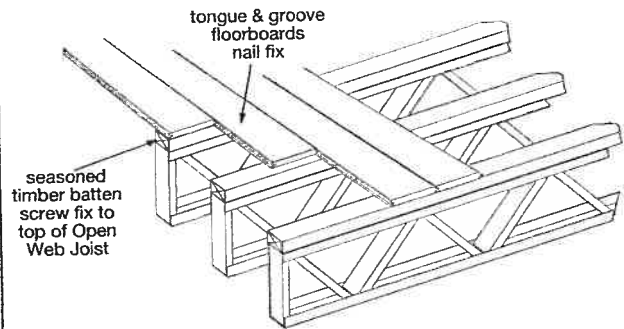
Floor Connection

If **particleboard flooring** is used, the sheeting is run perpendicular to the Open Web truss joists, glued and fixed with No. 10G x 45mm wing tipped screws positioned at 300mm centres in the sheet body and 150mm centres at the edges.

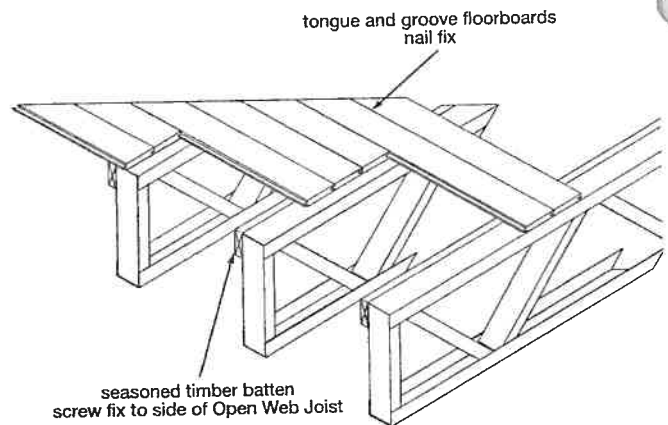


If **tongue and groove flooring** is to be used, affix seasoned (no more than 15% M.C) timber 35mm x 70mm battens to the top or side of Open Web joists as shown with SD 10G x 45mm wing tipped screws positioned at 300mm centres, ensuring that the fastening surface is completely level. Fasten the tongue and groove boards with conventional secret nailing techniques.

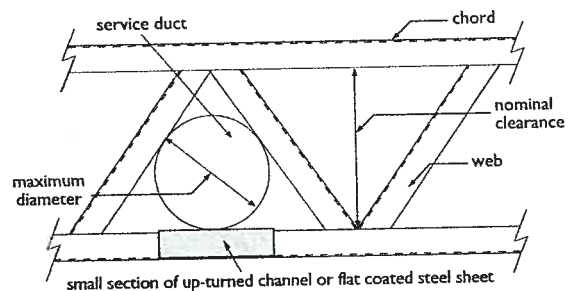
Fixing on top



Fixing on side



Services through joist



It is recommended that service ducts are not placed on upward facing channels. If unavoidable then small sections of up-turned channel or flat coated steel sheet should be placed between service duct and channel.

INSTALLATION

STRAMIT® Extended Bearer

Extended Bearers are used to span large internal openings, they can be designed to support roof load provided the joists are supported at both ends by load bearing walls.

The **Stramit®** C-Joist and Open Web Joist both have the Extended Bearer option. Extended Bearers provide design flexibility and allow for large spans to be achieved in house areas such as the garage, rumpus, living and balconies.

Stramit offers a series of extended bearer configurations, the information provided gives the connection details between the extended bearer and either the C-Joist and Bearer system or the Open Web Joist system. Connections between the extended bearer and the structural elements of the building are the responsibility of the building designer.

Simple installation procedures are used for the extended bearer range. The extended bearers consist of standard hot rolled sections, all applicable sizes are given within the Stramit extended bearer range table 4.

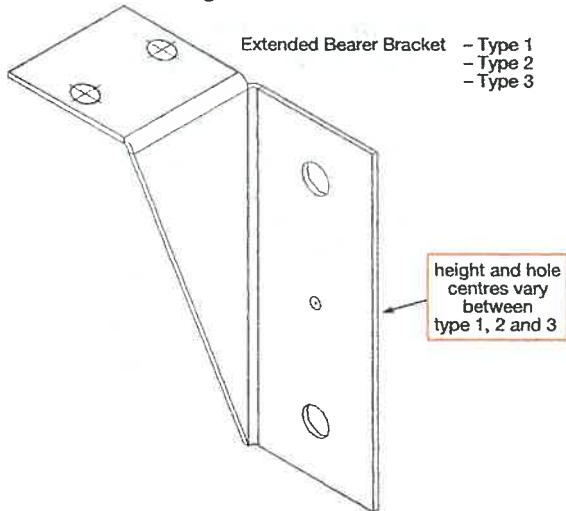
Brackets and Fixing - C-Joist

For **Stramit® C-Joist** Extended Bearer options there are three types of brackets, each differing in height.

Selection of Bracket and Fasteners - C-Joist

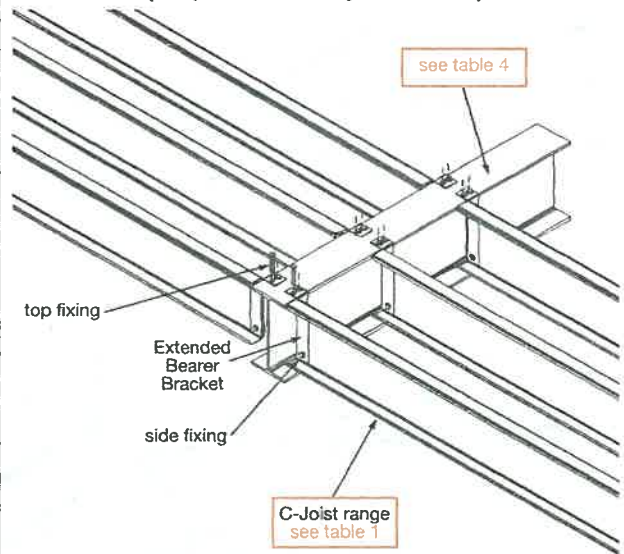
Stramit® C-Joist	Extended Bearer Bracket	Top Fixing 2 (of)	Side Fixing 2 (of)
J182	Type 1	SD12Gx32mm Extended Point Screws	M12x30mm Nut & Bolt GR4.6 plus 1x SD12Gx20 hex head screw
J235	Type 2		
J283	Type 3		

Ensure the Extended Bearer Brackets are fixed to the joist first. This allows the joist to be supported on the bearer for easier fixing.

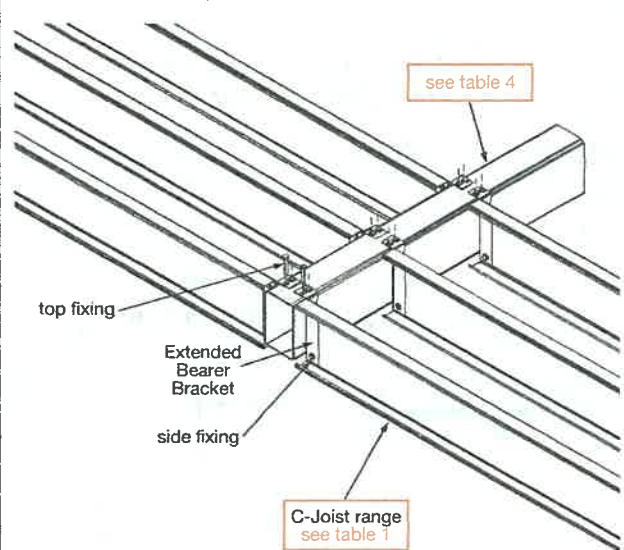


Note that C-Joists used with single RHS Extended Bearers can be connected with Extended Bearer Brackets or with continuous C-Bearers.

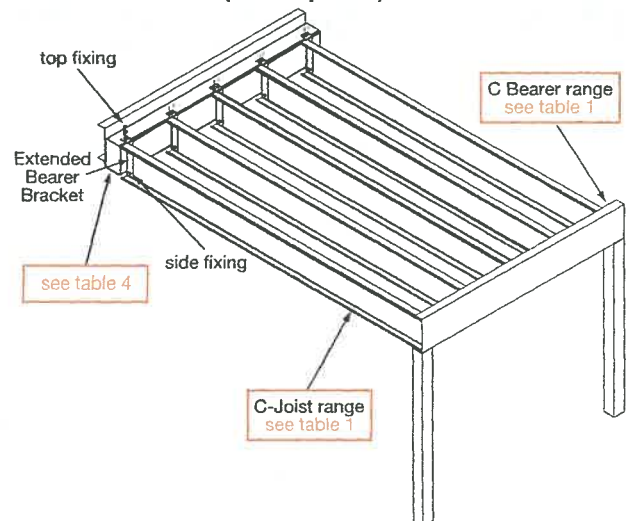
Stramit® C-Joist with U-Beam Extended Bearers (roof and non-roof load areas)



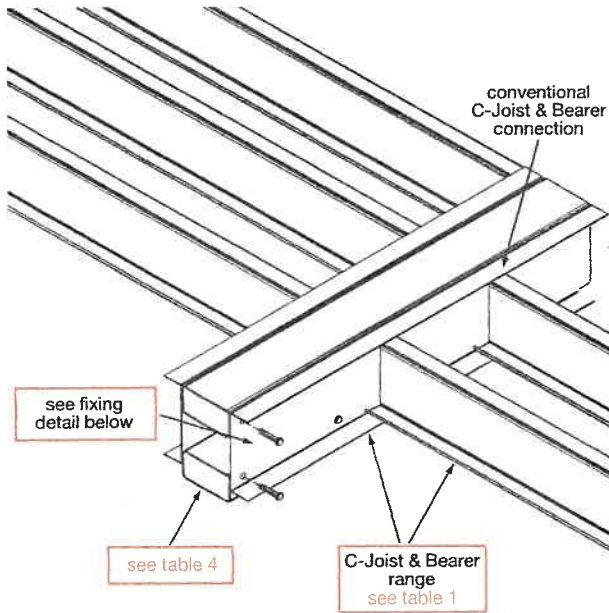
Stramit® C-Joist with single RHS Extended Bearers (non-roof load area)



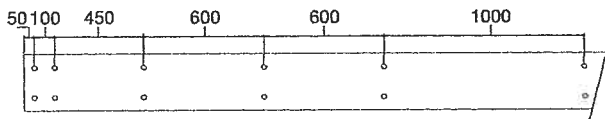
Stramit® C-Joist with single RHS Extended Bearer - (Balcony area)



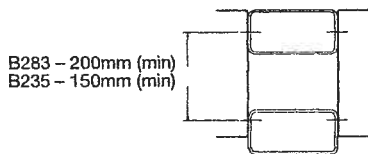
Stramit® C-Joist and Bearer with RHS pair Extended Bearers



Stramit® C-Joist and Bearer with RHS pair Extended Bearer – Fixing Detail

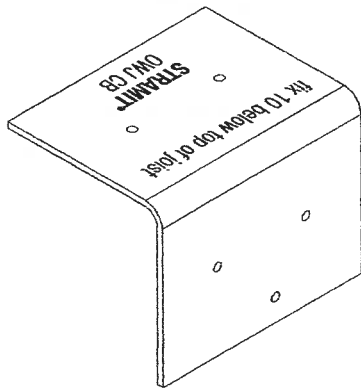


1.9mm & 2.4mm screw pattern
All Self Drilling Screws 12Gx20mm long



Brackets and Fixing – Open Web Joist

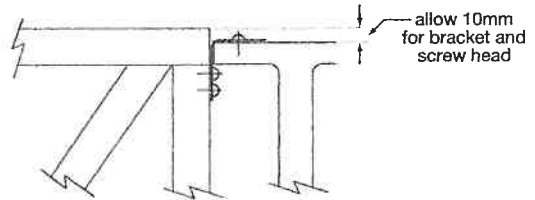
Stramit® Open Web Joist with Extended Bearer options has only one type of bracket for use in all applications. Ensure that Open Web Joists Connection Brackets are fixed to the joist first. This allows the joist to be supported on the bearer for easier fixing.



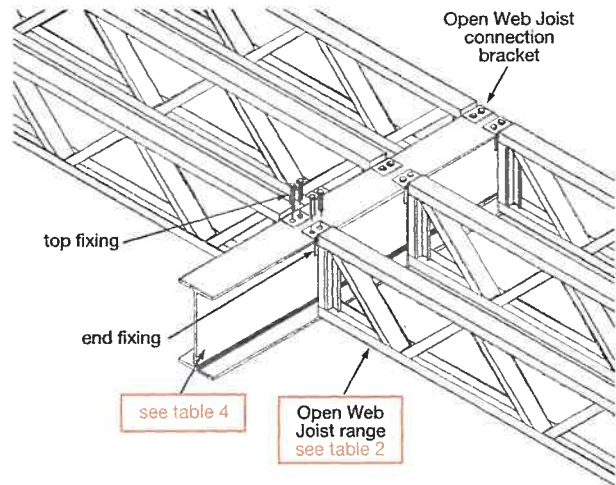
Open Web Joist connection bracket

Selection of Bracket and Fasteners

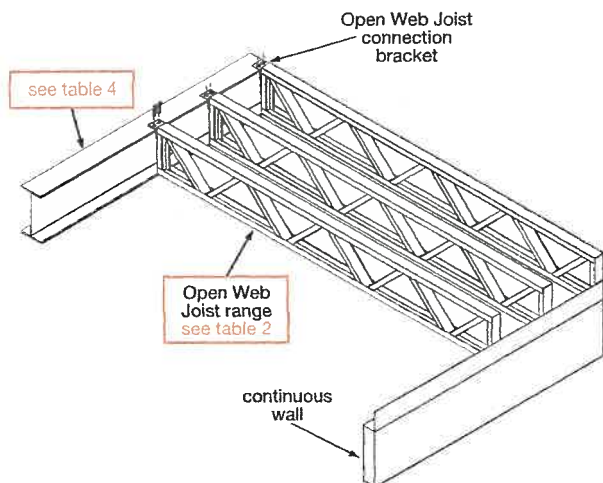
- For all Open Web Joist depths (250 - 450mm), use an open joist connection bracket per joist.
- For top fixing use two SD12G x 32mm Extended Point Screws.
- For end fixing use three SD12G x 20mm Hex HD.



Stramit® Open Web Joist with U-Beam Extended Bearer (roof and non roof)



Stramit® Open Web Joist with U-Beam Extended Bearer (balcony)

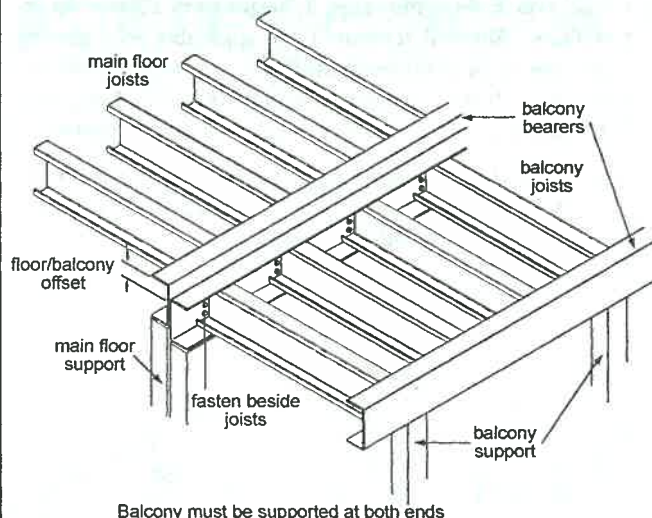


Balconies and Verandahs

Assembly

These are defined as floor areas that are external to the habitable building structure, and are located one or more metres above the ground. Balconies and verandahs usually incorporate a drop in height below the main floor level and must be designed with higher floor loadings. This is easily accomplished by treating the balcony or verandah as a separate floor section.

Balconies must be constructed with joists spanning between two bearers, both supported. In the Open Web Joist option the span must be between two continuously supported walls. Joists must not be cantilevered. Balconies and verandahs must not support any load bearing walls or non-load bearing walls. Roof loads must be supported independently of balconies and verandahs, ie. directly by column support to the ground. Should load bearing walls be present on the balcony or verandah, please contact your local Stramit office for assistance.



Balcony must be supported at both ends

Load Considerations

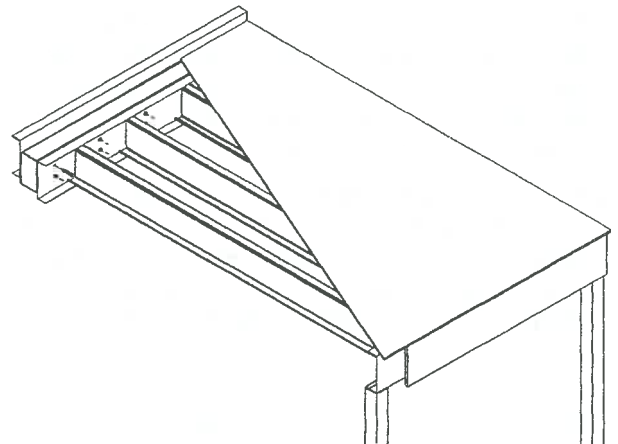
The **Stramit**[®] C-Joist and Bearer and Open Web Joist systems are both designed for use in balcony and verandah applications. All load data has been based on using 15mm fibre cement sheeting as the flooring material; this provides substantial cross bracing whilst maintaining the 3.0kPa live loading requirement.

Slope

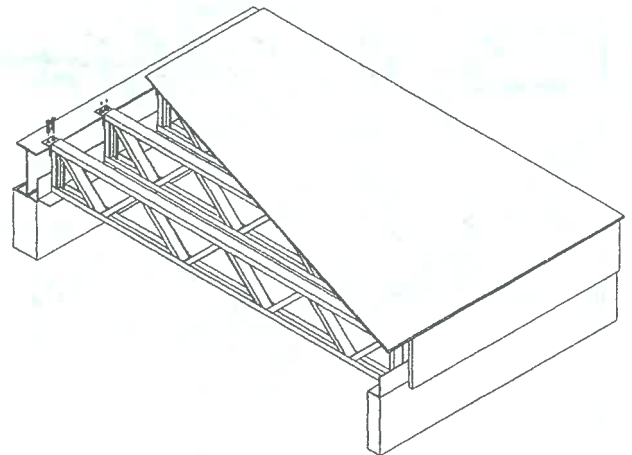
It is recommended that flooring used in balcony and verandah applications be assembled with fall away from the attached structure to enable water to run clear.

Floor Surface Options

Fibre Cement Flooring – Stramit[®] C-Joist and Bearer



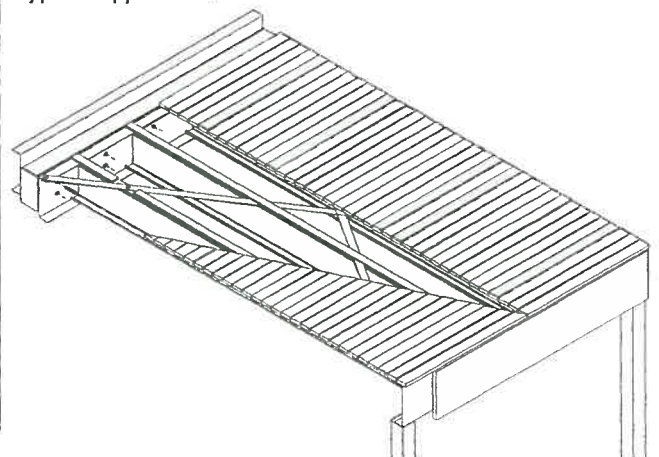
Fibre Cement Flooring – Stramit[®] Open Web Joist



Shot Edge Strip Flooring

An option for using shot edge strip flooring is provided but all load data and cross bracing will be subject to verification by the design engineer. Durability of **Stramit**[®] flooring, when used with shot edge strip flooring, may be reduced through contact with some acidic or treated timbers. All such materials including CCA treated timber should be separated from the **Stramit**[®] C-Joists and Bearers by a neutral packing material such as thick rubber strip placed along the joists.

Only **Stramit**[®] C-Joist and Bearers may be use for this type of application.

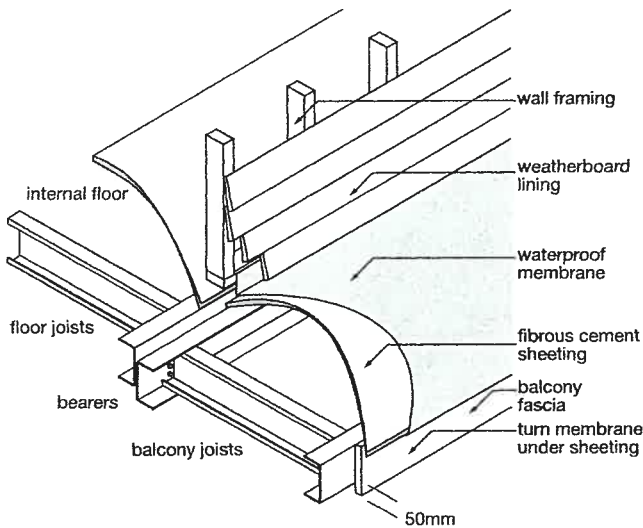


Weather Proofing

Detailed weather proofing alternatives for various locations are given in table 5 on page 21.

For improved durability, external floor areas such as balconies, require that the floor system be protected from rainwater runoff. The floor sheeting must be durable eg. fibrous cement and suitable flashings must be used to protect the structure.

Similar provisions apply to those areas where the floor system is exposed to the elements eg. below a timber weatherboard wall. The use of a waterproof membrane over the exterior floor, with materials meeting the relevant provisions of BCA is recommended.



Post/Piers and Bracing Systems

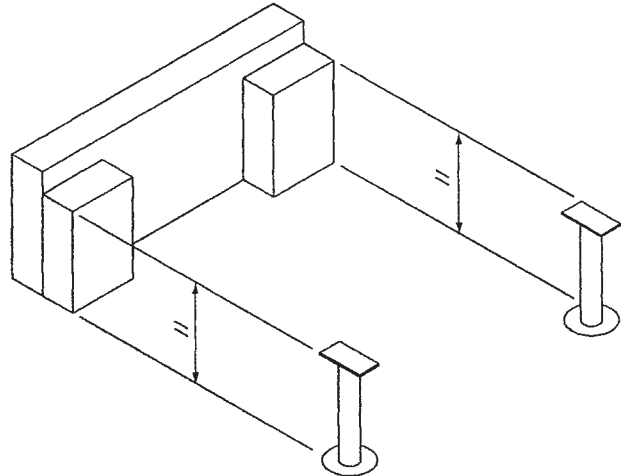
The use of any type of piercing or post construction method provides considerable environmental and cost benefits on a sloping site compared to cut and fill for slab on ground construction.

- Minimum site disturbance
- White ant problems solved without the use of hazardous chemicals
- Suitable for difficult sites
- Reduces excavation and landfill requirements
- Reduced site disturbance – site runoff

Selection

There are many systems available including concrete posts, screw piles and the more conventional metal piers. The major metal pier systems are adjustable in height by typically 200mm at each pier, have different load area ratings and range in height from 200mm up to 4000mm. Site soil conditions and applicable wind loading all have to be considered carefully prior to selection of pier type. It is advisable that a suitably qualified engineer be involved in the selection of sub – flooring systems.

It is crucial before ordering piers that the distance from the top of each footing to the underside of each bearer is correctly measured as shown.

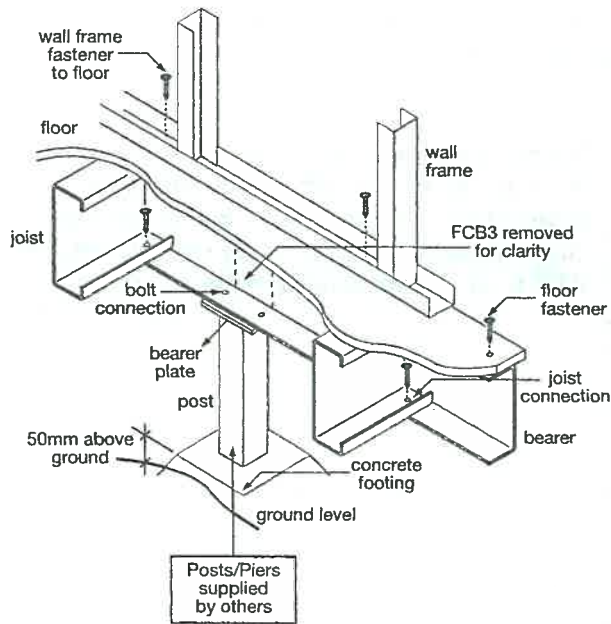


Connection

All connections used to connect the **Stramit®** Residential Floor Framing System to the rest of the structure should be capable of withstanding the required gravity, lateral and wind loads.

