

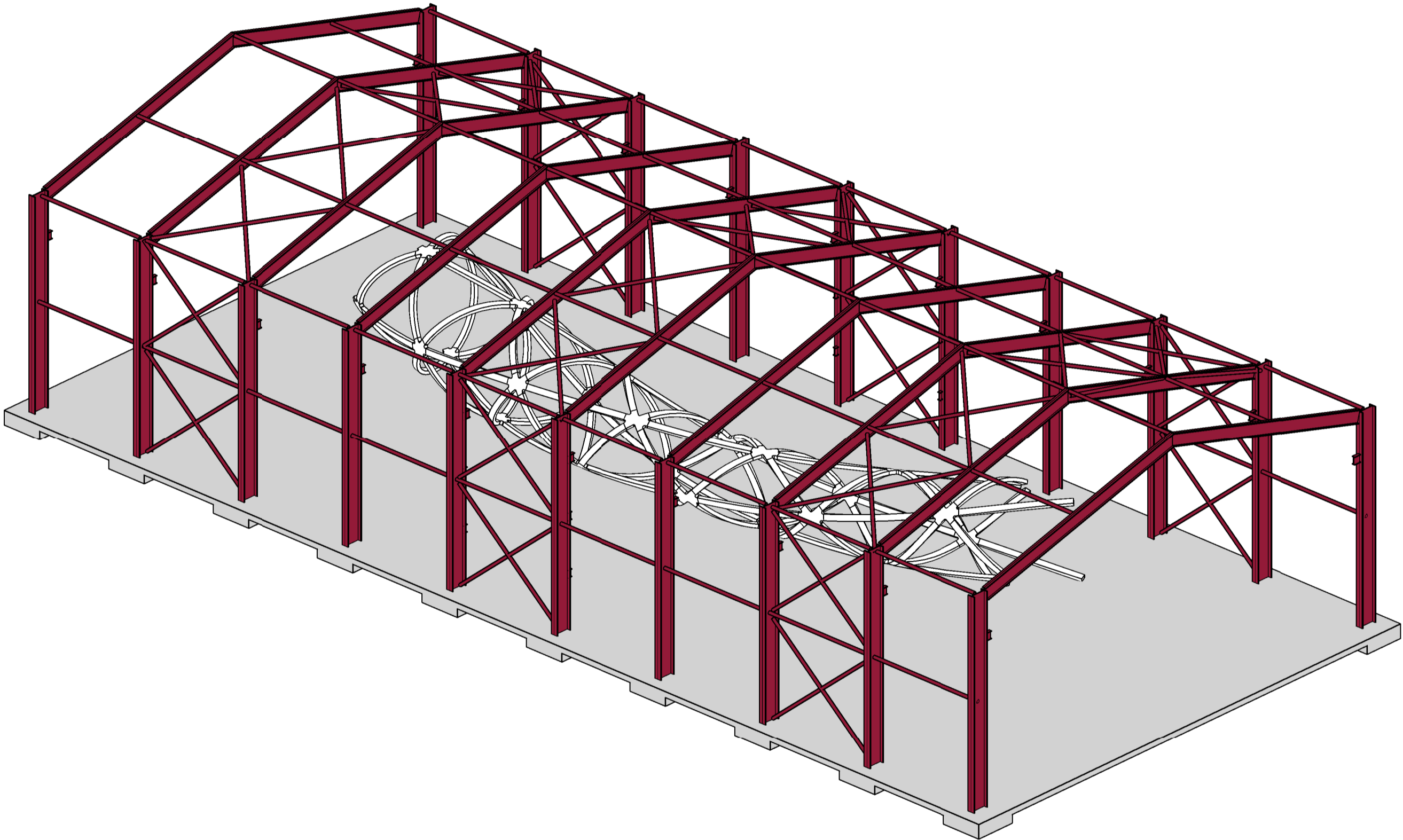
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A B C D E F G H I J K L M N

LACHLAN'S LINE TEMPORARY PORTAL SHED

Structural Drawings

Structural Drawing List	
Sheet No.	Sheet Name
S-0001	Cover Sheet
S-0010	General Notes
S-0020	Typical Details - Concrete
S-0025	Typical Details - Steel - Sheet 1
S-0100	Slab on Ground Plan & Details
S-0200	Structural Framing Plans
S-0210	Structural Framing Sections
S-0220	Steelwork Details - Sheet 1

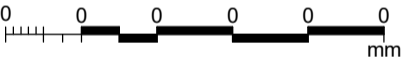


Isometric View

N.T.S.

* with Stage 4 Helix Structure inside for information

P1	22/12/17	DP	ZL	JD
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Project Title
LACHLAN'S LINE
TEMPORARY PORTAL SHED

Drawing Title
Cover Sheet

Scale at A1 N.T.S.

Role Structural

Suitability For Information

Arup Job No
247451-89

Rev
P1

Name
S-0001

PRELIMINARY ONLY
NOT FOR CONSTRUCTION

GENERAL

- G1

Structural drawings to be read in conjunction with the structural specifications and all architectural and other consultants' drawings and specifications.
- G2

Any discrepancies shall be referred to the Architect for a decision before proceeding with the work.
- G3

For setting out dimensions refer to architectural drawings. No dimensions are to be obtained by scaling from drawings.
- G4

Unless otherwise noted, all levels are given in metres and all dimensions are in millimetres.
- G5

The Builder shall be responsible for maintaining the stability of the structure until its completion and shall ensure that no part of the structure is overstressed by excessive construction loading or contains "locked in" stresses from temporary conditions.
- G6

All materials and workmanship shall be in accordance with Australian standards and codes of practice except where varied by the specification and/or drawings.
These Standards for this project shall be determined by reference to the document history on the Standards Australia website as of October 2016. This determination of applicable Standards shall be carried out during the Tender period and any queries relating to the appropriate Standard shall be raised with Arup during this period.
- G7

Each aspect of structural work is to be checked by the Engineer after the Builder has satisfied himself that it is correct, and before it is concealed. The Engineer is to be given 48 hours notice of inspection being required.
- G8

Design wind loads: To AS/NZS 1170.2

Importance Level (BCA Table B1.2a) = 2
Annual probability of exceedance = 1:500
Regional Wind speeds V25 = 37 m/s
Basic wind speed V20 (serviceability) = 37 m/s
Terrain category = 2.5
- G9

Design earthquake loads: to AS/NZS 1170.4

Earthquake design category = II
Site sub soil class = Ce
Site Hazard Factor = 0.08
Annual probability of exceedance (BCA Table B1.2b) = 500 years
Structural ductility factor / Performance factor = 0.38
- G10

Abbreviations.

NTS - Not to scale
UNO - Unless noted otherwise
NSOP - Not shown on plan
NSOE - Not shown on elevation.
- G11

Prior to construction of all concrete floors and walls, the contractor shall prepare, for review by the architect and design consultant, fully co-ordinated floor plans and wall elevations showing all proposed penetrations, openings and cast-in fixings, which shall also require the planning and co-ordination of all services who may require such penetrations, openings and fixings.
- G12

When construction involves modification or addition to existing structure, the builder shall advise if boney and/or spalling concrete, exposed reinforcement, rust stains, cracked concrete and cracked masonry walls are observed. These areas will need to be rectified as directed by the engineer. These drawings have been prepared based on available existing structural drawings and limited site inspections and should not be relied upon as being a true representation of the existing structure. It is the builder's responsibility to inspect the existing structure and advise of any discrepancies and obtain instructions from Arup prior to proceeding.
- SG1

Remove all top soil including roots and any other organic matter. store top soil as required.
- SG2

Excavate to the required formation level and proof roll formation with 6 passes of 10 tonne smooth wheeled roller. soft areas are to be removed and replaced with suitable fill compacted to the density nominated below.
- SG3

Where shown on the drawings, base and sand blinding are to be placed and compacted as specified.
- SG4

Fill material shall meet the requirements of the specification. Place in maximum 150mm thick layers in accordance with as 1289.5.4.1 for cohesive soils and in accordance with as 1289.5.6.1 for granular soils. Maximum depth of fill is to be 750mm unless noted otherwise by the engineer. The following table shall be used for minimum relative compaction levels of fill material.
- SG5

Clay subgrade formation is to be maintained at optimum moisture content -0,+3% prior to covering.

CONCRETE

- C1

All concrete work to be in accordance with AS 3600.
- *C2

Concrete shall be as follows unless noted otherwise on the drawings:

Slump:80mm ±15mm

Max. aggregate:20mm

Cement: type gp

* Strength grade

Min. cement (kg/m3)

Max w/c ratio

S25

250

0.55

S32

280

0.55

S40

330

0.50

S50

400

0.45

S65

400

0.45

*The fines ratio which is defined as the proportion by weight of aggregate passing the 1.18mm sieve size to the total aggregate in the mix, must not exceed 0.4.

or where control required is less critical.

Slump:80mm ±15mm

Max. aggregate:20mm

N20, N25, N32, N40 or N50.

Maximum drying shrinkage strain measured in accordance with AS 1012 Part 13 shall not exceed 650 x 10-6 at eight weeks for all critical elements.

C3

Unless noted otherwise, the characteristic concrete strength and clear cover to the reinforcement (including fitments) shall be as follows:

Element	Exposed to weather		Not Exposed to weather	
	Grade (Mpa)	Cover (mm)	Grade (Mpa)	Cover (mm)
Blinding and Mass Concrete	N15	-	N15	-
Slab on Grade	S32	40	S25	20

C4

Sizes of concrete elements do not include thickness of applied finishes.

C5

Beam depths are noted first and include thickness of slab if any.

C6

Cure concrete by keeping continuously wet for 7 days or by covering with clear plastic sheeting's. Alternative equivalent methods of curing may be submitted to the Engineer for approval.

C7

All penetrations required in concrete are shown on the structural drawings and/or an approved coordinated penetrations drawing, if any. The Builder is to seek the approval of the Engineer if any additional penetrations are required.

C8

No plumbing or vacuum pipes to be cast into slabs unless shown otherwise on the structural drawings or the Engineer has given written approval.

C9

If plastic shrinkage of the concrete is observed due to rapid drying or other conditions, apply a white spray coat of aliphatic alcohol evaporation retardant ("MasterKure 111CF-Confilm" by Master Builders or equal approved) immediately after screeding. Note: "Confilm" is not a curing compound.
Slurry to lubricate concrete pump lines shall not be used in any structural member.

CONSTRUCTION TOLERANCES

CT1

Unless noted otherwise, standard construction tolerances Shall be based on the requirements of AS 3600 and AS 4100.

CT2

Any construction tolerances noted in the drawings or Specification are to be considered in conjunction with the Standard tolerances as indicated above,unless specifically noted as an exception to, or in lieu of a standard tolerance

CT3

Attention is drawn to the fact that tolerances of the existing building are unknown and a site investigation to prove the setting out of members is required. Unless noted otherwise, new steel members are to be set out to align with the centroids and centrelines of existing structural elements.

STRUCTURAL STEEL

S1

All workmanship & materials to be in accordance with AS 4100 and the steel specification. All other materials (such as bolts, washers, straps and ties) which are not specifically indicated on the drawings but required in construction shall be provided at the builders expense. All section sizes have been based on the OneSteel catalogue.

S2

Steel shall have the following minimum values of yield stress (fy) UNO.
Hot rolled sections to AS/NZS 3679.1: Grade 300 plus
Hot rolled plates to AS/NZS 3678: Grade 350
Welded I sections to AS/NZS 3679.2: Grade 300
Hollow sections to AS 1163: Grade C350
Circular Hollow sections to AS 1163: Grade C350

S3

At least three weeks prior to the commencement of fabrication submit two copies of shop detail drawings for examination by the Engineer.

