Town of Port Hedland

Structural Review of Observation Tower, Wedge Street, Port Hedland

RSA 15-0440-150727-R

TOPH 139515

July 2015

R S A   E N G I N E E R I N G
Unit 6, 9 Playle Street, Myaree
WA 6154

+61 8 9317 3331
info@rsaeng.com.au
www.rsaengineering.com.au

DOCUMENT HISTORY

Revision	Date	PREP	CKD	AUTH	Revision Details
00A	07/08/15	AL	AA		Preliminary issued for review.
00B	04/10/15	AL	BS		Added opinion of probable construction cost

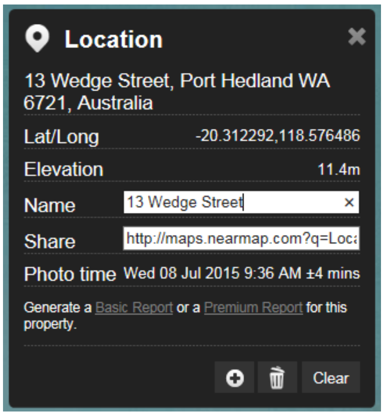
Prepared by

RSA Pty Ltd
Unit 6, 9 Playle Street, Myaree WA 6154
T +61 8 9317 3331 F +61 8 9317 3337

Table of Contents

1. Introduction

This document presents a structural review of the Observation Tower located at 13 Wedge Street, Port Hedland. The approximate site location is illustrated below:



The contents of this report is based on:

i. Desktop review of the existing drawings (Appendix A),
ii. Site inspection of the Observation Tower completed 28 July 2015, and
iii. Subsequent structural analysis of the observed structure.

2. Desktop Study

2.1 Background

The age of this structure is not known precisely. Existing drawings of the structure as in Appendix A have a title block indicating that the tower was originally used as a navigation aid (ranging lights) for the MGMA Mt Goldsworthy Project, Port Hedland, Finucane Island. The date on these drawings is not clearly legible, however could be read 22/3/65. Mount Goldsworthy Mining Associates (MGMA) was formed and granted an export licence in 1963 to ship iron ore from a port to be built at Finucane Island, Port Hedland. Construction of the port and town commenced in early 1965. It is therefore considered likely that 1965 is the correct year for construction of the tower.

Further, the mine at Goldsworthy was closed in 1982 and the associated town was abandoned in 1992. All associated structures were required to be removed. This fits with the Town of Port Hedland approval stamp dated 1991 which appears on the drawings, and with the Tower Relocation Note dated 1990. We conclude that the Observation Tower was most likely to have been constructed in 1965, and relocated to Port Hedland in 1990.

2.2 Nearmap Aerial Photography

Aerial photography is available for the site from nearmap.com. Several views of the site are reproduced below. Further images are provided in Appendix B.

2.3 Distance from Coast

Using imagery obtained from Nearmap.com the distance of the site from the coast can be estimated. On this basis the site is located approximately 275m from sheltered water, and 1km from more open harbour water. This is illustrated below:

Based on the site location as above, the relevant Australian Standard regions and categories can be identified. A summary is given in the following table:

Standard	Region / Category / Zone
AS/NZS 2312.1:2014	C3: Medium [coastal exterior], to C4: High [sea-shore (calm)]
AS 3600	Climatic Zone: Arid B2: above-ground exterior, coastal A2: in contact with the ground
AS/NZS 1170.2:2011	Wind Region D Terrain Category 1 (enclosed bay extending less than 10km in the wind direction)

With reference to AS 3600 Figure 4.3 and Table 4.3 respectively, the climate zone is Arid and the most onerous exposure classification is B2.

The atmospheric corrosivity category determined in accordance with Section 2.3 of AS/NZS 2312 is considered to be between C3: Medium and C4: High.

The site is located within Region D as per AS 1170.2:2011 Figure 3.1(A). Terrain Category 1 (TC1) is considered appropriate in this case. As per AS 1170.2 Amendment No 2 (December 2012) TC1 applies to terrain with enclosed, limited-sized water surfaces. An argument could be made that Terrain Category 1.5 (near-shore ocean water) applies. However, the harbour provides significant sheltering from shoaling waves such that TC1 is considered more appropriate.

3. Site Inspection

The Observation Tower was inspected on the 28th July 2015. Site inspection measurements and commentary are provided on the sketches attached to this document as Appendix C.

The top of one of the concrete footings was exposed to verify the size as given on the "Tower Relocation Note" included in Appendix A. This is illustrated on SK03 included in Appendix C.

3.1 Ladders

The original access ladders have been removed and replaced except for the top ladder between Level 5 and Level 6.

Figure 1: Photos showing the access ladder between Level 5 and 6

This ladder is in an unsafe condition with the steps being severely corroded. For this reason Level 6 was not accessed for the site inspection. The ladder is to be removed and replaced if required.

3.2 Stairways

Figure 2: Photo showing lower level stairways

The stairway steps are compared with the requirements of AS 1657.

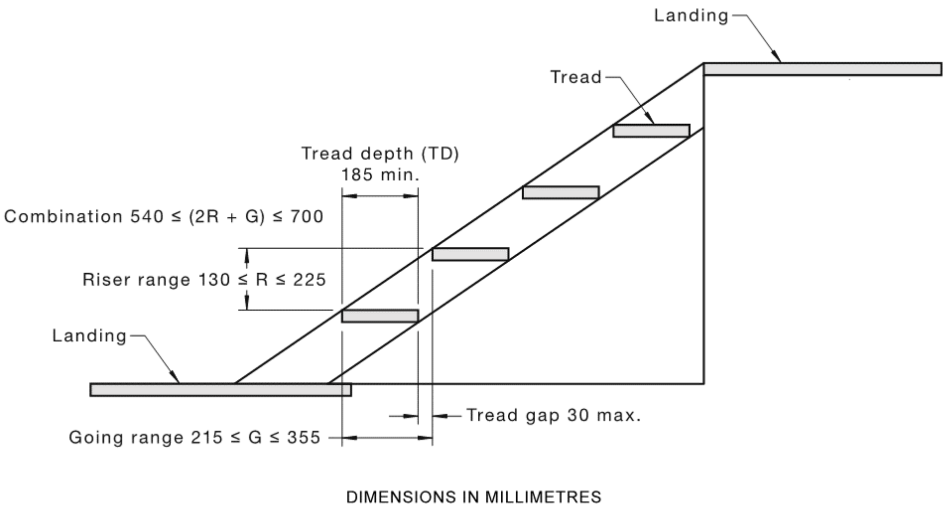
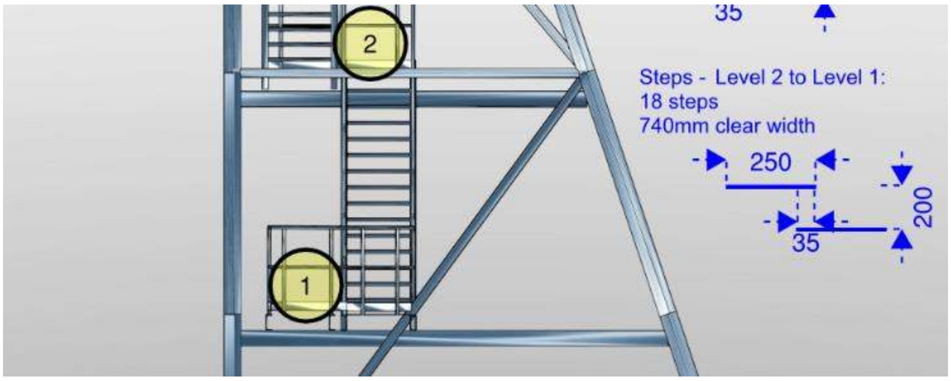


FIGURE 7.2 TYPICAL STAIRWAY TERMINOLOGY

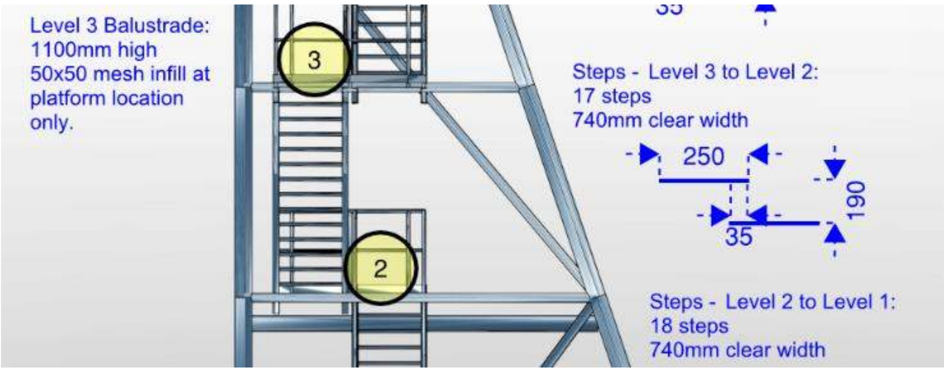
3.2.1 Level 1 to 2



Number	$2 \le N_{steps} = 18 \le 18$	……….OK
Riser	$130mm \le R = 200mm \le 225mm$	……….OK
Going	$215mm \le G = 215mm \le 355mm$	……….OK
Combination	$540mm \le (2R+G) = 615mm \le 700mm$	……….OK

The stairway steps comply with the requirements of AS 1657 for a stairway.

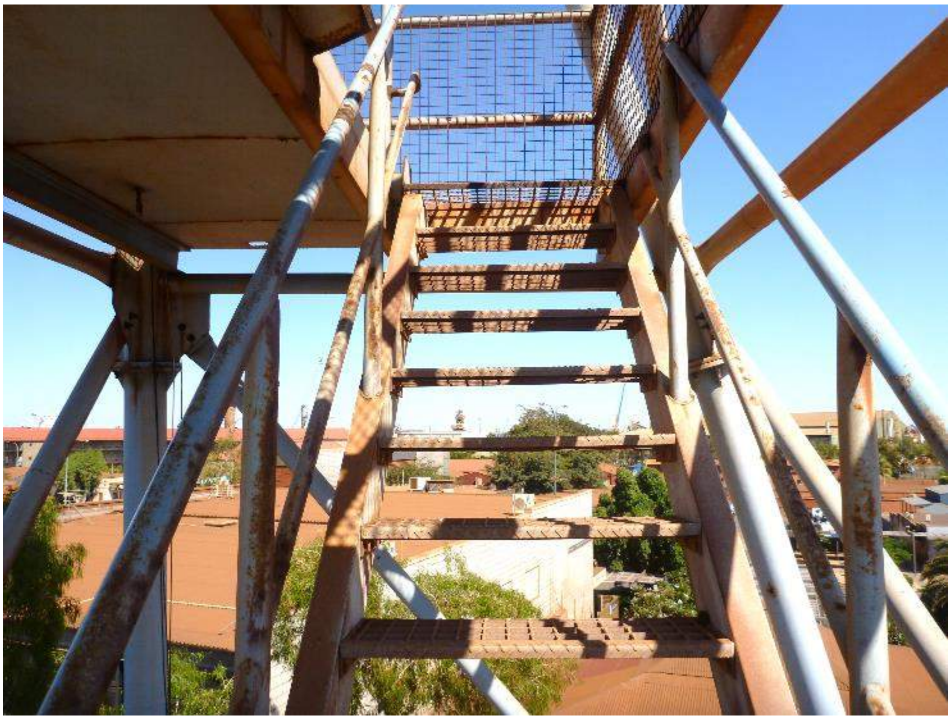
3.2.2 Level 2 to 3



Number	$2 \le N_{steps} = 17 \le 18$	..........OK
Riser	$130mm \le R = 190mm \le 225mm$	..........OK
Going	$215mm \le G = 215mm \le 355mm$	..........OK
Combination	$540mm \le (2R+G) = 595mm \le 700mm$	..........OK

The stairway steps comply with the requirements of AS 1657 for a stairway.

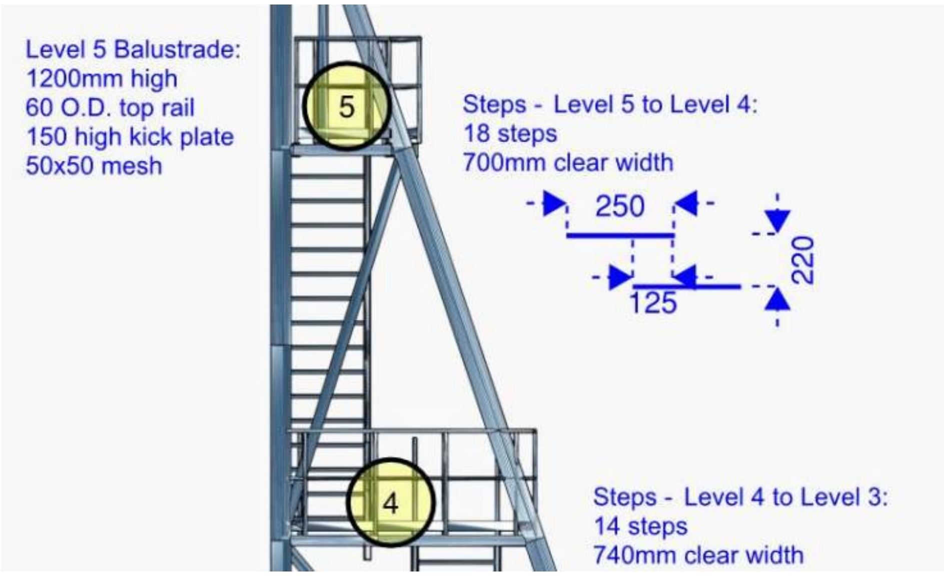
3.2.3 Level 3 to 4



Number	$2 \le N_{steps} = 14 \le 18$	..........OK
Riser	$130mm \le R = 200mm \le 225mm$	..........OK
Going	$215mm \le G = 215mm \le 355mm$	..........OK
Combination	$540mm \le (2R+G) = 615mm \le 700mm$	..........OK

The stairway steps comply with the requirements of AS 1657 for a stairway.