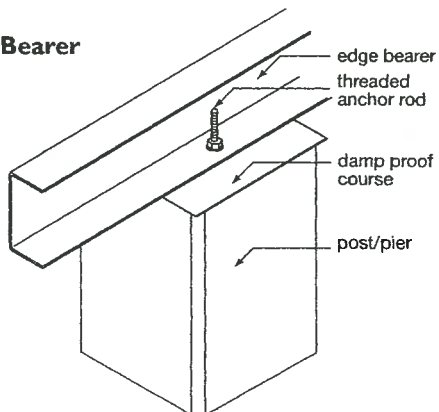
Posts or piers supplied by others should comply with the relevant Standards, and are connected to the floor system using conventional techniques.

Typical System Connection

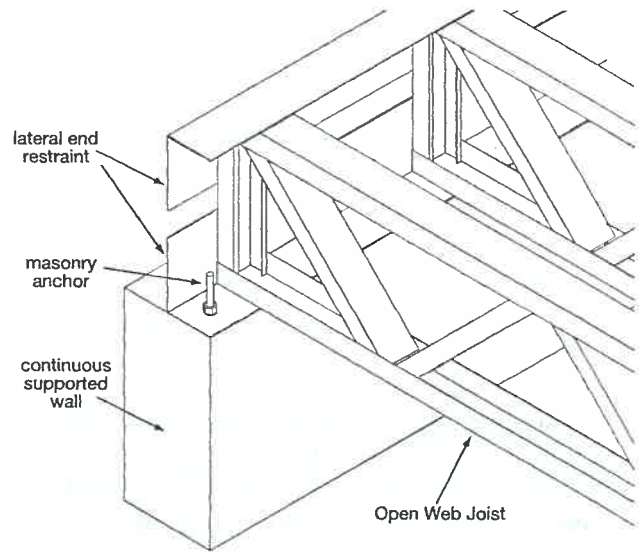


Connections directly into the bottom of the bearer or Open Web Joist offer the quickest and easiest solution.

to C-Bearer



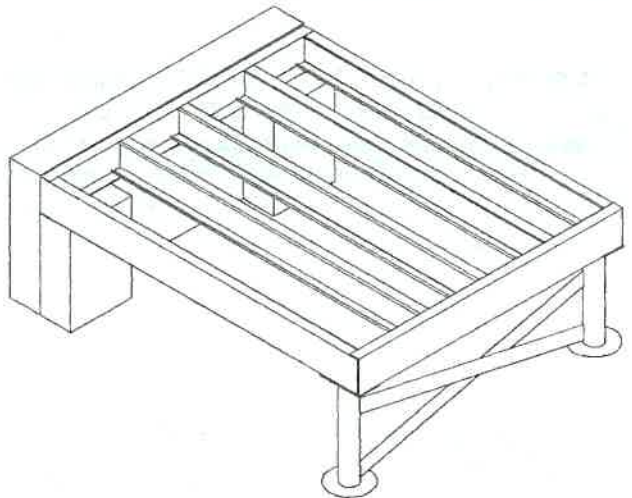
to Open Web Joist



Bracing

Bracing of posts/piers must not be connected to joists or bearers. Bracing designed by others, will be required subject to post design, spacing and relevant loads.

Stramit® C Bearer and Joist with Piers



PROCUREMENT

Components

The **Stramit**[®] flooring system comprises:

- The standard range of **Stramit**[®] C-Joists & Bearers
- The standard range of **Stramit**[®] C-Joist and Bearer connectors
- The standard range of **Stramit**[®] Open Web Joists
- The **Stramit**[®] Open Web Joist connection system
- The range of Extended Bearer design options
- The **Stramit**[®] range of Extended Bearer brackets

Availability

The **Stramit**[®] range of C-Joist and Bearers are available nationally. The **Stramit**[®] range of Open Web Joists are available nationally. The Extended Bearer components need to be sourced through local steel distributors

Prices

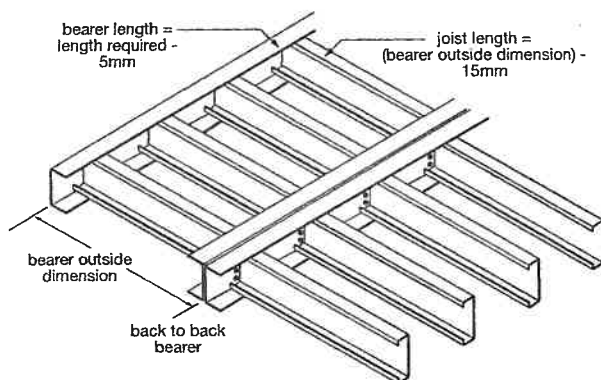
Prices of **Stramit**[®] Residential Floor Framing Systems can be obtained from your nearest Stramit location, or distributor of **Stramit**[®] products.

Lengths

Flooring lengths can be supplied to any nominated length as long as it falls within the joist and bearer span range. The tolerance on lengths supplied is +/- 10mm for C-Joists and Bearers, and +0/-5mm for Open Web Joists.

Detailing

All **Stramit**[®] C-Joist and Bearers are available custom cut to suit the installation requirements. To ensure easy installation, bearers should be ordered 5mm short and joists 15mm shorter than the bearer outside dimension, this will provide adequate clearance for production and installation tolerances.



Stramit[®] Open Web Joists should be detailed so that all

- web alignment requirements are noted
- vertical web requirements over internal supports are noted
- joists are to be detailed 5mm short

Orders

Stramit[®] Residential Floor Framing system components can be ordered directly from Stramit, or through distributors. Check with your local **Stramit**[®] office for availability of sections and sizes.

All Extended Bearer sections can be ordered through local steel distributors.

Ordering Details

Flooring components need to be broken down into individual floors, particularly in two storey designs. Details of the floor connection should be provided. Stramit Open Web Joists should be clearly specified, if there is any variance in configuration.

tables

Table 1

STRAMIT® C-Joist & Bearer Dimensions & Mass							
shape	section	depth D mm	width W mm	lip L mm	thickness t mm	mass kg/m	
C Joist	J18210	182	51	13	1.0	2.38	
	J18212	182	51	13	1.2	2.78	
	J18215	182	51	14	1.5	3.48	
	J18219	182	51	15	1.9	4.41	
	J18224	182	51	16	2.4	5.57	
	J23512	235	64	11	1.2	3.60	
	J23515	235	64	12	1.5	4.50	
	J23519	235	64	16	1.9	5.65	
	J23524	235	64	17	2.4	7.09	
	J28319	283	64	17	1.9	6.37	
	J28324	283	64	18	2.4	8.04	
	C Bearer	B18219	187	58	0	1.9	4.38
		B18224	187	58	0	2.4	5.52
B23519		240	72	0	1.9	5.59	
B23524		240	72	0	2.4	7.04	
B28319		288	72	0	1.9	6.31	
B28324		288	72	0	2.4	7.94	

Table 2

STRAMIT® Open Web Joist Dimensions & Mass					
designation	depth D mm	width W mm	chord thickness mm	web* thickness mm	mass kg/m
2506	250	78	0.6	0.6	2.61
2508	250	78	0.8	0.6	3.12
2510	250	78	1.0	0.6	3.62
2512	250	78	1.2	0.6	4.14
2515	250	78	1.5	0.6	4.91
3006	300	78	0.6	0.6	2.61
3008	300	78	0.8	0.6	3.12
3010	300	78	1.0	0.6	3.62
3012	300	78	1.2	0.6	4.14
3015	300	78	1.5	0.6	4.91
3506	350	78	0.6	0.6	2.61
3508	350	78	0.8	0.6	3.12
3510	350	78	1.0	0.6	3.62
3512	350	78	1.2	0.6	4.14
3515	350	78	1.5	0.6	4.91
4006	400	78	0.6	0.6	2.61
4008	400	78	0.8	0.6	3.12
4010	400	78	1.0	0.6	3.62
4012	400	78	1.2	0.6	4.14
4015	400	78	1.5	0.6	4.91
4506	450	78	0.6	0.6	2.61
4508	450	78 <td 0.8	0.6	3.12	
4510	450	78	1.0	0.6	3.62
4512	450	78	1.2	0.6	4.14
4515	450	78	1.5	0.6	4.91

*Vertical end webs are all 1.0mm.

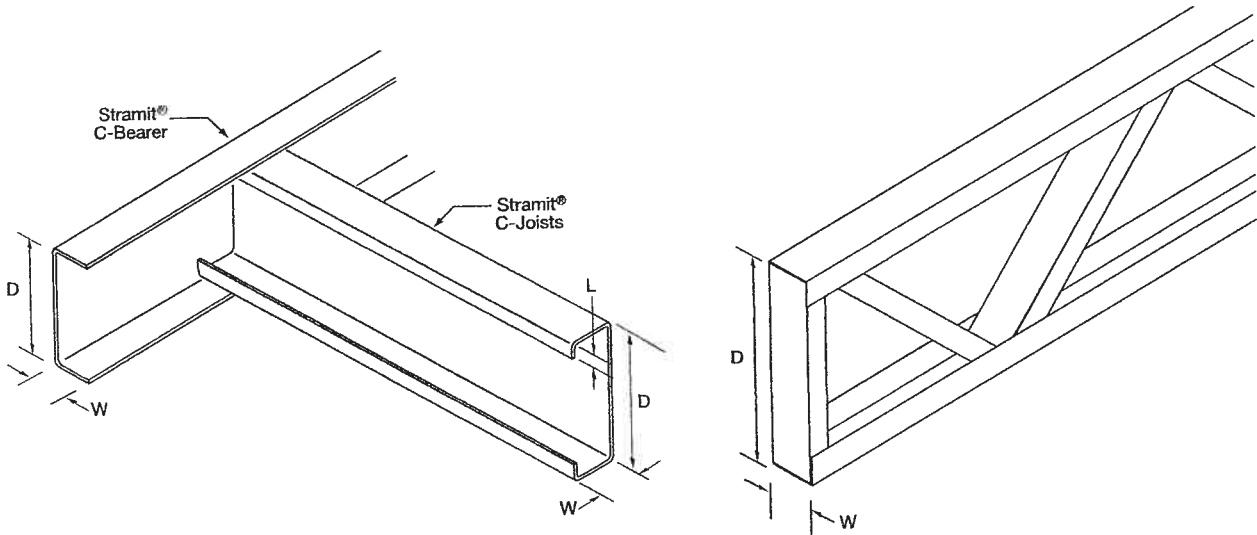
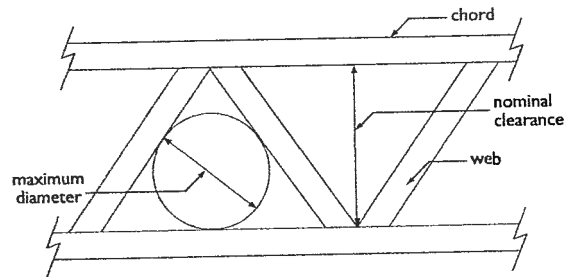


Table 3

STRAMIT® Open Web Joist Service Provision Allowance		
size	nominal clearance	maximum diameter
250	160mm	125mm
300	210mm	160mm
350	260mm	200mm
400	310mm	240mm
450	360mm	280mm



If web alignment is required for services specify at time of ordering

Table 4

STRAMIT [®] Extended Bearer Range Dimensions & Mass				
Shape	Section/s	Depth D (mm)	Width W (mm)	Mass (kg/m)
U-Beam Extended Bearer Range	180UB16.1*	173mm	90mm	16.1
	200UB18.2*	198mm	99mm	18.2
	250UB25.7*	248mm	124mm	25.7
	310UB32.0*	298mm	149mm	32.0
	310UB40.4*	304mm	165mm	40.4
	360UB44.7*	352mm	171mm	44.7
	360UB50.7*	356mm	171mm	50.7
C-Joist with RHS pair Extended Bearer Range	2 x 75x75x3.0 RHS* + 2 x B23519	257mm	219mm	19
	2 x 125x75x3.0 RHS* + 2 x B23519	257mm	269mm	24
	2 x 75x75x3.0 RHS* + 2 x B23524	257mm	219mm	20
	2 x 125x75x3.0 RHS* + 2 x B23524	257mm	269mm	25
	2 x 125x75x4.0 RHS* + 2 x B28319	305mm	269mm	30
	2 x 185x65x4.0 RHS* + 2 x B28319	305mm	329mm	36
	2 x 125x75x4.0 RHS* + 2 x B28324	305mm	269mm	31
	2 x 185x65x4.0 RHS* + 2 x B28324	305mm	329mm	38
Single RHS Extended Bearer Range	150x50x5.0 RHS Grade C350*	150mm	50mm	14.2
	200x50x4.0 RHS Grade C350*	200mm	50mm	14.8
	200x100x5.0 RHS Grade C350*	200mm	100mm	22.1
	250x150x5.0 RHS Grade C350*	250mm	150mm	29.9

*Sections supplied by others.

Table 5 - Durability Selection Criteria

One of the following applicable criteria must be adhered to ensure satisfactory performance of the floor system. The standard system is not suitable for applications closer than 300m to the coast.

Application	>10km from the coast & not in a heavy industrial area.	<10km but > 1km from the coast & not in a heavy industrial area.	< 1km but > 300m from the coast & not in a heavy industrial area.
Ground Floor	<ul style="list-style-type: none"> Sub-floor can be completely open 	<ul style="list-style-type: none"> Sub-floor must be enclosed and incorporate ventilators, or Sub-floor painted with etch primer plus water-based acrylic top coat. 	<ul style="list-style-type: none"> Sub-floor must be enclosed & incorporate ventilators, or Sub-floor painted with high build epoxy mastic based system
Upper Floor of Two Storey Building	<ul style="list-style-type: none"> No ceiling lining required 	<ul style="list-style-type: none"> If fully enclosed building, no ceiling lining required, or If not fully enclosed, sub-floor painted with etch primer plus water based acrylic top coat 	<ul style="list-style-type: none"> If fully enclosed building, no ceiling lining required, or If not fully enclosed, sub-floor painted with high build epoxy mastic system
Balcony	<ul style="list-style-type: none"> Provide weather tight top cover protection, or For open deck or strip flooring sub-floor painted with etch primer plus water-based acrylic top coat 	<ul style="list-style-type: none"> Provide weather tight top cover protection & complete encapsulation, or Sub-floor painted with etch primer plus water-based acrylic top coat 	<ul style="list-style-type: none"> Provide weather tight top cover protection & complete encapsulation, or Sub-floor painted with high build epoxy mastic system

Table 6

Roof Load Area

STRAMIT® RESIDENTIAL FLOOR SYSTEM Single Level or Upper Level of 2 Storey
C-Joists and Bearers alone OR with Extended Bearers Maximum Bearer Spans (m)

STRAMIT® C-Bearers

LOADED AREA (RLW×FLW) FOR METAL ROOF

FLW (m)	0.5	1.5	2.0	2.5	3.0	0.5	1.5	2.0	2.5	3.0	0.5	1.5	2.0	2.5	3.0
RLW (m)	B18219					B23519					B28319				
nominal	3.8	3.0	2.7	2.5	2.3	4.6	3.5	3.1	2.9	2.7	5.0	3.8	3.4	3.2	3.0
5.0	3.2	2.6	2.4	2.3	2.1	3.6	3.0	2.8	2.6	2.5	4.0	3.3	3.0	2.8	2.7
6.0	3.0	2.5	2.3	2.2	2.1	3.4	2.9	2.7	2.5	2.4	3.7	3.1	2.9	2.8	2.6
8.0	2.7	2.3	2.2	2.1	2.0	3.1	2.7	2.5	2.4	2.3	3.4	2.9	2.7	2.6	2.5
RLW (m)	B18224					B23524					B28324				
nominal	4.0	3.5	3.2	2.9	2.7	4.8	4.3	3.9	3.6	3.4	5.4	4.8	4.3	4.0	3.7
5.0	3.5	3.0	2.8	2.6	2.5	4.3	3.7	3.4	3.2	3.1	4.8	4.1	3.8	3.6	3.4
6.0	3.4	2.9	2.7	2.5	2.4	4.1	3.6	3.3	3.1	3.0	4.6	3.9	3.7	3.5	3.3
8.0	3.1	2.7	2.5	2.4	2.3	3.8	3.3	3.1	3.0	2.8	4.3	3.7	3.5	3.3	3.1

LOADED AREA (RLW×FLW) FOR TILED ROOF

FLW (m)	0.5	1.5	2.0	2.5	3.0	0.5	1.5	2.0	2.5	3.0	0.5	1.5	2.0	2.5	3.0
RLW (m)	B18219					B23519					B28319				
nominal	3.4	2.8	2.6	2.4	2.2	4.0	3.2	2.9	2.7	2.6	4.4	3.5	3.2	3.0	2.8
5.0	2.6	2.3	2.1	2.0	1.9	3.0	2.6	2.5	2.3	2.2	3.3	2.9	2.7	2.6	2.4
6.0	2.4	2.1	2.0	1.9	1.9	2.8	2.5	2.3	2.2	2.1	3.1	2.7	2.6	2.4	2.3
8.0	2.2	2.0	1.9	1.8	1.7	2.5	2.3	2.2	2.1	2.0	2.7	2.5	2.4	2.3	2.2
RLW (m)	B18224					B23524					B28324				
nominal	3.7	3.2	3.0	2.7	2.6	4.4	4.0	3.7	3.4	3.2	4.9	4.4	4.0	3.8	3.5
5.0	3.0	2.6	2.5	2.3	2.2	3.7	3.2	3.1	2.9	2.8	4.1	3.6	3.4	3.2	3.1
6.0	2.8	2.5	2.4	2.2	2.2	3.5	3.1	2.9	2.8	2.7	3.8	3.4	3.2	3.1	2.9
8.0	2.5	2.3	2.2	2.1	2.0	3.1	2.8	2.7	2.6	2.5	3.4	3.1	3.0	2.8	2.7

STRAMIT® Extended Bearers

LOADED AREA (RLW×FLW) FOR METAL ROOF

FLW (m)	0.5	2.0	2.5	3.0	3.5	0.5	2.0	2.5	3.0	3.5	0.5	2.0	2.5	3.0	3.5
RLW (m)	200UB18.2					250UB25.7					310UB32.0				
nominal	5.8	5.0	4.8	4.6	4.5	7.0	6.0	5.8	5.7	5.5	8.1	7.0	6.7	6.5	6.4
5.0	5.1	4.6	4.5	4.4	4.3	6.3	5.6	5.5	5.4	5.2	7.2	6.5	6.3	6.2	6.1
6.0	5.0	4.5	4.4	4.3	4.2	6.1	5.5	5.4	5.3	5.2	7.0	6.4	6.2	6.1	6.0
8.0	4.8	4.4	4.3	4.2	4.1	5.8	5.4	5.2	5.1	5.0	6.7	6.2	6.0	5.9	5.8
RLW (m)	310UB40.4					360UBB44.7					360UB50.7				
nominal	8.7	7.5	7.3	7.0	6.9	9.4	8.1	7.9	7.6	7.4	9.7	8.5	8.2	7.9	7.7
5.0	7.8	7.0	6.8	6.7	6.5	8.4	7.6	7.4	7.3	7.1	8.7	7.9	7.7	7.5	7.4
6.0	7.6	6.9	6.7	6.6	6.4	8.2	7.5	7.3	7.1	7.0	8.5	7.8	7.6	7.4	7.3
8.0	7.2	6.7	6.5	6.4	6.3	7.8	7.2	7.1	6.9	6.8	8.1	7.5	7.4	7.2	7.1

LOADED AREA (RLW×FLW) FOR TILED ROOF

FLW (m)	0.5	2.0	2.5	3.0	3.5	0.5	2.0	2.5	3.0	3.5	0.5	2.0	2.5	3.0	3.5
RLW (m)	200UB18.2					250UB25.7					310UB32.0				
nominal	5.2	4.7	4.5	4.4	4.3	6.5	5.8	5.6	5.4	5.3	7.4	6.6	6.4	6.3	6.1
5.0	4.5	4.2	4.1	4.1	4.0	5.5	5.2	5.1	5.0	4.9	6.4	6.0	5.9	5.8	5.7
6.0	4.3	4.1	4.0	4.0	3.9	5.4	5.0	5.0	4.9	4.8	6.2	5.8	5.7	5.6	5.5
8.0	4.1	3.9	3.9	3.8	3.8	5.1	4.8	4.7	4.7	4.6	5.8	5.6	5.5	5.4	5.3
RLW (m)	310UB40.4					360UBB44.7					360UB50.7				
nominal	8.0	7.2	7.0	6.8	6.6	8.7	7.8	7.6	7.4	7.2	9.0	8.1	7.8	7.6	7.5
5.0	6.9	6.4	6.3	6.2	6.1	7.5	7.0	6.9	6.8	6.6	7.8	7.3	7.1	7.0	6.9
6.0	6.7	6.3	6.2	6.1	6.0	7.2	6.8	6.7	6.6	6.5	7.5	7.1	7.0	6.9	6.8
8.0	6.3	6.0	5.9	5.8	5.8	6.8	6.5	6.4	6.3	6.3	7.1	6.8	6.7	6.6	6.5

- Notes: 1 only for joists at 450mm centres
- 2 suitable for 19mm and 22mm thick particleboard floors
- 3 RLW (m) : Roof load width in metres
- 4 FLW (m) : Floor load width in metres
- 5 OH = Eave Overhang in metres
- 6 x = Roof truss span in metres
- 7 y = Floor width between supports
- 8 Combined load system of roof and floor areas
- 9 For bearers supporting load bearing wall and roof loads
- 10 Limiting Criteria $G+0.4Q D \leq L/300$ and $D_{max} = 12mm$

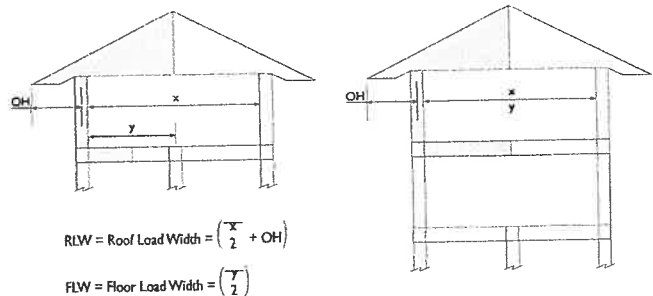


Table 7

STRAMIT® RESIDENTIAL FLOOR SYSTEM Lower Level of 2 Storey
C-Joists and Bearers alone OR with Extended Bearers Maximum Bearer Spans (m)