S4

No steelwork shall be fabricated until all review comments on the workshop drawings have been resolved to the Engineers satisfaction.

S5

All dimensions and levels (including H.D. Bolts as constructed) affecting new steelwork shall be checked on site and incorporated in workshop drawings.

S6

The Builder shall be responsible for providing temporary bracing until the structure is complete.

S7

Bolts types and designations shall be as follows:

4.6/S Commercial bolts to be AS/NZS 1111, snug tightened. 8.8/S High strength structural bolts, nuts and hardened washers
8.8/TB.-High strength structural bolts as above, fully tensioned to AS 4100 in a bearing type joint.
8.8/TF.High strength structural bolts as above, fully tensioned to AS 4100 in a friction type joint with contact surfaces left uncoated.

Where 8.8 Bolts are shown as torqued (TB or TF) they shall be assembled in accordance with AS 4100 using "coronet" load indicating washers.

S8

All bolts shall be M20 8.8/S U.N.O. No steel to steel connection shall have less than 2M16 8.8/S bolts U.N.O.

S9

M12 and smaller bolts to be grade 4.6/S. M16 and larger bolts to be high strength snug tightened grade 8.8/S unless shown otherwise.

S10

All holding down bolts shall be commercial bolts or be made from bars with minimum yield stress 250 MPa with threads to AS 1275 unless shown otherwise.

S11

All plates shall be 10mm thick U.N.O.

S12

All reactions, where shown, are in kN Ultimate limit state U.N.O.

S13

The ends of all hollow sections shall be sealed with 3mm end plates U.N.O.

S14

Unless specified otherwise corrosion protection shall be as follows:

(a) Internal steelwork generally: Primed and Painted

(b) External steelwork: Hot dip Galvanized

(c) Members embedded in either leaf or the cavity of external masonry walls to be hot dip galvanised in accordance with AS/NZS 4680. Minimum coating to be 500 g/m2.

(d) Bolts, nuts and washers to be supplied as hot dip galvanised by the bolt manufacturer. After tightening, exposed faces of bolts, nuts and washers shall be prepared and coated as specified, or as for adjacent steelwork.

(e) Holding down bolts to be hot dipped galvanised.

S15

In addition to the finish specified, steelwork in contact with the ground is to be coated with a Interzone 954 HS or equivalent approved, to a minimum thickness of 0.4mm.

S16

For galvanised coatings, repair field damage and site welds with two coats of a two pack epoxy polyamide zinc-rich paint containing a minimum of 92% zinc dust in the dry film which shall be built up to 75 micrometres minimum.

S17

For paint coatings, repair field damage and site welds using the same parent coating system. Successive paint layers shall be abraded to a feathered edge of approximately 25mm width per layer. Mechanically grind surfaces to achieve smooth and bright metal comparable to class 2.5. Paint reinstatement shall fully cover the feathered part of the same layer.

S18

All sealed hollow sections to be galvanised shall have vent holes as per the galvaniser's requirement, to the Engineers approval. These are to be shown on the workshop drawings.

S19

Grout under baseplates to be high strength cementitious non-shrink (Masterflow 870 by Master Builders or equal approved) unless shown otherwise.

S20

Cold formed steel structures shall conform to AS/NZS 4600.

S21

Cold formed sections such as purlins and girts are to be roll formed from zinc coated high strength "zinc hi-ten" steel strip, conforming to AS 1397 - G450 - Z450 (450 MPa minimum yield stress, 450g/m2 minimum coating mass). Sections are to have dimensions equivalent to those shown in the BHP catalogue.

S22

Purlin cleats are to be in accordance with the manufacturer's standard details except where the top flange of the purlin is between 250mm and 750mm above supporting steelwork 75 x 75 x 8 angle cleats shall be used.
Purlins shall be fixed using approved flanged bolts and washers.

S23

Bridging to be in accordance with the manufacturer's standard details.

S24

Ceiling systems, ductwork etc. to be suspended from purlins should be fixed with hook bolts through the purlin web. The flanges of the purlins or girts shall not be holed.

S25

Provide 50 x 50 x 3 galvanised angle trimmers to carry sheeting as required at purlin and girt ends. Fix with one No. 14 Teks screw per purlin/girt. This will generally require two angles on hips and valleys, one angle on gables and one vertical angle at corners.

S26

Contractor shall provide minimum 100mm concrete cover around all steel members or steel components adjacent to and exposed to soil. Minimum reinforcement in cover concrete shall be N12 @ 300 EV.

S27

Abbreviations.
C.F.W. - Continuous fillet weld
F.S.B.W. - Full strength butt weld
P.P.B.W. - Partial penetration butt weld

S28

Majority of existing structure is encased in concrete. Any breaking out or scabbling of concrete for testing or new connections to be made good using Renderoc HB70 or similar approved product.

S29

Match fitting of all steelwork in shop is required to ensure correct alignment and fit up.

S30

Match fitting of all steelwork in shop is required to ensure correct alignment and fit up.

S31

Welds on external steelwork to be finished to architects specification.

S32

8.8 grade bolt, nut and washer assemblies are to comply with AS 1252.Prior to bolts being installed on site the contractor shall provide a manufacturers test certificate and a certificate of compliance with AS 1252 from a NATA accredited testing laboratory to the engineer for review.

S33

In all cases where the wall thickness of SHS or RHS is less than 6mm and to which a fin plate is welded, provide a 6mm plate stiffener, width to be 15mm less than face of section, welded all around.

S34

The ends of all hollow sections shall be sealed with 6mm end plates U.N.O.

S35

TF interfaces between mating plates (and steel surface directly under washers) to have minimum slip factor of 0.45 - to be verified through testing.

S36

All mating surfaces to achieve full contact bearing in accordance with AS 4100

S37

Open sections on their sides with flanges vertically up shall have 10mm diameter drain holes at quarter points in length.

S38

Where noted slotted holes should have bolts with lock nuts.

S39

Contractor and detailer to allow for all shims, plates, washers etc to facilitate adjustment to suit the tolerances as a result of the contractors method of construction.

S40

The contractor shall be responsible for the provision of sufficient temporary supports, props, ties or bracing as required to efficiently deal with wind or other eccentric loading experienced by the structure during their chosen erection sequence.

S41

Not all structural steel is necessarily shown on the structural drawings. Refer also to the architect's drawings.

S42

We acknowledge that not every detail has been drawn in either the architectural or structural documents. Tenderers are to allow for the cost of the structural steel shop detailer to establish or resolve details in close liaison with the architect and structural engineer. A response from the structural steel sub-contractor that they we unaware of the complication of detailing / fabrication required being unexpectedly high, even though they viewed the tender documents will not be accepted. Refer to the specification regarding the obligations of detailing non-typical connections, secondary attachments etc.

STRUCTURAL STEEL WELDING

SW1

All welding to be Structural Purpose (SP) in accordance with AS/NZS 1554. The weld consumable strength shall be as follows:

Nominal yield strength of steel to be welded	Nominal tensile strength of weld metal, fuw (MPa)
All steel with grade ≤ 300 MPa	430
All steel with 300 < Grade ≤ 450 MPa	490
Quench & tempered steel to Grade 690 MPa	760

SW2

Welds to be 6mm continuous fillet welds unless otherwise noted. Butt welds are to be complete penetration butt welds as defined in AS/NZS 1554 U.N.O.

SW3

Non destructive testing of welds shall be carried out in accordance with the specification.

SW4

Contractor is responsible for welding joint preparations and welding procedures, including (but not limited to):
Welding procedures, required root openings, root face dimensions, groove angles, backing bars, copes, surface roughness values, and welding tapers of unequal parts.

SW5

Sequences and procedures of welding shall minimize the effect of shrinkage and residual stresses, and maintain erection tolerances.

SW6

All groove and butt welds shall be complete joint penetration Welds, unless noted otherwise. All partial penetration groove Weld sizes shown on the drawings refer to effective throat Thickness.

SW7

All complete penetration welds shall be ultrasonically tested, except where plate thickness is less than 6mm the welds shall be magnetic particle tested.

SW8

Fillet weld sizes shown on the structural drawings are minimum sizes. Increase weld size to aws minimum sizes, based on plate thicknesses. Minimum weld size (excluding seal welds) to be 6mm.

SW9

Fillet weld lengths shown on the drawings are the net effective length required. Where length of weld is not shown it shall be full length of joint, member or plate.

SW10

All steel permanently exposed to the weather that is not hot-dipped galvanized inside and out shall have additional seal welding to protect members and connections from moisture infiltration. Show seal welding on shop drawings for review by the architect/engineer.

SW11

Protective coating systems shall be applied in accordance with the schedule in the specification unless noted otherwise on the contract drawings.

SW12

Site welding shall only be carried out with prior written consent of Arup structural engineer.

SW13

All steel plate subject to through plate tension provide Z15 grade Min.

CRANE LOADS

CL1

Weights of crane components are based on a 30m span crane from Munck.

Trolley/crab weight = 4565lbs = 20kN
Crane weight = 53845lbs = 238kN
Block and hook weight = 1000kg = 10kN

Crane type assumed "Class 3" = Heavy engineering shop cranes, heavy duty warehouse cranes.
Crane drive system assumed "W=type"

P1	22/12/17	DP	ZL	JD
Issued for Information				
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Project Title
LACHLAN'S LINE
TEMPORARY PORTAL SHED

Drawing Title
General Notes

Scale at A1 N.T.S.

Role Structural

Suitability For Information

Arup Job No
247451-89

Name
S-0010

Rev
P1

PRELIMINARY ONLY

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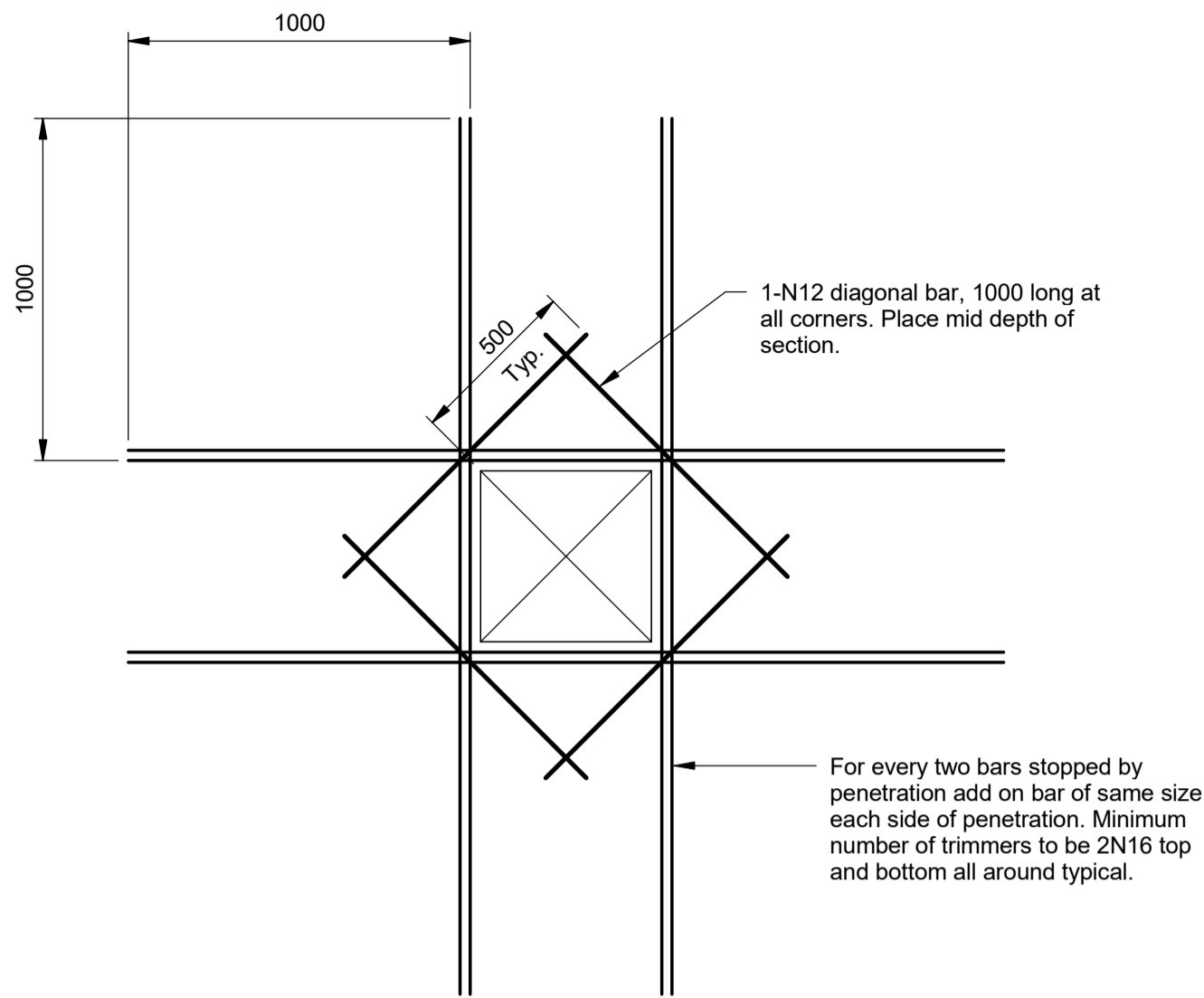
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Standard Penetration