3.2.4 Level 4 to 5



Number	$2 \le N_{steps} = 18 \le 18$	……….OK
Riser	$130mm \le R = 220mm \le 225mm$	……….OK

Going $G = 125mm \leq 215mm$ ……….NG

Combination $540mm \leq (2R + G) = 565mm \leq 700mm$ ……….OK

The stairway steps do not comply with the requirements of AS 1657 for a stairway. They do, however, comply with the requirements of AS 1657 for a step-type ladder.

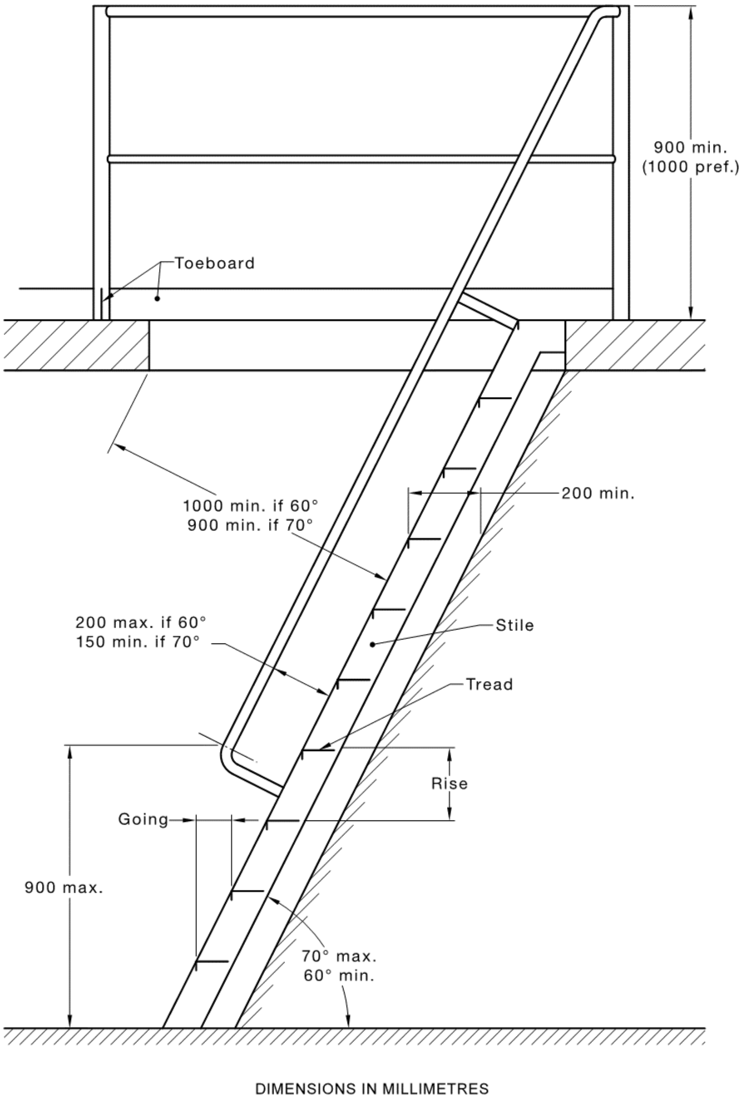


FIGURE 7.4 TYPICAL DIMENSIONS FOR STEP-TYPE LADDERS

3.3 Platforms

This section contains photos illustrating the condition of the platforms at the time of inspection. Level 6 was not accessible due to the poor condition of the access ladder. As shown in the photos, Levels 4 through 6 have a solid floor plate, and Levels 1 through 3 have grating. Refer to the sketches included in Appendix C for further information.

3.3.1 Level 5

Figure 3: Photo showing Level 5 platform

3.3.2 Level 4

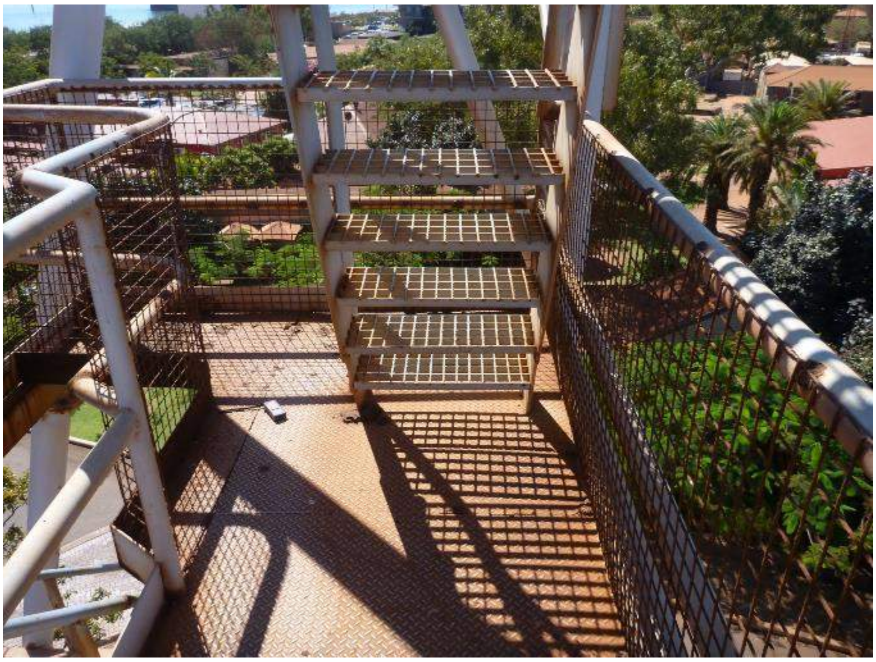


Figure 4: Photo showing Level 4 platform

3.3.3 Level 3

Figure 5: Photo showing Level 3 platform

3.3.4 Level 2

Figure 6: Photo showing Level 2 platform

3.3.5 Level 1

Figure 7: Photo showing Level 1 platform

3.4 Typical Steel Connections

This section contains photos illustrating the condition of several typical steel connections at the time of the inspection. Refer to the drawings included in Appendix A and the sketches in Appendix C for further details.

Figure 8: Column base connection to foundation

Figure 9: Column splice and strut and brace connections

Figure 10: Closer view of column splice connection

Figure 11: Underside of connection between beam B1 and column

Figure 12: Side of connection between beam B1 and column

Figure 13: Connection between struts and braces at base of column

4. Structural Analysis

4.1 Steel Properties

It is understood that the tower was constructed in 1965. With reference to *Steel Shapes and Sections – The Broken Hill Proprietary Company Limited* dated 1961 (BHP, 1961):

- The dimensions of the structural sections are mainly those of the Standards Association of Australia Code A1-19
- Structural grade steel was supplied to the British Standard Specification BS15 amended 1959 which required yield stress not less than
  - 16 tons per square inch for structural sections and other material not more than ¾" thick
  - 15 tons per square inch for material over ¾" and not more than 1½" thick
  - 14.75 tons per square inch for material over 1½" thick

With reference to *Safe Load Tables for Structural Steel* dated 1969 (AISC, 1969):

- The normal strength steel section refers to AS A149
- Yield stresses are:
  - 36.0 kips/in^2 up to ¾" thickness
  - 34.0 kips/in^2 over ¾" to 1½"

On this basis the yield strength of any original steel is taken to be approximately:

Thickness, t [mm]	Yield Strength [MPa]
t <= 19.05	221
19.05 < t <= 38.1	207
t > 38.1	203

4.2 Stairways

Stairways consist typically of 200PFC stringers. The stairways are to support a live load of 2.5kPa unfirmly distributed as per AS 1657. A simplified model is prepared using Space Gass software.

The wall thickness of the supporting 200x100 RHS section is unknown. The section is taken to be 200x100x5 RHS C350. Similarly, the grade of the supporting 114.3x4.5 CHS is unknown. This section is taken to be 114.3x4.5 CHS C250.

Figure 14: Space Gass model of stairway

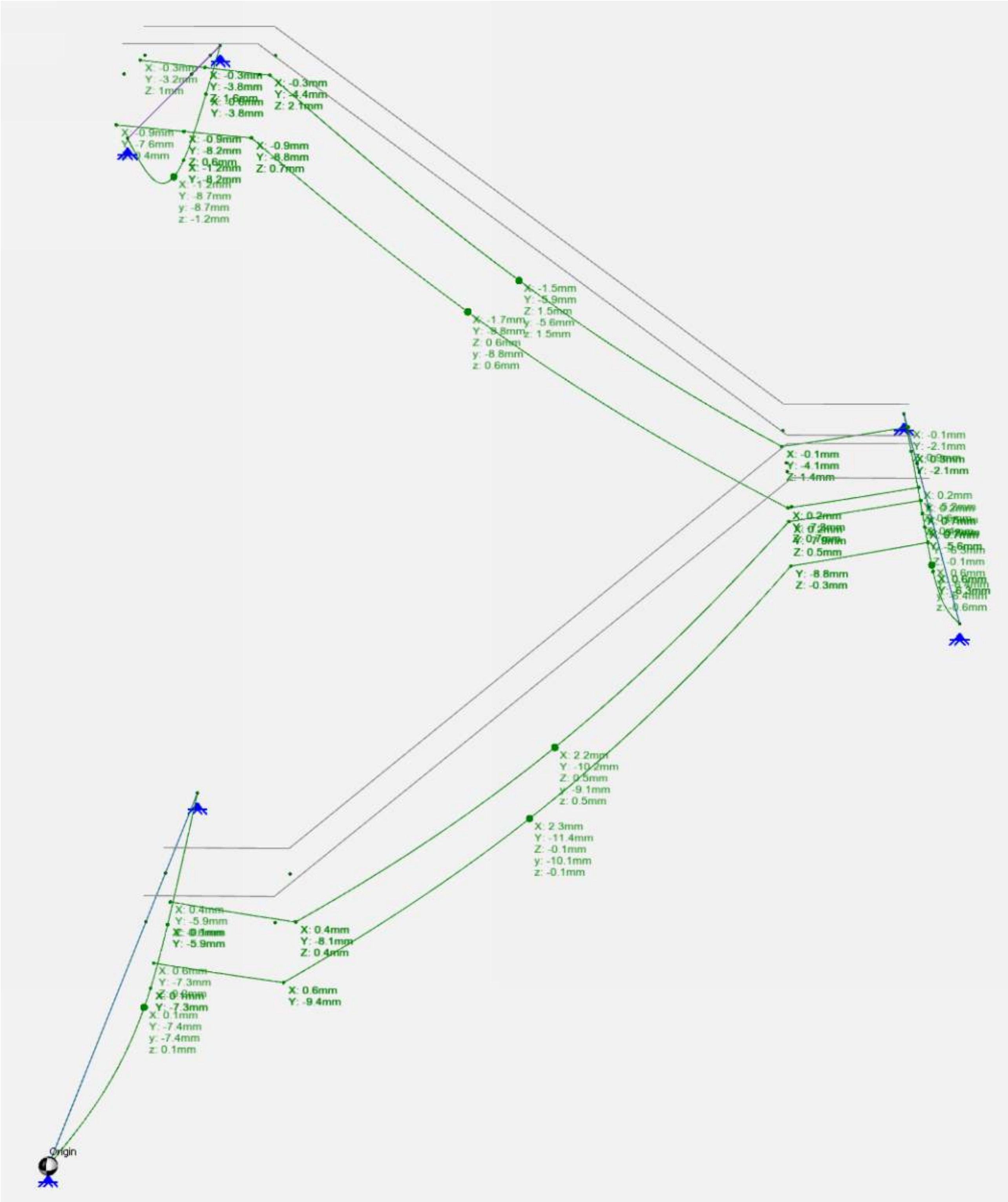


Figure 15: Deformation for Load Combination G+0.7Q

The maximum vertical deflection of approximately 11.4mm occurs for the lower stairway stringers which span nominally 6,000mm between supporting beams.