STRAMIT® C-Bearers

LOADED AREA (RLW×FLW) FOR METAL ROOF															
FLW (m)	3.0	3.5	4.0	4.5	5.0	3.0	3.5	4.0	4.5	5.0	3.0	3.5	4.0	4.5	5.0
RLW (m)	B18219					B23519					B28319				
nominal	2.3	2.1	2.0	1.9	1.9	2.6	2.5	2.3	2.2	2.1	2.8	2.7	2.6	2.4	2.3
5.0	2.1	2.0	1.9	1.8	1.7	2.4	2.3	2.2	2.1	2.0	2.6	2.5	2.4	2.3	2.2
6.0	2.0	1.9	1.8	1.8	1.7	2.3	2.2	2.1	2.0	2.0	2.5	2.4	2.3	2.2	2.2
8.0	1.9	1.8	1.8	1.7	1.7	2.2	2.1	2.0	2.0	1.9	2.4	2.3	2.2	2.2	2.1
RLW (m)	B18224					B23524					B28324				
nominal	2.6	2.5	2.3	2.2	2.1	3.2	3.1	2.9	2.8	2.7	3.6	3.4	3.2	3.1	2.9
5.0	2.4	2.3	2.2	2.1	2.0	3.0	2.8	2.7	2.6	2.5	3.3	3.1	3.0	2.9	2.8
6.0	2.3	2.2	2.1	2.0	2.0	2.9	2.8	2.6	2.5	2.4	3.2	3.0	2.9	2.8	2.7
8.0	2.2	2.1	2.0	2.0	1.9	2.7	2.6	2.5	2.4	2.4	3.0	2.9	2.8	2.7	2.6
LOADED AREA (RLW×FLW) FOR TILED ROOF															
FLW (m)	3.0	3.5	4.0	4.5	5.0	3.0	3.5	4.0	4.5	5.0	3.0	3.5	4.0	4.5	5.0
RLW (m)	B18219					B23519					B28319				
nominal	2.2	2.1	2.0	1.9	1.8	2.5	2.4	2.2	2.2	2.1	2.7	2.6	2.5	2.4	2.3
5.0	1.9	1.8	1.7	1.7	1.6	2.2	2.1	2.0	1.9	1.9	2.4	2.3	2.2	2.1	2.1
6.0	1.8	1.8	1.7	1.6	1.6	2.1	2.0	1.9	1.9	1.8	2.3	2.2	2.1	2.1	2.0
8.0	1.7	1.6	1.6	1.5	1.5	2.0	1.9	1.8	1.8	1.7	2.1	2.1	2.0	1.9	1.9
RLW (m)	B18224					B23524					B28324				
nominal	2.5	2.4	2.3	2.2	2.1	3.1	2.9	2.8	2.7	2.6	3.4	3.2	3.1	3.0	2.8
5.0	2.2	2.1	2.0	1.9	1.9	2.7	2.6	2.5	2.4	2.3	3.0	2.9	2.8	2.7	2.6
6.0	2.1	2.0	2.0	1.9	1.8	2.6	2.5	2.4	2.3	2.3	2.9	2.8	2.7	2.6	2.5
8.0	2.0	1.9	1.8	1.8	1.7	2.4	2.4	2.3	2.2	2.2	2.7	2.6	2.5	2.4	2.4

STRAMIT® Extended Bearers

LOADED AREA (RLW×FLW) FOR METAL ROOF															
FLW (m)	3.0	3.5	4.0	4.5	5.0	3.0	3.5	4.0	4.5	5.0	3.0	3.5	4.0	4.5	5.0
RLW (m)	200UB18.2					250UB25.7					310UB32.0				
nominal	4.5	4.4	4.3	4.2	4.1	5.5	5.4	5.3	5.1	5.0	6.3	6.2	6.1	5.9	5.8
5.0	4.3	4.2	4.1	4.1	4.0	5.2	5.1	5.0	5.0	4.9	6.0	5.9	5.8	5.7	5.6
6.0	4.2	4.1	4.1	4.0	3.9	5.2	5.1	5.0	4.9	4.8	6.0	5.8	5.7	5.7	5.6
8.0	4.1	4.0	4.0	3.9	3.9	5.0	4.9	4.9	4.8	4.7	5.8	5.7	5.6	5.5	5.5
RLW (m)	310UB40.4					360UBB44.7					360UB50.7				
nominal	6.8	6.7	6.5	6.4	6.3	7.4	7.3	7.1	7.0	6.8	7.7	7.5	7.4	7.2	7.1
5.0	6.5	6.4	6.3	6.2	6.1	7.1	6.9	6.8	6.7	6.6	7.4	7.2	7.1	7.0	6.9
6.0	6.4	6.3	6.2	6.1	6.0	7.0	6.9	6.7	6.6	6.5	7.3	7.1	7.0	6.9	6.8
8.0	6.3	6.2	6.1	6.0	5.9	6.8	6.7	6.6	6.5	6.4	7.1	7.0	6.8	6.7	6.7
LOADED AREA (RLW×FLW) FOR TILED ROOF															
FLW (m)	3.0	3.5	4.0	4.5	5.0	3.0	3.5	4.0	4.5	5.0	3.0	3.5	4.0	4.5	5.0
RLW (m)	200UB18.2					250UB25.7					310UB32.0				
nominal	4.3	4.2	4.1	4.1	4.0	5.3	5.2	5.1	5.0	4.9	6.1	6.0	5.9	5.8	5.7
5.0	4.0	3.9	3.9	3.8	3.8	4.9	4.8	4.8	4.7	4.6	5.7	5.6	5.5	5.4	5.3
6.0	3.9	3.8	3.8	3.7	3.7	4.8	4.7	4.7	4.6	4.5	5.5	5.5	5.4	5.3	5.3
8.0	3.8	3.7	3.7	3.6	3.6	4.6	4.6	4.5	4.5	4.4	5.3	5.3	5.2	5.1	5.1
RLW (m)	310UB40.4					360UBB44.7					360UB50.7				
nominal	6.6	6.5	6.4	6.2	6.1	7.2	7.0	6.9	6.8	6.7	7.5	7.3	7.2	7.0	6.9
5.0	6.1	6.0	5.9	5.8	5.8	6.6	6.5	6.4	6.4	6.3	6.9	6.8	6.7	6.6	6.5
6.0	6.0	5.9	5.8	5.7	5.7	6.5	6.4	6.3	6.2	6.2	6.8	6.7	6.6	6.5	6.4
8.0	5.7	5.7	5.6	5.6	5.5	6.2	6.2	6.1	6.0	6.0	6.5	6.4	6.3	6.3	6.2

- Notes:
- 1 only for joists at 450mm centres
 - 2 suitable for 19mm and 22mm thick particleboard floors
 - 3 RLW (m) : Roof load width in metres
 - 4 FLW (m) : Floor load width in metres
 - 5 OH = Eave Overhang in metres
 - 6 x = Roof truss span in metres
 - 7 y = Floor width between supports
 - 8 Combined load system of roof and floor areas
 - 9 For bearers supporting load bearing wall and roof loads
 - 10 Limiting Criteria $G+0.4Q \leq L/300$ and $D_{max} = 12mm$

$$RLW = \text{Roof Load Width} = \left(\frac{x}{2} + OH \right)$$

$$FLW = \text{Floor Load Width} = \left(\frac{x}{2} + \frac{y}{2} \right)$$

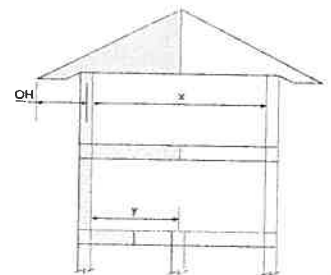


Table 8a

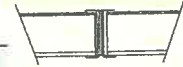
Non-Roof Load Area

STRAMIT® RESIDENTIAL FLOOR SYSTEM Any Floor Level

C-Joists and Bearers alone, supported on walls OR with Extended Bearers

Maximum Joist Span (m)

STRAMIT® C-Bearers



C-Joists

	J18210	J18212	J18215	J18219	J18224	J23512	J23515	J23519	J23524	J28319	J28324
wall	3.8	4.1	4.3	4.6	4.8	5.0	5.2	5.5	5.8	6.1	6.4
bearer span (m)	B18219					B23519				B28319	
2.0	3.6	3.8	4.0	4.1	4.3	4.7	5.0	5.2	5.4	5.9	6.1
2.2	3.5	3.6	3.8	3.9	4.1	4.6	4.8	5.0	5.3	5.8	6.0
2.4	3.3	3.4	3.5	3.6	3.7	4.5	4.7	4.8	5.0	5.6	5.8
2.6	3.0	3.1	3.2	3.3	3.3	4.3	4.4	4.6	4.7	5.4	5.6
2.8	2.7	2.7	2.8	2.8	2.8	4.0	4.1	4.3	4.4	5.1	5.3
3.0	2.3	2.3	2.3	2.3	2.3	3.7	3.8	3.9	3.9	4.8	4.9
3.2	1.9	1.9	1.9	1.9	1.8	3.3	3.3	3.4	3.4	4.4	4.5
3.4	1.5	1.5	1.5	1.5	1.4	2.9	2.9	2.9	2.8	3.9	3.9
3.6						2.4	2.4	2.4	2.3	3.4	3.4
3.8						2.0	2.0	1.9	1.9	2.9	2.8
4.0						1.6	1.6	1.6	1.5	2.4	2.3
bearer span (m)	B18224					B23524				B28324	
2.0	3.7	3.8	4.0	4.2	4.4	4.8	5.0	5.2	5.5	5.9	6.2
2.2	3.6	3.7	3.9	4.1	4.2	4.7	4.9	5.1	5.4	5.8	6.1
2.4	3.4	3.5	3.7	3.8	4.0	4.6	4.8	5.0	5.2	5.7	6.0
2.6	3.2	3.3	3.4	3.5	3.6	4.4	4.6	4.8	5.0	5.5	5.8
2.8	2.9	3.0	3.1	3.2	3.2	4.2	4.4	4.5	4.7	5.3	5.5
3.0	2.6	2.7	2.7	2.7	2.7	4.0	4.1	4.2	4.3	5.1	5.2
3.2	2.2	2.2	2.3	2.2	2.2	3.6	3.7	3.8	3.8	4.8	4.9
3.4	1.9	1.8	1.8	1.8	1.8	3.3	3.3	3.3	3.3	4.4	4.4
3.6	1.5	1.5	1.5	1.5	1.4	2.8	2.8	2.8	2.8	3.9	3.9
3.8						2.4	2.4	2.4	2.3	3.4	3.4
4.0						2.0	2.0	1.9	1.9	2.9	2.8

STRAMIT® Shallow Extended Bearers - In Plane



C-Joists

	J18210	J18212	J18215	J18219	J18224	J23512	J23515	J23519	J23524	J28319	J28324
bearer span (m)						2 x 75x75x3.0 RHS plus 2 x B23519				2 x 125x75x4.0 RHS plus 2 x B28319	
2.5						4.8	5.0	5.2	5.5	6.0	6.3
3.0						4.6	4.8	5.0	5.2	6.0	6.2
3.5						4.3	4.5	4.6	4.8	5.8	6.1
4.0						3.9	4.0	4.1	4.1	5.6	5.9
4.5	not applicable					3.2	3.3	3.3	3.3	5.3	5.5
5.0						2.5	2.5	2.4	2.4	4.9	5.0
5.5						1.8	1.8	1.7	1.7	4.2	4.3
bearer span (m)						2 x 125x75x3.0 RHS plus 2 x B23519				2 x 185x65x4.0 RHS plus 2 x B28319	
2.5						4.8	5.0	5.3	5.5	6.1	6.3
3.0						4.7	4.9	5.1	5.3	6.0	6.3
3.5						4.4	4.6	4.8	5.0	5.9	6.2
4.0						4.1	4.2	4.3	4.5	5.7	6.0
4.5	not applicable					3.6	3.6	3.7	3.7	5.5	5.7
5.0						2.9	2.9	2.9	2.9	5.1	5.3
5.5						2.2	2.2	2.1	2.1	4.6	4.7
bearer span (m)						2 x 75x75x3.0 RHS plus 2 x B23524				2 x 125x75x4.0 RHS plus 2 x B23524	
2.5						4.8	5.0	5.2	5.5	6.0	6.3
3.0						4.6	4.8	5.0	5.2	6.0	6.3
3.5						4.3	4.5	4.7	4.9	5.8	6.1
4.0						3.9	4.1	4.2	4.3	5.7	5.9
4.5	not applicable					3.4	3.4	3.5	3.5	5.4	5.6
5.0						2.7	2.6	2.6	2.6	4.9	5.1
5.5						1.9	1.9	1.9	1.8	4.4	4.4
bearer span (m)						2 x 125x75x3.0 RHS plus 2 x B23524				2 x 185x65x4.0 RHS plus 2 x B23524	
2.5						4.9	5.1	5.4	5.6	6.1	6.4
3.0						4.8	5.0	5.3	5.5	6.0	6.3
3.5						4.7	4.9	5.1	5.3	5.9	6.2
4.0						4.5	4.7	4.8	5.0	5.7	6.0
4.5	not applicable					4.1	4.3	4.4	4.6	5.5	5.7
5.0						3.7	3.8	3.8	3.9	5.2	5.3
5.5						3.0	3.0	3.1	3.0	4.7	4.8

Table 8b

Non-Roof Load Area

STRAMIT® RESIDENTIAL FLOOR SYSTEM Any Floor Level
 C-Joists and Bearers with alternative Extended Bearers Maximum Joist Span (m)

STRAMIT® Single RHS Extended Bearers



bearer span (m)	C-Joists										
	J18210	J18212	J18215	J18219	J18224	J23512	J23515	J23519	J23524	J28319	J28324
150x50x5.0 RHS - Grade C350											
2.5	3.5	3.6	3.7	3.9	4.0	4.2	4.3	4.5	4.6	4.8	4.9
3.0	2.9	2.9	3.0	3.1	3.1	3.2	3.3	3.3	3.3	3.4	3.3
3.5	2.0	2.0	2.0	2.0	1.9	2.0	2.0	2.0	1.9	1.9	1.9
4.0	1.2	1.2	1.2	1.1	1.1	1.2	1.1	1.1	1.1	1.1	1.1
200x50x4.0 RHS - Grade C350											
2.5	3.7	3.8	4.0	4.2	4.4	4.5	4.7	4.9	5.1	5.4	5.6
3.0	3.4	3.5	3.6	3.8	3.9	4.0	4.2	4.3	4.4	4.6	4.7
3.5	2.9	2.9	3.0	3.0	3.1	3.2	3.2	3.2	3.2	3.3	3.3
4.0	2.1	2.1	2.1	2.1	2.0	2.1	2.1	2.1	2.0	2.1	2.0
4.5	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.2	1.2	1.2
200x100x5.0 RHS - Grade C350											
2.5	3.8	4.0	4.1	4.4	4.6	4.7	4.9	5.2	5.4	5.7	6.0
3.0	3.6	3.8	3.9	4.1	4.3	4.5	4.6	4.8	5.0	5.3	5.5
3.5	3.3	3.5	3.6	3.7	3.8	4.0	4.1	4.2	4.3	4.5	4.6
4.0	2.9	2.9	3.0	3.1	3.1	3.2	3.3	3.3	3.3	3.4	3.4
4.5	2.2	2.2	2.2	2.2	2.2	2.3	2.3	2.2	2.2	2.2	2.2
5.0	1.5	1.5	1.5	1.5	1.4	1.5	1.5	1.4	1.4	1.4	1.4
250x150x5.0 RHS - Grade C350											
2.5	3.9	4.0	4.2	4.5	4.7	4.9	5.1	5.4	5.6	5.9	6.2
3.0	3.8	4.0	4.2	4.4	4.6	4.7	5.0	5.2	5.4	5.8	6.0
3.5	3.7	3.8	4.0	4.2	4.4	4.5	4.7	5.0	5.2	5.4	5.7
4.0	3.5	3.6	3.8	3.9	4.1	4.2	4.4	4.5	4.7	4.9	5.1
4.5	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.2	4.2
5.0	2.8	2.8	2.9	2.9	2.9	3.1	3.1	3.1	3.1	3.2	3.1
5.5	2.2	2.2	2.2	2.2	2.2	2.3	2.3	2.2	2.2	2.2	2.2

STRAMIT® U-Beam Extended Bearers



bearer span (m)	C-Joists										
	J18210	J18212	J18215	J18219	J18224	J23512	J23515	J23519	J23524	J28319	J28324
180UB16.1											
3.0	3.5	3.6	3.8	4.0	4.1	4.3	4.4	4.6	4.7	5.0	5.1
3.5	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.8	4.0	4.0
4.0	2.5	2.5	2.6	2.6	2.6	2.7	2.7	2.7	2.6	2.7	2.6
4.5	1.8	1.8	1.7	1.7	1.7	1.8	1.7	1.7	1.6	1.7	1.6
5.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.1	1.0
200UB18.2											
3.0	3.7	3.8	4.0	4.2	4.4	4.5	4.7	4.9	5.1	5.4	5.6
3.5	3.4	3.5	3.7	3.8	3.9	4.1	4.2	4.4	4.5	4.7	4.8
4.0	3.0	3.1	3.2	3.2	3.3	3.4	3.5	3.5	3.5	3.6	3.6
4.5	2.4	2.4	2.4	2.4	2.4	2.5	2.5	2.5	2.4	2.5	2.4
5.0	1.7	1.7	1.7	1.7	1.6	1.7	1.7	1.6	1.6	1.6	1.6
5.5	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.1	1.0
250UB25.7											
3.0	3.8	4.0	4.2	4.4	4.6	4.8	5.0	5.2	5.5	5.8	6.0
3.5	3.7	3.9	4.0	4.2	4.4	4.6	4.8	5.0	5.2	5.5	5.7
4.0	3.5	3.7	3.8	4.0	4.1	4.3	4.5	4.6	4.8	5.0	5.2
4.5	3.3	3.4	3.5	3.6	3.7	3.9	4.0	4.1	4.2	4.3	4.4
5.0	2.9	2.9	3.0	3.1	3.1	3.2	3.3	3.3	3.3	3.4	3.4
5.5	2.4	2.4	2.4	2.4	2.4	2.5	2.5	2.4	2.4	2.4	2.4
6.0	1.8	1.8	1.7	1.7	1.7	1.8	1.7	1.7	1.7	1.7	1.6
310UB32.0											
3.0	3.9	4.0	4.2	4.5	4.7	4.9	5.1	5.3	5.6	5.9	6.2
3.5	3.8	4.0	4.2	4.4	4.6	4.8	5.0	5.2	5.4	5.8	6.0
4.0	3.7	3.9	4.0	4.2	4.4	4.6	4.8	5.0	5.2	5.5	5.7
4.5	3.6	3.7	3.9	4.0	4.2	4.4	4.5	4.7	4.9	5.1	5.3
5.0	3.4	3.5	3.6	3.8	3.9	4.0	4.2	4.3	4.4	4.6	4.7
5.5	3.1	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.7	3.8	3.8
6.0	2.7	2.7	2.8	2.8	2.8	2.9	2.9	2.9	2.9	3.0	2.9

Tables 8a and 8b

- Notes: 1 only for joists at 450mm centres
 2 suitable for 19mm and 22mm thick particleboard floors
 3 suitable for large openings that require large spans
 4 not suitable to support load bearing walls or large concentrated loads
 * wall only for joists when supported at both ends by load bearing walls

Table 9

Non-Roof Load Area

STRAMIT® RESIDENTIAL FLOOR SYSTEM Any Floor Level
 Open Web Joists supported on walls OR Extended Bearers Maximum Joist Span (m)

STRAMIT® U-Beam Extended Bearers



Open Web Joist

wall	2506	2508	2510	2512	2515	3006	3008	3010	3012	3015	3506	3508	3510	3512	3515
		3.3	4.7	4.9	5.0	5.3	3.6	5.1	5.3	5.5	5.8	3.9	5.6	5.8	6.0
	200UB18.2					250UB25.7					310UB32.0				
3.0	3.3	4.3	4.4	4.5	4.7	3.6	4.9	5.1	5.3	5.5	3.9	5.4	5.6	5.8	6.1
3.5	3.3	3.9	4.0	4.1	4.2	3.6	4.7	4.9	5.0	5.2	3.9	5.3	5.5	5.7	5.9
4.0	3.2	3.3	3.4	3.4	3.5	3.6	4.4	4.6	4.7	4.8	3.9	5.1	5.3	5.4	5.7
4.5	2.5	2.5	2.5	2.5	2.5	3.6	4.0	4.1	4.1	4.2	3.9	4.8	5.0	5.1	5.3
5.0	1.7	1.7	1.7	1.7	1.7	3.2	3.3	3.3	3.4	3.4	3.9	4.4	4.5	4.6	4.7
5.5	1.1	1.1	1.1	1.1	1.1	2.5	2.5	2.5	2.5	2.5	3.7	3.8	3.8	3.9	3.9
6.0	0.7	0.7	0.7	0.7	0.7	1.8	1.8	1.8	1.8	1.7	3.0	3.0	3.1	3.1	3.1

Open Web Joist

wall	3506	3508	3510	3512	3515	4006	4008	4010	4012	4015	4506	4508	4510	4512	4515
		3.9	5.6	5.8	6.0	6.3	4.2	5.9	6.2	6.4	6.7	4.5	6.3	6.6	6.8
	310UB40.4					360UB44.7					360UB50.7				
3.0	3.9	5.4	5.7	5.9	6.1	4.2	5.9	6.1	6.3	6.6	4.5	6.2	6.5	6.7	7.0
3.5	3.9	5.4	5.6	5.7	6.0	4.2	5.8	6.0	6.2	6.5	4.5	6.2	6.4	6.6	6.9
4.0	3.9	5.2	5.4	5.6	5.8	4.2	5.7	5.9	6.1	6.3	4.5	6.0	6.3	6.5	6.8
4.5	3.9	5.0	5.2	5.3	5.5	4.2	5.5	5.7	5.9	6.1	4.5	5.9	6.1	6.3	6.6
5.0	3.9	4.7	4.8	5.0	5.1	4.2	5.3	5.4	5.6	5.8	4.5	5.6	5.8	6.0	6.3
5.5	3.9	4.3	4.4	4.5	4.6	4.2	4.9	5.0	5.2	5.3	4.5	5.3	5.5	5.6	5.8
6.0	3.6	3.7	3.7	3.8	3.8	4.2	4.4	4.5	4.6	4.7	4.5	4.9	5.0	5.1	5.2
6.5	3.0	3.0	3.0	3.0	3.0	3.8	3.8	3.9	3.9	3.9	4.2	4.3	4.3	4.4	4.4
7.0	2.3	2.3	2.2	2.2	2.2	3.1	3.1	3.1	3.1	3.1	3.5	3.5	3.6	3.6	3.6
7.5	1.7	1.7	1.6	1.6	1.6	2.4	2.4	2.4	2.4	2.3	2.8	2.8	2.8	2.8	2.7
8.0	1.2	1.2	1.2	1.2	1.2	1.8	1.8	1.8	1.7	1.7	2.1	2.1	2.1	2.1	2.0
8.5	0.9	0.9	0.8	0.8	0.8	1.3	1.3	1.3	1.3	1.3	1.6	1.6	1.5	1.5	1.5

- Notes:
- 1 only for joists at 450mm centres
 - 2 suitable for 19mm and 22mm thick particleboard floors
 - 3 suitable for large openings that require large spans
 - 4 not suitable to support load bearing walls or large concentrated loads
 - * wall only for joists when supported at both ends by continuous load bearing walls