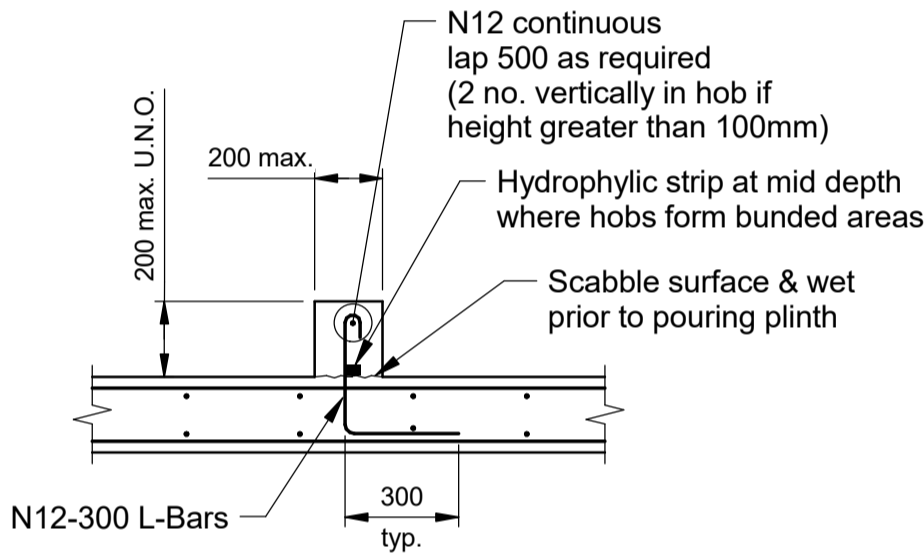
Bar Dia.	Lap Length (mm)	
	Bottom Reinf. Less than 300mm concrete below bar	Top Reinf. More than 300mm concrete below bar
N10	400	500
N12	500	600
N16	600	800
N20	850	1100
N24	1100	1400
N28	1350	1750
N32	1600	2100
N36	1900	2400
N40	2200	2800

Beam & Slab
Lap Length Schedule

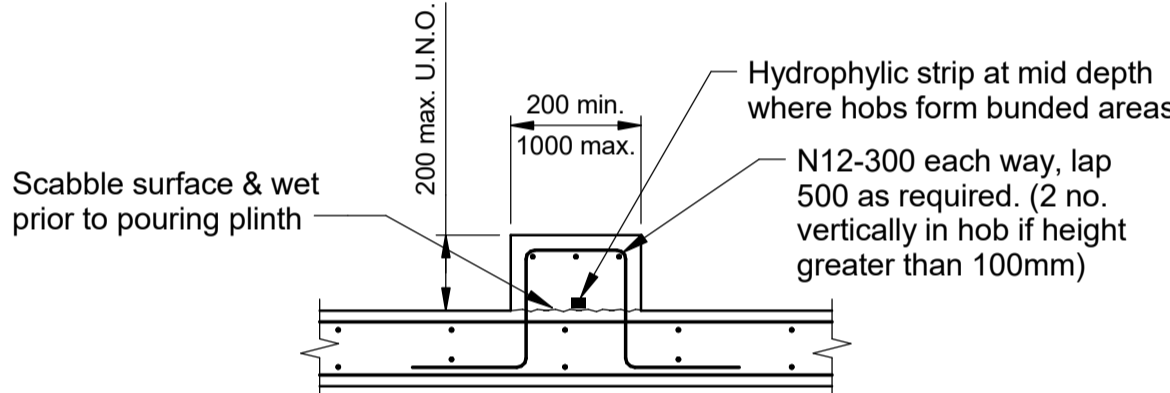
Bar Dia.	Lap Length (mm)
N10, 12, 16	70
N20	80
N24	96
N28	112
N32	128
N36	144
N40	160

Cog Length Schedule

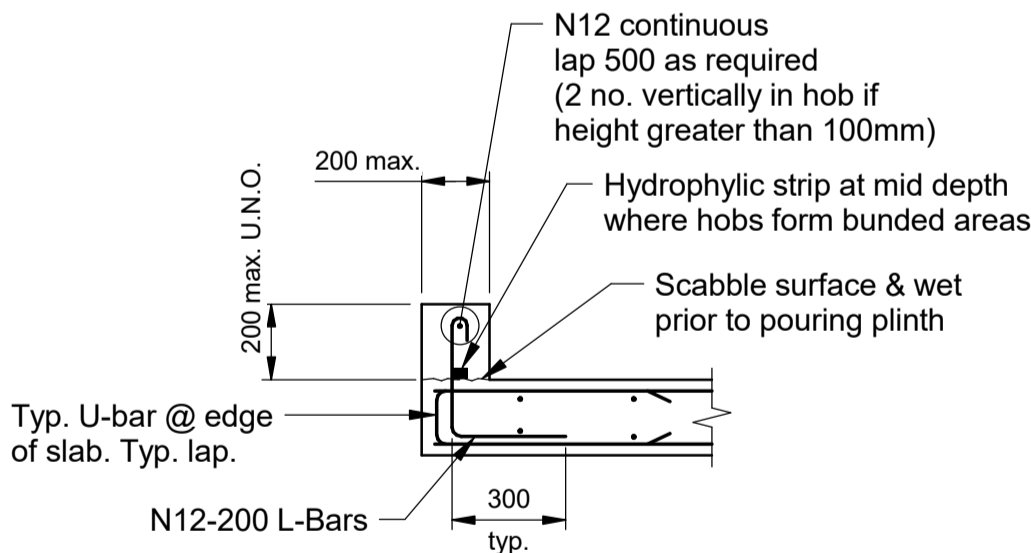
Note: Minimum extension lengths beyond bend noted



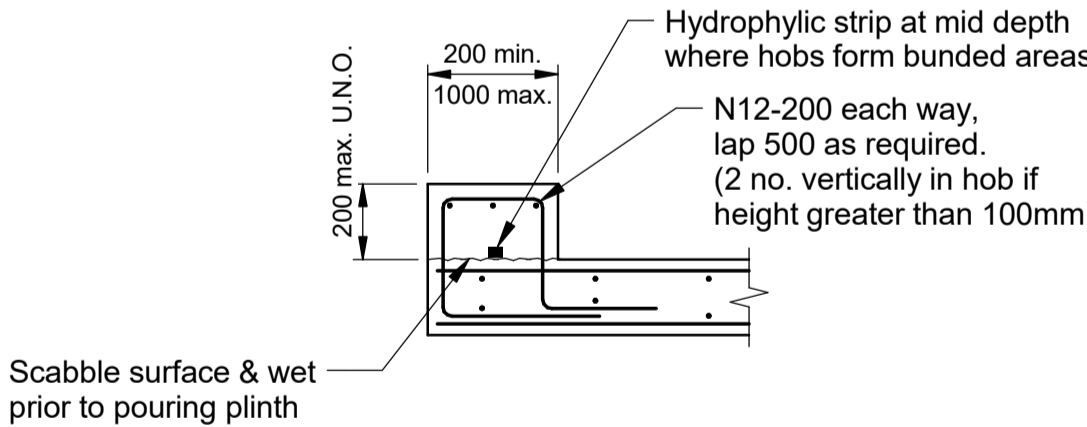
Typical Hob Detail
200mm Wide and Less



Typical Plinth Detail
200mm to 1000mm Wide

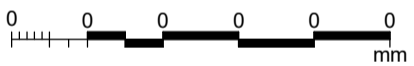


Typical Edge Hob Detail
Under 200mm Wide



Typical Edge Plinth Detail
200mm to 1000mm Wide

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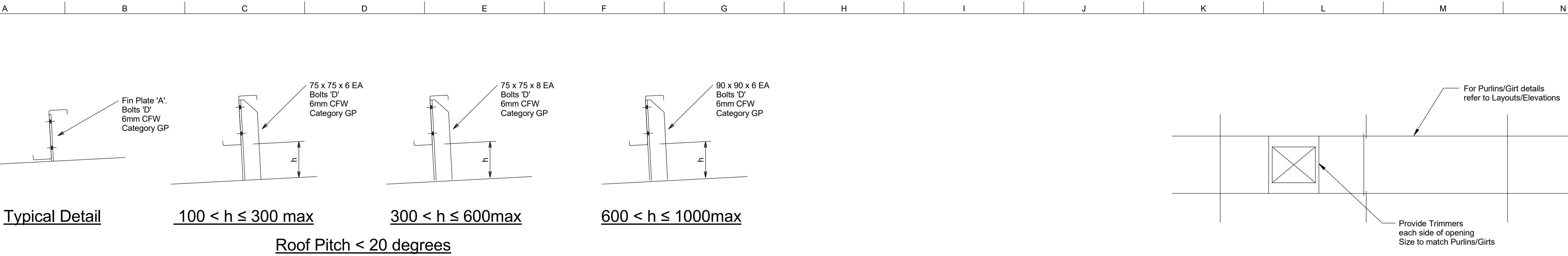
Project Title
LACHLAN'S LINE
TEMPORARY PORTAL SHED

Drawing Title
Typical Details - Concrete

Scale at A1	N.T.S.
Role	Structural
Suitability	For Information
Arup Job No 247451-89	Rev P1
Name S-0020	