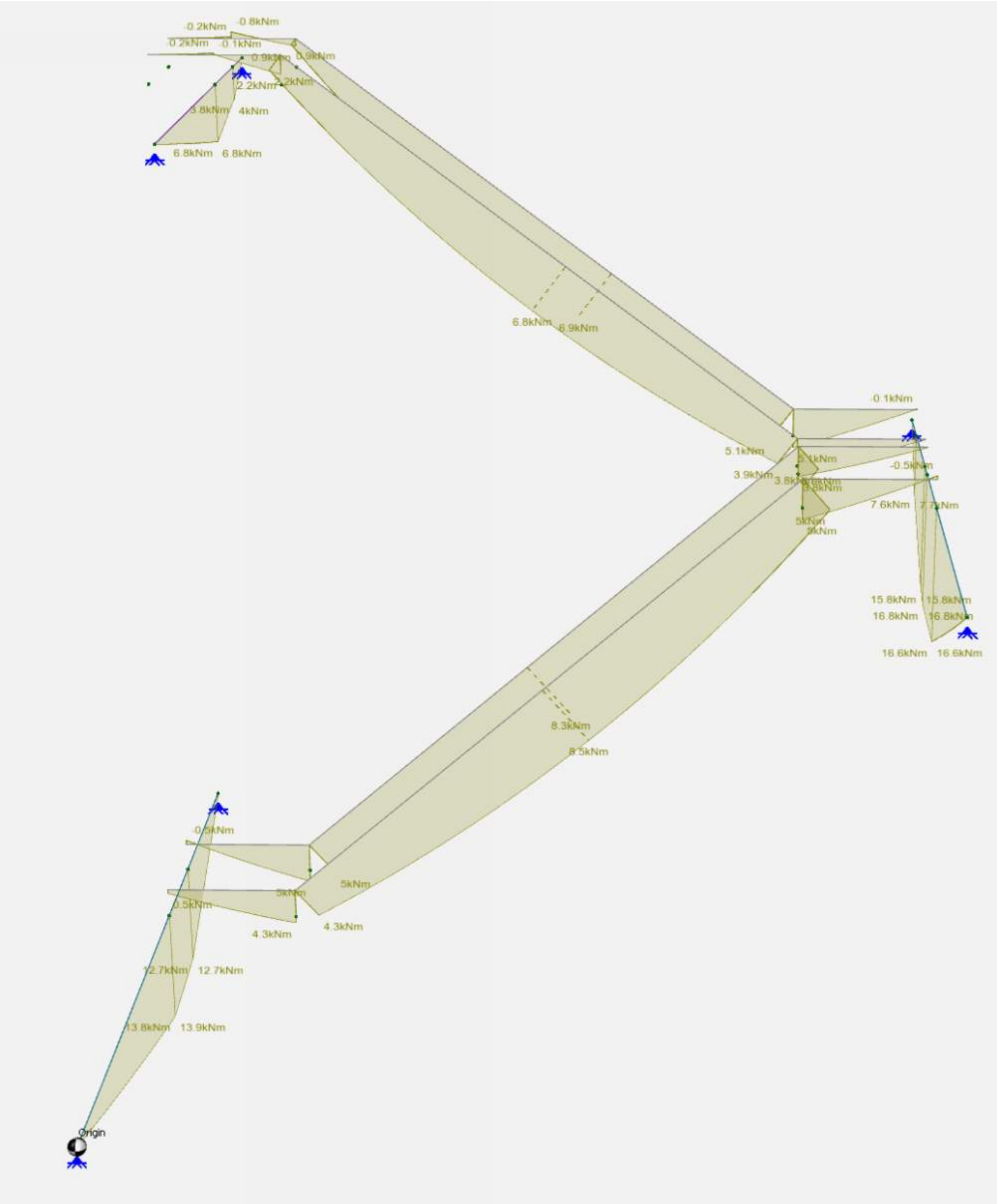


Figure 16: Bending Moment Diagram for Load Combination 1.2G + 1.5Q

The maximum bending moment in the stair stringer is approximately 8.5kNm. The maximum bending moment in the top supporting CHS is approximately 6.8kNm. The maximum bending moment in the support RHS sections is approximately 16.8kNm.

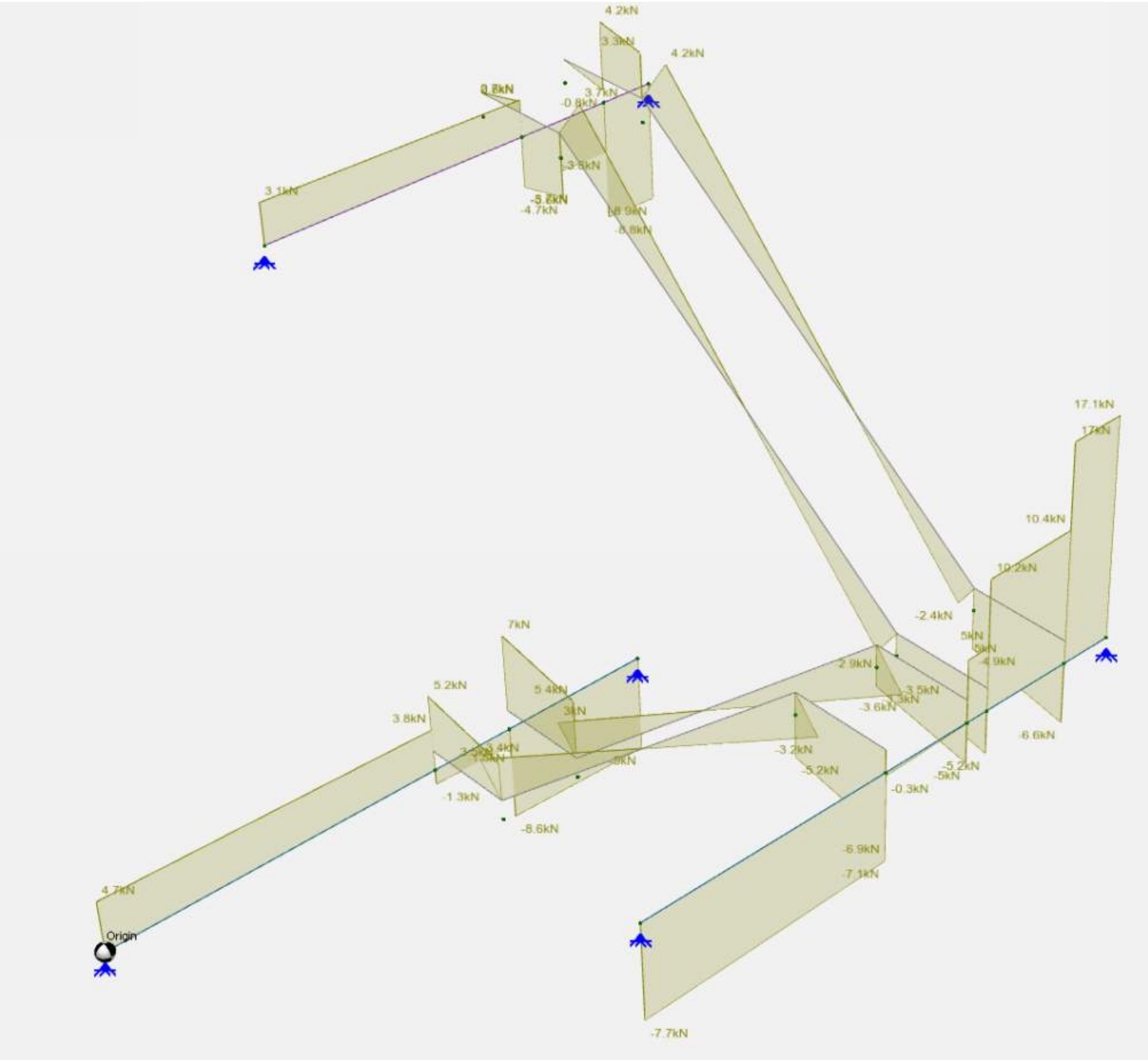


Figure 17: Shear Force Diagram for Load Combination 1.2G+1.5Q

The maximum shear force in the stair stringers is approximately 7kN. The maximum shear force in the top supporting CHS is approximately 8.9kN. The maximum shear force in the supporting RHS sections is approximately 17.1kN.

The calculated design actions are less than the factored section capacity. No structural deficiencies are identified.

4.3 Platforms

The lower level platforms are supported by 200PFC stringers as analysed in the previous section. The upper platforms are supported by 150PFC sections. These are to support a live load of 2.5kPa uniformly distributed as per AS 1657. A simplified model of the Level 4 platform is prepared using Space Gass software.

This platform consists of 150PFC sections which support a floor plate (with nominal thickness of approximately 6mm)

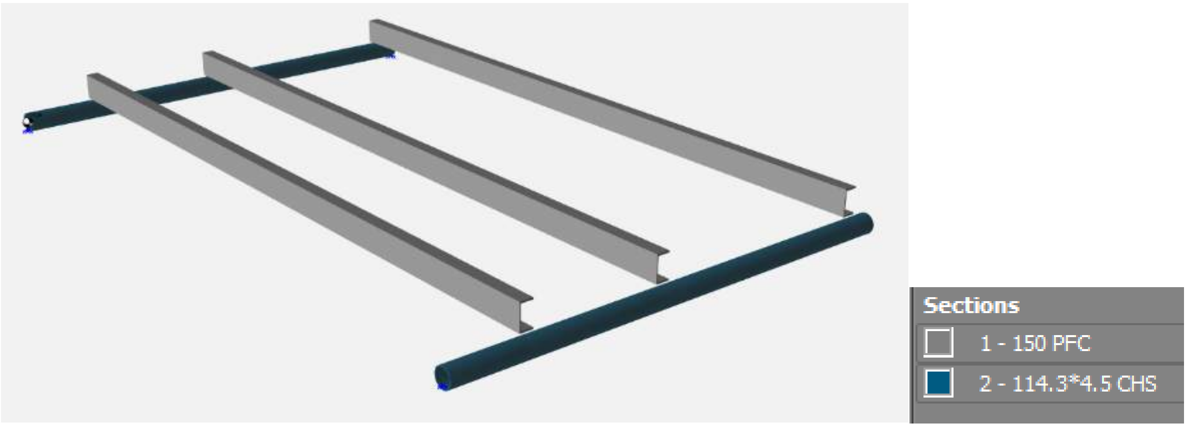


Figure 18: Space Gass model of typical platform

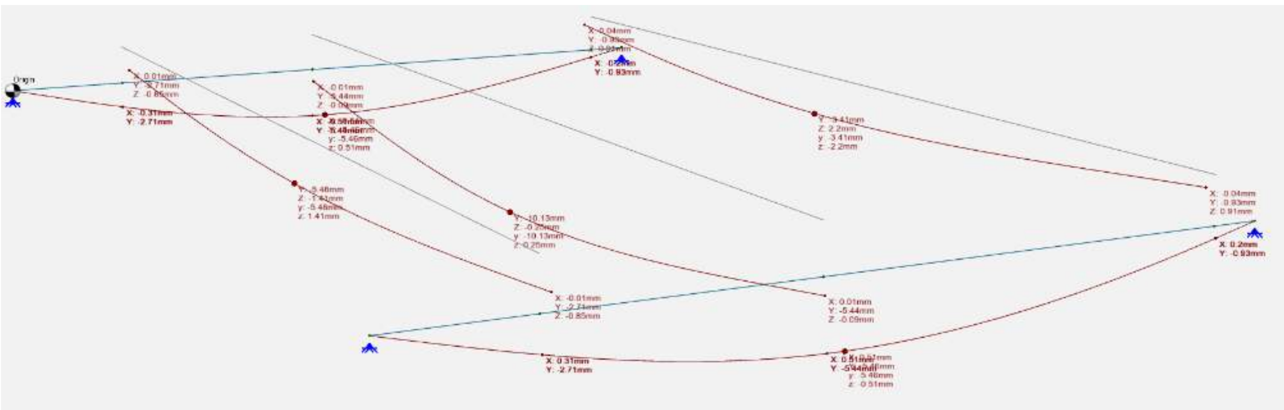


Figure 19: Deformation for Load Combination G+0.7Q

The maximum vertical deflection of a 150PFC is approximately 10.1mm (for a span of approximately 4.3m). The maximum vertical deflection of a supporting CHS is approximately 5.5mm for a span of approximately 2.7m.

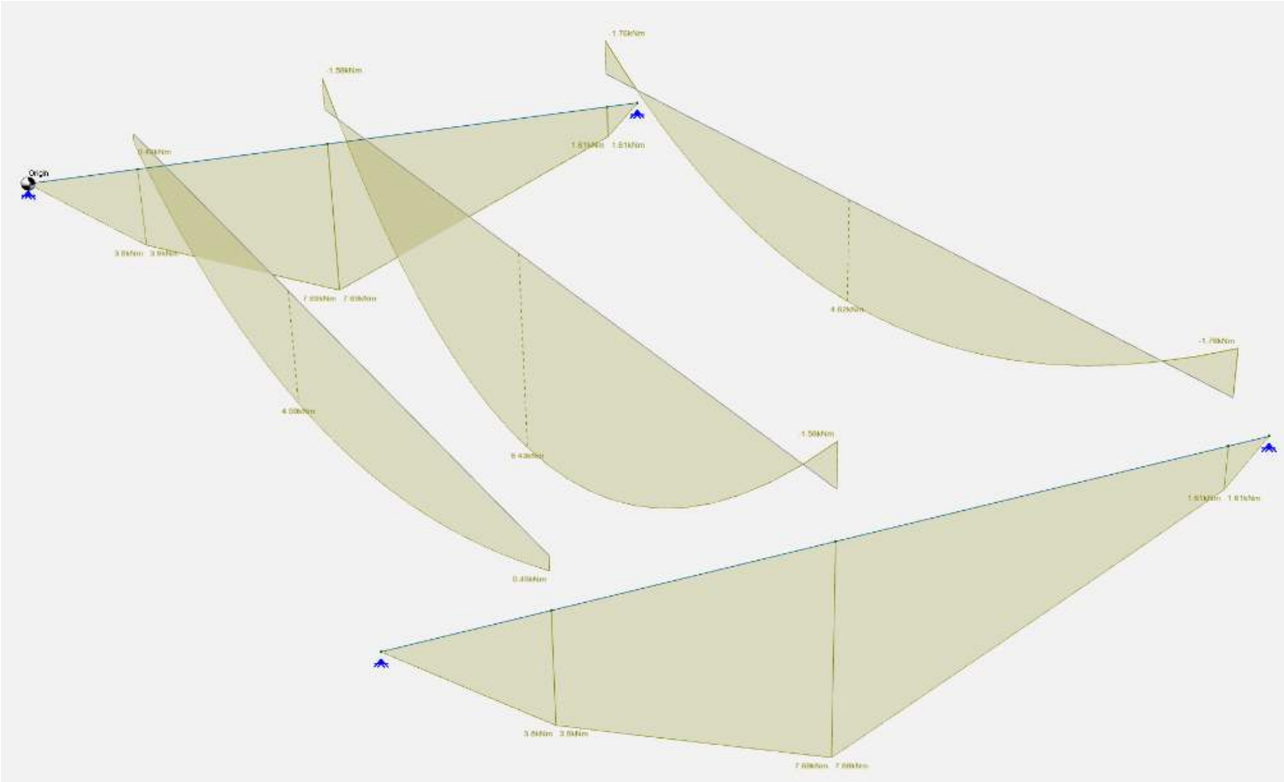


Figure 20: Bending Moment Diagram for Load Combination 1.2G + 1.5Q

The maximum bending moment in a 150PFC is approximately 8.4kNm. This assumes that a bending moment of approximately 1.6kNm can be transferred at the welded connection between the 150PFC and the supporting 114CHS section.