Table 10

Balcony Non-Roof Load Area

STRAMIT® RESIDENTIAL FLOOR SYSTEM Balconies and Verandahs											
C-Joists and Bearers alone, supported on walls OR with Extended Bearers										Maximum Joist Span (m)	
STRAMIT® C-Bearers											
C-Joists											
	J18210	J18212	J18215	J18219	J18224	J23512	J23515	J23519	J23524	J28319	J28324
wall	3.9	4.0	4.2	4.4	4.7	4.8	5.1	5.3	5.6	5.9	6.2
bearer span (m)	B18219					B23519				B28319	
2.0	3.2	3.3	3.5	3.7	3.8	4.2	4.4	4.7	4.9	5.3	5.6
2.2	3.0	3.1	3.3	3.4	3.5	4.1	4.3	4.5	4.7	5.2	5.4
2.4	2.8	2.9	3.0	3.0	3.1	3.9	4.1	4.3	4.4	5.0	5.2
2.6	2.5	2.5	2.6	2.6	2.6	3.7	3.8	3.9	4.1	4.7	4.9
2.8	2.1	2.1	2.1	2.1	2.1	3.4	3.5	3.6	3.6	4.4	4.6
3.0	1.7	1.7	1.7	1.7	1.7	3.0	3.0	3.1	3.1	4.0	4.1
3.2	1.3	1.3	1.3	1.3	1.3	2.6	2.6	2.6	2.6	3.6	3.6
3.4	1.1	1.1	1.0	1.0	1.0	2.1	2.1	2.1	2.1	3.0	3.0
3.6	0.8	0.8	0.8	0.8	0.8	1.7	1.7	1.7	1.7	2.5	2.5
3.8	0.7	0.7	0.7	0.7	0.6	1.4	1.4	1.4	1.3	2.1	2.0
4.0	0.5	0.5	0.5	0.5	0.5	1.1	1.1	1.1	1.1	1.7	1.7
bearer span (m)	B18224					B23524				B28324	
2.0	3.3	3.4	3.6	3.8	3.9	4.3	4.5	4.7	5.0	5.4	5.6
2.2	3.2	3.3	3.4	3.6	3.7	4.2	4.4	4.6	4.8	5.3	5.5
2.4	3.0	3.1	3.2	3.3	3.4	4.1	4.2	4.4	4.6	5.1	5.3
2.6	2.7	2.8	2.8	2.9	3.0	3.9	4.0	4.2	4.3	4.9	5.1
2.8	2.4	2.4	2.5	2.5	2.5	3.6	3.7	3.9	4.0	4.7	4.8
3.0	2.0	2.0	2.0	2.0	2.0	3.3	3.4	3.5	3.5	4.4	4.5
3.2	1.6	1.6	1.6	1.6	1.6	2.9	3.0	3.0	3.0	4.0	4.0
3.4	1.3	1.3	1.3	1.3	1.3	2.5	2.5	2.5	2.5	3.5	3.5
3.6	1.1	1.0	1.0	1.0	1.0	2.1	2.1	2.1	2.1	3.0	3.0
3.8	0.8	0.8	0.8	0.8	0.8	1.7	1.7	1.7	1.7	2.5	2.5
4.0	0.7	0.7	0.7	0.7	0.6	1.4	1.4	1.4	1.4	2.1	2.1
RHS Extended Bearers											
C-Joists											
	J18210	J18212	J18215	J18219	J18224	J23512	J23515	J23519	J23524	J28319	J28324
bearer span (m)	150x50x5.0 RHS - Grade C350										
2.5	3.0	3.1	3.2	3.3	3.5	3.6	3.7	3.8	3.9	4.0	4.1
3.0	2.3	2.3	2.4	2.4	2.4	2.5	2.5	2.5	2.5	2.5	2.5
3.5	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
4.0	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
bearer span (m)	200x50x4.0 RHS - Grade C350										
2.5	3.3	3.4	3.6	3.7	3.9	4.0	4.2	4.4	4.5	4.8	4.9
3.0	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9
3.5	2.3	2.3	2.3	2.4	2.4	2.4	2.5	2.4	2.4	2.5	2.4
4.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.5	1.4
4.5	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
bearer span (m)	200x100x5.0 RHS - Grade C350										
2.5	3.4	3.6	3.7	3.9	4.1	4.2	4.4	4.7	4.9	5.1	5.4
3.0	3.2	3.3	3.5	3.6	3.8	3.9	4.1	4.2	4.4	4.6	4.8
3.5	2.9	3.0	3.1	3.2	3.3	3.4	3.4	3.5	3.6	3.7	3.8
4.0	2.3	2.4	2.4	2.4	2.4	2.5	2.5	2.5	2.5	2.5	2.5
4.5	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
5.0	1.1	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
bearer span (m)	250x150x5.0 RHS - Grade C350										
2.5	3.5	3.7	3.9	4.1	4.3	4.4	4.6	4.9	5.1	5.4	5.7
3.0	3.4	3.6	3.7	3.9	4.1	4.3	4.5	4.7	4.9	5.2	5.4
3.5	3.3	3.4	3.6	3.7	3.9	4.0	4.2	4.4	4.6	4.8	5.0
4.0	3.1	3.2	3.3	3.4	3.5	3.6	3.8	3.9	4.0	4.2	4.3
4.5	2.7	2.8	2.8	2.9	3.0	3.1	3.1	3.2	3.2	3.3	3.3
5.0	2.2	2.2	2.2	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
5.5	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.5

- Notes:
- 1 only for joists at 450mm centres
 - 2 suitable for 15mm thick fibre-cement floors
 - 3 not suitable to support load bearing walls, large concentrated loads or roof loads
 - 4 suitable for large openings that require large spans
 - * wall only for joists when supported at both ends by load bearing walls

Table 11

Balcony Non-Roof Load Area

STRAMIT® RESIDENTIAL FLOOR SYSTEM Balconies and Verandahs															
Open Web Joists supported on walls OR with Extended Bearers Maximum Joist Span (m)															
STRAMIT® U-Beam Extended Bearers															
wall	Open Web Joist														
	2506	2508	2510	2512	2515	3006	3008	3010	3012	3015	3506	3508	3510	3512	3515
	2.4	3.6	4.3	4.9	5.1	2.7	3.9	4.8	5.4	5.6	2.9	4.3	5.2	5.8	6.1
	200UB18.2					250UB25.7					310UB32.0				
3.0	2.4	3.6	4.2	4.3	4.4	2.7	3.9	4.8	5.1	5.3	2.9	4.3	5.2	5.6	5.9
3.5	2.4	3.5	3.6	3.7	3.7	2.7	3.9	4.6	4.7	4.9	2.9	4.3	5.2	5.4	5.6
4.0	2.4	2.7	2.7	2.8	2.8	2.7	3.9	4.2	4.2	4.4	2.9	4.3	5.0	5.1	5.3
4.5	1.8	1.8	1.8	1.8	1.8	2.7	3.4	3.5	3.5	3.5	2.9	4.3	4.5	4.6	4.8
5.0	1.2	1.2	1.2	1.2	1.2	2.6	2.6	2.6	2.6	2.6	2.9	3.8	3.9	3.9	4.0
5.5	0.8	0.8	0.8	0.8	0.8	1.8	1.8	1.8	1.8	1.8	2.9	3.0	3.1	3.1	3.1
6.0						1.3	1.3	1.2	1.2	1.2	2.3	2.3	2.3	2.2	2.2
wall	Open Web Joist														
	3506	3508	3510	3512	3515	4006	4008	4010	4012	4015	4506	4508	4510	4512	4515
	2.9	4.3	5.2	5.8	6.1	3.1	4.6	5.6	6.3	6.5	3.3	4.9	6.0	6.6	6.9
	310UB30.4					360UB44.7					360UB50.7				
3.0	2.9	4.3	5.2	5.7	5.9	3.1	4.6	5.6	6.1	6.4	3.3	4.9	6.0	6.5	6.8
3.5	2.9	4.3	5.2	5.5	5.8	3.1	4.6	5.6	6.0	6.3	3.3	4.9	6.0	6.4	6.7
4.0	2.9	4.3	5.2	5.3	5.5	3.1	4.6	5.6	5.8	6.0	3.3	4.9	6.0	6.2	6.5
4.5	2.9	4.3	4.8	5.0	5.1	3.1	4.6	5.4	5.5	5.7	3.3	4.9	5.8	6.0	6.2
5.0	2.9	4.2	4.4	4.5	4.6	3.1	4.6	5.0	5.1	5.3	3.3	4.9	5.4	5.6	5.8
5.5	2.9	3.7	3.7	3.8	3.8	3.1	4.4	4.5	4.6	4.7	3.3	4.8	4.9	5.0	5.2
6.0	2.9	2.9	2.9	2.9	2.9	3.1	3.7	3.8	3.8	3.9	3.3	4.2	4.3	4.3	4.4

- Notes: 1 only for joists at 450mm centres
- 2 suitable for 15mm thick fibre-cement floors
- 3 not suitable to support load bearing walls, large concentrated loads or roof loads
- 4 suitable for large openings that require large spans
- * wall only for joists when supported at both ends by load bearing walls

Structural Support Systems - FCB3 Brackets

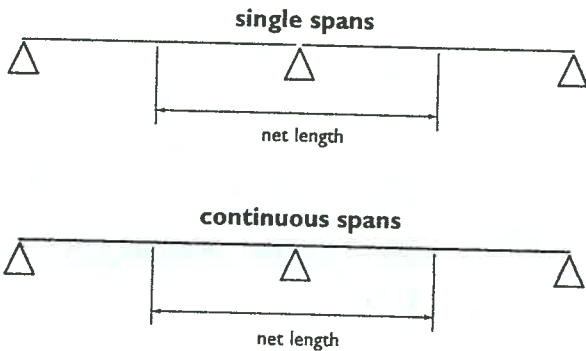
Table 12

STRAMIT® FCB3 Brackets														
Bearer Loading (kN/m)														
NON-ROOF LOAD AREA	SINGLE STOREY OR UPPER LEVEL OF TWO STOREY							LOWER LEVEL OF DOUBLE STOREY						
	FLW floor load width: (m)							FLW floor load width: (m)						
	0.5	1.0	1.5	2.0	2.5	3.0	3.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0
	2.5	4.1	5.7	7.4	9.0	10.6	12.2	11.5	13.1	14.7	16.3	18.0	19.6	21.2
	Loaded Area (FLW x RLW) for Metal Roof													
2.0	3.5	5.1	6.8	8.4	10.0	11.6	13.3	12.5	14.1	15.7	17.4	19.0	20.6	22.2
4.0	4.6	6.2	7.8	9.4	11.0	12.7	14.3	13.5	15.1	16.8	18.4	20.0	21.6	23.3
6.0	5.6	7.2	8.8	10.4	12.1	13.7	15.3	14.6	16.2	17.8	19.4	21.0	22.7	24.3
8.0	6.6	8.2	9.9	11.5	13.1	14.7	16.3	15.6	17.2	18.8	20.5	22.1	23.7	25.3
	Loaded Area (FLW x RLW) for Tiled Roof													
2.0	4.7	6.4	8.0	9.6	11.2	12.9	14.5	13.7	15.3	17.0	18.6	20.2	21.8	23.5
4.0	7.0	8.6	10.2	11.9	13.5	15.1	16.7	16.0	17.6	19.2	20.8	22.5	24.1	25.7
6.0	9.3	10.9	12.5	14.1	15.7	17.4	19.0	18.2	19.9	21.5	23.1	24.7	26.3	28.0
8.0	11.5	13.1	14.8	16.4	18.0	19.6	21.3	20.5	22.1	23.7	25.4	27.0	28.6	30.2

See pages 22 and 23 for explanation of RLW and FLW

Table 13

STRAMIT® FCB3 Brackets Bearers Maximum Concentrated Load capacity (kN)					
Bearer	without FCB3	number of screws with FCB3			
		4	6	8	10
B18219	4.57	25.0	34.4	34.4	34.4
B18224	8.19	28.6	38.8	49.0	59.2
B23519	4.19	24.6	26.3	26.3	26.3
B23524	7.68	28.1	38.3	48.5	53.4
B28319	3.85	21.7	21.7	21.7	21.7
B28324	7.22	27.6	37.8	44.0	44.0



Example 1

data:

single storey (footings: piers), with metal roof.
 single span bearer(B23519), 1.8mspan
 RLW = 5m + 0.5mOH = 5.5m
 FLW = 1.5m (joist span perpendicular to wall:3m)

bearer net length:

1.8m

from Table 12:

8.55kN/m

total concentrated load:

8.55kN/m x 1.8m = 15.4kN

from Table 13,

we need a **FCB3 bracket with 4 screws**
 = 24.6kN > 15.4 ✓OK

Example 2

data:

double storey(footings: piers), with roof tiles.
 continuous double span bearer(B28324), 1.8m span.
 RLW = 6.5m + 0.5mOH = 7.0m
 FLW = 1.5m lower level + 3m upper level = 4.5m

bearer net length:

1.8m

from Table 12:

24.25kN/m

total concentrated load:

24.25kN/m x 1.8m = 43.7kN

from Table 13,

we need a **FCB3 bracket with 8 screws** =44.0kN
 44.0kN > 43.7kN ✓ OK

**Table 14 - Stramit® C-Beam,
Lateral End Racking Capacity (kN/m)**

Stramit® C-Joist and Bearer System	Racking Resistance Capacity (kN/m)
Stramit® Bearer	
B182 -19	21
B235 -19	21
B283 -19	21
B182 -24	44
B235 -24	44
B283 -24	44

**Table 15 - Stramit® Open Web Joist,
Lateral End Restraint Size**

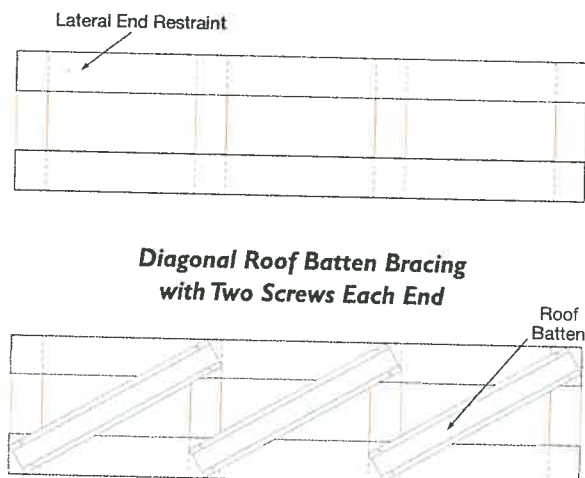
Stramit® Open Web Joist	Lateral End Restraint
250	50 x 75 x 1.0
300	50 x 75 x 1.0
350	50 x 100 x 1.0
400	50 x 100 x 1.0
450	50 x 100 x 1.0

*Where **Stramit® C-joists** are used with **Stramit® C-Bearers** they need no additional lateral restraint.

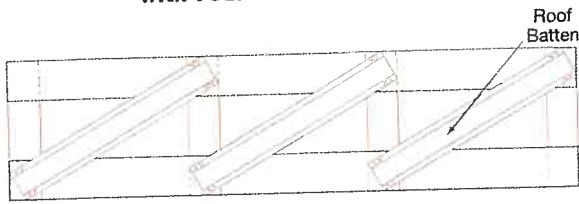
Below are three levels of racking capacity for the **Stramit® Open Web Joist System**.

**Table 16 - Stramit® Open Web Joist,
Lateral End Restraint Racking
Capacity (kN/m)**

Stramit® Open Web Joist Depth (mm)	Lateral End Restraints only	Diagonal Batten Bracing use 2 screws	Diagonal Batten Bracing use 4 screws
250	0.84	4.3	8.5
300	0.69	4.1	8.1
350	0.88	3.9	7.7
400	0.78	3.6	7.2
450	0.68	3.5	6.9



**Diagonal Roof Batten Bracing
with Four Screws Each End**

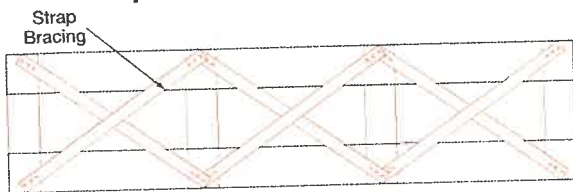


**Table 17 - Stramit® Open Web Joist,
Roof Batten Brace Lengths (mm)**

Stramit® Open Web Joist Size	Roof Batten Length for Bracing
250	529
300	534
350	564
400	584
450	614

Alternative Bracing Method

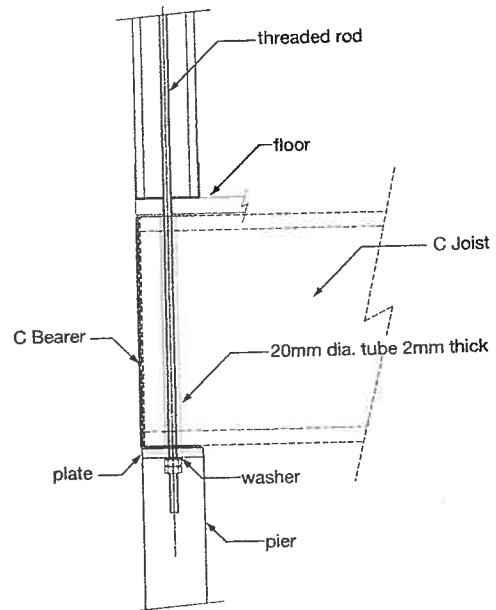
**Diagonal Strap Bracing 30mm x 0.8mm
Requires Three Screws Each End**



**Tie Downs for
Cyclonic Conditions**

All designs in cyclonic areas must be verified by a qualified engineer or building designer.

**Stramit® C-Joist and Bearer System
Cyclonic Tie Down**



**Table 18 - Stramit® C-Joist & Bearer,
Cyclonic Tie Down**

Bolt*	Plate	Tube
M16	50 x 80 x 10	20mm dia. x 2mm thick
M20	50 x 80 x 12	25mm dia. x 2mm thick

Additional Information

As well as our standard range of Technical Manuals, Installation Leaflets, Case Studies and other promotional literature Stramit has a series of Guides to aid design.

These include:

- Concealed Fixed Decking
- Roof Slope Guide
- Foot Traffic Guide
- Roof System Selection Guide
- Bullnosing, Curving and Crimping
- Acoustic Panels
- Cyclonic Areas
- Spring Curving Guide

Other Products

Stramit offers a wide range of building products, including:

- Formwork decking
- Roof and wall sheeting
- Lightweight structural sections
- Truss components
- Gutters and downpipes
- Fascias
- Custom flashings
- Insulating products
- Fasteners



Stramit

Building Products

The Stramit web page can be found at:
www.stramit.com.au
 Details of many **Stramit**® products can also be seen on the RALIA site 'Product Selector' at:
www.selector.com.au

		prices	availability	general	technical
			products coating colours	other	advice product data
contact numbers for information					
SYDNEY 33-83 Quarry Road, Erskine Park NSW 2759	phone fax	(02) 9834 0909 (02) 9834 0988		(02) 9834 0900 (02) 9834 0884	
CANBERRA 4 Bass Street, Queanbeyan NSW 2620	phone fax		(02) 6297 3533 (02) 6297 8089		
COFFS HARBOUR 6 Mansbridge Drive, Coffs Harbour NSW 2450	phone fax		(02) 6652 6333 (02) 6651 3395		(02) 9834 0900 (02) 9834 0977
NEWCASTLE 17 Nelson Road, Cardiff NSW 2285	phone fax		(02) 4954 5033 (02) 4954 5856		
ORANGE 51 Leewood Drive, Orange NSW 2800	phone fax		(02) 6361 0444 (02) 6361 9814		
MELBOURNE - KILSYTH 180-186 Colchester Road, Kilsyth VIC 3137	phone fax	(03) 9721 8333		(03) 9721 8333 (03) 9721 8347	
MELBOURNE - BAYSWATER 491 Mountain Highway, Bayswater VIC 3153	phone fax	(03) 9722 5555 (03) 9722 5519	(03) 9722 5500		
MELBOURNE - PRESTON 219 Dundas Street, Preston VIC 3072	phone fax		(03) 9484 0193 (03) 9484 5060		
MELBOURNE - MULGRAVE 2 Faigh Street, Mulgrave VIC 3170	phone fax		(03) 9484 0193 (03) 9484 5060		(03) 9722 5599 (03) 9722 5598
ALBURY 18 Ariel Drive, Albury NSW 2640	phone fax		(02) 6041 7600 (02) 6041 7666		
BENDIGO Ramsay Court, Kangaroo Flat VIC 3555	phone fax		(03) 5447 8455 (03) 5447 9677		
HOBART 57 Crooked Billett Drive, Brighton TAS 7030	phone fax		(03) 6263 5536 (03) 6263 6950		(03) 6263 5536 (03) 6263 6950
LAUNCESTON 9 Richard Street, Western Junction TAS 7212	phone fax		(03) 6391 9293 (03) 6391 8774		
ADELAIDE 11 Stock Road, Cavan SA 5094	phone fax		(08) 8262 4444 (08) 8262 6333		(08) 8262 4444 (08) 8262 6333
BRISBANE 57-71 Platinum Street, Crestmead QLD 4132	phone fax		(07) 3803 9999 (07) 3803 1499		
TOWNSVILLE 402-408 Bayswater Road, Garbutt QLD 4814	phone fax		(07) 4779 0844 (07) 4775 7155		
CAIRNS Vickers Street, Edmonton QLD 4869	phone fax		(07) 4045 3069 (07) 4045 4762		
MACKAY Brickworks Court, Glenella QLD 4741	phone fax		(07) 4942 3488 (07) 4942 2343		(07) 3803 9999 (07) 3803 1499
MARYBOROUGH 10 Activity St, Maryborough QLD 4650	phone fax		(07) 4121 2433 (07) 4123 3139		
GLADSTONE 25 Beckinsale St, Gladstone QLD 4680	phone fax		(07) 4972 8455 (07) 4972 8355		
ROCKHAMPTON 41 Johnson St, Parkhurst QLD 4702	phone fax		(07) 4936 2577 (07) 4936 4603		
SUNSHINE COAST Unit 1, 5 Kerryl St, Kunda Park QLD 4556	phone fax		(07) 5456 4083 (07) 5456 4862		
MURWILLUMBAH 6 Kay Street, Murwillumbah NSW 2484	phone fax		(02) 6672 8542 (02) 6672 6798		
DARWIN 55 Albatross Street, Winnellie NT 0820	phone fax		(08) 8947 0780 (08) 8947 1577		
PERTH 605-615 Bickley Road, Maddington WA 6109	phone fax			(08) 9493 8800 (08) 9493 8899	
BUNBURY 25 Proffit Street, Bunbury WA 6230	phone fax			(08) 9721 8046 (08) 9721 8017	

© Registered trademarks of Stramit Corporation Pty Limited. ABN 57 005 010 195 trading as Stramit Building Products
 A member of the Fletcher Building Group
 COLORBOND® and ZINCALUME® are registered trademarks of BlueScope Steel Limited
 © Stramit Corporation Pty. Limited May 2008.

This document replaces all previous issues. Please destroy, or clearly mark as superseded, all previous issues.



Holding Tank

Fibreglass Double Wall

Technical Data Sheet

F 980 REV D

DOUBLE WALL FIBREGLASS STORAGE TANKS

Tank Solutions Pty Ltd is the market leader in the manufacture of Double Wall Fibreglass Storage Tanks.

Our Double Wall Fibreglass Tanks offer a full 360-degree secondary containment with a variety of monitoring devices, which can be installed in the interstitial space between the two walls. Due to the unique integral rib design, Double Wall Fibreglass Tanks are the strongest, most robust underground tanks available. They are rust-proof, maintenance free and formulated to be compatible with all petroleum fuel products, alcohols and alcohol-gasoline mixtures. By choosing a Tank Solutions Double Wall Fibreglass Storage Tank, you can be assured of maximum protection in the unlikely event of a leak in the primary wall therefore preventing ground water contamination. Capacities range from 2,000 litres to 110,000 litres.

Double Wall Multi-Compartment tanks are also available in a wide variety of sizes and feature a choice of two or three completely separate compartments within one tank. This enables the storage of multiple products within the same tank.