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Typical Detail

100 < h ≤ 300 max

300 < h ≤ 600max

600 < h ≤ 1000max

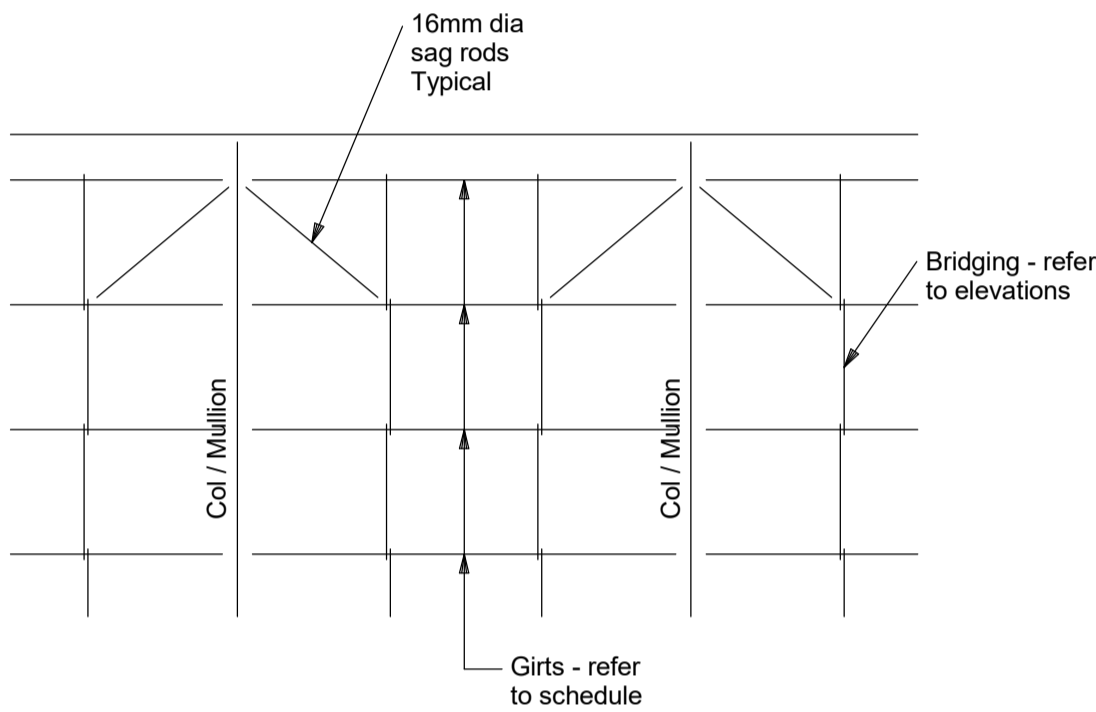
Roof Pitch < 20 degrees

Typical Purlin/Girt Connection Details

Nominal Purlin Section size (mm)	Fin Plate 'A'	Bolts 'D' (Grade 4.6/s u.n.o.)
100	8mm thick	2-M12
150	8mm thick	2-M12
200	8mm thick	2-M12
250	8mm thick	2-M12
300	12mm thick	2-M16
350	12mm thick	2-M16

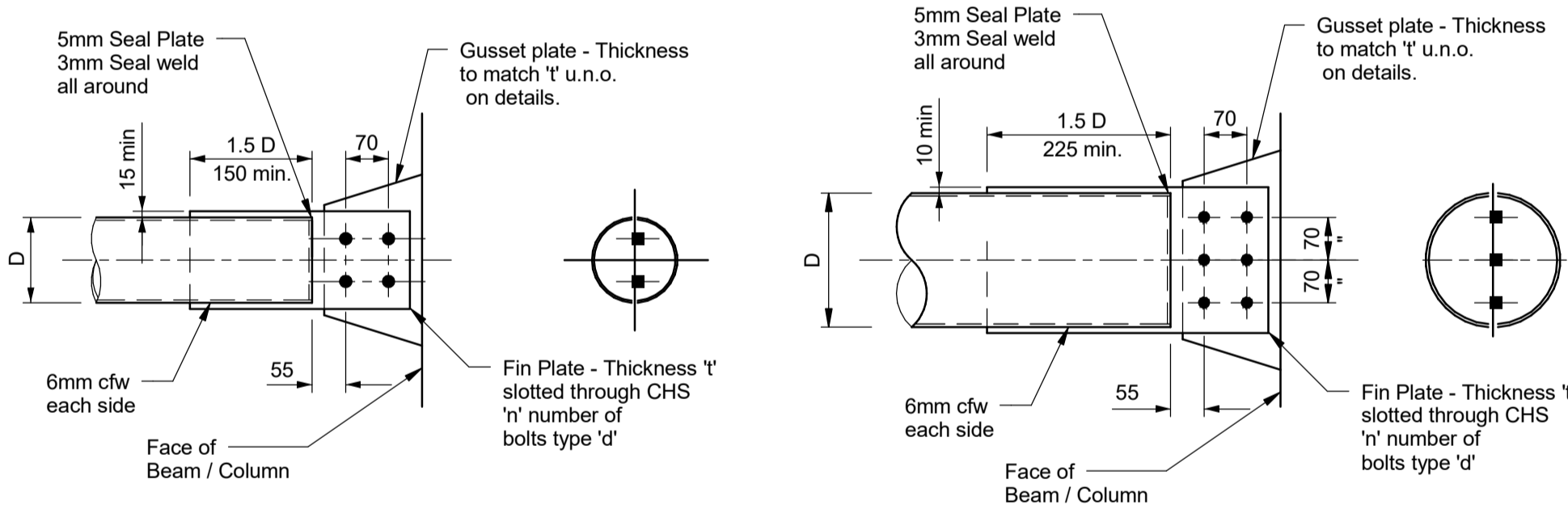
- Note:-
- Details of bolt holes and laps to purlins and girts to be in accordance with manufacturers recommendations.
 - Details of bridging to purlins and girts to be in accordance with manufacturers recommendations.
 - At concrete connection provide 16mm base plate with 2M16 HIT-V anchors. Drill and epoxy to 125mm embedment with HIT-HY 200

Typical Purlin/Girt Trimmer Detail
At Roof/Wall Penetrations
Typical Girt Details



Typical Girt Sag Rod Detail

1:100



Type SP-B / t / n-d
(2 Rows of Bolts)

(Typical for CHS, RHS and SHS Sections)
where n = number of bolts
d = diameter of bolts
t = thickness of cleat pl

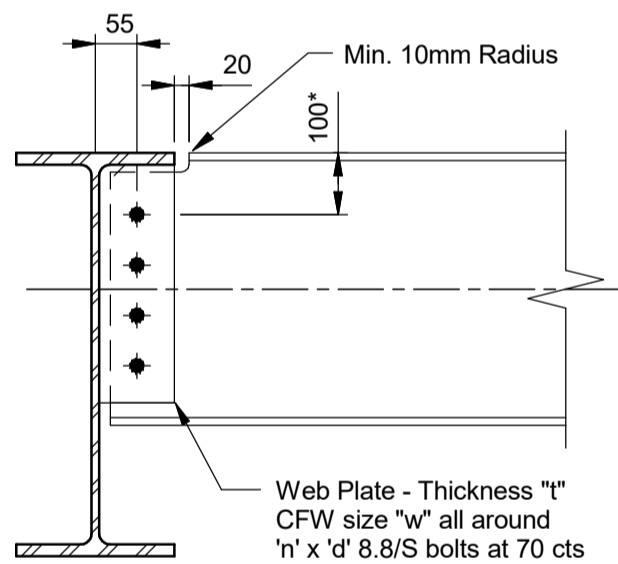
Type SP-C / t / n-d

(Typical for CHS, RHS and SHS Sections)
where n = number of bolts
d = diameter of bolts
t = thickness of cleat pl

Slotted Plate

Typical Bracing End Connection Details
(indicative only)

Scale : 1 : 10



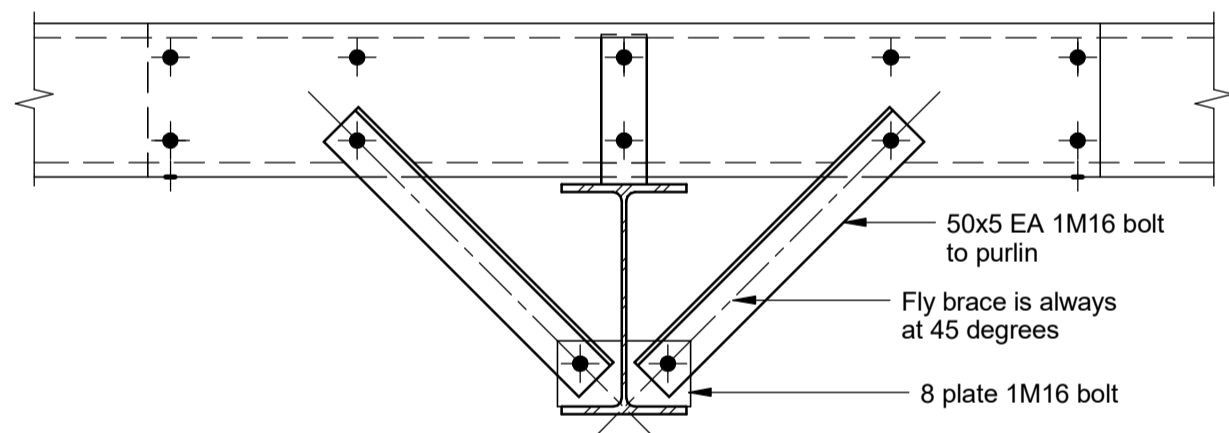
Beam to Beam

Web Side Plate - Type WP-A / t / n-d / w**

- * - 70mm for members <250mm deep
** - Welds 6 CFW UNO

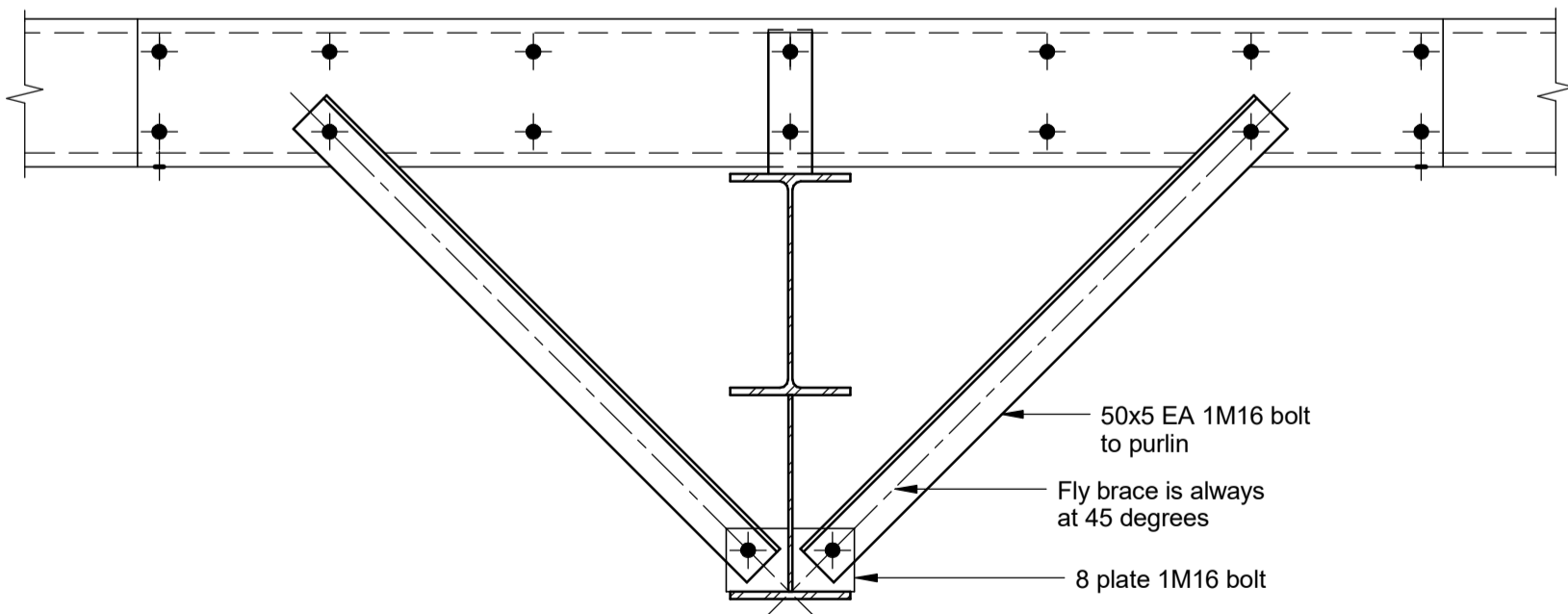
Typical Beam Connection Details
(indicative only)