The maximum bending moment in the supporting CHS is approximately 7.7kNm.

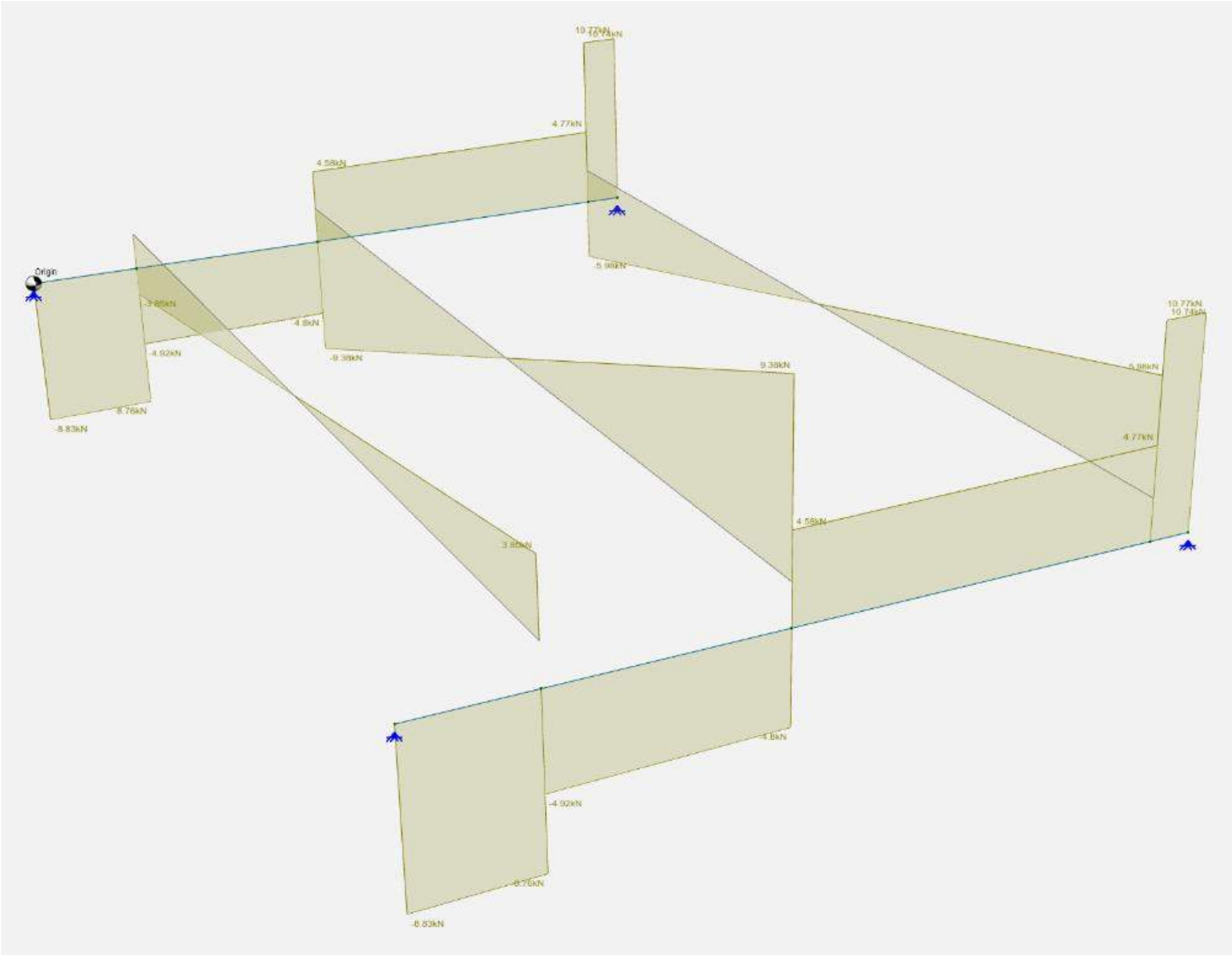


Figure 21: Shear Force Diagram for Load Combination 1.2G+1.5Q

The maximum shear force in a 150PFC is approximately 9.4kN. The maximum shear force in a supporting CHS section is approximately 11kN.

The calculated design actions are less than the factored section capacity. No structural deficiencies are identified.

4.4 Main Structure

The main structure is to resist lateral wind load. A simplified model is prepared using SAP2000 software, as illustrated below:

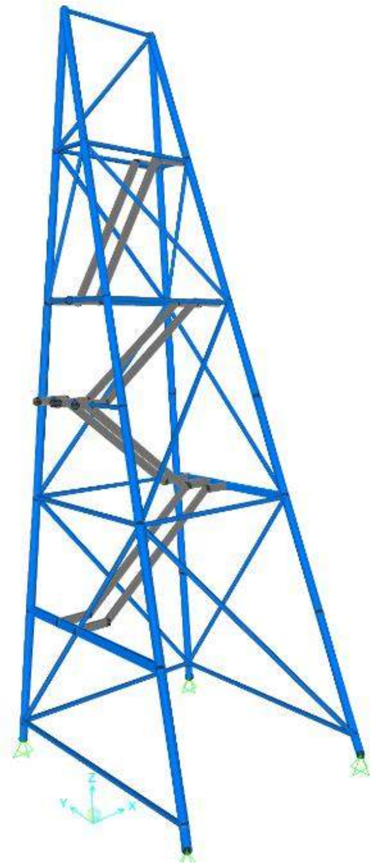


Figure 22: SAP2000 model of main structural frame

Wind loads were applied as illustrated on the following page. Key results are presented in Appendix C. No structural deficiency was identified.

Under wind loading the maximum calculated uplift is approximately 65kN. As noted previously, the top of one of the concrete footings was exposed to verify the size as given on the "Tower Relocation Note" included in Appendix A. This is illustrated on SK03 included in Appendix C. The footing size is therefore nominally 2.5x2.5x1.3m with a factored mass of 0.9G=175.5kN based on a concrete unit weight of 24kN/m^3. On this basis the existing footing is considered adequate to resist the applied uplift.

The largest axial compression force in the lower level braces is approximately 75kN. In comparison the factored axial compression capacity of these members is approximately 105kN, based on C250 steel and effective length of 6m. This is reduced to 92kN noting that the yield strength is considered to be 221MPa rather than 250MPa. On this basis we can tolerate a reduction in steel material of approximately 20% before the remaining material is no longer sufficient to carry the calculated design action.

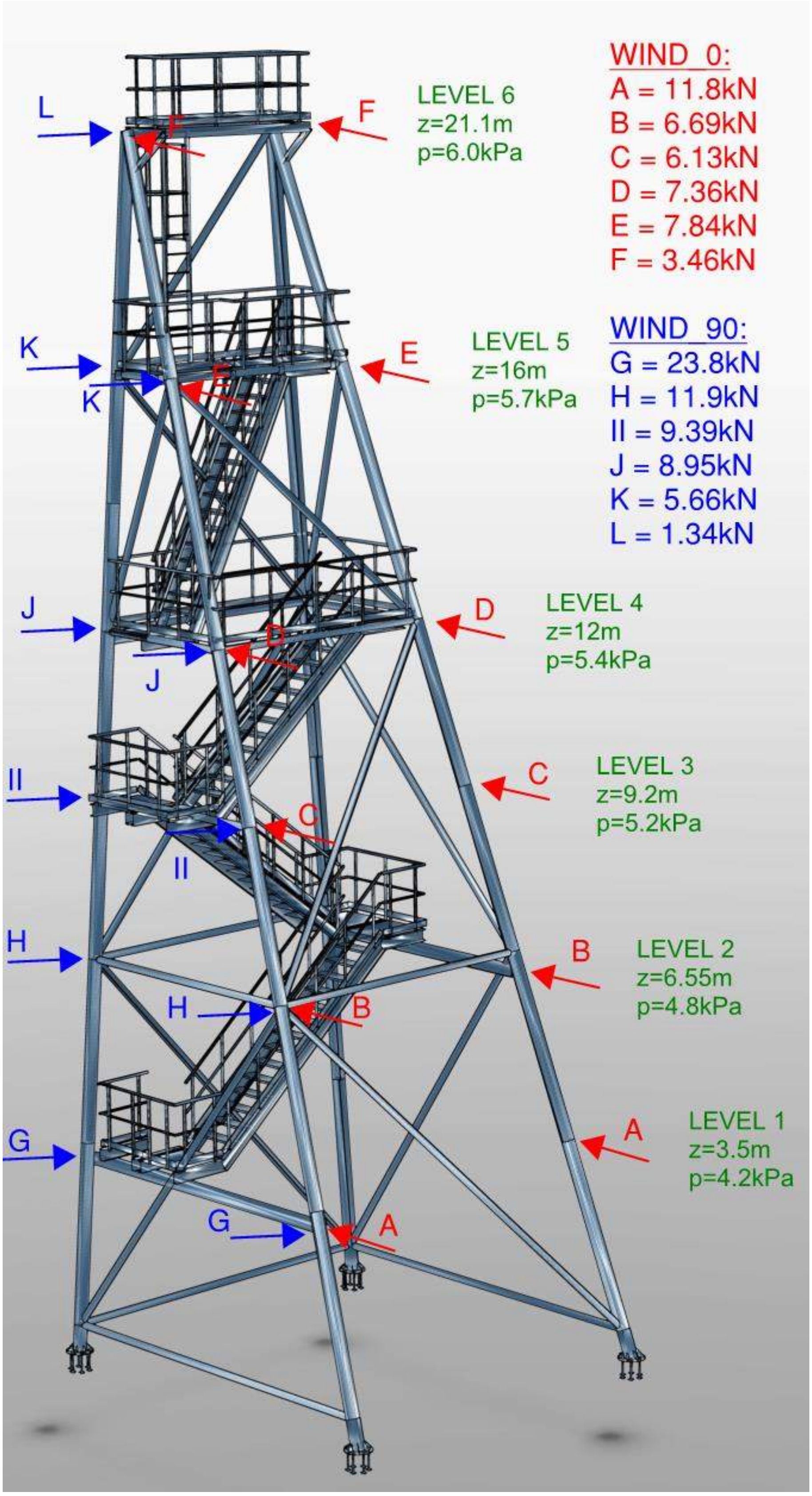


Figure 23: Wind Load Applied in SAP Computer Model

5. Remedial Works

This section outlines proposed site works in a format which can later be incorporated within a project specification document. These notes are to be read in conjunction with the sketches as included in Appendix C of this document. All dimensions are to be confirmed prior to construction.

Explanatory Note / Commentary
Explanatory notes are included to give additional background information relevant to the proposed works.

0.0 All works and materials shall comply with all relevant Australian Standards including:

Steel Work

AS 1111	ISO metric hexagon bolts and screws - product grade C
AS 1112	ISO metric hexagon nuts
AS 1163	Cold formed structural steel hollow sections
AS 1214	Hot dip galvanised coatings on threaded fasteners
AS/NZS 1252	High strength steel bolts & associated nuts & washers for structural engineering
AS 1275	Metric screw threads for fasteners
AS 1397	Steel sheet and strip-hot dipped zinc coated or aluminium/zinc coated
AS/NZS 1554	Structural steel welding
AS 1594	Hot rolled steel flat products
AS 1595	Cold rolled, unalloyed, steel sheet & strip
AS 1627	Metal finishing - Preparation & pre-treatment of surfaces
AS 2312	Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings
AS/NZS 3678	Structural steel - Hot rolled plates, floor plates and slabs
AS/NZS 3679	Structural steel - Hot rolled bars and sections
AS 4100	Steel structures
AS/NZS 4600	Cold formed steel structures
AS/NZS 4680	Hot dip galvanized (zinc) coatings on fabricated ferrous articles

Steel

Unless noted otherwise in the member schedule, all new structural steel shall comply with the following Australian Standards in respect of grade and conditions of supply:

Rolled sections	AS/NZS 3679.1 Grade 300
Hollow sections	AS/NZS 1163 Grade C350
Plate	AS 3678 – 250

The original structure is understood to have been constructed in 1965 with steel complying with Standards Association of Australia Code A1-19 and British Standard Specification BS15 amended 1959. The stairways are understood to have been installed at a later date, replacing the original access ladders.

Welding

All welding shall comply with AS/NZS 1554.1 unless noted otherwise on the structural steel details. Welding category shall be SP unless noted otherwise. All weld metal shall have a nominal weld metal tensile strength of 490MPa unless noted otherwise.

The extent of non-destructive weld examination required shall be as follows:

Visual scanning	100%
Visual examination	min 10%

All non-destructive examination shall comply with the requirements of AS/NZS 1554.1 and shall be carried out in accordance with the Australian Standards cited in AS/NZS 1554.1.