DOUBLE WALL FIBREGLASS TANK FEATURES

Suitable for a wide range of liquids:

- Petroleum, Petrochemical and Chemical applications

Strength, Durability and Safety:

- All Tank Solutions Fibreglass Tanks are constructed of virgin resin and glass fibre reinforcement
- All Tank Solutions Tanks incorporate integral ribs for maximum strength
- All Tank Solutions Fibreglass Tanks undergo stringent testing during manufacture
- All Tank Solutions Tanks carry a 30 year warranty against structural failure, internal and external corrosion

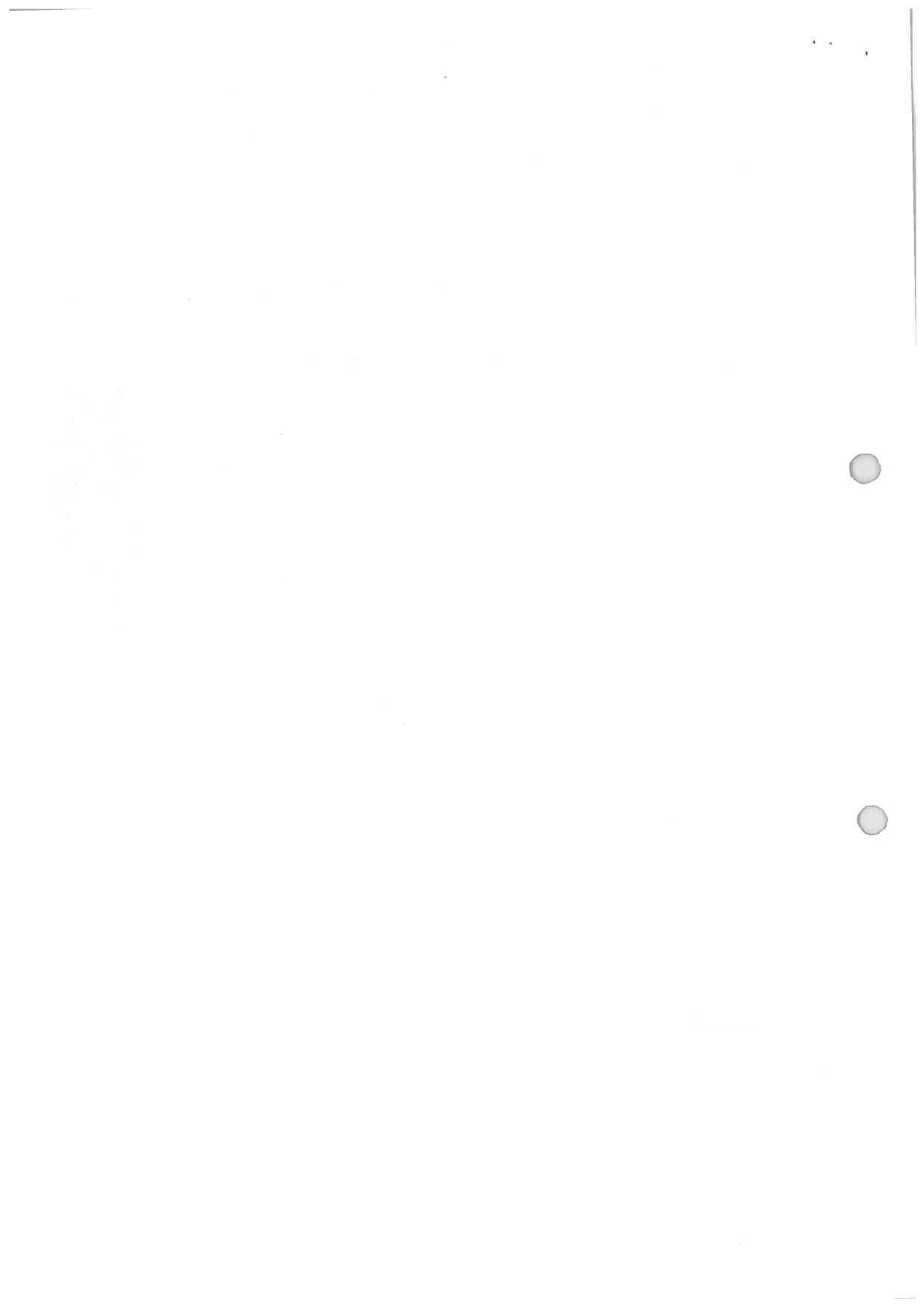
A standard of consistent quality:

- Manufactured to meet or exceed industry and statutory requirements:
 - UL 1316
 - AS1692

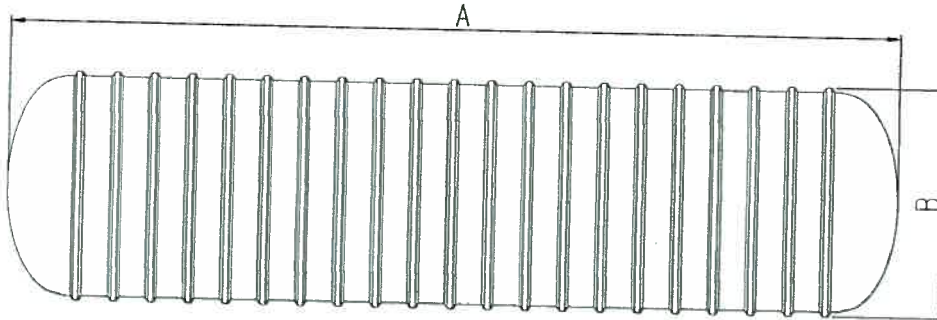
COMPANY FEATURES

- Australian owned and operated
- Application and installation technical support
- Extensive manufacturing experience
- Full range of optional equipment and accessories to suit the complete project

Fibreglass Tanks



DIMENSIONS AND CAPACITIES



Type	Nominal Capacity Litres	Double Wall Actual Capacity Litres	Length Overall 'A' mm	External Diameter 'B' mm	Double Wall Shipping Weight Kg	No. of Straps
DWII T2	2,000	2,400	1,700	1470	300	2
DWII T5	5,000	5,100	3,300	1470	500	2
DWII T10	10,000	13,200	3,295	2600	1,300	2
DWII T15	15,000	15,200	3,720	2600	1,500	2
DWII T20	20,000	21,300	4,995	2600	1,900	2
DWII T25	25,000	25,400	5,845	2600	2,200	2
DWII T30	30,000	29,500	6,695	2600	2,500	4
DWII T40	40,000	39,700	7,970	2600	2,900	4
DWII T45	45,000	45,800	8,820	2600	3,200	4
DWII T50	50,000	49,800	10,095	2600	3,600	4
DWII T55	55,000	56,000	10,945	2600	3,900	6
DWII T60	60,000	60,000	12,200	2600	4,300	6
DWII T70	70,000	69,400	13,070	2600	4,600	6
DWII T80	80,000	79,200	9,994	3275	4,200	4
DWII T90	90,000	89,000	11,254	3275	4,700	4
DWII T100	100,000	102,000	12,514	3275	5,100	6
DWII T110	110,000	108,600	14,194	3275	5,600	6
					6,700	7

Weights, Capacities & Dimensions are nominal only

Custom manufactured tanks can be supplied upon request

Tanks are supplied as standard with:

- Access Manways, Riser and Standard Cover (for pressure systems only)
- Hold Down Straps and Lifting Lugs
- Fill, Dip, Vent, Suction, Spare Point, Dipstick and Striker Plates
- Non Slip Surface on Tank Top • Tag Lines (Guide Rope)

Options and accessories available on request include:

- Water Tight Riser Cover • Dry and Wet Monitoring System • Driveway Covers
- Concrete Anchors and Hold Down Hardware for Bottom Anchoring
- Access Manways, Fabricated Steel Cover complete with 5 Sockets

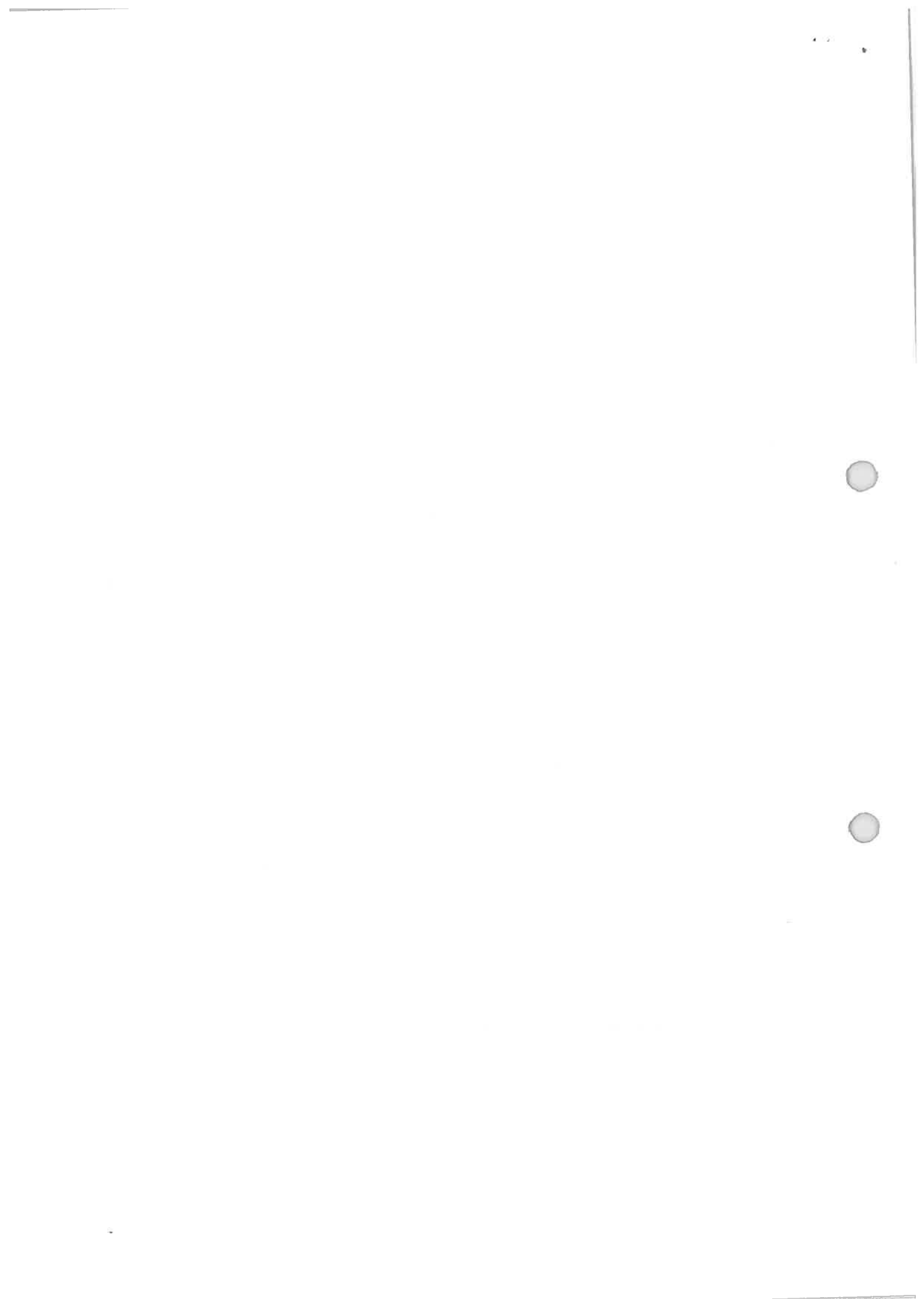
Tank Solutions Pty Ltd

ABN 59 142 807 949

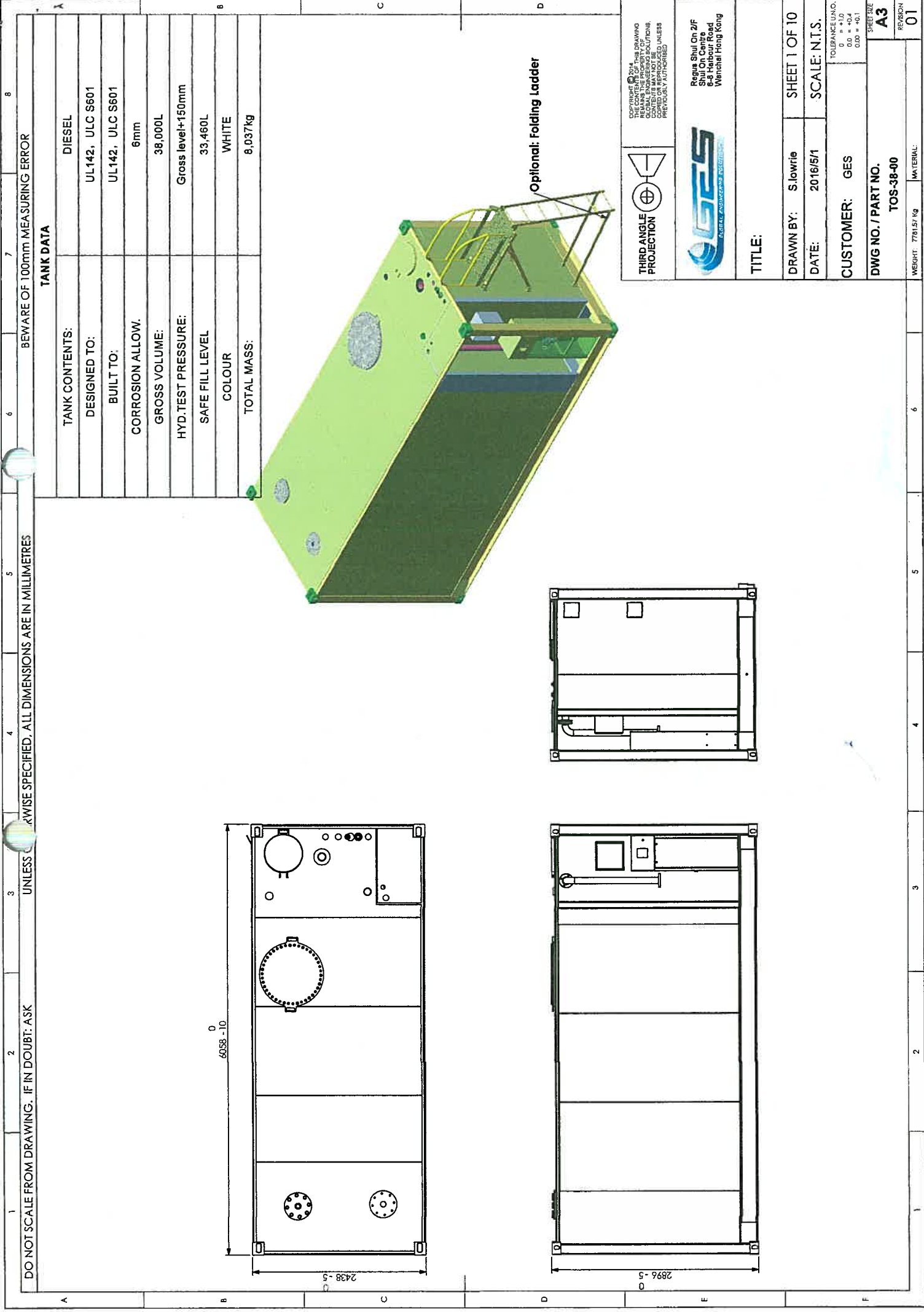
e sales@tanksolutions.com.au w www.tanksolutions.com.au

New South Wales: 513 Tomago Road, Tomago, NSW 2322. PO Box 623, Raymond Terrace, NSW 2324. p 61 2 4964 8270 f 61 2 4964 8522

Queensland: Unit 3, 40 Ingleston Road, Wakerly, Qld 4154. p 61 7 3390 4800 f 61 7 3390 4667



35,000L diesel tank



BEWARE OF 100mm MEASURING ERROR

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETRES

DO NOT SCALE FROM DRAWING. IF IN DOUBT, ASK

TANK DATA

TANK CONTENTS:	DIESEL
DESIGNED TO:	UL142, ULC S601
BUILT TO:	UL142, ULC S601
CORROSION ALLOW.	6mm
GROSS VOLUME:	38,000L
HYD. TEST PRESSURE:	Gross level ± 150mm
SAFE FILL LEVEL	33,460L
COLOUR	WHITE
TOTAL MASS:	8,037kg

Optional Folding Ladder



COPYRIGHT © 2014, ALL RIGHTS RESERVED. THIS DRAWING REMAINS THE PROPERTY OF GBS. IT IS TO BE USED ONLY FOR THE PROJECT SPECIFICALLY IDENTIFIED. ANY REPRODUCTION, COPIED OR REPRODUCED UNLESS PREVIOUSLY AUTHORIZED.



Regus Shui On 2/F
Shui On Centre
6-8 Henbour Road
Wanchai Hong Kong

TITLE:

DRAWN BY: Slowrie
DATE: 2016/5/1
SCALE: N.T.S.

CUSTOMER: GES

DWG NO. / PART NO.
TOS-38-00

WEIGHT: 7781.57 kg MATERIAL:

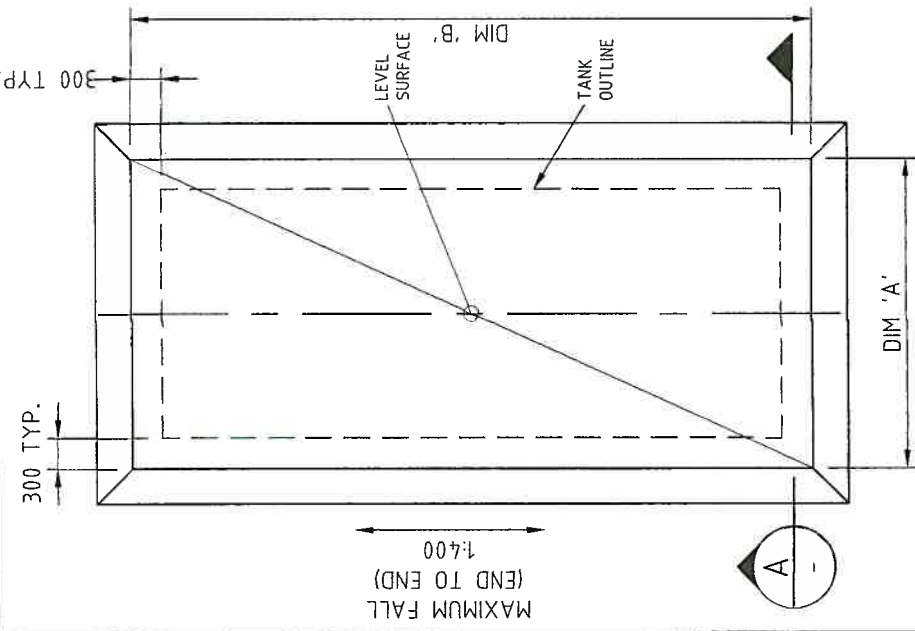
SHEET NO. **A3**

REVISION **01**

TOLERANCE UNLESS OTHERWISE SPECIFIED:
0.00 = ±0.0
0.00 = ±0.1



1 2 3 4 5 6 7 8

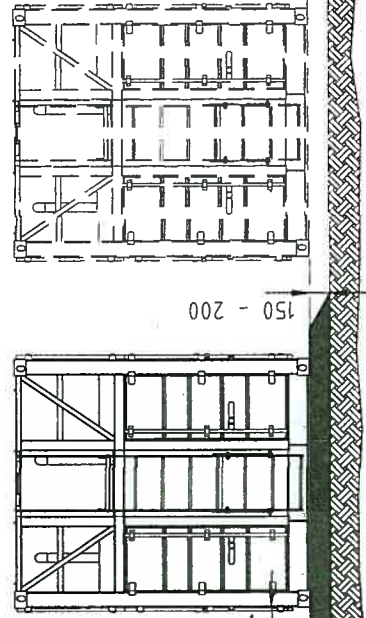


- NOTES:**
1. REMOVE EXISTING GRASS/VEGETATION FROM FOUNDATION AREA AND TRIM LEVEL.
 2. COMPACT EXISTING SUB-GRADE TO 100% OF MATERIAL'S MAX. DRY DENSITY TO AS 1289.
 3. TOP COURSE - 150-200mm MIN. THICK CBR45 ROADBASE PLACED IN MOIST 150-200mm LAYERS & COMPACTED TO 95% MODIFIED COMPACTION.
 4. TRIM SURFACE LEVEL AFTER COMPACTION TO TOLERANCES AS SPECIFIED.
 5. IN ALL CASES, THE TANKS MUST REST ON ALL 4 CORNERS WHEN PLACED ON THE FINISHED FOUNDATION.
 6. IT IS VERY IMPORTANT THAT THE TANKS BE INSTALLED ON A STABLE FOUNDATION WHICH WILL ADEQUATELY SUPPORT THE TANKS. WHERE MULTIPLE TANKS ARE INSTALLED AND PIPED TOGETHER, IT IS PARTICULARLY IMPORTANT THAT THERE IS NO DIFFERENTIAL SETTLEMENT BETWEEN TANKS.

TANK	NUMERICAL DIMENSIONS L x W x H (mm)	APPROX EMPTY WEIGHT (KG)	APPROX FULL WEIGHT (KG)	DIM 'A' MIN. (mm)	DIM 'B' MIN. (mm)
T12	3000 x 2440 x 2900	5000	14070	3040	3600
ST20	6000 x 2440 x 2600	9000	24120	3040	6600
T20	6000 x 2440 x 2900	9000	24120	3040	6600
T30/ST25/ST30	6000 x 2440 x 2900	9000	31680	3040	6600
T55	12200 x 2440 x 2900	16000	57580	2940	12800
T68/ST60/ST66	12200 x 2440 x 2900	16000	67490	2940	12800
T80	14630 x 2440 x 2900	18500	78980	3040	15200
T90	14630 x 2440 x 2900	18500	86540	3040	15200
T100	12200 x 3040 x 3400	18500	94100	3640	12800
T105	14630 x 2500 x 3200	18500	97880	3040	15200
T108E	13110 x 3040 x 3500	19500	101150	3640	13600
DGS	2000 x 2500 x 2850	1000	5000	3040	2600
DGM	6000 x 2500 x 2850	3000	20000	3040	6600

NOTE: FULL WEIGHT BASED ON DIESEL PRODUCT AND INCLUDES TYPICAL DISPENSING EQUIPMENT.

UNCONTROLLED COPY



COMPACTED CBR45
- SEE NOTES
COMPACTED EXISTING SUBGRADE

CAUTION
THIS DRAWING IS INTENDED AS A GUIDE ONLY. USERS SHOULD CONSIDER SITE SOIL CONDITIONS AND OBTAIN INDEPENDENT ADVICE PRIOR TO INSTALLATION.

SECTION A
1:50

<p>DOCUMENT UNCONTROLLED UNLESS STAMPED OTHERWISE WHEN CONTROLLED - COPY ISSUED TO ALL ON DISTRIBUTION STAMP</p>		<p>CONSULTANT PANEL</p>		<p>3RD ANGLE PROJECTION UNDO</p>	
<p>PROJECT TRANSTANK</p>		<p>TITLE TRANSTANK STANDARD DRAWING GENERIC TANK FOUNDATION</p>		<p>SCALE - 1:50</p>	
<p>REV. DATE</p>		<p>DESCRIPTION</p>		<p>DWG. No.</p>	
<p>DRAWN (CHECKED) ENGR APP'D</p>		<p>REFERENCE DRAWINGS</p>		<p>DWG. No.</p>	
<p>D 22.11.10 ST. TANKS ADDED</p>		<p>IB</p>		<p>IB</p>	
<p>C 19.11.10 TIME ADDED</p>		<p>IB</p>		<p>IB</p>	
<p>B 09.11.10 DGS & DGM ADDED</p>		<p>IB</p>		<p>IB</p>	
<p>A 06.09.07 ORIGINAL ISSUE</p>		<p>IB</p>		<p>IB</p>	
<p>TT-SD00-19004</p>		<p>TT-SD00-19004</p>		<p>REVISION</p>	
<p>SCALE - 1:50</p>		<p>SCALE - 1:50</p>		<p>SCALE - 1:50</p>	
<p>TT-SD00-19004</p>		<p>TT-SD00-19004</p>		<p>TT-SD00-19004</p>	
<p>TT-SD00-19004</p>		<p>TT-SD00-19004</p>		<p>TT-SD00-19004</p>	

1 2 3 4 5 6 7 8



UPSS Precision Test Report
Report Number
1807241



Customer;

Xpress Group
Attention: Mark Bassal
15/3 Lancaster St,
Ingleburn NSW 2565

Site Name & Address;
Glen Rest Tourist Park
9807 New England Highway
Glen Innes NSW

Test Date;
24th July 2018

Reason for testing;
Integrity testing of all Underground tanks and Fuel lines

Executive Summary

NEO Consulting was asked to perform integrity testing of the 3 underground fuel storage tanks and their associated fuel suction lines. The ULP 1 tank had a single fuel suction line, but it had outlets for 2 bowzers. The PULP 2 tank had a single fuel suction line and a single outlet for a bowser. The DSL 3 tank also had a single fuel suction line which supplied a single bowser.

LINE TESTS:

All fuel suction lines were tested with the EPA approved, Acurite™ Pipeline tester. The lines were tested at 1BAR of pressure with nitrogen gas. A sustained leak rate of 0.01 US gallons per hour (GPH) or higher is considered a failure. If, in the first 30min, a line has an apparent leak rate higher than 0.01 GPH then the test is continued until the apparent leak rate drops below the 0.01 GPH threshold. However, if the leak rate stabilizes above the 0.01 GPH threshold then a failure is recorded. [0.01 GPH = 37.85mil/hr]

The line from the ULP 1 tank to the ULP bowzers.....FAILED with an apparent leak rate of 60mil/hr

The line from the PULP 2 tank to the PULP bowser.....FAILED with an apparent leak rate of 140mil/hr

The line from the DSL 3 tank to the DSL bowser.....FAILED with a leak rate too fast to measure.

TANK TESTS:

All 3 underground fuel storage tanks were vacuumed and subjected to the EPA approved MESA 2-D acoustical tightness test. All tanks were plugged at their dip/fill points and were vacuumed and tested through their vents.

Results: All 3 tanks FAILED

Conclusions

It is obvious that the DSL foot valve at the tank end of the line is not holding. This explains why both the line and tank failed. While under vacuum the DSL tank is drawing fuel/air back into the tank. It doesn't mean that the DSL tank and fuel suction line don't have leaks but it does mean that even if neither is leaking they wouldn't pass. It's possible that the other tanks and fuel suction lines are suffering the same foot valve problems. All it would take is the foot valves no longer seal or are seated properly due to their age or how long they have been out of use.