Scale : 1 : 10



Typical 'C' Purlin Fly Brace Detail

Scale 1 : 10

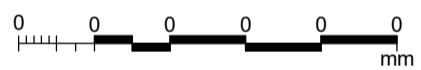


Typical 'C' Purlin Fly Brace Detail
at Rafter End

Scale 1 : 10

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Project Title
LACHLAN'S LINE
TEMPORARY PORTAL SHED

Drawing Title
Typical Details - Steel
Sheet 1

Scale at A1 1 : 10

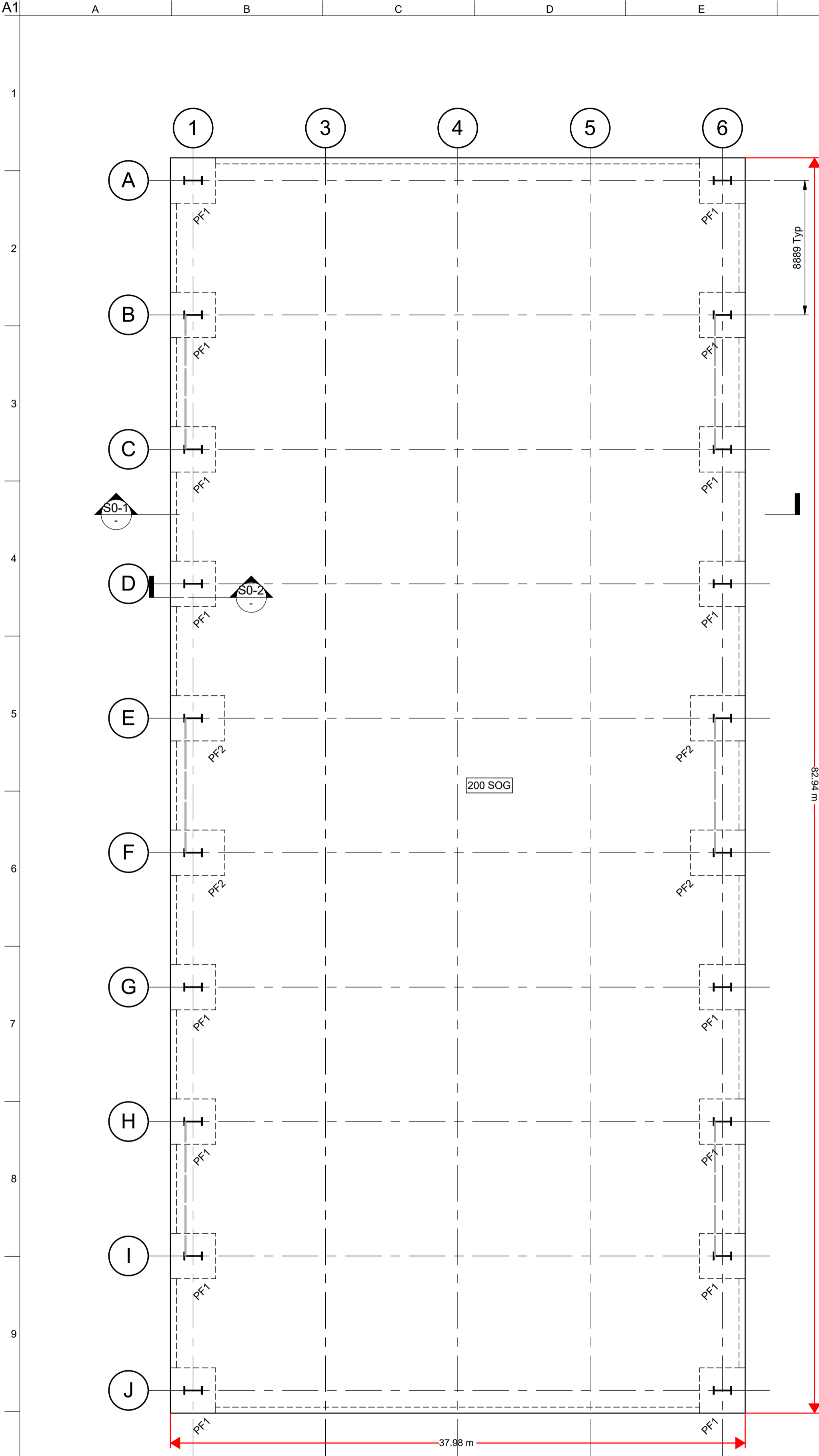
Role Structural

Suitability For Information

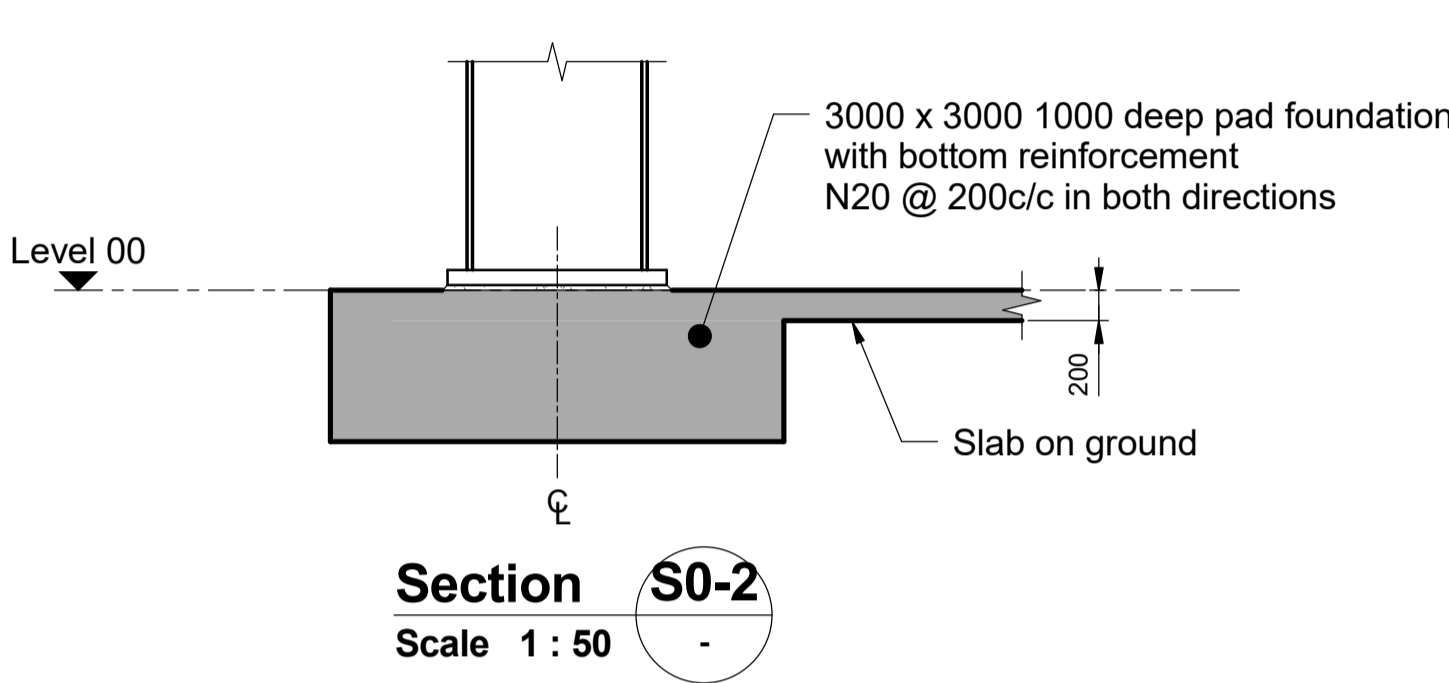
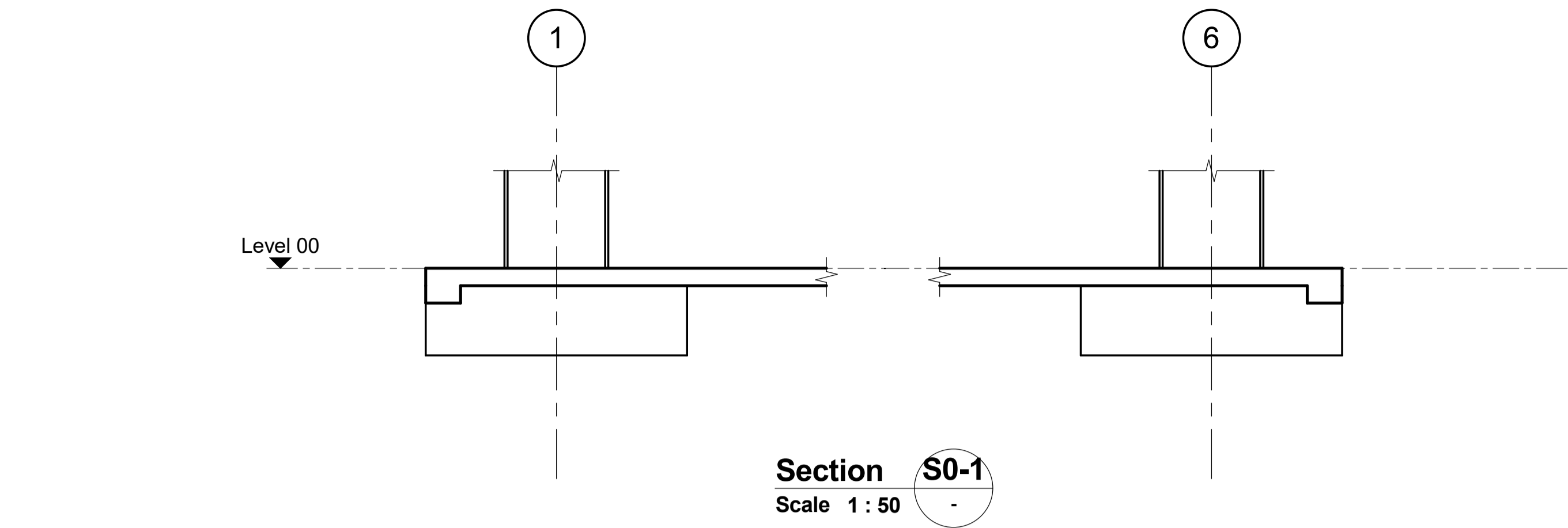
Arup Job No
247451-89