All welding personnel shall be qualified in accordance with Clause 4.12 of AS/NZS 1554.1.

Fillet welds performed on site are to be GP quality. All weld metal shall have a nominal weld metal tensile strength of 430MPa.

1.0 Further Assess Condition of Remaining Steel Material

Assess the thickness of the remaining steel using an ultrasonic thickness gauge. The thickness of the steel is to be measured through the existing protective coating (paint). Where the steel thickness is reduced by more than 15% contact the Engineer for further advice. The affected frame member may require replacement, or local patch repair.

The thickness of the steel is to be measured through the existing protective coating (paint). The gauge used must therefore have THRU-COAT or Thru-Paint or similar capability.
From visual inspection completed 28 July 2015 it is anticipated that at least two of the 114 CHS brace/strut frame members will require local repair.

2.0 Replace and Repair Structural Steel and Access Ladder and Stairways

2.1 Replace and Repair Structural Steel

Where removal of rust and assessment of condition as per item 1.0 reveals deficiency, replace or repair the structural steel member as advised by the Engineer.

2.2 Replace All Structural Bolts

All structural bolts are to be replaced with new 8.8/s hot dip galvanised structural bolts.

2.3 Remove Existing Access Ladder

The existing access ladder (Level 5 to Level 6) is to be removed. Refer section 3.1 of this report.

2.4 Provide Nosing to Existing Treads on the Stairway Between Level 4 and 5

Provide floor plate or abrasive nosing to the existing treads on the stairway between Level 4 and 5. AS 1657 requires that the nosing of the tread is clearly visible against the background. Refer section 3.2.4 of this report.

2.5 Make Good (Repair and/or Replace) Floor Plate to Levels 4, 5, and 6

The existing floor plate to Levels 4, 5, and 6 is rusting with significant corrosion and holes in some locations. The floor plate on these levels is to be replaced or repaired as appropriate.

2.6 Make Good (Repair and/or Replace) Balustrade to All Levels

The existing balustrading to all levels is rusting with significant corrosion in some locations. Balustrades on all levels are to be replaced or repaired as appropriate. This includes all components of the balustrade, including but not limited to the existing 60mm outside diameter rails, 50x50mm welded mesh, and 150mm high kick plate / toe board.

2.7 Provide New Stairway with Balustrade between Level 1 and Ground Level

Provide new stairway with balustrade between Level 1 and Ground Level. Details to match existing stairways. Provide slab on ground at base of new stairway.

3.0 Apply Protective Coating

Prepare and apply protective coatings to all exposed steel as outlined below:

AS/NZS 2312 / PUR4:

Surface prep.	Sa 2.5 (Class 2.5 to AS1627)
Coat 1	Inorganic zinc silicate 75µm (nom. DFT)
Coat 2	High-build epoxy 125µm
Coat 3	Poly-urethane gloss 50µm**, top coat colour, finish to TOPH's specification (the existing structure is faded pale blue)**

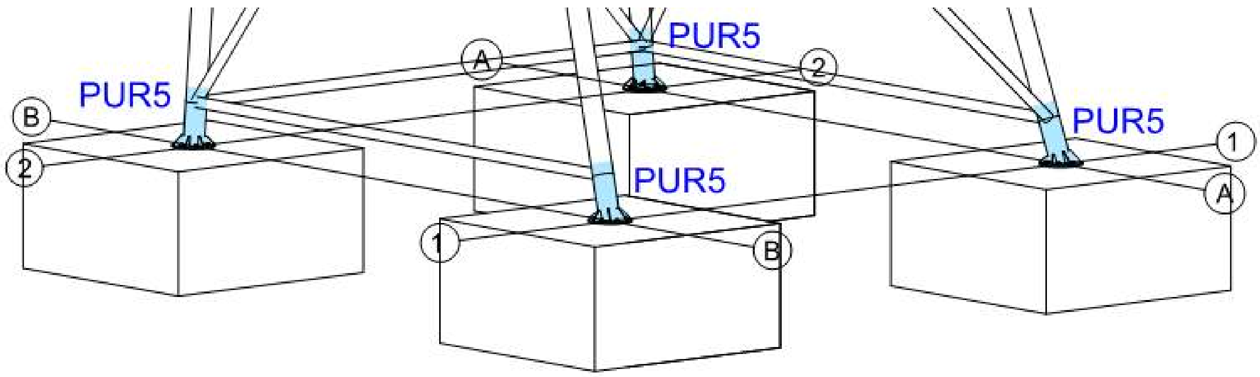
Storage, handling, mixing, thinning and application of all materials shall be in accordance with the manufacturer's recommendations. All coatings shall be used prior to expiration of shelf life, and catalysed coatings shall be used prior to expiration of pot life.

No surface preparation or coating application shall take place if the relative humidity is greater than 85%, the surface temperature less than three degrees above the dew point or under other unfavourable weather conditions, unless the work is well protected from such conditions. In addition, the coating shall not be applied if the ambient temperature is below 10degC or surface temperature above 45degC.

All surfaces shall be coated as specified within 4 hours of surface preparation for shop work and 2 hours for field work. In unfavourable locations these times may have to be decreased.

The above coating specification is selected with reference to Australian Standard AS 2312 (Standards Australia, 2002) and also to "Producing Coating Specification That Work" by RA Francis as published in Steel Construction, Journal of the Australian Steel Institute (Francis, 2011). The atmospheric corrosivity category determined in accordance with Section 2.3 of AS/NZS 2312 is considered to be between C3: Medium and C4: High. For the selected coating system PUR4 AS 2312 indicates a Durability (Years to First Maintenance) of approximately 15 years (range of 10 to 25 years). It is recommended that after remedial works are completed that the structure be inspected by an Engineer every 3 to 5 years, or immediately following a cyclone or high wind event.

At column bases provide additional thickness of the mid coating, extending up to the top of the lower strut and brace connection as illustrated and outlined below:



AS/NZS 2312 / PUR5:

Surface prep.	Sa 2.5 (Class 2.5 to AS1627)
Coat 1	Inorganic zinc silicate 75µm (nom. DFT)
Coat 2	High-build epoxy **200µm**
Coat 3	Poly-urethane gloss 50µm**, top coat colour, finish to TOPH's specification**

A more durable protective coating is specified for column bases. Site inspection suggests that this zone is more prone to corrosion, as evidenced by greater corrosion in this area.

6. Opinion of Probable Construction Costs

6.1 Basis

An opinion of probable construction costs (OPCC) was prepared for the proposed works as given in Section 5 of this report.

The OPCC is considered to be Class 3. This is based on the classification system recommended by the Australian Cost Engineering Society (ACES) and as published by AACE International (formerly the Association for the Advancement of Cost Engineering). A summary of this system is given in the following table.

ESTIMATE CLASS	**MATURITY LEVEL OF PROJECT DEFINITION DELIVERABLES** *Expressed as % of complete definition*	**END USAGE** *Typical purpose of estimate*	**METHODOLOGY** *Typical estimating method*	**TYPICAL EXPECTED ACCURACY RANGE**
Class 5	0 to 2%	Screening or feasibility	m^2 factoring, parametric models, judgement, or analogy	-30%, +50%
Class 4	1 to 15%	Concept study or feasibility	Parametric models, assembly driven models	-20%, +30%
Class 3	10 to 40%	Budget authorization or control	Semi-detailed unit costs with assembly level line items	-15%, +20%
Class 2	30 to 75%	Control or bid/tender	Detailed unit cost with forced detailed take-off	-10%, +15%
Class 1	65 to 100%	Check estimate or bid/tender	Detailed unit cost with detailed take-off	-5%, +10%

6.2 Results

A summary of the OPCC is given in the following table. The total estimated cost is approximately $180,000.00 including project management.

Item	Units	Rate‡	Total	Total Including Regional Loading [x1.6] ¶
Scaffolding x 4 sides full height	512	$61.00	$31,232.00	$49,971.20
Sand Blasting	256*	$60.00	$15,360.00	$24,576.00
Paint – Inorganic Zinc Silicate	256*	$45.00	$11,520.00	$18,432.00
High Build epoxy	256*	$76.00	$19,456.00	$31,129.60
Poly Urethane Gloss top	256*	$58.00	$14,848.00	$23,756.80
Material & Bolt Replacement	2†	$5,650.00	$11,300.00	$18,080.00
Total Estimated Construction Cost				$165,945.60
Project Management allowance§				$12,445.92
Total Project Budget				$178,391.50

6.3 Explanation of Assumptions for Critical Items

* The total surface area of steelwork for blasting and painting is estimated to be 256m^2. This is based on the existing drawings, and site inspection completed 28 July 2015.

† The total mass of the existing structure is estimated to be 10,000kg. It is assumed that 20% of the total existing material will need to be replaced. On this basis the estimate allows for a mass of 2,000kg of steel.

‡ The unit rates used are based on experience with previous construction works conducted in Port Hedland, and rates published in Rawlinsons Australian Construction Handbook.

§ The project management allowance is calculated as 7.5% of the total estimated construction cost including regional loading factor. The total project budget is calculated by summing the total estimated construction cost and the project management allowance.

¶ A regional loading factor of 1.6 is applied to the estimated item total costs.

7. References

AISC, 1969. *Safe Load Tables for Structural Steel.* Sydney: Australian Institute of Steel Construction.

BHP, 1961. *Steel Shapes and Sections.* s.l.:The Broken Hill Proprietary Company Limited.

Francis, R. A., 2011. AS 4312: An Australian Atmospheric Corrosivity Standard. *Steel Construction,* December, 45(1), pp. 2-10.

Francis, R. A., 2011. Producing Coating Specifications That Work. *Steel Construction,* December, 45(1), pp. 11-21.

Francis, R., Golding, P. & Key, P., 2015. Design and Detailing for Corrosion Protection of Steel Structures. *Steel Construction,* May, 47(2), pp. 3-31.

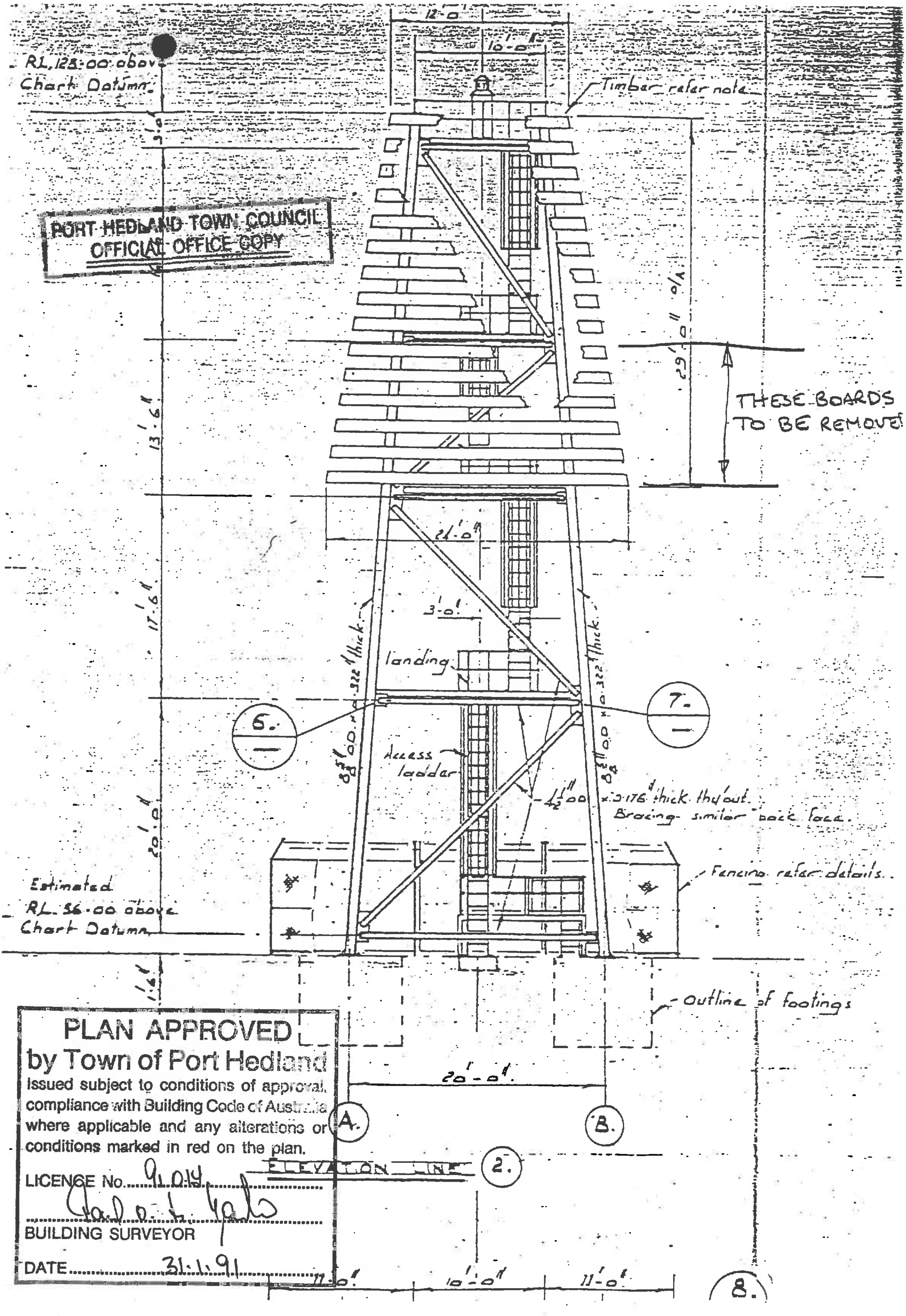
nearmap.com, n.d. *Nearmap.* [Online]
Available at: http://au.nearmap.com/

Onesteel, 2014. *Hot Rolled and Structural Steel Products.* 7th ed. s.l.:Onesteel.