Recommendations

All of the fuel suction lines appeared to be quite rusted, due to their age, even if they have only failed on the day because of faulty foot valves during the test, it might be worth replacing them before future problems develop.

It is recommended that the tanks themselves have their tank tops exposed and have all of their pipe work including their vents and fuel lines disconnected so that the tanks themselves can be retested in isolation. The site should monitor the Statistical Inventory Reconciliation Analysis (SIRA) to maintain the Underground Petroleum Storage System (UPSS) integrity and ensure any potential anomalies are detected immediately once in operation.

It is also recommended that a Tank and Line integrity routine test be implemented once every 3 years as recommended in the Australian Standards AS 4897-2008 to ensure the site complies with the UPSS regulation 2008.

Aim

determine the integrity of all underground infrastructure.

Method

Implementing methods that as a minimum meet the AS 4897-2008. NEO use and operate the MESA 2-D system which is capable of detecting a leak of 0.38 L per hour, with a probability of detection of at least 0.95 and a probability of false detection of 0.05 or less.

Addendum

All tests are conducted by competent and experienced persons who provide qualification verification cards and are made readily available to the client. The MESA 2-D system has been independently certified as meeting the USEPA standard evaluation for tank tightness testing methods.

Onsite photos & Technicians notes:

The PULP and DSL tanks are both only covered by gravel and the ULP tank appears only to have its top covered by concrete. With none of the tanks being underneath large concrete slabs, it would be relatively quick and easy for soil sampling to be done close to these tanks at a depth of 2.5m to 3m in order to find any potential contamination caused by leaks and also undertake repairs or replacement of faulty foot vales.

As a final note, The PULP 2 and DSL 3 tanks didn't have dip sticks in them so the ULP 1 tank's dipstick was used to find the fuel level etc, but the amount of fuel in litres was estimated based on how high the fuel level was up the stick. This report says there is 7,000L of fuel in the DSL tank for instance, but there may have been more or less in reality. Also the site didn't have ground water monitoring wells so the ground water was assumed to be below the tank bottoms but this may not be the case.



MESA 2-D Tank Test

metric

Job No: 1807241	Customer: Xpress Group
Date: 7/24/2018	Location/Site Address: 9807 New England Hwy, Glenn Innes
Technician: Chris	Phone:
Lic./Cert.#: M/AU221	Facility ID: Glenn Rest Tourist P... Province: NSW

Tank Testing Results Summary			
Tank Number	Capacity	Contents	MESA 2-D Test Result
ULP 1	27,600	ULP (Unleaded Petrol)	FAIL by MESA
PULP 2	4,500	Premium/Super	FAIL by MESA
DSL 3	10,000	Diesel	FAIL by MESA

Comments:

NEO Consulting was asked to perform integrity testing of the 3 underground fuel storage tanks and their associated fuel suction lines. The ULP 1 tank had a single fuel suction line, but it had outlets for 2 bowsers. The PULP 2 tank had a single fuel suction line and a single outlet for a bowser. The DSL 3 tank also had a single fuel suction line which supplied a single bowser.

LINE TESTS:

All fuel suction lines were tested with the EPA approved, Acurite™ Pipeline tester. The lines were tested at 1BAR of pressure with nitrogen gas. A sustained leak rate of 0.01 US gallons per hour (GPH) or higher is considered a failure. If, in the first 30min, a line has an apparent leak rate higher than 0.01 GPH then the test is continued until the apparent leak rate drops below the 0.01 GPH threshold. However, if the leak rate stabilizes above the 0.01 GPH threshold then a failure is recorded. [0.01 GPH = 37.85mil/hr]

Results:

The line from the ULP 1 tank to the ULP bowsers FAILED with an apparent leak rate of 60mil/hr
 The line from the PULP 2 tank to the PULP bowser FAILED with an apparent leak rate of 140mil/hr
 The line from the DSL 3 tank to the DSL bowser FAILED with a leak rate too fast to measure.

TANK TESTS:

All 3 underground fuel storage tanks were vacuumed and subjected to the EPA approved MESA 2-D acoustical tightness test. The tanks were plugged at their dip/fill points and were vacuumed and tested through their vents.

Results:

All 3 underground tanks FAILED

The ULP and PULP fuel suction lines were tested first. Both of these lines failed due to either/or leaks in the lines themselves or product draining back into their respective tanks. Neither of these lines were able to hold pressure. The ULP 1 tank was then tested. Although the tank held vacuum and no sounds could be heard by technicians with headphones the Sonde did fail the tank. The next tank to be tested was the PULP 2 tank. This tank also held vacuum but failed the acoustical test and technicians could hear a infrequent "drip sound" when listening manually. The DSL 3 tank was then tested. Again, this tank held vacuum but there was an obvious dripping sound present when the tank was put under vacuum. While this tank was under vacuum the DSL fuel suction line was put under test and as this happened the "dripping sound" changed to what sounded like a very loud gush of product back into the tank.

Conclusions:

It is obvious that the DSL foot valve at the tank end of the line is not holding. This explains why both the line and tank failed. While under vacuum the DSL tank is drawing fuel/air back into the tank. It doesn't mean that the DSL tank and fuel suction line don't have leaks but it does mean that even if neither is leaking they wouldn't pass. It's possible that the other tanks and fuel suction lines are suffering the same foot valve problems. All it would take is that all three foot valves are no longer sealing or seated properly due to their age or how long they have been out of use.

Recommendation:

All of the fuel suction lines appeared to be quite rusted, due to their age, even if they have only failed on the day because of faulty foot valves during the test, it might be worth replacing them before future problems

develop.

It is recommended that the tanks themselves have their tank tops exposed and have all of their pipe work including their vents and fuel lines disconnected so that the tanks themselves can be retested in isolation.

The PULP and DSL tanks are both only covered by gravel and the ULP tank appears only to have its top covered by concrete. With none of the tanks being underneath large concrete slabs, it would be relatively quick and easy for soil sampling to be done close to these tanks at a depth of 2.5m to 3m in order to find any potential contamination caused by leaks.

As a final note, The PULP 2 and DSL 3 tanks didn't have dip sticks in them so the ULP 1 tank's dipstick was used to find the fuel level etc, but the amount of fuel in litres was estimated based on how high the fuel level was up the stick. This report says there is 7,000L of fuel in the DSL tank for instance, but there may have been more or less in reality. Also the site didn't have ground water monitoring wells so the ground water was assumed to be bellow the tank bottoms but this may not be the case.

MESA 2-D Tank Test

Job No: 1807241	Customer: Xpress Group
Date: 7/24/2018	Location/Site Address: 9807 New England Hwy, Glenn Innes
Technician: Chris	Phone:
Lic./Cert.#: M/AU221	Facility ID: Glenn Rest Tourist Park Province: NSW

General Tank Information Underground Storage Tank Steel

Tank# ULP 1	Location between forecourt canopy and road	Retest? No	Isolated? No
Product: ULP (Unleaded Petrol)	Capacity: 27,600 liters	Diameter: 220	centim.
Start Total Liquid: 48.000		Bottom To Grade: 290	
Start Water (cm.): 15.500		Product in Tank: 32.500	Depth of Ground Water from surface, 290.000 (if found)
Start Fuel (cm.): 32.500		Water in Tank: 15.500	
Prod. specific gravity: 0.7300			
Tank bottom to grade: 290			
Minimum depth of sample required to test ground water (includes 5 cm. add'l)	255.855		

Pressure Sensor Calculation (Tank #ULP 1)

Depth of Groundwater from Grade: 290.000	Depth of Groundwater Determined: by: None found
Centimeters of Water Outside Tank: 0.000	where:
	60.000 Normal Pressure
	60.000 Inches of Water Column
Test Pressure:	14.914 Kilopascals

Water Sensor Calibration (Tank #ULP 1)

Added:	Calibration #1	Calibration #2	Calibration #3	Average:
Average ÷ 3780= "A" factor:			÷ 0.05	= Time of Test:
Water Test Intrusion Period	Test Began:		Test Ended:	

Mesa 2-D Test Results (Tank #ULP 1)

Sonde Serial #	SBO 183	Calibration Test:
Vacuum Pressure Start: 60		Vacuum Pressure Finish: 60
Vacuum Start Time: 12:10PM	Vacuum Finish Time: 12:30PM	Total Vacuum Time: 20min
MESA 2-D Result: FAIL by MESA		
End Total Liquid: 48.000	End Water: 15.500	End Fuel: 32.500

MESA 2-D Tank Test

Job No: 1807241	Customer: Xpress Group
Date: 7/24/2018	Location/Site Address: 9807 New England Hwy, Glenn Innes
Technician: Chris	Phone:
Lic./Cert.#: M/AU221	Facility ID: Glenn Rest Tourist Park Province: NSW

General Tank Information

Underground Storage Tank

Steel

Tank# PULP 2	Location near DSL bowser	Retest? No	Isolated? No
Product: Premium/Super	Capacity: 4,500 liters	Diameter: 190	centim.
Start Total Liquid: 4.600			
Start Water (cm.): 4.600			
Start Fuel (cm.): 0.000			
Prod. specific gravity: 0.7370	Product in Tank: 0.000		
Tank bottom to grade: 232	Water in Tank: 4.600		
Minimum depth of sample required to test ground water (includes 5 cm. add'l): 232.480			

Pressure Sensor Calculation

(Tank #PULP 2)

Depth of Groundwater from Grade: 232.000	Depth of Groundwater Determined: by: None found
Centimeters of Water Outside Tank: 0.000	where:
Test Pressure:	60.000 Normal Pressure
	Pressure Adjustment
	60.000 Inches of Water Column
	14.914 Kilopascals

Water Sensor Calibration

(Tank #PULP 2)

Added:	Calibration #1	Calibration #2	Calibration #3	Average:
Average ÷ 3780 = "A" factor:			÷ 0.05	= Time of Test:
Water Test Intrusion Period	Test Began:		Test Ended:	

Mesa 2-D Test Results

(Tank #PULP 2)

Sonde Serial #	SBO 183	Calibration Test:	
Vacuum Pressure Start:	60	Vacuum Pressure Finish:	60
Vacuum Start Time:	2:20PM	Vacuum Finish Time:	2:40PM
		Total Vacuum Time:	20min
MESA 2-D Result: FAIL by MESA			
End Total Liquid:	4.600	End Water:	4.600
		End Fuel:	0.000

MESA 2-D Tank Test

Job No: 1807241	Customer: Xpress Group
Date: 7/24/2018	Location/Site Address: 9807 New England Hwy, Glenn Innes
Technician: Chris	Phone:
Lic./Cert.#: M/AU221	Facility ID: Glenn Rest Tourist Park Province: NSW

General Tank Information Underground Storage Tank Steel

Tank# DSL 3	Location furthest tank from shop	Retest? No	Isolated? No
Product: Diesel	Capacity: 10,000 liters	Diameter: 200	centim.
Start Total Liquid: 122.000			
Start Water (cm.): 0.000			
Start Fuel (cm.): 122.000			
Prod. specific gravity: 0.8600	Product in Tank: 122.000		
Tank bottom to grade: 246	Water in Tank: 0.000	Bottom To Grade: 246	Depth of Ground Water from surface, 246.000 (if found)
Minimum depth of sample required to test ground water (includes 5 cm. add'l)	146.160		

Pressure Sensor Calculation (Tank #DSL 3)

Depth of Groundwater from Grade: 246.000	Depth of Groundwater Determined: by: None found
Centimeters of Water Outside Tank: 0.000	where:
Test Pressure:	60.000 Normal Pressure
	60.000 Inches of Water Column
	14.914 Kilopascals

Water Sensor Calibration (Tank #DSL 3)

Added:	Calibration #1	Calibration #2	Calibration #3	Average:
Average ÷ 3780 = "A" factor:			÷ 0.05	= Time of Test:
Water Test Intrusion Period	Test Began:		Test Ended:	

Mesa 2-D Test Results (Tank #DSL 3)

Sonde Serial #	SBO 183	Calibration Test:
Vacuum Pressure Start: 60	Vacuum Pressure Finish: 60	
Vacuum Start Time: 3:00PM	Vacuum Finish Time: 3:20PM	Total Vacuum Time: 20min
MESA 2-D Result: FAIL by MESA		
End Total Liquid: 122.000	End Water: 0.000	End Fuel: 122.000

RGS31708.1-AA

13 November 2018

East West Enviroag Pty
82 Plain Street
TAMWORTH NSW 2340

Attention: Steve Mitchell

Dear Steve

**RE: Proposed Office & Shop – 9807 New England Highway, Glen Innes
Geotechnical Site Classification**

1 INTRODUCTION

At the request of East West Enviroag Pty Ltd (East West), Regional Geotechnical Solutions Pty Ltd (RGS) has completed a geotechnical assessment for the proposed new office and shop structure that is to replace part of the existing building at the Glen Rest Tourist Park, Glen Innes.

The provided drawings indicate that the new structure is to be supported on pad, strip or shallow bored piles and it has been assumed that the performance expectations of AS2870-2011 are acceptable for the proposed structure.

The purpose of the geotechnical assessment was to provide a site classification in accordance with AS2870-2011 *Residential Slabs and Footings*, to assist in the design of foundations for the proposed structure.

The assessment presented herein was undertaken based on the information provided by East West as summarised below.

- Two borehole logs, dated 23 October 2018;
- Figure showing the borehole locations;
- A laboratory shrink-swell test result sheet; and
- Two site photographs.

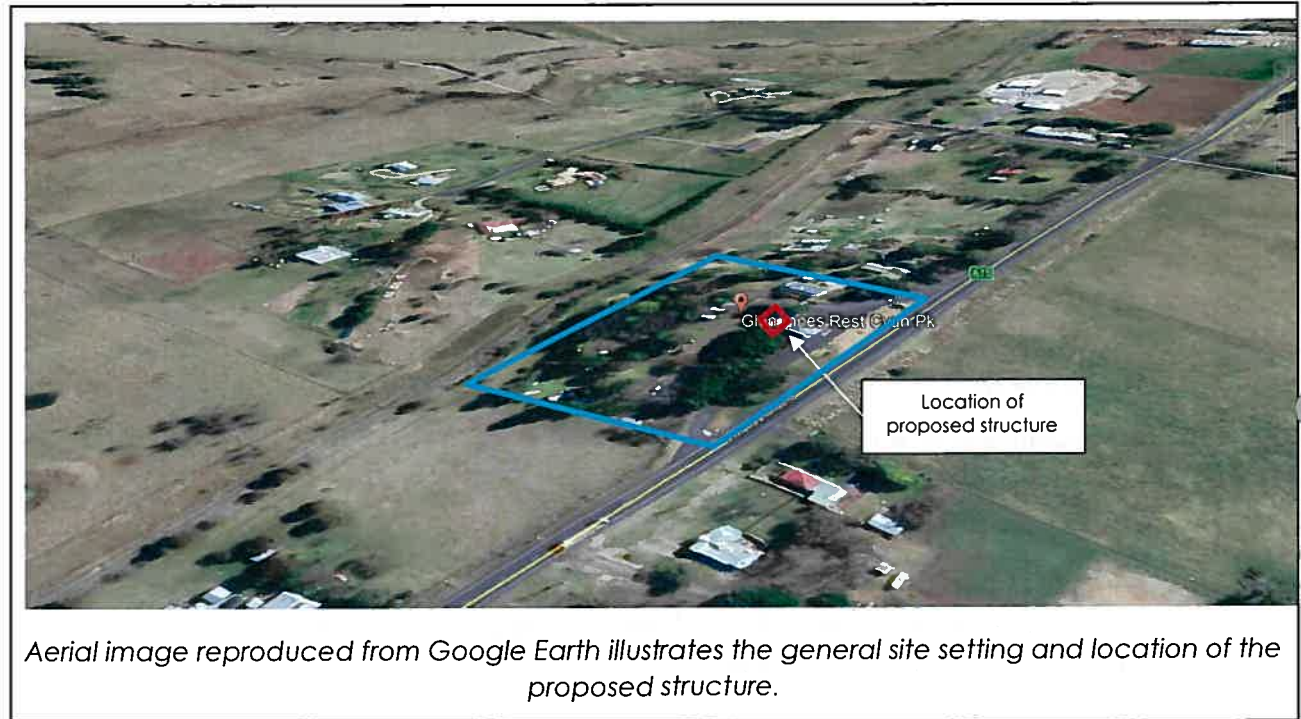
2 FIELDWORK

The site investigation work was undertaken by East West, the results of which are presented in the attachments. The investigations included the drilling of two boreholes (BH1 and BH2) which were drilled at the locations shown on the attached Figure.

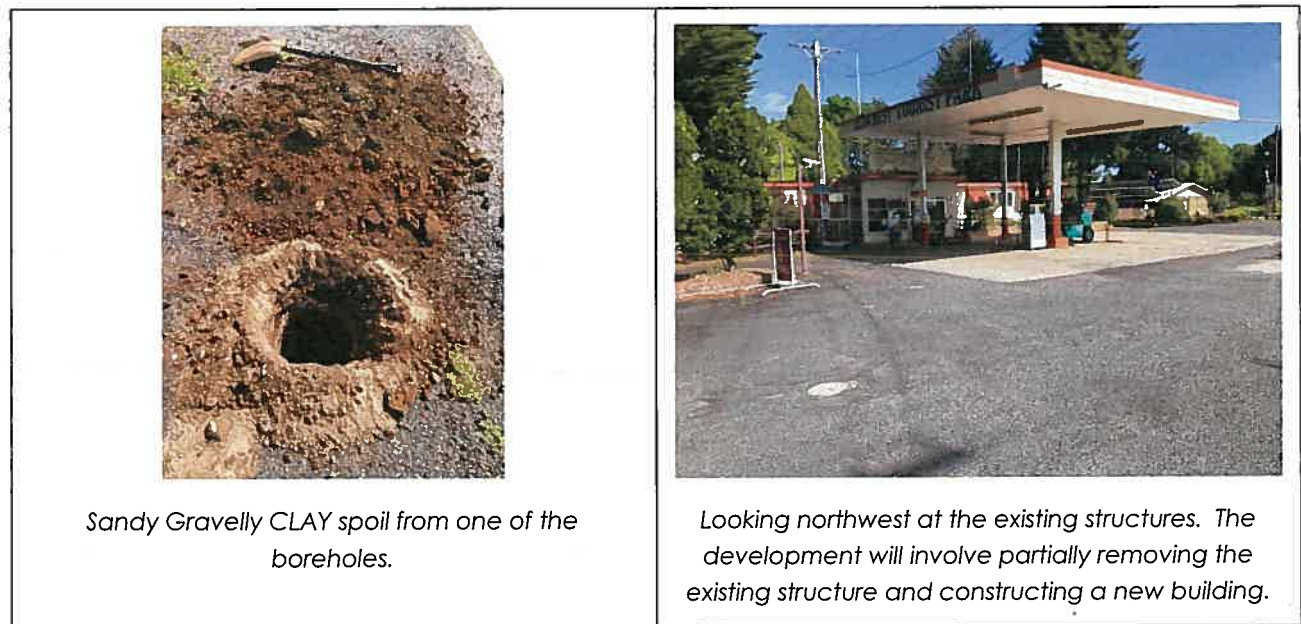


3 SITE CONDITIONS

The site is located within residual terrain that grades gently down to the west. The aerial image below reproduced from Google Earth illustrates the general site setting and location of the proposed structure relative to other site facilities.



The proposed development will involve demolishing part of the existing structure and constructing a new office and shop between the existing amenities buildings and the existing canopy. The provided photographs (presented below) indicate that the site is gently sloping with sealed hardstand. Mature trees are located within an estimated 10m of the proposed structure. Typical site photographs are presented below.





The 1:250,000 Grafton Geology Map indicates the site is underlain by basalts and dolerites.

The investigations undertaken by East West indicate that the subsurface profile comprises stiff medium plasticity Sandy Gravelly CLAY and high plasticity CLAY to at least the maximum depth of the investigation of 1.8m. Sandy GRAVEL was encountered in the upper 0.4m in BH2. Groundwater was not encountered during drilling. Further details are presented on the attached borehole logs.

Laboratory testing indicates that a sample of the Sandy Gravelly CLAY from BH2 has a shrink-swell index of 1%. A laboratory test result sheet is attached.

4 SITE CLASSIFICATION AND SHRINK-SWELL RELATED SURFACE MOVEMENTS

AS2870-2011, 'Residential Slabs and Footings', sets out criteria for the classification of a site and the design and construction of a footing system for a single dwelling house, townhouse or similar structure. The site classification presented herein is provided on the basis that the performance expectations of AS2870-2011 are acceptable for the proposed structure.

The site classification is based on the following:

- Depth of design suction change of $H_s=1.8\text{m}$;
- Crack depth multiplication factor of 0.5;
- Change in suction at design surface level of $\Delta u=1.2$;
- Shrink-swell index of 1% for the stiff Sandy Gravelly CLAY that extends to a depth of at least 1.0m;
- Shrink-swell index of 3.5% for the high plasticity clay; and
- Groups of mature trees are located closer than half the mature height of the tree from the proposed structure.

Based on the above, a characteristic surface movement of $y_s = 20\text{mm}$ is predicted when assessed in accordance with AS2870-2011, however, due to the presence a group of trees near the structure the site will be subjected to potential additional surface movement due to tree induced suction change. The potential surface movement due to tree-induced suction change (i.e. $y_s + y_{tmax}$) is estimated to be $y_t=35\text{mm}$. The site is therefore classified as **Class 'M'** (Moderately Reactive) in accordance with AS2870-2011.

Shrink-swell related movements can be affected by alterations to the soil profile by cutting and filling, and by the suction related effects of trees close to the building area. The effects of any such cutting, filling or tree planting should be considered when selecting design values for differential movement across the slab.

5 FOOTING OPTIONS & DESIGN PARAMETERS

It is anticipated the structure will be founded on shallow footings at or near existing grade. Shallow footings comprising of pad and/or strip footings, raft slabs, waffle pods or short bored piers would be feasible. Footings should be founded as follows:

- All footings including slab thickenings should be founded in residual soils below all topsoil and any uncontrolled fill materials;
- Shallow footings founded within residual soil of at least very stiff strength can be designed based on an allowable base bearing pressure of **100kPa**;



- Settlements can be assessed using a Young's Modulus (E) of 20Mpa;
- All footings should be entirely founded on similar material and outside or below all zones of influence resulting from existing or future service trenches or underground fuel storage tanks.

Prior to the placement of concrete, we recommend that footings be observed and assessed by an experienced Geotechnical Engineer to assess that the correct founding material has been achieved. Concrete should be placed immediately after the excavation and assessment of the footings.

6 LIMITATIONS

The assessment presented herein was undertaken based on site information provided by East West. It has been assumed that the information provided is a true and accurate representation of site conditions.

The findings presented in the report and used as the basis for recommendations presented herein were obtained using normal, industry accepted geotechnical design practises and standards. To our knowledge, they represent a reasonable interpretation of the general condition of the site. Under no circumstances, however, can it be considered that these findings represent the actual state of the site at all points. If site conditions encountered during construction vary significantly from those discussed in this report, Regional Geotechnical Solutions Pty Ltd should be contacted for further advice.

This report alone should not be used by contractors as the basis for preparation of tender documents or project estimates. Contractors using this report as a basis for preparation of tender documents should avail themselves of all relevant background information regarding the site before deciding on selection of construction materials and equipment.

If you have any questions regarding this project, or require any additional consultations, please contact the undersigned.

For and on behalf of

Regional Geotechnical Solutions Pty Ltd

Prepared by

Simon Keen

Senior Geotechnical Engineer

Reviewed by

Adam Holzhauser

Associate Geotechnical Engineer

Attachments: Borehole Location Plan
 Borehole Logs
 Laboratory Test Result Sheet



This note is an integral part of the plan and is to be read in conjunction with the other notes. The position of services where provided is shown for information only. No guarantee is given that all services are as shown.

GENERAL NOTES:

It is the responsibility of the contractor to determine the location of services on the site. The position of services where provided is shown for information only. No guarantee is given that all services are as shown.

The Contractor is to ensure that all work is done in a safe manner and in accordance with the 'Safety Act'. Other safety requirements also be followed.

The Contractor is to liaise with the relevant authorities to determine the location of services on the site. The position of services where provided is shown for information only. No guarantee is given that all services are as shown.