Name
S-0025

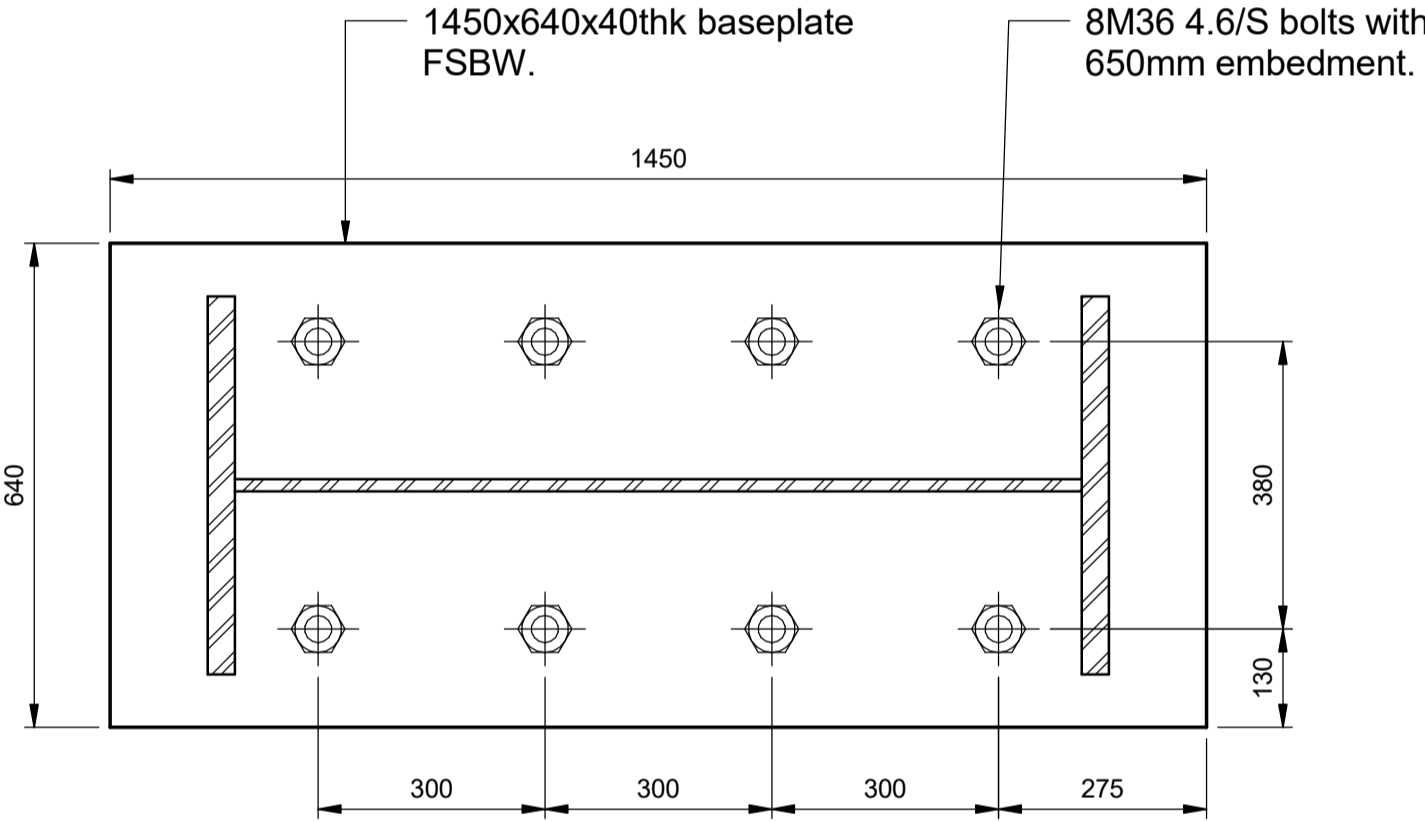
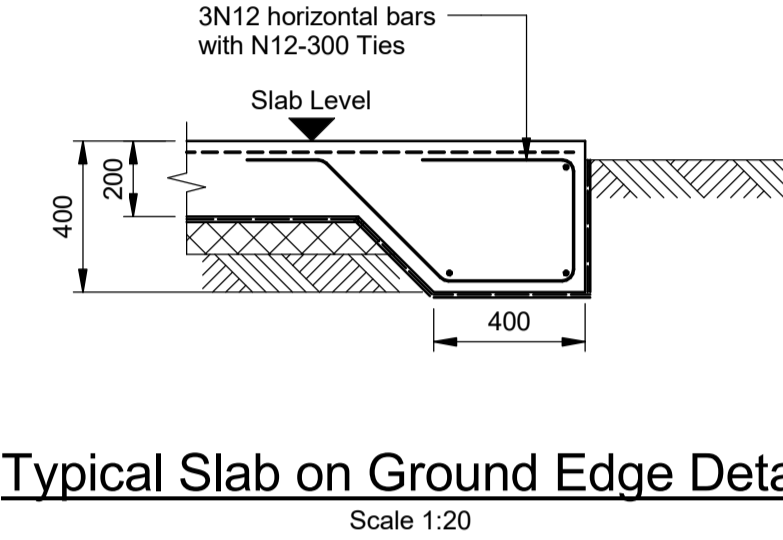
Rev
P1



Slab on Ground GA
1 : 200



Structural Schedule - Pad Footing			
Mark	Pad Dimensions (mm)		
	L	W	D
PF1	3000	3000	1000
PF2	3600	3000	1000



C1 - 1200WB423

Base Plate Details
1 : 10

Note:
1. For general notes refer to drawing S-0010

P1	22/12/17	DP	ZL	JD
Issued for Information				
Rev	Date	By	Chkd	Appd



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Client
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Project Title
LACHLAN'S LINE
TEMPORARY PORTAL SHED

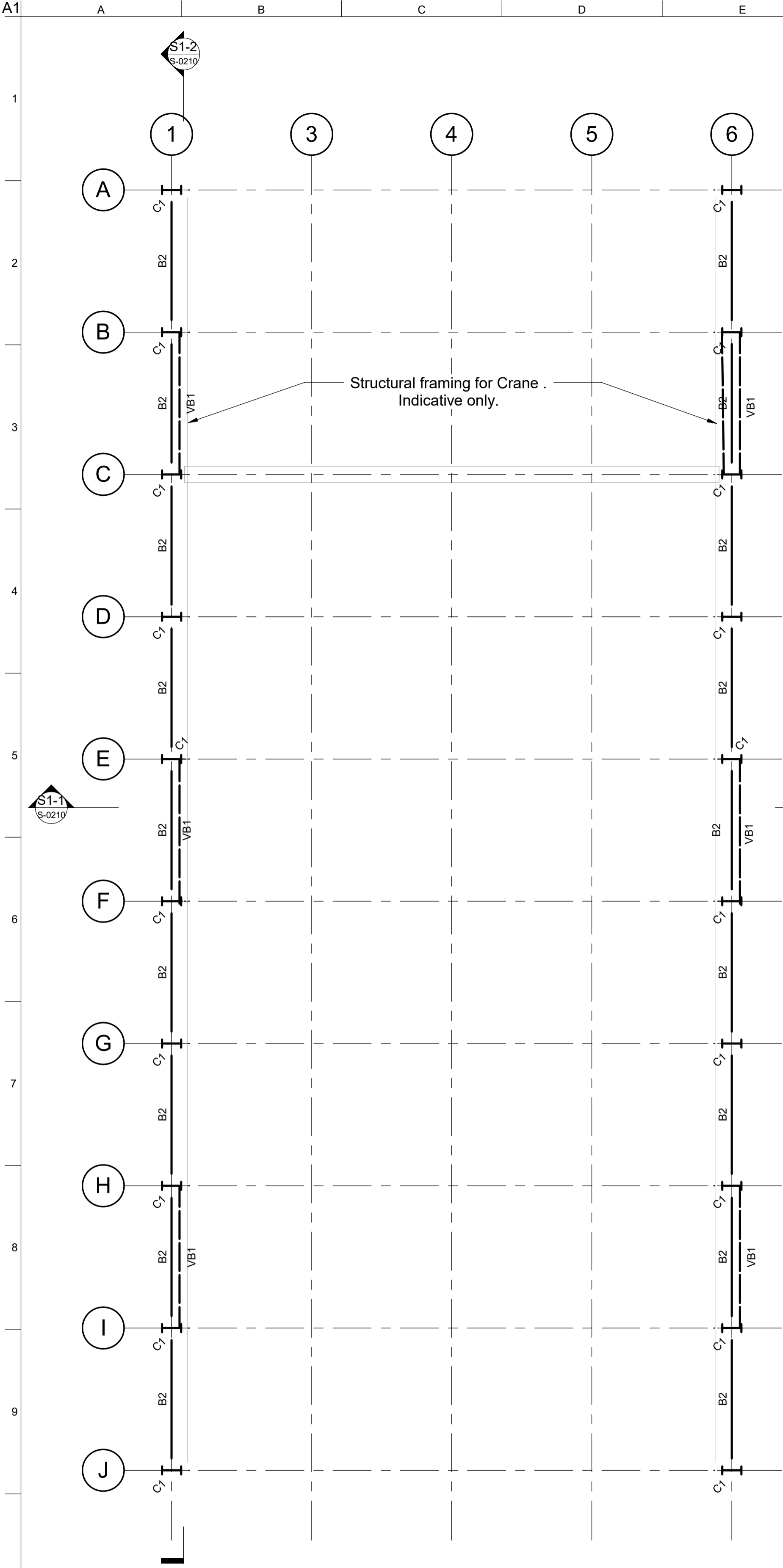
Drawing Title
Slab on Ground
Plan & Details

Scale at A1
As indicated
Role
Structural
Suitability
For Information

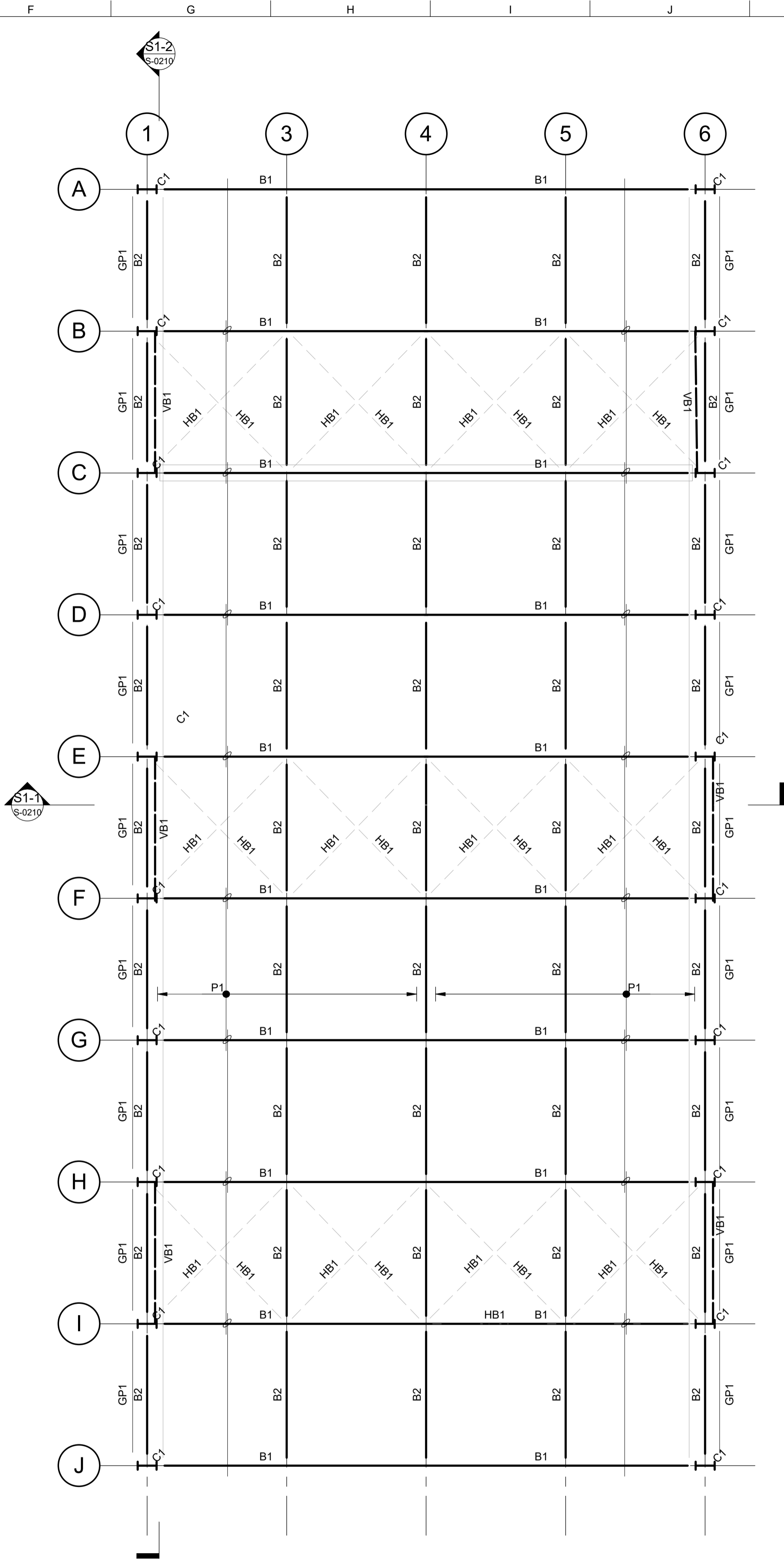
Arup Job No
247451-89
Name
S-0100

Rev
P1

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Plan at Gantry Level
1 : 200



Plan at Roof Level
1 : 200

Structural Schedule - Column		
Mark	Size	Comments
C1	1200WB423	

Structural Schedule - Framing		
Mark	Size	Comments
B1	900WB175	
B2	219.1x8.2CHS	
B3	530UB92.4	
HB1	219.1x4.8CHS	Horizontal bracing
VB1	219.1x6.4CHS	Vertical bracing

P1 - Purlins 250 Z 24 @ 1200 c/c with 1 row of bridging. Lap 15% of greater span.
P2 - Girts 250 C 24 @ 1200 c/c with 1 row of bridging. Lap 15% of greater span.
GP1 - Gutter Purlins 250 C 24.