Standards Australia, 2002. AS/NZS 2312:2002 Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings.

Standards Australia, 2008. AS 4312-2008 Atmospheric corrosivity zones in Australia.

8. Appendix A: Drawings

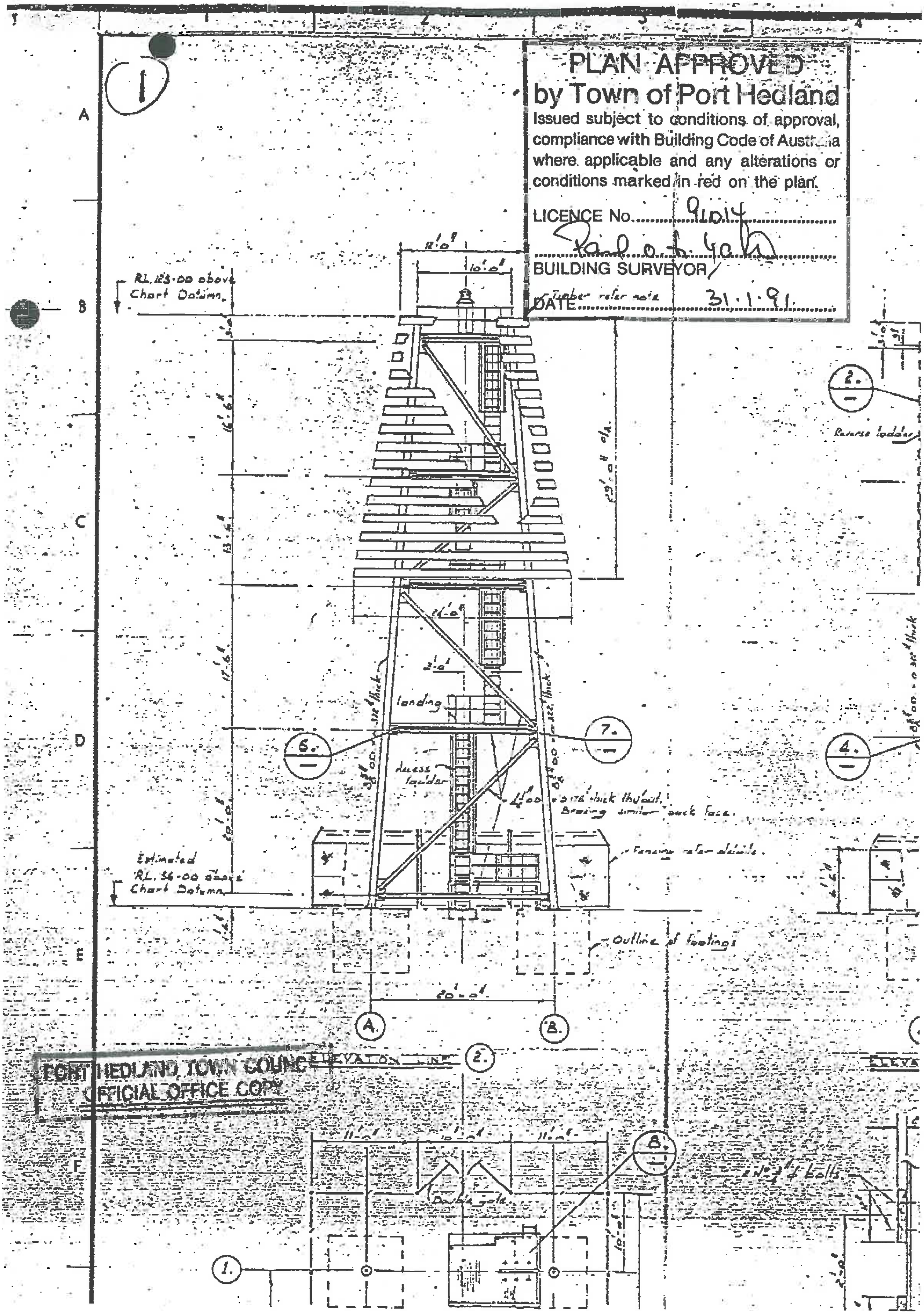

12'-0"
10'-0"
RL 128.00 above Chart Datum
Timber refer note
29'-0" o/A
13'-6"
THESE BOARDS TO BE REMOVED
21'-0"
17'-6"
3'-0"
landing
8 3/4" O.D. x 0.322" thick
6.
7.
Access ladder
4 1/2" OD x 0.176" thick thr'out.
Bracing similar back face.
20'-0"
Fencing refer details.
Estimated RL 56.00 above Chart Datum
1'-6"
outline of footings
20'-0"
A.
B.
ELEVATION LINE
2.
11'-0"
10'-0"
11'-0"
8.

PLAN APPROVED
by Town of Port Hedland
Issued subject to conditions of approval, compliance with Building Code of Australia where applicable and any alterations or conditions marked in red on the plan.

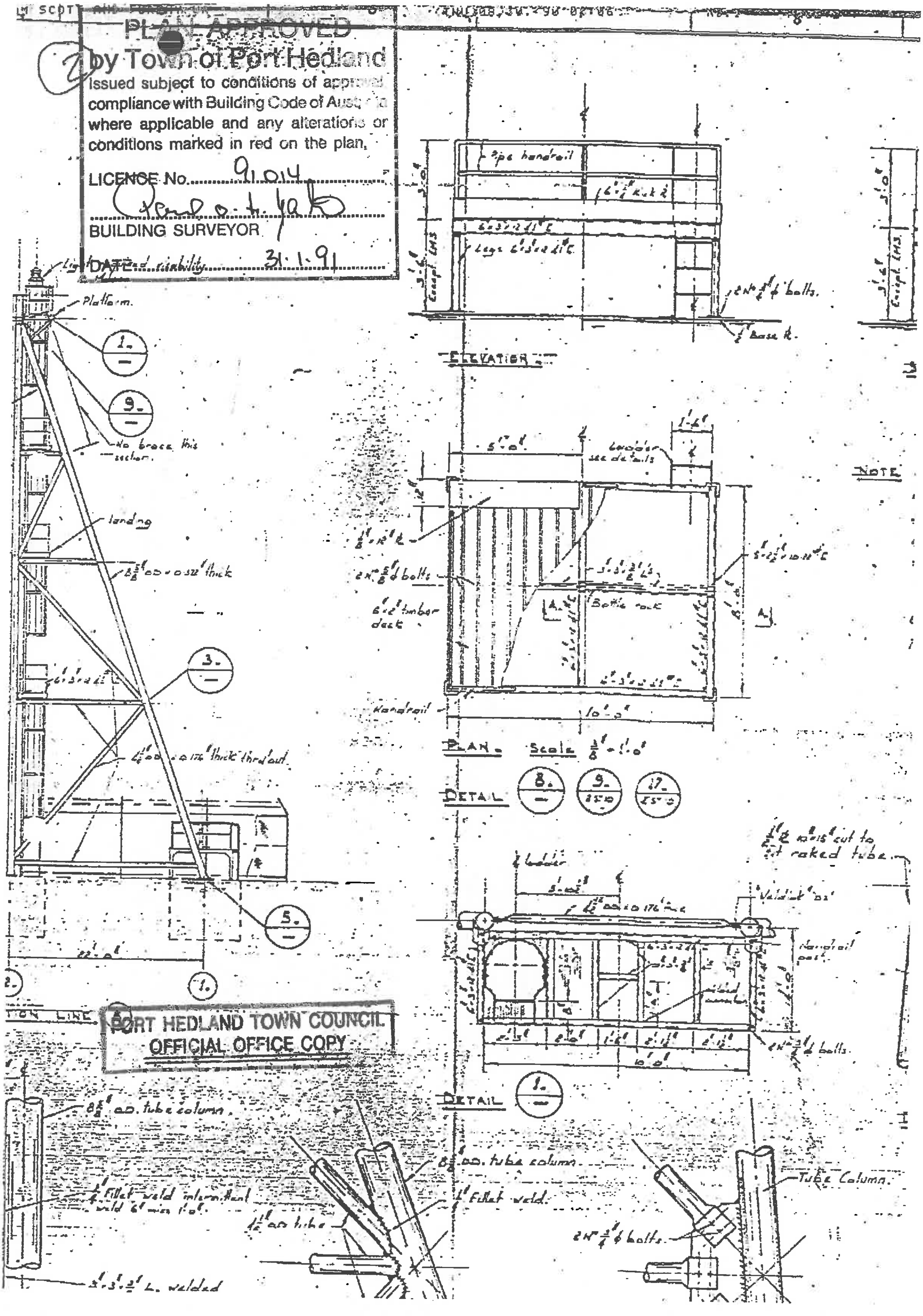
LICENCE No. 91014

BUILDING SURVEYOR

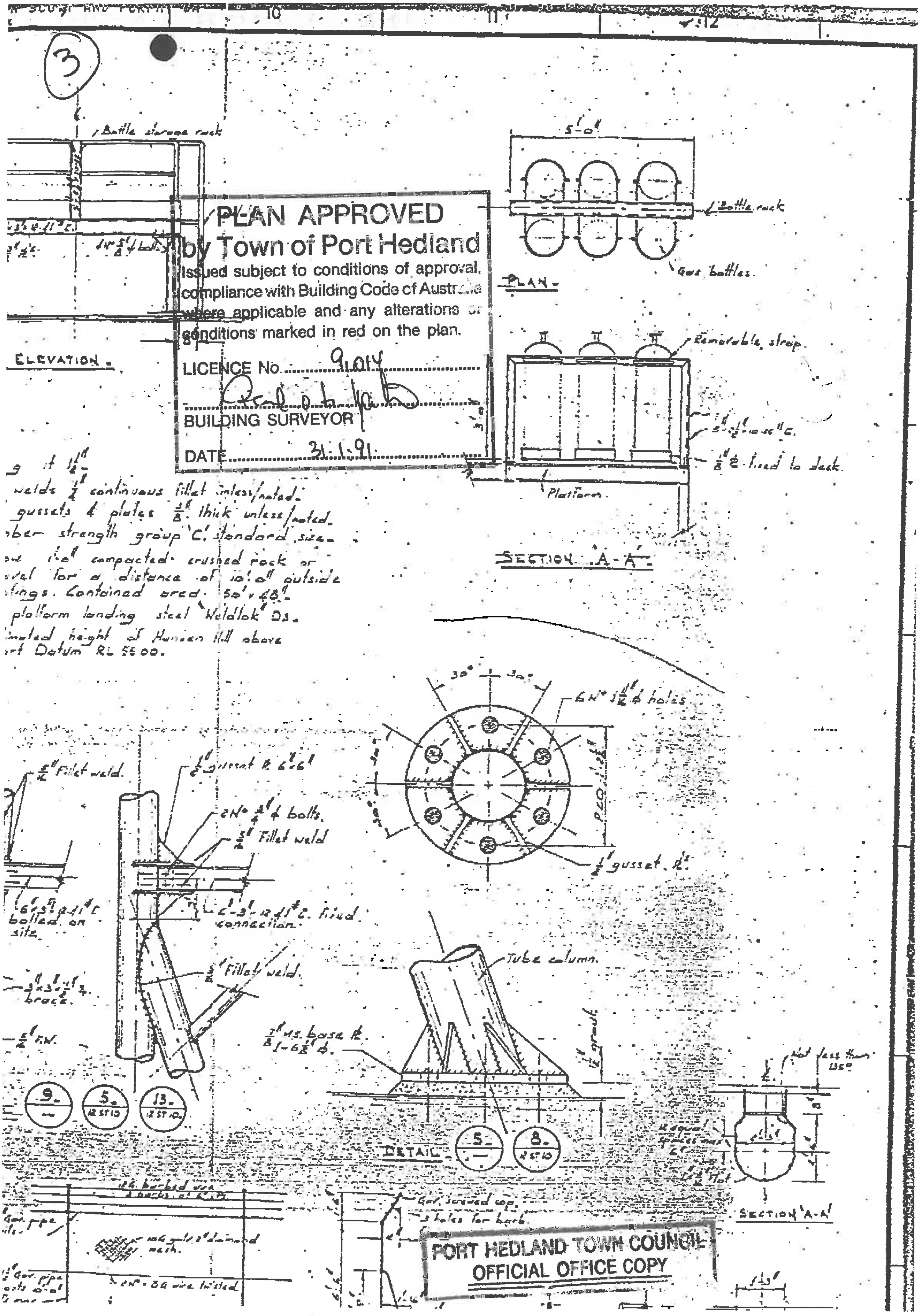
DATE 31.1.91.