BUILDING - LAND & CONSTRUCTION OFFICE: 58 FITZROY ST P: 0410 659 795 E: info@fullspectrum.com.au THE FULL SPECTRUM	
CLIENT	XPRESS FUEL
PROJECT	PROPOSED (REPLACE EX)
LOCATION	LOT C DP 348 9807 NEW ENGLAND
DRAWING TITLE	PROPOSED SIT
No	Amendment
1	Issued for client
2	Issued for DA/CC



BOREHOLE LOG

BOREHOLE NO.:

BH 1

CLIENT: Allspec & Partners Pty Ltd
 PROJECT: Geotechnical Investigation

JOB NO.:

EW185300

LOCATION: Glen Rest Tourist Park - Glen Innes

CO-ORDINATES: ,

START DATE: 23/10/2018

ELEVATION:

END DATE: 23/10/2018

RIG: Mini Excavator

DRILL BIT:

OPERATOR: B.F.

LOGGER: B.F.

USCS	DESCRIPTION	METHOD	DEPTH	GRAPHIC	SPT BLOWS				DATA	SAMPLES	WATER
					-10	-20	-30	-40			
					DCP BLOWS						
	Sandy Gravelly CLAY, Medium Plasticity, Brown, MC = WP				5	10	15	20	pp 0.50m 160kPa	0.20 - 0.40m, Small disturbed sample 0.60 - 0.80m, Small disturbed sample	Groundwater Not Encountered
	CLAY, High Plasticity, Grey/Brown, MC > WP, Trace Grave		1.0								
	BORE HOLE TERMINATED AT 1.8m		2.0								
					EOH: 2.20m						

REMARKS

HOLE DEPTH: 2.20m

Sheet 1 of 1



BOREHOLE LOG

BOREHOLE NO.:
BH 2

CLIENT: Allspec & Partners Pty Ltd
PROJECT: Geotechnical Investigation
LOCATION: Glen Rest Tourist Park - Glen Innes

JOB NO.:
EW185300

CO-ORDINATES: , **START DATE:** 23/10/2018
ELEVATION: **END DATE:** 23/10/2018
RIG: Mini Excavator **DRILL BIT:** **OPERATOR:** B.F. **LOGGER:** B.F.

USCS	DESCRIPTION	METHOD	DEPTH	GRAPHIC	SPT BLOWS				DATA	SAMPLES	WATER
					DCP BLOWS						
					-10	-20	-30	-40			
	Sandy Gravel, Low Plasticity, Brown, MC < WP			[Pattern]	-5	-10	-15	-20			
	Sandy Gravelly CLAY, Medium Plasticity, Grey/Brown, MC = WP			[Pattern]							
	CLAY, High Plasticity, Grey/Brown, MC = WP, Trace Gravel		1.0	[Pattern]					pp 1.20m 130kPa		Groundwater Not Encountered
	BORE HOLE TERMINATED AT 1.8m										
			2.0	[Pattern]							
					EOH: 2.20m						

REMARKS

HOLE DEPTH: 2.20m

Sheet 1 of 1

SHRINK SWELL TEST REPORT

Australian Standard 1289.7.1.1

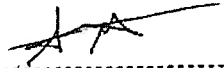
CLIENT: Allspec & Partners		REPORT NO: EW185300-1
CLIENT ADDRESS: Shop 1, 58 Fitzroy Street, Tumut NSW 2720		PROJECT NO: EW185300
PROJECT: Geotechnical Investigation		
SITE LOCATION: Glen Rest Tourist Park - Glen Innes		
DATE OF TESTING: 29/10/2018		DATE OF REPORT: 1/11/2018
TECHNICIAN: B.F.		DATE SAMPLED: 23/10/2018
Sampled by East West Enviroag		
Sampling Method: <input type="checkbox"/> AS1289.1.2.1.6.4 b <input type="checkbox"/> AS12891.2.1.6.5.1 <input checked="" type="checkbox"/> AS1289.1.2.1.6.5.3 <input type="checkbox"/> AS1289.1.2.6.5.4		

Sample Number:	1		
Sample Location:	BH 2		
Sample Description:	Brown gravelly CLAY		
Depth	0.6 - 0.8m		
Test Result			
Shrink Specimen Moisture Content %	25.0		
Swell Specimen Moisture Content Before and After %	21.5 / 28.2		
Maximum Swell (Esw) %	0		
Maximum Shrink (Esh) %	1.79		
Shrink Swell Index (Iss) %	1.0		
Cracking:	Slightly Cracked		
Crumbling:	Nil		
Inert Inclusions: %	30%		
Sample By:	B.F.		

Remarks: Sample 1 was remoulded at Field moisture content prior to testing.

This report remains the property of East West Enviroag Pty Ltd until paid in full

Signed:


 Approved Signatory


Accredited for compliance with ISO/IEC 17025 - Testing

This document shall not be produced, except in full.

NATA Accredited Laboratory Number. 12360

Signatory Name: S Mitchell

Document ID: REP-117

Issue No: 2

Date of Issue: 24-Apr-13

Phase 1: Environmental Site Assessment



Site Name and Address

Glen Rest Tourist Park
9807 New England Highway, Glen Innes NSW 2370
Lot C DP 348764

Report Number

N3390

Date

17/10/18

Report Number: N3390

Date: 17.10.18

PROJECT DETAILS**Business Name:**

NEO Consulting Pty Ltd

Project Number: N3390**Project Title:**

Phase 1: Environmental Site Assessment

Glen Rest Tourist Park

9807 New England Highway, Glen Innes NSW 2370

Report Completed for

Xpress Group Pty Ltd

Report Completed by

NEO Consulting Pty Ltd

ABN: 26 615 633 988

PO Box 279 Riverstone

NSW 2765

e: admin@neoconsulting.com.au**Written By**

Shahid Javed

Environmental Engineer

Reviewed and Approved by:

Nick Caltabiano

*Project Manager***Review Date:** 17th October 2018**File Name:** N3390**Report Status:** DRAFT**Document Details**

Project Number	N3390	Document Number	1
Document Title	Environmental Site Assessment – Glen Rest Tourist Park		
Site Address	9807 New England Highway, Glen Innes NSW 2370		
Report Prepared for	Xpress Group Pty Ltd		
File Name	Glen Rest Tourist Park - N3390		

Document status and review

Revision	Prepared by	Reviewed by	Date issue
Draft	Shahid Javed	Nick Caltabiano	17.10.18

Report Number: N3390

Date: 17.10.18

Executive Summary

NEO Consulting was engaged by Xpress Group to undertake an onsite Phase 1 Environmental Site Assessment. The site does not currently have water monitoring wells, so the investigation was limited to Soil assessment. The purpose of the Investigation was to determine whether the operation of the service station has resulted in any gross contamination at Glen Rest Tourist Park, Glen Innes. The Investigation has been undertaken in accordance with the requirements of the Office of Environment and Heritage (OEH), Guidelines for Consultants Reporting on Contaminated Sites (2011) and the Protection of the Environment Operations Act 1997 (POEO Act). NEO adopted the values for assessment from;

- CRC Care (2011) Health Screening Levels for Petroleum Hydrocarbons in Soil and Groundwater, and
- NEPC (1999) National Environmental Protection (Assessment of Site Contamination) Measure (NEPM).

NEO Consulting arrived onsite on the 8th October 2018 to conduct a Phase 1: Environmental Site Assessment at 9807 New England Highway, Glen Innes NSW 2370. Data obtained prior to attending the site consisted of Geology and Hydrology searches, DBYD (job no. 15052276) information.

Data obtained during the Environmental Site Assessment indicates the following:

- The site was in full operation as a service station and caravan park at the time of assessment.
- The fuel service area is in the eastern section of the site, along the highway. The retail shop is in a single storey building and there is a free-standing metal canopy over 3 bowzers with a 4th bowser is along the driveway to the north of the forecourt, with no canopy.
- The USTs (3) are north of the canopy (2) near the lone bowser, and (1) east of the forecourt; with associated lines, this makes up the UPSS. The fuel service area is concreted groundcover at the forecourt and bitumen elsewhere, including the driveways (2); north and south along the highway. There is grass and trees on the property; all appearing healthy at the time of assessment. Entrance into the accommodation area of the tourist park is between and to the west of the forecourt and lone bowser. See Attachment A
- 3 soil assessment holes were advanced at the site. All soil assessment holes were located around and adjacent to the UPSS.
- Field observations and analytical results indicate that there are no hydrocarbon impacts within the soil samples taken at the site.
- The site has no water monitoring wells.
- The soil assessment holes encountered similar geology, described as dark brown clay with no hydrocarbon odour;

No soil sample taken whilst doing the field work had any indication of contamination visually or aromatically. Laboratory analysis of each soil sample indicates the site is well within the acceptable contamination and had no evidence of reaching any health-based investigation levels.

Based on these results, NEO Consulting finds that this site is suitable to continue as its current land use.

TABLE OF CONTENTS

- 1 INTRODUCTION**
 - 1.1 OBJECTIVES
 - 1.2 SCOPE OF WORK
- 2 LIMITATIONS OF THIS REPORT**
- 3 SITE DESCRIPTION**
 - 3.1 TABLE
 - 3.2 LAYOUT AND FEATURES
 - 3.3 ADJOINING LAND USES
 - 3.4 SITE TOPOGRAPHY
 - 3.5 SOILS AND HYDROLOGY
 - 3.6 SENSITIVE RECEPTORS
- 4 SITE ASSESSMENT**
 - 4.1 OVERVIEW
 - 4.2 SOIL ASSESSMENT & SAMPLING LOCATIONS
 - 4.2.1 DRILLING AND SOIL SAMPLING METHODOLOGY
 - 4.2.2 SAMPLE ANALYSIS
 - 4.3 FIELD WORK NOTES
- 5 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)**
 - 5.1 DATA QUALITY OBJECTIVES
 - 5.2 DATA QUALITY INDICATORS
 - 5.3 SAMPLING AND ANALYSIS METHODOLOGY
 - 5.3.1 SOIL SAMPLING METHODS
 - 5.4 ENVIRONMENTAL QUALITY CRITERIA
- 6 ANALYTICAL RESULTS SUMMARY**
- 7 PRELIMINARY CONCEPTUAL SITE MODEL**
- 8 CONCLUSIONS AND RECOMMENDATIONS**
- REFERENCES**
- LIST OF ATTACHMENTS**
 - ATTACHMENT A: FIGURES**
 - ATTACHMENT B: LABORATORY RESULTS SUMMARY TABLES**
 - ATTACHMENT C: LABORATORY CERTIFICATES OF ANALYSIS**
 - ATTACHMENT D: BORELOGS**
 - ATTACHMENT E: POTENTIAL RECEPTORS & CONTAMINATION ROUTES**

1 INTRODUCTION

1.1 Project Objectives

The objectives of the P1-ESA were as follows:

- Assess the extent of hydrocarbon impacts (if any) at the site related to the storage of petroleum products at the site;
- Assess potential risk of harm to human health posed by any identified contamination at the site from continued use of the site for commercial/industrial purposes; and
- Assess potential risks to the environment posed by any identified contamination at the site.

1.2 Scope of Work

To achieve the objectives outlined in Section 1.1 NEO Consulting conducted the following work:

- Application for Dial Before You Dig Plans.
- Completed Work Clearance Form.
- Conducted a site inspection to establish current site conditions, surrounding land uses and potential human and environmental receptors located near the site.
- Advanced soil assessment holes at 3 locations across the site. All borehole locations were chosen as they were within close proximity and down gradient of the Underground Storage Tanks. A small trailer-mounted drill rig equipped with solid flight augers was used to advance the holes at the site.
- Collected samples of natural soil and/or fill material from within each soil assessment hole.
- Screened soil samples in the field for the presence of volatile organic compounds using a photoionization detector (PID).
- Analysed 6 primary soil samples in a laboratory for total recoverable hydrocarbons (TRH), benzene, toluene, ethylbenzene and xylenes (BTEX) and Lead;
- Assessed the reported concentrations of potential contaminants of concern in each soil sample against appropriate human health and environmental protection guidelines, and
- Prepared this factual report outlining the findings of the P1-ESA.

2 LIMITATIONS OF THIS REPORT

The findings of this report are based on the Scope of Work outlined in Section 1.2. NEO Consulting performed the services in a manner consistent with the normal level of care and expertise exercised by members of the environmental consulting profession. No warranties, express or implied are made.

The results of this assessment are based upon the information documented and presented in this report. All conclusions and recommendations regarding the site are the professional opinions of NEO Consulting personnel involved with the project, subject to the qualifications made above. While normal assessments of data reliability have been made, NEO Consulting assumes no responsibility or liability for errors in any data obtained from regulatory agencies, statements from sources outside of NEO Consulting, or developments resulting from situations outside the scope of this project.

Subject to the Scope of the Work, NEO Consulting assessment is strictly limited to assessing soil at the site. Soil samples were analysed for common contaminants and/or indicators of contamination only. The absence of targeted contaminants of concern in soil samples cannot be interpreted as a guarantee that such materials, or other potentially toxic or hazardous compounds, do not exist at the site.

The results of this assessment are based on the site conditions identified at the time of the site inspection and validation sampling. NEO Consulting will not be liable to revise the report to account for any changes in site characteristics, regulatory requirements, assessment criteria or the availability of additional information, subsequent to the issue date of this report.

NEO Consulting is not engaged in environmental consulting and reporting for the purpose of advertising sales promoting, or endorsement of any client interests, including raising investment capital, recommending investment decisions, or other publicity purposes.

3 SITE DESCRIPTION

3.1 Table 1: Summary of Site Details

	Description
Street Address:	9807 New England Highway, Glen Innes NSW 2370
Local Government Area:	Glen Innes Severn
Lot/Deposited Plan	C/348764
Geographical Coordinates of UPSS:	-29.77094° South 151.73135° East
Approx. land size:	1660 ha

3.2 Site Layout and Features

The site layout is shown Figure 1 of Attachment A.

The site is located in a predominantly rural area of Glen Innes.

At the time of the walkover inspection, the site was occupied by a tourist park with a service station which does not appear to be in full operation. A single storey building with a free-standing metal canopy housed the retail shop for the fuel service and also the reception for the tourist park. The service station was serviced by a concrete forecourt and bitumen driveway on the eastern side of the site with 2 entry/exit points along the highway. There were 3 bowsers under the canopy and a 4th without cover along the northern driveway. Three UST's were located; (2) north of the canopy, (1) east of the forecourt/UGST. Slope runs from south to north in a downward direction and also east to west in a downward direction. Entrance to the accommodation area of the tourist park is between the forecourt and the lone bower. No Water Monitoring Wells were located onsite.

3.3 Adjoining Land Uses

At the time of the assessment land uses adjacent to the UPSS at were as follows:

- North – Residence
- East – New England Highway followed by rural property
- West – Railway line followed by rural property
- South – Rural Residence

3.4 Site Topography

The site's elevation range is 1116m-1124m asl. The downward slope runs from south to north and also east to west. The highest point of the land is in the south east corner and the lowest point of the land is in the north west corner.

Surface water drainage would likely flow offsite to the north west.

This information was based on both visual information and topographic government mapping facilities. See References for further information on sources.

3.5 Soils and Hydrology

The regional geological map of Grafton-Maclean 1976 indicates the site to be underlain by Volcanic rocks, predominantly mafic; basalt, trachyte, trachybasalt, trachyandesite, leucite, basanite, nephelinite, limburgite, rhyolite, tuff and high level intrusives; rare volcanoclastic sediments of the Mafic Volcanic Rocks 38495. The regional Water Table Aquifer map of Grafton-Maclean 1976 indicates the site is underlain by a water table of the New England Province – Local flow systems in Cainozoic volcanics or Mesozoic sediments/volcanics.

Bores within a 1km radius:

Bore ID	Distance from site – approx..	Date	Depth	Purpose	Status	Co-ordinates
GW900702.1.1	250m NW	1997	47m	Water Supply	Unknown	-29769258/151.729658
GW902291.1.1	270m WNW	2000	-	Water Supply	Unknown	-29.770333/151.728424
GW901528.1.1	280m WNW	1994	-	Water Supply	Unknown	-29.770013/151.728138
GW900703.1.1	280m NW	1997	47m	Water Supply	Unknown	-29.768985/151.728641
GW900704.1.1	300m NNW	1997	31.7m	Water Supply	Unknown	-29.767833/151.729013
GW900701.1.1	500m NNW	1997	25.9m	Water Supply	Unknown	-29.766647/151.730124
GW068340.1.1	500m NNE	1989	53.3m	Unknown	Unknown	-29.766835/151.733497
GW052791.1.1	700m N	1981	42.6m	Water Supply	Unknown	-29.764808/151.731377
GW068820.1.1	850m NNE	1991	16.7m	Water Supply	Unknown	-29.763506/151.735737
GW902124.1.1	850m SSE	1994	50.3m	Water Supply	Unknown	-29.779641/151.732763

3.6 Sensitive Receptors

The nearest surface water body to the site is 400m north west, Rocky Ponds Creek.

The nearest residential property which could have vegetable/fruit growing for human consumption is 70m north of the forecourt; on adjacent property.

Schools in the area: 2km north north east is Glen Innes High School.

See also Attachment E.

4 SITE ASSESSMENT

4.1 Overview

An environmental technician experienced in the handling of potentially contaminated soil and ground water undertook the fieldwork. The scope of the work included: A site inspection, location of services, collection of samples, reinstatement of all excavations.

4.2 Potential Contaminants

Potential sources of contamination on the site were identified as the forecourt, lone diesel bowser and the fuel fill spill box. Petroleum hydrocarbon contamination is possible in delivery, storage and dispensing of fuel and oil products, spills and overflows at refilling, leakage of UST due to corrosion and leakages of feeder lines due to pipe work failures. Contamination is possible from fuel spills and overflows at the time of refilling and pump dispensing.

Potential contaminants include:

- Unleaded petrol – detected by laboratory analysis of TRH (C6-C40) and BTEX
- Leaded petrol – detected by laboratory analysis of lead, TRH (C6-C40) and BTEX
- Diesel – detected by laboratory analysis of TRH (C10-C40) and naphthalene
- Movement of contaminants is possible in the groundwater or underground electricity, stormwater, sewer and telephone services conduits.

4.3 Soil Sampling Locations and Assessment

Soil assessment holes were advanced at 3 locations across the site. The sampling locations were selected based on the location of underground infrastructure, accessibility and probability of picking up potential contamination. Figure 1 and Figure 2 of Attachment A show the location of the soil assessment holes at the site.

NEO collected soil samples from each soil assessment hole. Soil samples were collected at various depths within each hole. The depth at which each soil/fill material sample was collected from are shown in the bore logs presented in Attachment D. A total of 15 soil samples were collected at the site.

4.3.1 Drilling and Soil Sampling Methodology

A small trailer-mounted drill rig equipped with 125mm diameter solid flight augers was used to advance 3 soil assessment holes at the site. The soil assessment holes were advanced to a minimum depth of 4.5m below ground level, or until the first water bearing zone was encountered or rock was encountered.

See section 5.3.1 for details about the samples being collected in accordance with QA/QC Guidelines.

4.3.2 Sample Analysis

The samples were sent to Envirolab (Chatswood) in accordance with QA/QC Guidelines. See section 5.3.2 for further details.

4.4 Fieldwork Notes

The fill material and natural soils encountered in each soil assessment hole are described in the bore logs presented in Attachment D.

Bore Hole 1 – was advanced east of the canopy area. Drilling encountered bitumen initially followed by 3.5m of dark brown clay that was damp at 1.0m and more so by 1.5m. A section of loose rock was encountered at 3.0m, then drilling finished with solid rock at 3.5m. No odour was detected in this hole.

Bore Hole 2 – was advanced immediately south of the lone bowser to the north of the forecourt. Drilling encountered bitumen followed by dark brown clay that was damp from 1.0m onward. Drilling finished with solid rock at 3.0m. No odour was detected in this hole.

Bore Hole 3 – was advanced to the south east of the PULP UST located south east of the lone bowser. Drilling encountered bitumen followed by dark brown clay till 3.5m and was found to have a section of loose rock at 3.0m. Drilling finished at 3.5m with encountering of solid rock. No odour was detected in this hole.

Soil samples were screened in the field for volatile organic compounds (VOC's) using a PID. PID readings for each soil sample are noted in the borelogs presented in Attachment D.

5 QUALITY ASSURANCE/QUALITY CONTROL QA/QC

5.1 Data Quality Objectives

The Data Quality Objectives (DQOs) define the quality and quantity of data needed to support decisions relating to the environmental condition of a site. It outlines the defining criteria that a data collection design should satisfy, including when, where, how and how many samples to be collected. The DQO process is a seven (7) step planning approach to outline the project goals, decisions, constraints and an assessment of the project uncertainties and how to address these when they arise.

The DQOs for the sampling and analysis investigations were to:

State the Problem.

Determine if ground contamination exists across the site and if so, why and what new environmental data, and what resources are available to resolve the problem within the allocated deadlines of the Project.

Identify the Decision.

Determine the decisions that need to be made on the contamination and the new environmental data required to make them if contamination exists. This includes considering relevant site criteria for each medium (fill, soil and sediment), considering whether a proposed use of the 95% UCL on the mean concentrations or results for all chemicals of potential concern were less than the site criteria.

Identify Inputs to Decision.

Identification of the information needed to allow informed, defensible decisions and specify which inputs require new environmental measurements.

Define the Study Boundaries.

Specify the spatial and temporal aspects of the environmental media that the data must represent to support decisions. To identify the boundaries (both spatial and temporal) of the investigation and to identify any restrictions that may hinder the assessment process.

Develop a Decision Rule.

To define the parameter(s) of interest, specify the action level and provide a logical basis for choosing from alternative actions. This may include defining acceptable limits for chemicals of concern detected in field blanks, volatile-spiked trip samples, laboratory method blanks to ensure the action levels exceed the measurement detection limits.

Specify Limits on Decision Errors.

Specify the decision-maker's acceptable limits on decision errors, which are used to establish performance goals for limiting uncertainties in the data. Incorrect decisions are caused by using data that is not representative of site conditions because of sampling or analytical error, leading to a conclusion that is inappropriate for the site in question.

Optimise the Design for Obtaining Data.

Identify a resource-effective sampling and analysis design for general data that are expected to satisfy the DQOs.

a. DATA QUALITY INDICATORS

DATA QUALITY OBJECTIVE	REQUIREMENT	DATA QUALITY INDICATOR
PRECISION		
Intra-laboratory Duplicates	1 per 20 samples	RPDs <50%
Inter laboratory Duplicates	1 per 20 samples	RPDs <50%
Laboratory Duplicates	Minimum of 1 per batch per analyte	RPDs <50%
ACCURACY		
Laboratory Matrix Spikes	1 per batch per volatile/semi-volatile analyte	Recoveries 50% to 150%
Laboratory Surrogate Spikes	1 per volatile/semi-volatile analyte samples (as appropriate)	Recoveries 70%-130%
Laboratory Method Blanks	At least 1 per batch per analyte tested for	Results <Limit of Reporting
Laboratory Control Samples	At least 1 per batch per analyte tested for	Result <Limit of Reporting
Trip Blanks	1 per lab batch for volatile analytes	Result <Limit of Reporting
Trip Spikes	1 per lab batch for volatile analytes	Recoveries 60-100%
Representatives		
Sampling methodology	Appropriate for the sample type of analytes	Meet Requirement
Samples extracted and analysed within holding times	Specific to each analyte	Meet Requirement
Comparability		
Sampling approach	Consistent for each sample	Meet Requirement
Analysis methodology	Consistent methodology for each sample	Meet Requirement
Handling conditions and sampler	Consistent for each sample	Meet Requirement
Field observations and analytical	Field observations to support analytical results	Meet Requirement
Consistent laboratory Limit of Reporting (LOR)	Consistent between primary and secondary laboratories	Meet Requirement
Completeness		
Chain of Custody Documentation	Appropriately completed	Meet Requirement
Field Sampling Documentation	Appropriately completed	Meet Requirement
Satisfactory quality assurance/quality control procedures	In accordance with relevant guidance	Meet Requirement

5.3 QA/QC Sampling and Analysis Methodology

5.3.1 Soil Sampling Methods

The sampler wore a clean pair of disposable nitrile gloves at each sampling location to minimize potential cross contamination of samples. Soil samples were collected using a split spoon sampler. Samples were collected in a 250ml laboratory supplied glass jar and plastic zip lock bags marked with appropriate sample identification.