Note:

1. For general notes refer to drawing S-0010

P1	22/12/17	DP	ZL	JD
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Project Title
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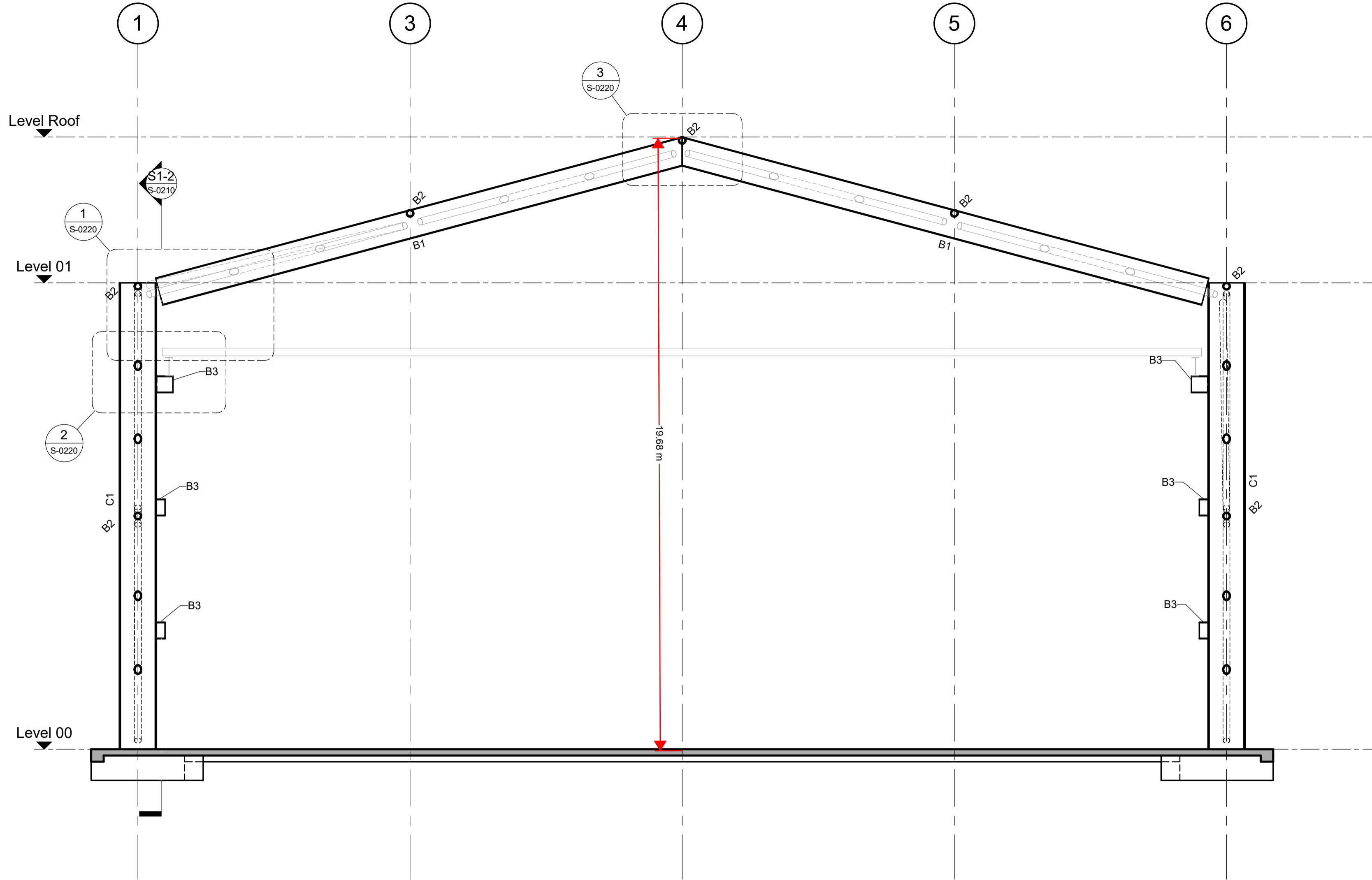
Drawing Title
Structural Framing Plans

Scale at A1	As indicated
Role	Structural
Suitability	For Information
Arup Job No 247451-89	Rev P1
Name S-0200	

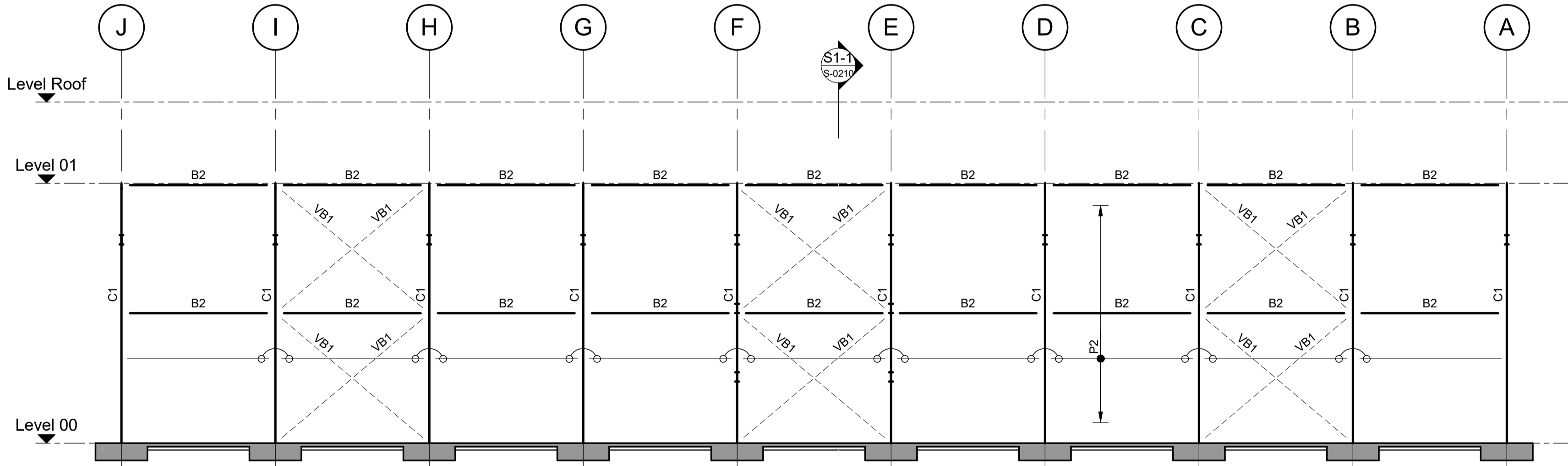
PRELIMINARY ONLY
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A B C D E F G H I J K L M N



Section **S1-1**
Scale 1 : 100 S-0200



Section **S1-2**
Scale 1 : 200 S-0200

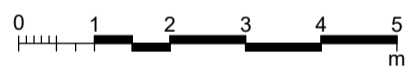
Structural Schedule - Column		
Mark	Size	Comments
C1	1200WB423	

Structural Schedule - Framing		
Mark	Size	Comments
B1	900WB175	
B2	219.1x8.2CHS	
B3	530UB92.4	
HB1	219.1x4.8CHS	Horizontal bracing
VB1	219.1x6.4CHS	Vertical bracing

P1 - Purlins 250 Z 24 @ 1200 c/c with 1 row of bridging. Lap 15% of greater span.
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GP1 - Gutter Purlins 250 C 24.

Note:
1. For general notes refer to drawing S-0010

P1	22/12/17	DP	ZL	JD
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Project Title
LACHLAN'S LINE
TEMPORARY PORTAL SHED

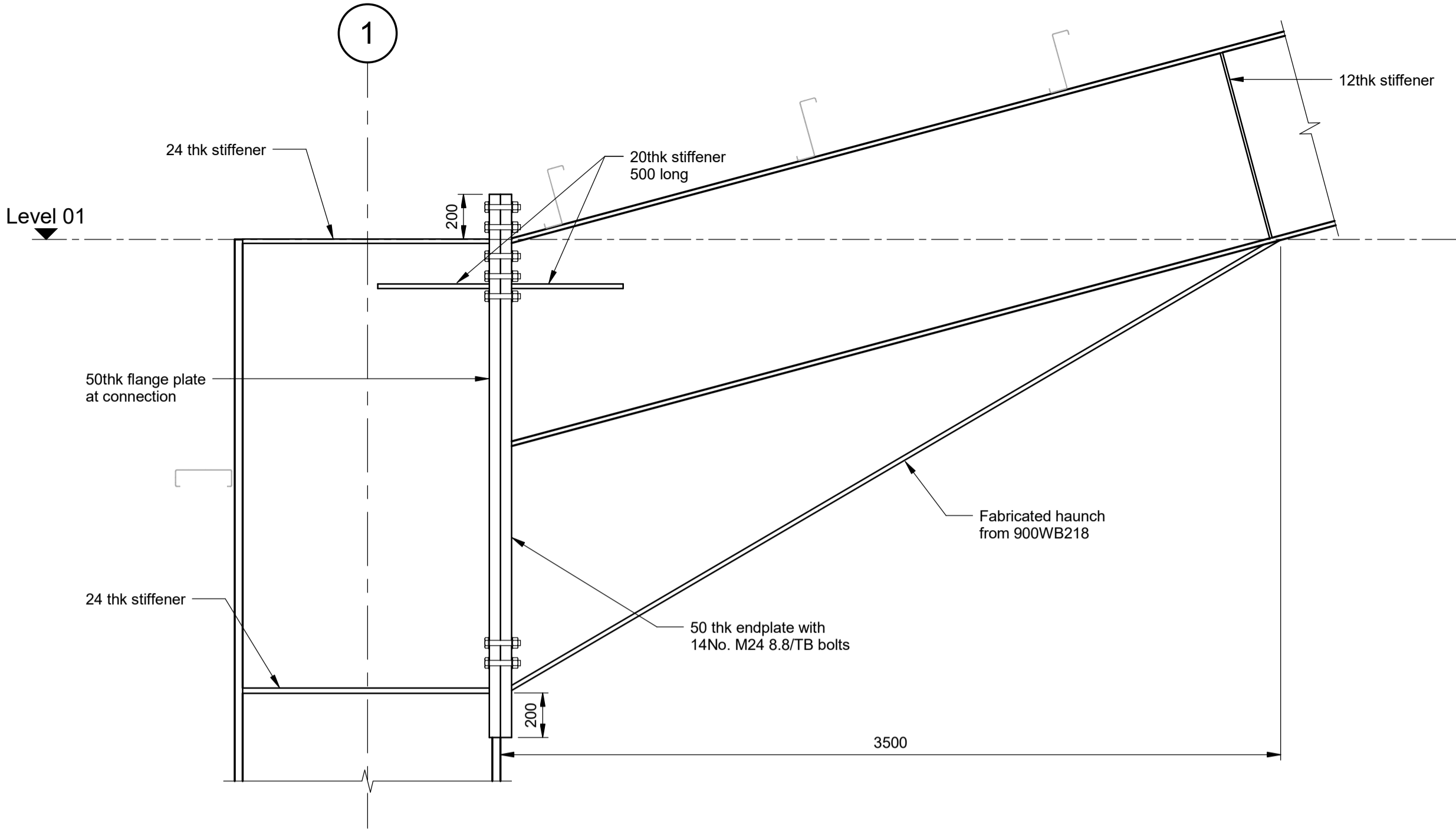
Drawing Title
Structural Framing Plans

Scale at A1	As indicated
Role	Structural
Suitability	For Information
Arup Job No 247451-89	Rev P1
Name S-0210	