PLAN APPROVED
by Town of Port Hedland
Issued subject to conditions of approval compliance with Building Code of Australia where applicable and any alterations or conditions marked in red on the plan.
LICENCE No. 9.014
BUILDING SURVEYOR
DATE 31.1.91

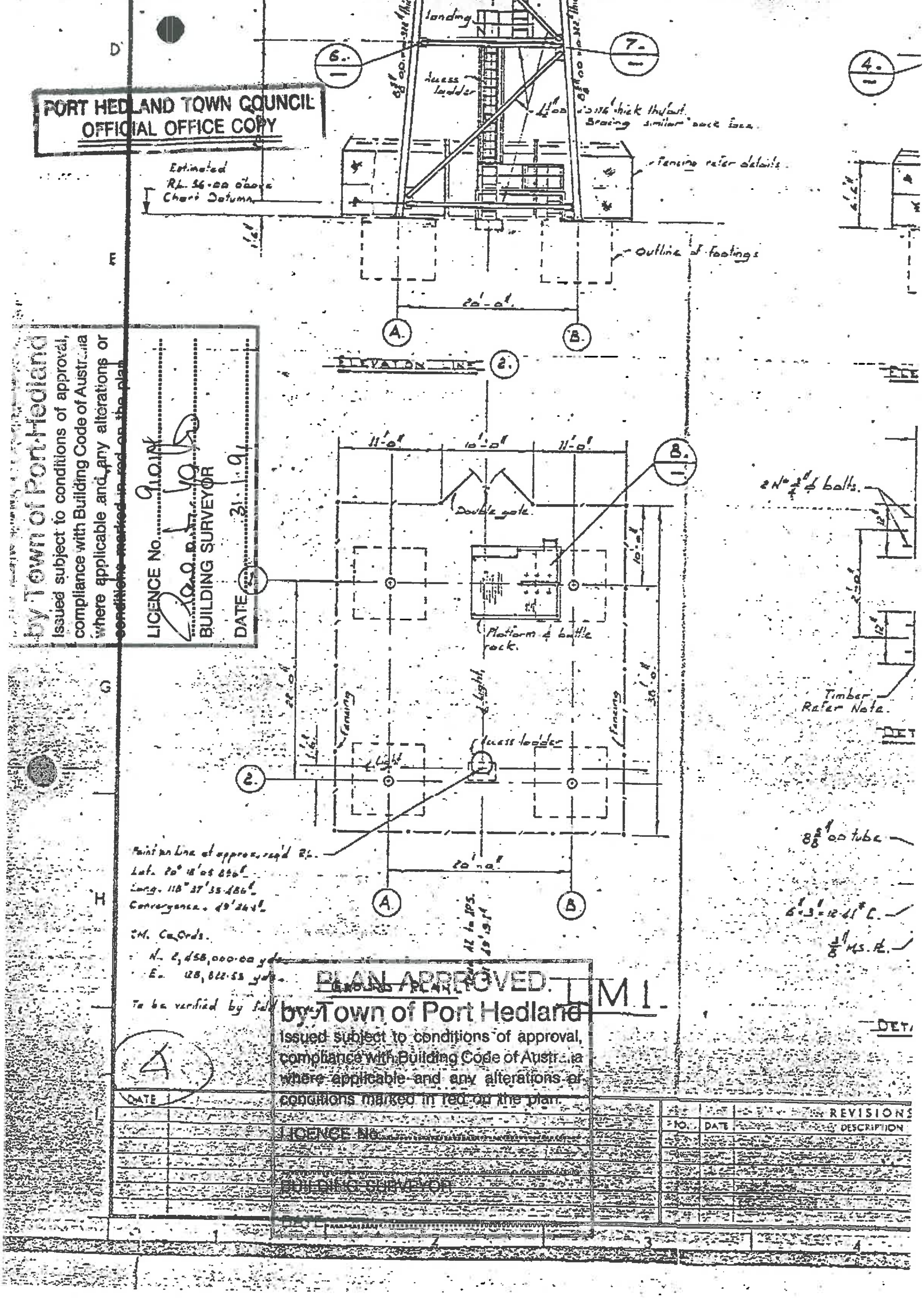


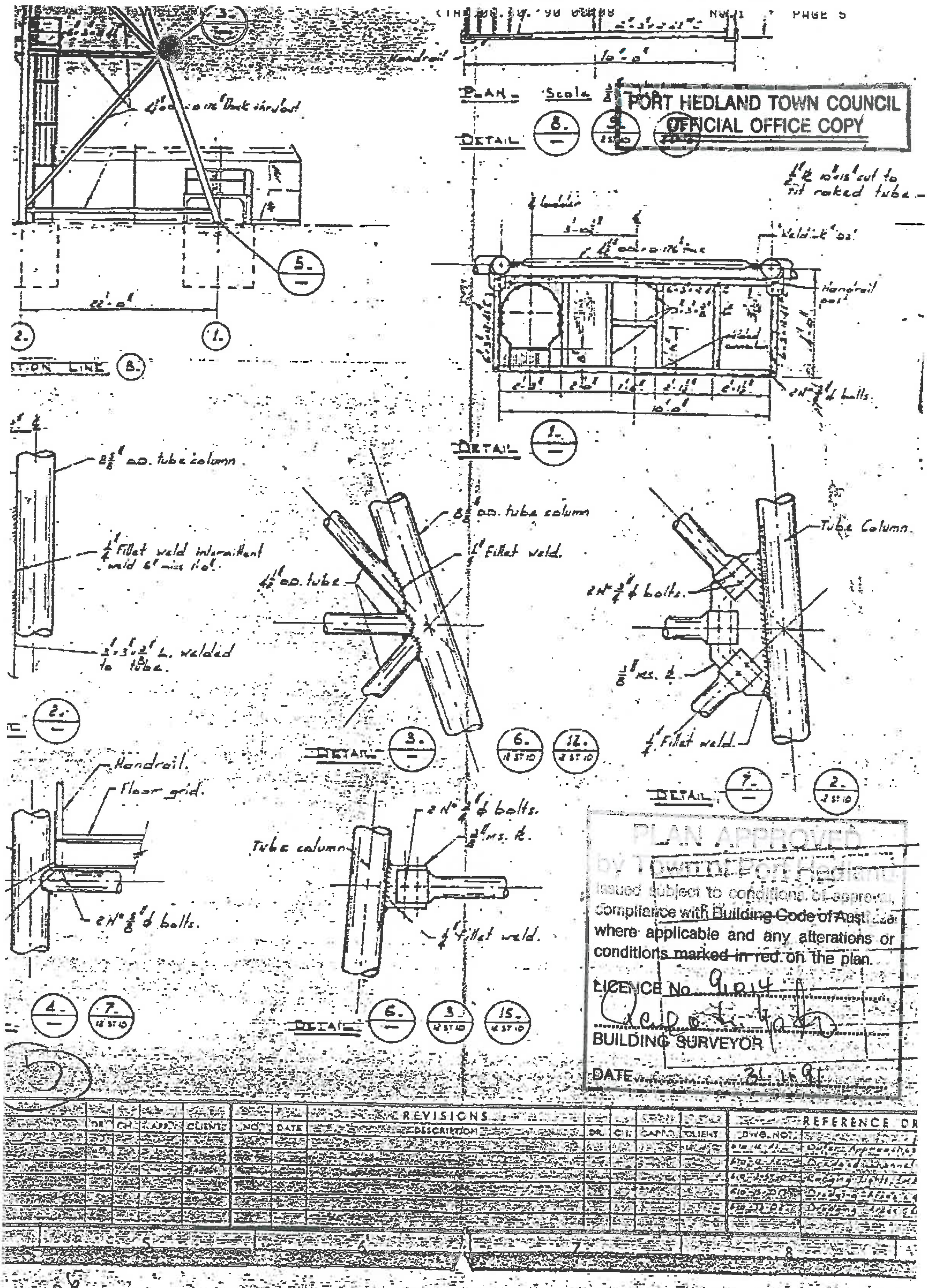
PORT HEDLAND TOWN COUNCIL
OFFICIAL OFFICE COPY



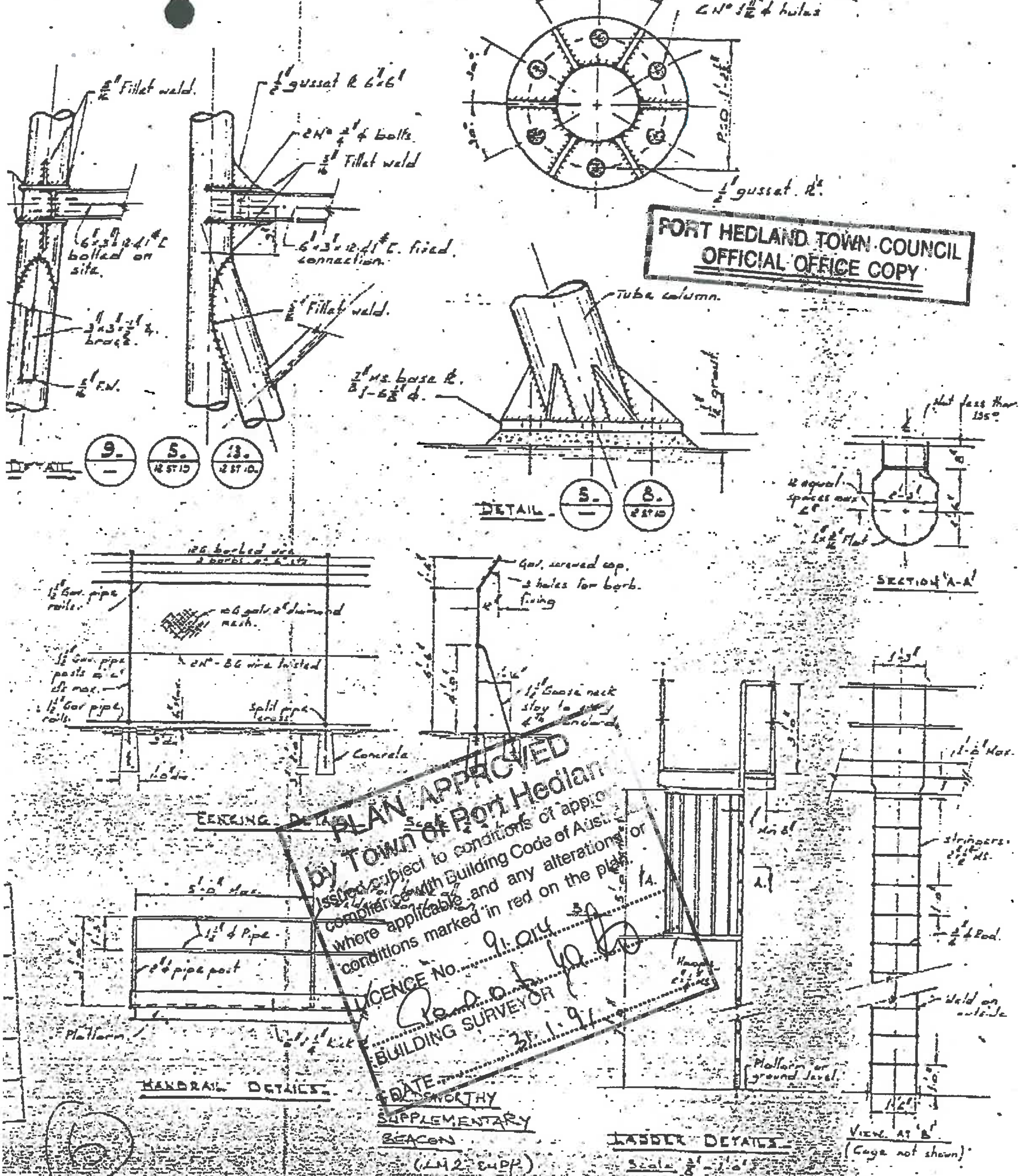
PLAN APPROVED
by Town of Port Hedland
Issued subject to conditions of approval, compliance with Building Code of Australia where applicable and any alterations or conditions marked in red on the plan.
LICENCE No. 91014
BUILDING SURVEYOR
DATE 31.1.91

PORT HEDLAND TOWN COUNCIL
OFFICIAL OFFICE COPY


PORT HEDLAND TOWN COUNCIL
OFFICIAL OFFICE COPY
landing
Access ladder
Bracing similar each face.
Fencing refer details
Estimated RL 56·00 above Chart Datum
Outline of footings
20'-0"
A
B
ELEVATION LINE
2
11'-0"
10'-0"
11'-0"
Double gate
Platform & battle rack.
Fencing
Access ladder
Light
Paint on Line at approx. read 2L
Lat. 20° 18' 05.856"
Long. 118° 37' 35.486"
Convergence 49' 24.4"
T.M. Co.Ords.
N. 2,458,000·00 yds
E. 128,822·55 yds
To be verified by field
20'-0"
2 No. 3/4" ϕ bolts.
Timber Refer Note.
8 5/8" od tube
REVISIONS
No.
DATE
DESCRIPTION
DATE
PLAN APPROVED
GROUND PLAN
LM1
by Town of Port Hedland
Issued subject to conditions of approval, compliance with Building Code of Austr..ia where applicable and any alterations or conditions marked in red on the plan.
LICENCE No.
BUILDING SURVEYOR
DATE