Care was taken to minimize volatile and semi-volatile organic compound losses during sampling by minimizing the head space in each sample jar. The bagged sample was screened for the presence of volatile organic compounds (VOC's) using a photo-ionisation detector (PID).

The jarred samples were placed on ice in an esky immediately after sampling to minimize potential losses of volatile and semi-volatile compounds during transport.

The soil profile of each borehole was logged in the field to include soil type, colour, moisture conditions, grain size, inclusions, staining, odour and the results of PID screening.

A Chain of Custody (COC) form was completed for the samples. The samples and the COC were sent to Envirolab (Chatswood).

Samples from each soil assessment hole were analysed for TRH, BTEX and Lead. Soil samples were selected for analysis on the basis of field observations and field screening with a PID.

A total of 6 primary soil samples were selected for laboratory analysis. Laboratory analysis was undertaken by Envirolab (Chatswood) using NATA accredited analytical methods. Please see Attachment C for Envirolab's Laboratory Methods used.

5.4 Environmental Quality Criteria

For the purpose of assessing the results of analytical testing of soils at the Site, the following guidelines were considered:

- NSW DEC (2006) Guidelines for the NSW Auditor Scheme (Second Edition);
- NSW EPA Contaminated Sites – Guidelines for Assessing Service Station Sites 1994.
- CRC Care (2011) Health Screening Levels for Petroleum Hydrocarbons in Soil and Groundwater, and
- NEPC (1999) National Environmental Protection (Assessment of Site Contamination) Measure (NEPM) and the subsequent amendment (Amended NEPM, 2013) officially approved by the Standing Council of Environment and Water (SCEW) on 11 April 2013.

In accordance with the decision-making process for assessing urban redevelopment sites (Appendix 1, EPA, 2006), soil concentrations were compared against the following soil investigation levels (SILs);

- Health-based criteria for the current and proposed land use: Amended NEPM (2013) Health-based Investigation levels (HILa) for Commercial/Industrial land use, the Health Screening Levels (HSLs) and the CRC Care (2011) Soil Health Screening Levels for Direct Contact (HSLs).
- Environmental Criteria: Amended NEPM (2013) Ecological Screening Levels (ESLs) and Ecological Investigation Levels (EILs) for Commercial/Industrial Land Use.

The National Environment Protection Council (NEPC) has amended the National Environment Protection (Assessment of Site Contamination) Measure 1999 on the 11th April 2013. It is understood that the amendment (ASC NEPM, 2013) took effect in each jurisdiction on 16th May 2013, the day after it was registered on the Federal Register of Legislative Instruments (FRLI).

NEO has adopted the most recent Amended NEPM (2013) Tier 1 Guidelines over the criteria listed in NSW DEC (2006) as it is the most recent guidance available that has been approved by the NSW EPA under Section 105 of the Contaminated Land Management Act, 1997.

5.4.1 Soil

The site is a service station with a commercial business in a rural setting. The appropriate land-use classification for assessing contaminants is commercial. Soil criteria as determined by measurement of volatile organic compounds (VOC) are used to determine the potential for volatile hydrocarbon contamination. These criteria have been developed based on experience to assist in the assessment of hydrocarbon contamination levels in soil. It is important to note these generalised criteria are only a guide and that the level of VOC varies with hydrocarbon type.

The assessment criteria for the soil data in commercial sites is described in Table 1A (1) of Guideline on Investigation Levels for Soil and Groundwater (NEPC 2013). The criteria list health investigation levels (HIL) for a range of land-uses. The appropriate initial comparison for the site is column 4, commercial or industrial (HIL D). The HIL D threshold is considered appropriate for the current land-use of the site. The NEPC (2013) also provides health screening levels (HSL) for hydrocarbons in soil. The HSLs have been developed to be protective of human health for soil types, depths below surface and apply to exposure to hydrocarbons through the predominant vapour exposure pathway.

Ecological investigation levels (EIL) have been developed for the protection of terrestrial ecosystems for selected metals and organic substances in the soil in the guideline (NEPC 2013). Ecological screening levels (ESL) assess the risk to terrestrial ecosystems from petroleum hydrocarbons in the soil. The EILs and ESLs consider the properties of the soil and contaminants and the capacity of the local ecosystem to accommodate increases in contaminant levels.

EILs vary with land-use and apply to contaminants up to 2m depth below the surface. EILs for lead are determined by identifying ambient background concentration (ABC) and adding the added contaminant limits (ACL). The ABC has been assumed to be zero for lead as a conservative measure.

ESLs are dependent on land-use, soil types and are applicable to contaminants up to 2m below the surface. The appropriate ESL for the site is commercial and fine soil.

Management limits have been developed to assess petroleum hydrocarbons following evaluation of human health and ecological risks (NEPC 2013). Management units are applicable as screening levels after consideration of relevant ESLs and HSLs.

6.0 ANALYTICAL RESULTS SUMMARY

Soil analytical results are summarized and compared to the relevant assessment criteria in Attachment B. The laboratory certificate of analysis for the soil samples collected at the site is presented as Attach C. The reported concentration of Benzene was less than the laboratory LOR (limit of reporting –detection limit) to which was less than the adopted assessment criteria.

Toluene - The reported concentration of Toluene was less than the laboratory LOR (limit of reporting –detection limit) to which was less than the adopted assessment criteria.

Ethylbenzene - The reported concentration of Ethylbenzene was less than the laboratory LOR (limit of reporting –detection limit) to which was less than the adopted assessment criteria.

Xylene (total) - The reported concentration of Xylene (total) was less than the laboratory LOR (limit of reporting –detection limit) to which was less than the adopted assessment criteria.

TPH (C6-C10) Less BTEX (F1) - The reported concentration of TPH (C6-C10) Less BTEX (F1) was less than the laboratory LOR (limit of reporting –detection limit) to which was less than the adopted assessment criteria.

TPH (>C10-C16) Less Naphthalene (F2) - The reported concentration of TPH (>C10-C16) Less Naphthalene (F2) was less than the laboratory LOR (limit of reporting –detection limit) to which was less than the adopted assessment criteria.

TPH (>C16-C34) (F3) - The reported concentration of TPH (>C16-C34) was less than the laboratory LOR (limit of reporting –detection limit) to which was less than the adopted assessment criteria.

TPH (>C34-C40) (F4) - The reported concentration of TPH (>C34-C40) was less than the laboratory LOR (limit of reporting –detection limit) to which was less than the adopted assessment criteria.

Naphthalene - The reported concentration of Naphthalene was less than the laboratory LOR (limit of reporting –detection limit) to which was less than the adopted assessment criteria.

Lead - The reported concentration of Lead was less than the laboratory LOR (limit of reporting – detection limit) to which was less than the adopted assessment criteria.

7.0 PRELIMINARY CONCEPTUAL SITE MODEL

7.1 Principal Contaminants of Concern (PCC)

For the purposes of this study the Principal Contaminants of Concern (PCC) were considered to be:

- Lead resulting from the historic use of leaded petrol
- Monocyclic aromatic hydrocarbons (benzene, toluene, ethyl benzene and xylenes – BTEX) associated with the fuel products
- Light, mid and heavy-fraction petroleum hydrocarbons (TPH C6-C36) associated with the fuel and oil products.

Table: Contamination Fate and Transport – The fate of the PCC identified above is summarized in the following table:

PCC	FATE & TRANSPORT
Non-volatile contaminants including lead and heavy fraction hydrocarbons.	Non-volatile contaminants are expected to be bound within the fill matrix and are hence less mobile. The mobility of these contaminants would depend on a range of factors including age of the fill, soil porosity, solubility in water and surface water infiltration.
Volatile contaminants including light-fraction TPH and BTEX.	Volatile contaminants are usually more mobile when compared to the non-volatile compounds. The potential for migration of volatile contaminants such as light-fraction TPH is relatively high in sandy soil with a high water table. These contaminants break down rapidly as a result of microbial activity and availability of nutrients including nitrogen, oxygen etc. The mobile contaminants would be expected to move down to the rock surface or groundwater table and migrate down gradient from the source. The mobility would depend on a range of factors like the porosity, confining layers within the aquifer, solubility in groundwater etc.

8.0 CONCLUSIONS AND RECOMMENDATIONS

On the 8th October 2018 NEO Consulting conducted a Phase 1: Environmental Site Assessment at 9807 New England Highway, Glen Innes NSW 2370. Data obtained during the assessment indicates the following:

- Field observations and analytical results indicate that there are no hydrocarbon impacts within the soil samples taken at the site.
- The soil assessment holes encountered similar geology, described as dark brown clay with no hydrocarbon odour.
- Statistical Inventory Reconciliation Analysis (SIRA) of deliveries, sales and dips on a monthly basis should be undertaken in accordance with EPA guidelines.
- The site has no water monitoring wells, a minimum of 3 water monitoring wells should be installed onsite to meet the UPSS regulation.

No soil sample taken whilst doing the field work had any indication of contamination visually or aromatically. Laboratory analysis of each soil sample indicates the site is well within the acceptable contamination and had no evidence of reaching any health-based investigation levels.

Based on these results, NEO Consulting finds that this site is suitable to continue as its current land use.

REFERENCES

- Geological Survey of NSW Grafton-Maclean 1976 1:250,000 Geological Series Sheet SH 56-06. www.resourcesandenergy.gov.au Department of Industries
- National Maps www.nationalmap.gov.au
- National Environment Protection (Assessment of Site Contamination) Measure (2013), 'Schedule B (1) – Guidelines on the Investigation Levels for Soil and Groundwater.'
- NSW EPA (1994) 'Guidelines for Assessing Service Stations
- NSW Government (2016), NSW Spatial Information Exchange Website, <http://www.sixmaps.gov.au>
- Bureau of Meteorology <http://www.bom.gov.au/water/groundwater/explorer/map.shtml>

Attachment A
Figures

Report Number: **N3390**
Onsite date: **08.10.18**
Report date: **18.10.18**





NB: This map is not to scale. It is used as a reference tool to identify location of infrastructure and work done onsite.

Symbol	Identification
●	Bore Holes
■	Bowser areas (3 at forecourt; 1 on driveway)
□	UPSS areas
▭	Above ground building perimeter

Onsite Photos:



BH1

ULP UST



BH2

Diesel UST



BH3

PULP UST

Attachment B
Laboratory Table

Report Number: **N3390**
Onsite date: **08.10.18**
Report date: **18.10.18**



Soil Analytical Summary
BTEX, TRH and Lead

Analyte	Sample ID		Sample Date				Ecological investigation Guideline Value
	Predominant Soil Texture		Soil (mg/kg)				
	Health Assessment Criteria	BH1 2.5	BH1 3.5	BH2 2.0	BH2 3.0	BH3 2.5	BH3 3.5
		Brown silty clay	Brown silty clay	Brown silty clay	Brown silty clay	Brown silty clay	Brown silty clay
		8/10/2018	8/10/2018	8/10/2018	8/10/2018	8/10/2018	8/10/2018
VOCs (via PID)	-	0.0	0.0	0.0	0.0	0.0	0.0
BTEXN	NEPM Soil HSL D for Vapour intrusion	NEPM Soil HSL for direct contact	NEPM Soil ESL D				
Benzene	3	1100	C: 75 / F: 95	<0.2	<0.2	<0.2	<0.2
Toluene	-	120000	135	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	-	85000	C: 165 / F: 185	<1	<1	<1	<1
Total Xylene	230	130000	C: 180 / F: 95	<1	<1	<1	<1
NEPM HSL	NEPM Soil HSL D for Vapour intrusion	NEPM Soil HSL for direct contact	NEPM Soil ESL D				
F1	<1m: 260; 1-2m: 370	82000	215	<25	<25	<25	<25
F2	-	62000	170	<50	<50	<50	<50
F3	-	85000	C: 1700 / F: 2500	<100	<100	<100	<100
F4	-	120000	C: 3300 / F: 6600	<100	<100	<100	<100
Metals	NEPM HIL D		EIL				
Lead	1 500	-	Generic EIL: 1100	2	2	3	1

Notes - Highlighting denotes an exceedance of the guideline - '-' denotes 'not analysed' or 'no guideline value'

Attachment C
Laboratory Results

Report Number: **N3390**
Onsite date: **08.10.18**
Report date: **18.10.18**





CERTIFICATE OF ANALYSIS 202925

Client Details

Client	NEO Consulting Pty Ltd
Attention	Nick Caltabiano
Address	PO Box 279, Riverstone, NSW, 2765

Sample Details

Your Reference	<u>N3390</u>
Number of Samples	6 Soil
Date samples received	12/10/2018
Date completed instructions received	12/10/2018

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	17/10/2018
Date of Issue	16/10/2018

NATA Accreditation Number 2901. This document shall not be reproduced except in full.
Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By

Jeremy Faircloth, Organics Supervisor
Long Pham, Team Leader, Metals

Authorised By

Jacinta Hurst, Laboratory Manager

vTRH(C6-C10)/BTEXN in Soil						
Our Reference		202925-1	202925-2	202925-3	202925-4	202925-5
Your Reference	UNITS	BH1	BH1	BH2	BH2	BH3
Depth		2.5	3.5	2.0	3.0	2.5
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	15/10/2018	15/10/2018	15/10/2018	15/10/2018	15/10/2018
Date analysed	-	16/10/2018	16/10/2018	16/10/2018	16/10/2018	16/10/2018
TRH C ₆ - C ₉	mg/kg	<25	<25	<25	<25	<25
TRH C ₆ - C ₁₀	mg/kg	<25	<25	<25	<25	<25
vTPH C ₆ - C ₁₀ less BTEX (F1)	mg/kg	<25	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1	<1
Total +ve Xylenes	mg/kg	<1	<1	<1	<1	<1
Surrogate aaa-Trifluorotoluene	%	83	88	87	80	86

vTRH(C6-C10)/BTEXN in Soil		
Our Reference		202925-6
Your Reference	UNITS	BH3
Depth		3.5
Type of sample		Soil
Date extracted	-	15/10/2018
Date analysed	-	16/10/2018
TRH C ₆ - C ₉	mg/kg	<25
TRH C ₆ - C ₁₀	mg/kg	<25
vTPH C ₆ - C ₁₀ less BTEX (F1)	mg/kg	<25
Benzene	mg/kg	<0.2
Toluene	mg/kg	<0.5
Ethylbenzene	mg/kg	<1
m+p-xylene	mg/kg	<2
o-Xylene	mg/kg	<1
naphthalene	mg/kg	<1
Total +ve Xylenes	mg/kg	<1
Surrogate aaa-Trifluorotoluene	%	90

svTRH (C10-C40) in Soil						
Our Reference		202925-1	202925-2	202925-3	202925-4	202925-5
Your Reference	UNITS	BH1	BH1	BH2	BH2	BH3
Depth		2.5	3.5	2.0	3.0	2.5
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	15/10/2018	15/10/2018	15/10/2018	15/10/2018	15/10/2018
Date analysed	-	15/10/2018	15/10/2018	16/10/2018	16/10/2018	16/10/2018
TRH C ₁₀ - C ₁₄	mg/kg	<50	<50	<50	<50	<50
TRH C ₁₅ - C ₂₈	mg/kg	<100	<100	<100	<100	<100
TRH C ₂₉ - C ₃₆	mg/kg	<100	<100	<100	<100	<100
TRH >C ₁₀ -C ₁₆	mg/kg	<50	<50	<50	<50	<50
TRH >C ₁₀ - C ₁₆ less Naphthalene (F2)	mg/kg	<50	<50	<50	<50	<50
TRH >C ₁₆ -C ₃₄	mg/kg	<100	<100	<100	<100	<100
TRH >C ₃₄ -C ₄₀	mg/kg	<100	<100	<100	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50	<50	<50	<50
Surrogate o-Terphenyl	%	117	116	117	116	117

svTRH (C10-C40) in Soil		
Our Reference		202925-6
Your Reference	UNITS	BH3
Depth		3.5
Type of sample		Soil
Date extracted	-	15/10/2018
Date analysed	-	16/10/2018
TRH C ₁₀ - C ₁₄	mg/kg	<50
TRH C ₁₅ - C ₂₈	mg/kg	<100
TRH C ₂₉ - C ₃₆	mg/kg	<100
TRH >C ₁₀ -C ₁₆	mg/kg	<50
TRH >C ₁₀ - C ₁₆ less Naphthalene (F2)	mg/kg	<50
TRH >C ₁₆ -C ₃₄	mg/kg	<100
TRH >C ₃₄ -C ₄₀	mg/kg	<100
Total +ve TRH (>C10-C40)	mg/kg	<50
Surrogate o-Terphenyl	%	115

Acid Extractable metals in soil						
Our Reference		202925-1	202925-2	202925-3	202925-4	202925-5
Your Reference	UNITS	BH1	BH1	BH2	BH2	BH3
Depth		2.5	3.5	2.0	3.0	2.5
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	15/10/2018	15/10/2018	15/10/2018	15/10/2018	15/10/2018
Date analysed	-	15/10/2018	15/10/2018	15/10/2018	15/10/2018	15/10/2018
Lead	mg/kg	2	2	1	2	3

Acid Extractable metals in soil		
Our Reference		202925-6
Your Reference	UNITS	BH3
Depth		3.5
Type of sample		Soil
Date prepared	-	15/10/2018
Date analysed	-	15/10/2018
Lead	mg/kg	1

Moisture						
Our Reference		202925-1	202925-2	202925-3	202925-4	202925-5
Your Reference	UNITS	BH1	BH1	BH2	BH2	BH3
Depth		2.5	3.5	2.0	3.0	2.5
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	15/10/2018	15/10/2018	15/10/2018	15/10/2018	15/10/2018
Date analysed	-	16/10/2018	16/10/2018	16/10/2018	16/10/2018	16/10/2018
Moisture	%	16	16	18	18	11

Moisture		
Our Reference		202925-6
Your Reference	UNITS	BH3
Depth		3.5
Type of sample		Soil
Date prepared	-	15/10/2018
Date analysed	-	16/10/2018
Moisture	%	9.9

Method ID	Methodology Summary
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Metals-020	Determination of various metals by ICP-AES.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).
Org-014	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. Note, the Total +ve Xylene PQL is reflective of the lowest individual PQL and is therefore "Total +ve Xylenes" is simply a sum of the positive individual Xylenes.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil				Duplicate			Spike Recovery %			
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	202925-1
Date extracted	-			15/10/2018	2	15/10/2018	15/10/2018		15/10/2018	15/10/2018
Date analysed	-			16/10/2018	2	16/10/2018	16/10/2018		16/10/2018	16/10/2018
TRH C ₆ - C ₉	mg/kg	25	Org-016	<25	2	<25	<25	0	97	89
TRH C ₆ - C ₁₀	mg/kg	25	Org-016	<25	2	<25	<25	0	97	89
Benzene	mg/kg	0.2	Org-016	<0.2	2	<0.2	<0.2	0	102	92
Toluene	mg/kg	0.5	Org-016	<0.5	2	<0.5	<0.5	0	99	89
Ethylbenzene	mg/kg	1	Org-016	<1	2	<1	<1	0	96	89
m+p-xylene	mg/kg	2	Org-016	<2	2	<2	<2	0	95	88
o-Xylene	mg/kg	1	Org-016	<1	2	<1	<1	0	94	87
naphthalene	mg/kg	1	Org-014	<1	2	<1	<1	0		
Surrogate aaa-Trifluorotoluene	%		Org-016	85	2	88	86	2	94	82

QUALITY CONTROL: svTRH (C10-C40) in Soil					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	202925-1
Date extracted	-			15/10/2018	2	15/10/2018	15/10/2018		15/10/2018	15/10/2018
Date analysed	-			15/10/2018	2	15/10/2018	15/10/2018		15/10/2018	15/10/2018
TRH C ₁₀ - C ₁₄	mg/kg	50	Org-003	<50	2	<50	<50	0	113	111
TRH C ₁₅ - C ₂₈	mg/kg	100	Org-003	<100	2	<100	<100	0	104	100
TRH C ₂₉ - C ₃₆	mg/kg	100	Org-003	<100	2	<100	<100	0	104	89
TRH >C ₁₀ -C ₁₆	mg/kg	50	Org-003	<50	2	<50	<50	0	113	111
TRH >C ₁₆ -C ₃₄	mg/kg	100	Org-003	<100	2	<100	<100	0	104	100
TRH >C ₃₄ -C ₄₀	mg/kg	100	Org-003	<100	2	<100	<100	0	104	89
Surrogate o-Terphenyl	%		Org-003	115	2	116	117	1	90	117

QUALITY CONTROL: Acid Extractable metals in soil				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	202925-1
Date prepared	-			15/10/2018					15/10/2018	15/10/2018
Date analysed	-			15/10/2018					15/10/2018	15/10/2018
Lead	mg/kg	1	Metals-020	<1					102	68

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.
<p>Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.</p>	

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Report Comments

Acid Extractable Metals in Soil - Spike recovery for Pb in sample #1 at 68% which is outside lab acceptance criteria (70-130%), however, the LCS recovery is acceptable at 102%, sample heterogeneity suspected

Attachment D
Bore logs

Report Number: **N3390**
Onsite date: **08.10.18**
Report date: **18.10.18**








Division of Environmental Health & Safety

Client	Glen Rest Tourist Park	Job Number	N3390	BORE Number	BH1
Project	Phase 1 Environmental Site Assessment	Commenced		Date	8.10.18
Location	9807 New England Highway, Glen Innes NSW 2370	Completed		Date	8.10.18
Driller	NEO Consulting Pty Ltd	Logged By			CC

Borehole Angle: 90° Borehole Size: 100mm

Borehole Location Description: east of the forecourt

Depth (m)	Graphic log	Material Description	Field Records / Comments
		Bitumen 100mm	
		NO odour detected in this hole	
1		Dark Brown Clay, dry till 1m.	BH1 2.5
2		Dark Brown Clay, damp after 1m and more so by 1.5m	
3		Some rock at 3.0m then drilling finished when solid rock was encountered at 3.5m	BH1 3.5
4			

END LOG



Division of Environmental Health & Safety

Client	Glen Rest Tourist Park	Job Number	N3390	BORE Number	BH2
Project	Environmental Site Assessment	Commenced		Date	8.10.18
Location	9807 New England Highway, Glen Innes NSW 2370	Completed		Date	8.10.18
Driller	NEO Consulting Pty Ltd	Logged By			CC

Borehole Angle: 90° Borehole Size: 100mm

Borehole Location Description: **Immediately south of lone bowser along driveway.**

Depth (m)	Graphic log	Material Description		Field Records / Comments
		Bitumen 100mm		
1		Dark Brown Clay, dry till 1m.		BH2 2.0
2		No odour detected in this hole		
3		Solid rock was encountered at 3.0m		BH2 3.0
4				

END LOG





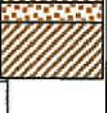



Division of Environmental Health & Safety

Client	Glen Rest Tourist Park	Job Number	N3390	BORE Number	BH3
Project	Environmental Site Assessment	Commenced		Date	8.10.18
Location	9807 New England Highway, Glen Innes NSW 2370	Completed		Date	8.10.18
Driller	NEO Consulting Pty Ltd	Logged By			CC

Borehole Angle: 90° Borehole Size: 100mm

Borehole Location Description: south east of PULP UST; near lone bowser

Depth (m)	Graphic log	Material Description	Field Records / Comments
		Bitumen 100mm	
1		Dark Brown Clay, dry till 1m.	BH3 2.5
2		No odour detected in this hole	
3	 	Some light rock at 3m then Solid rock was encountered at 3.5m	BH3 3.5
4			

END OF LOG

Attachment E
Potential offsite receptors

Report Number: **N3390**
Onsite date: **08.10.18**
Report date: **18.10.18**



TABLE: POTENTIAL RECEPTORS AND CONTAMINATION ROUTES

LOCATION	RECEPTOR	ROUTE
On-site	Human receptors include: <ul style="list-style-type: none"> • Site occupants • Site visitors • Contractors and workers • Future site occupants 	Exposure by direct contact via skin, ingesting and inhaling. Migration and consumption of contaminated groundwater. Migration of soluble contaminants with surface water run-off.
Off-site	Human receptors include: <ul style="list-style-type: none"> • Off-site occupants/residents of their own property • Off-site visitors/customers • Contractors and workers dealing with projects on adjoining land 	Migration of contaminated underground water. Migration of contaminated surface water or similar. Extraction and use of groundwater down-gradient from the site.