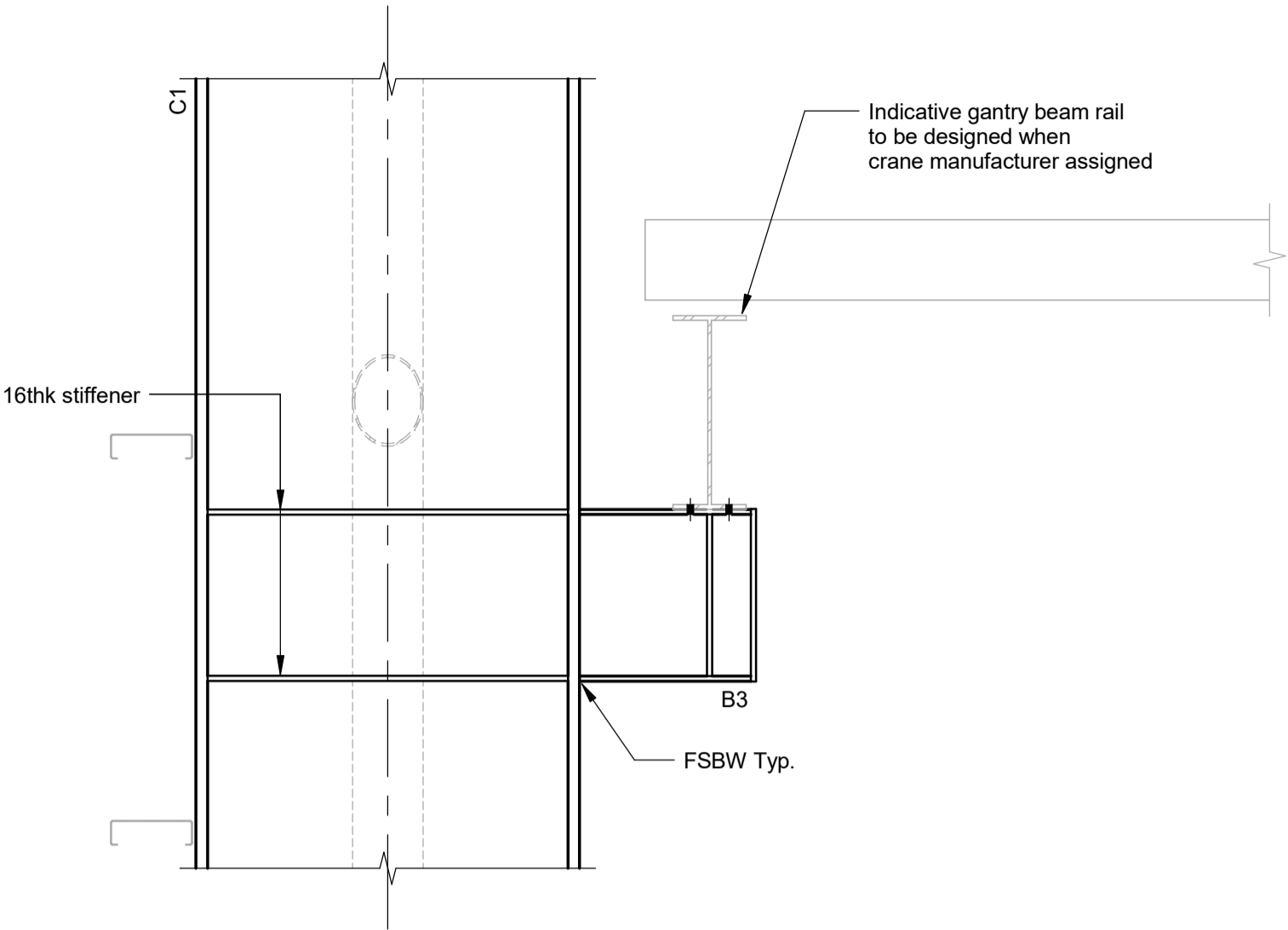
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A1
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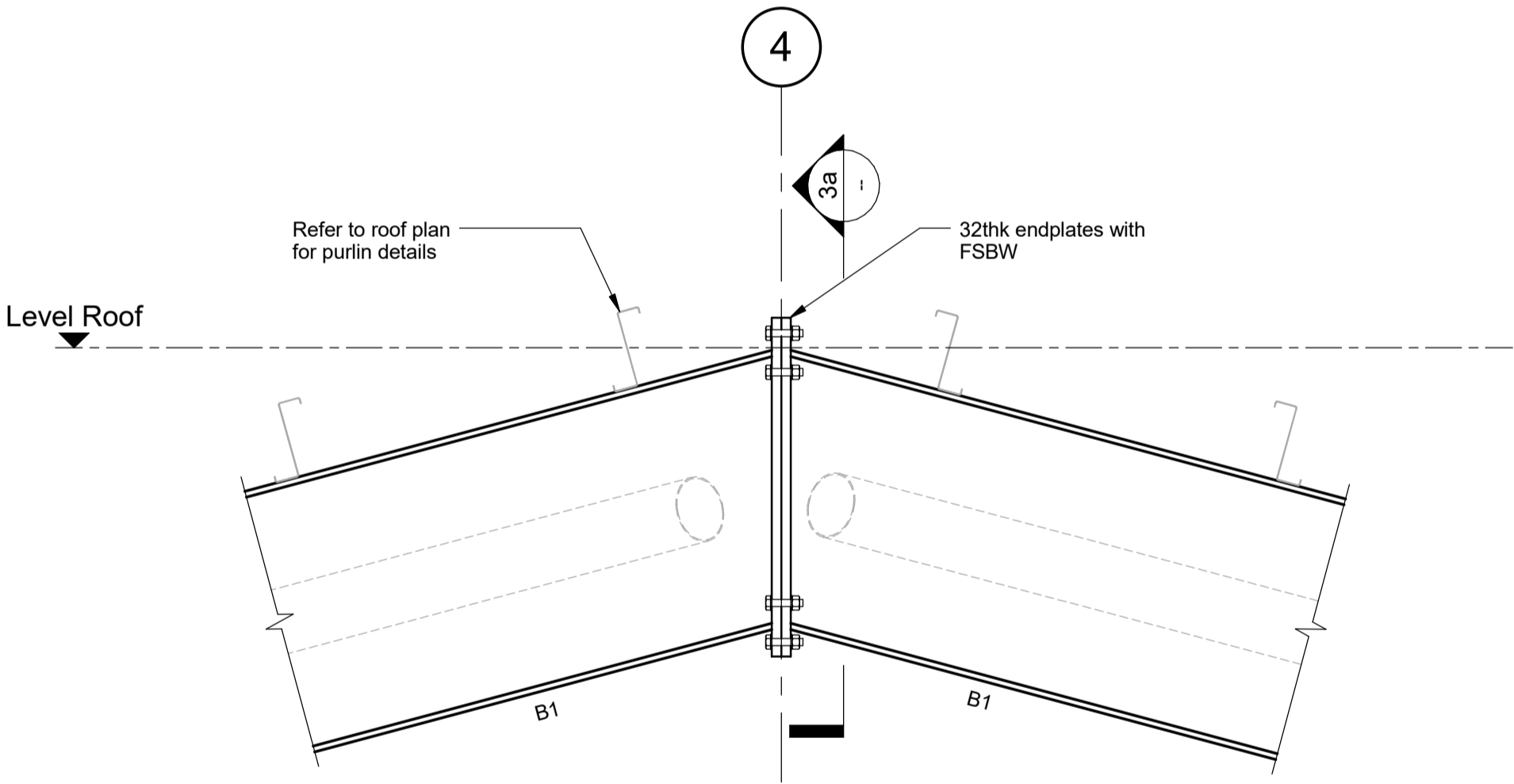
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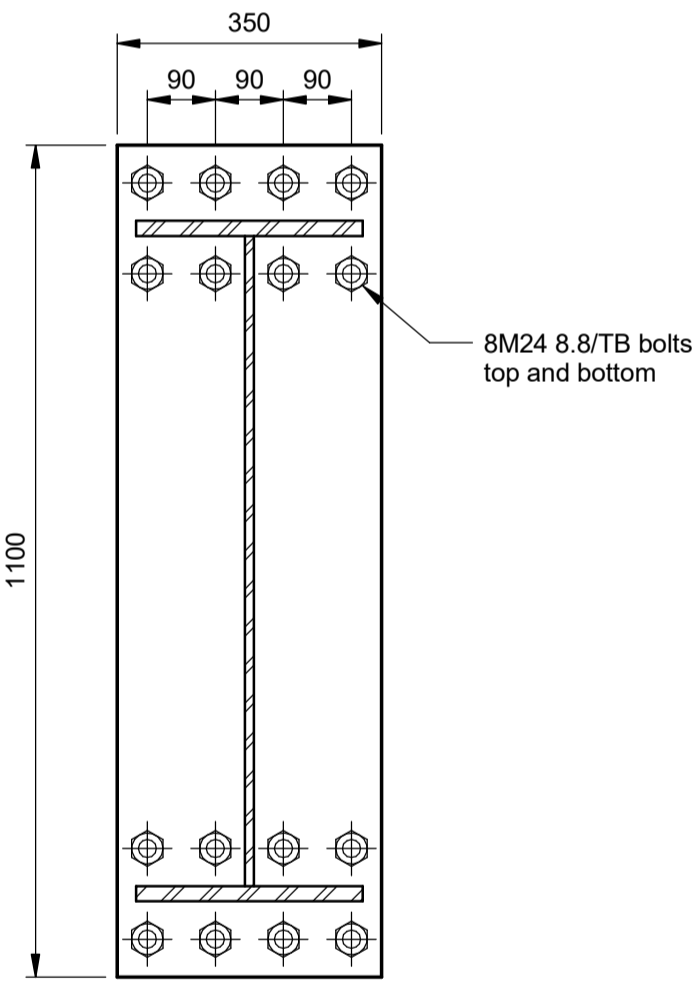
Detail 1
Scale 1 : 20 S-0210



Detail 2
Scale 1 : 20 S-0210



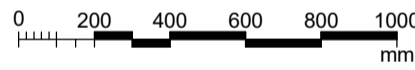
Detail 3
Scale 1 : 20 S-0210



Section 3a
Scale 1 : 10 -

Note:
1. For general notes refer to drawing S-0010

P1	22/12/17	DP	ZL	JD
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Project Title
**LACHLAN'S LINE
TEMPORARY PORTAL SHED**

Drawing Title
**Steelwork Details
Sheet 1**

Scale at A1 As indicated
Role Structural
Suitability For Information

Arup Job No 247451-89	Rev P1
Name S-0220	

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