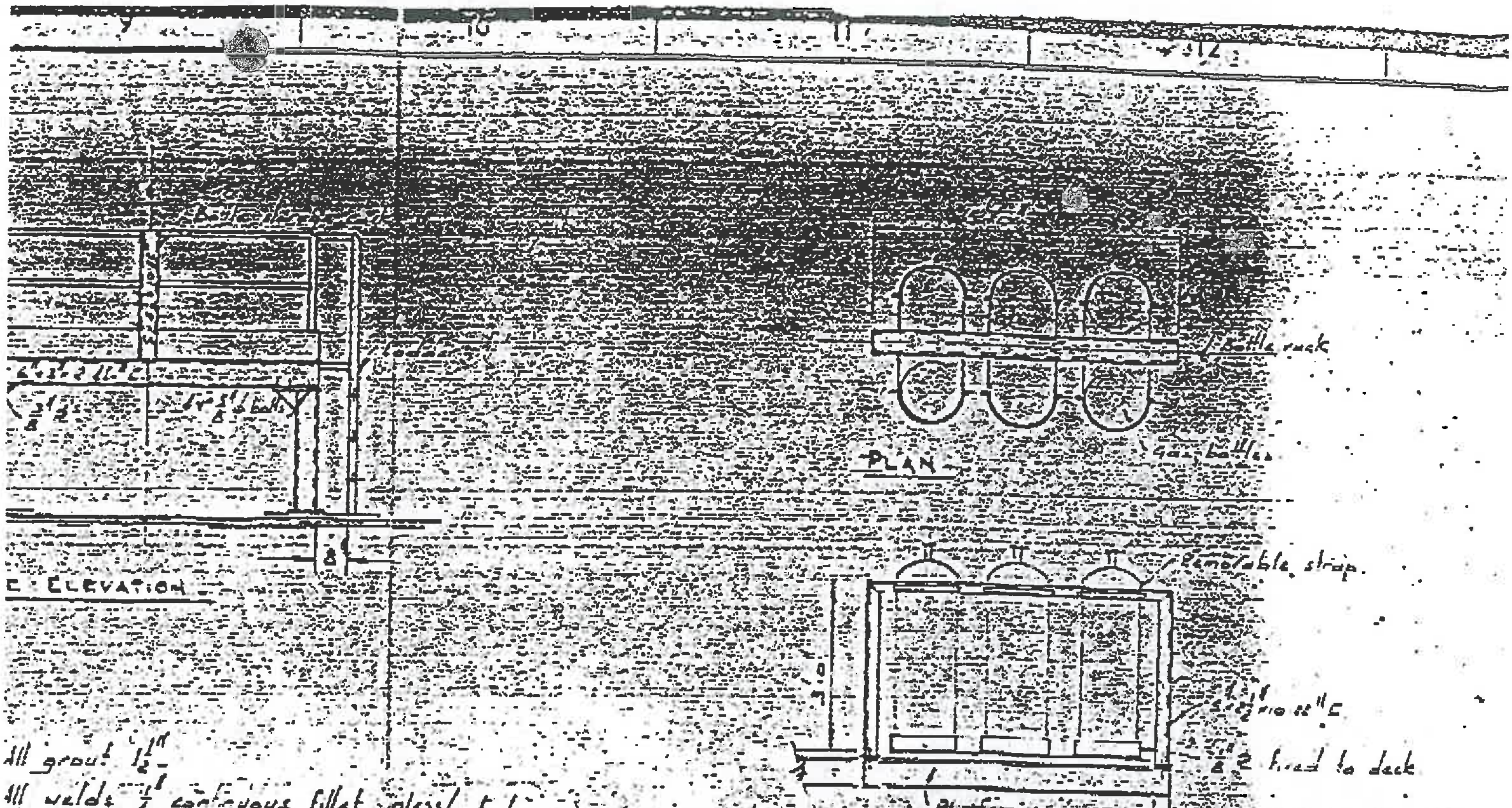

Handrail
10'-0"
PLAN - Scale
DETAIL
22'-0"
LINE
8" o.d. tube column
1/4" Fillet weld intermittent weld 6" min. 1'-0"
3 1/2" x 3" x 3/8" L. welded to tube.
8 5/8" o.d. tube column
1/4" Fillet weld.
4 1/2" o.d. tube
DETAIL
Tube Column.
2N° 3/4" ⌀ bolts.
3/8" ms. ℄.
1/4" Fillet weld.
DETAIL
Handrail.
Floor grid.
2N° 5/8" ⌀ bolts.
Tube column
2N° 3/4" ⌀ bolts.
3/8" ms. ℄.
1/4" Fillet weld.
DETAIL
℄ ladder
Handrail post
2N° 3/4" ⌀ bolts.
10'-0"
DETAIL
REVISIONS
DESCRIPTION
NO.
DATE
DR.
CH.
APPD.
CLIENT
REFERENCE DR
DWG. NO.
5
6
7
8

106

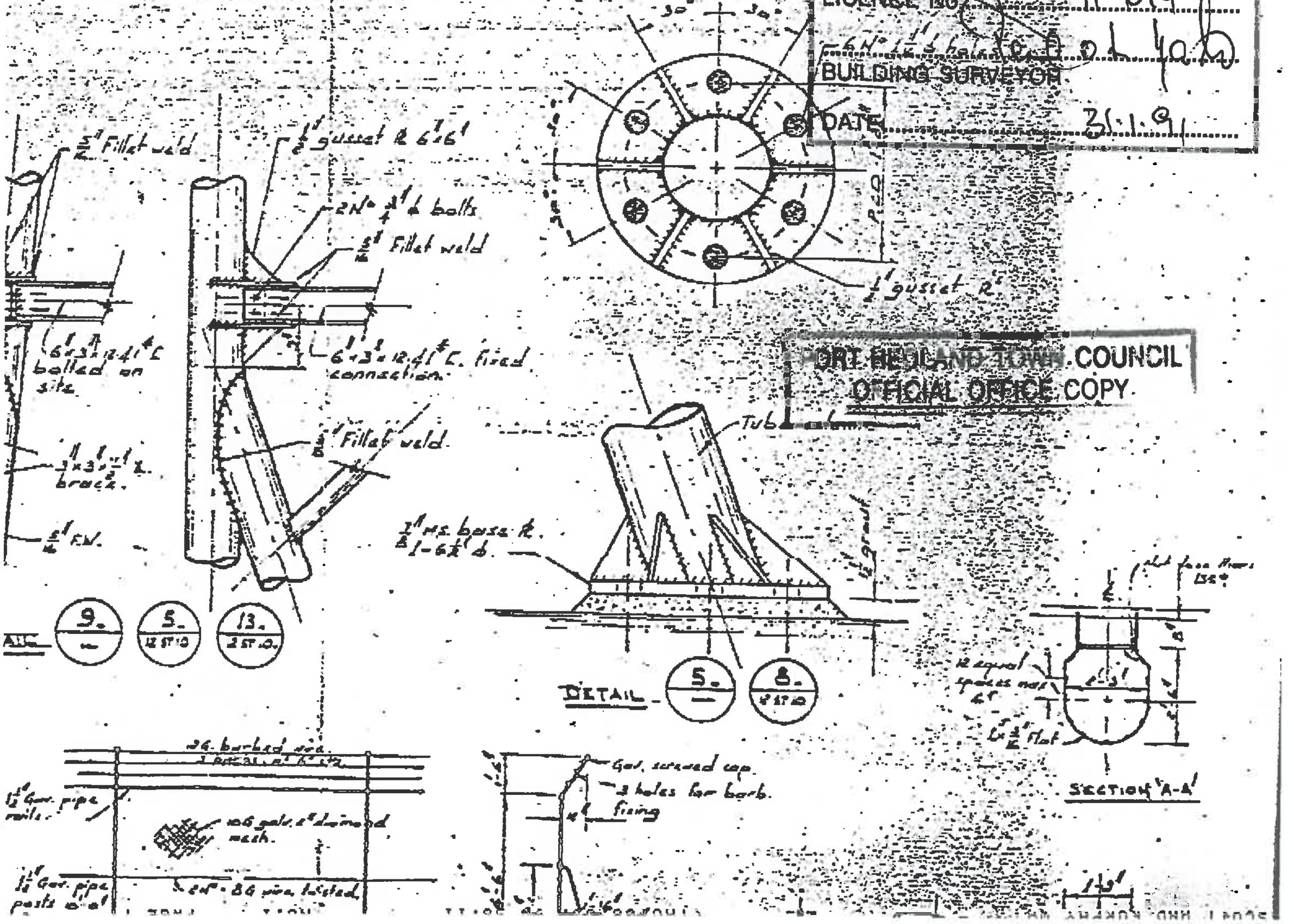


DRAWINGS	UTAH CONSTRUCTION & ENGINEERING PTY. LIMITED ENGINEERS CONTRACTORS ST KILDA ROAD MELBOURNE	DESIGNED / DRAWN / CHECKED / APPROVED	M.G.M.A. - MT. GOLDSWORTHY PROJECT PORT HEDLAND - FINUCANE ISLAND NAVIGATION AIDS - RANGING LIGHTS
		DRAWING	610 - 12 - ST. 9 — 0

9 10 11 12



All grout 1½"
All welds ¼" continuous fillet unless noted.
All gussets & plates ⅜" thick unless noted.
Timber strength group C standard size.
Allow 6" compacted crushed rock or gravel for a distance of 10'0" outside footings. Contained area 50' x 48'.
All platform landing steel Weldlok D3.
Estimated height of Hansen Hill above Chart Datum R.L. 36.00.



Supplied. 2/06/2015

SCOTT & FURPHY

Rendel Scott Furphy

47 Ord Street, West Perth, W.A. 6005, Australia
Telephone (09) 321-4582 Fax (09) 481-2136

Ref:MJS:rd:7586:0216

1st November 1990

Mr. Roger Richardson
C/- Mt. Newman Mining Co.
Nelson Point
Port Hedland 6721

SPOIL DISPOSAL
All Site vegetation, spoil and building rubble to be disposed of at an approved council tip site

RE: COOKE POINT LIGHT TOWER

Dear Sir

We understand it is proposed to relocate the above tower to the car park of the Tourist Bureau in Port Hedland.

As discussed if the lower six (6) planks of the daymark are removed as shown on the attached extract of the drawing the base under each leg must have a mass of 19.5t or about 8.1m^3 of concrete.

We would recommend that each base is 2.5m x 2.5m x 1.3m deep. No reinforcement is required provided the holding down bolts have a 1.0m penetration into the base. The bolts should be a minimum of 24mm dia. but we would recommend 30mm dia. unless they are galvanized.

If you are able to obtain iron ore to use as concrete aggregate the mass must be maintained but the size can be rduced but keeping about the same ratio of depth to width.

We trust the above is satisfactory but if you require further information do not hesitate to contact the writer.

Yours faithfully
RENDEL SCOTT FURPHY

per

M.J. SEARLE
Manager

PORT HEDLAND TOWN COUNCIL
OFFICIAL OFFICE COPY

c.c. -Peter Blenkinsopp - Port Hedland Port Authority

PLAN APPROVED
by Town of Port Hedland
Issued subject to conditions of approval, compliance with Building Code of Australia where applicable and any alterations or conditions marked in red on the plan.

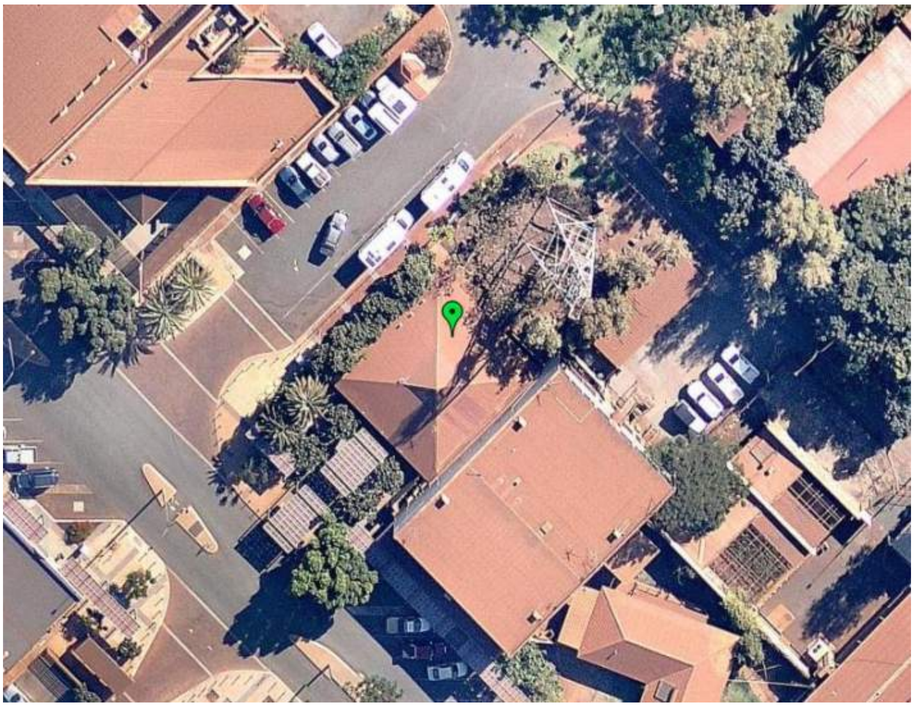
LICENCE No. 91014

BUILDING SURVEYOR

DATE 31.1.91

9. APPENDIX B: Nearmap Aerial Photography

Figure 24: Aerial Photo Taken 08/07/2015




nearmap
current. clear. change.
Showing: Wed 08 Jul 2015


nearmap
current : clear : change
Showing: Thu 20 Nov 2014
20 m
Terms of Use

Date of Aerial Image	Snapshot taken from Nearmap aerial imagery
08/07/15	
20/11/14	
11/07/14	

03/01/14	
29/03/13	
06/08/12	

05/11/11	  nearmap current : clear : change Showing: Sat 05 Nov 2011 5 m Terms of Use

10. Appendix C: Sketches

TOWN OF PORT HEDLAND

OBSERVATION TOWER
WEDGE ST., PORT HEDLAND
SITE INSPECTION JULY 2015

Site Inspection Measurements & Commentary

SK01 Plan View
SK02 Perspective View
SK03 Perspective View
SK04 Front Elevation
SK05 Side Elevation
SK06 Site Measurement of Platforms 4 & 5
SK07 Site Measurement of Platforms 1, 2 & 3
SK08 Site Measurement of Stairs

Structural Analysis

SK10 Wind Load
SK11
SK12
SK13
SK14
SK15
SK16

Proposed Remedial Works

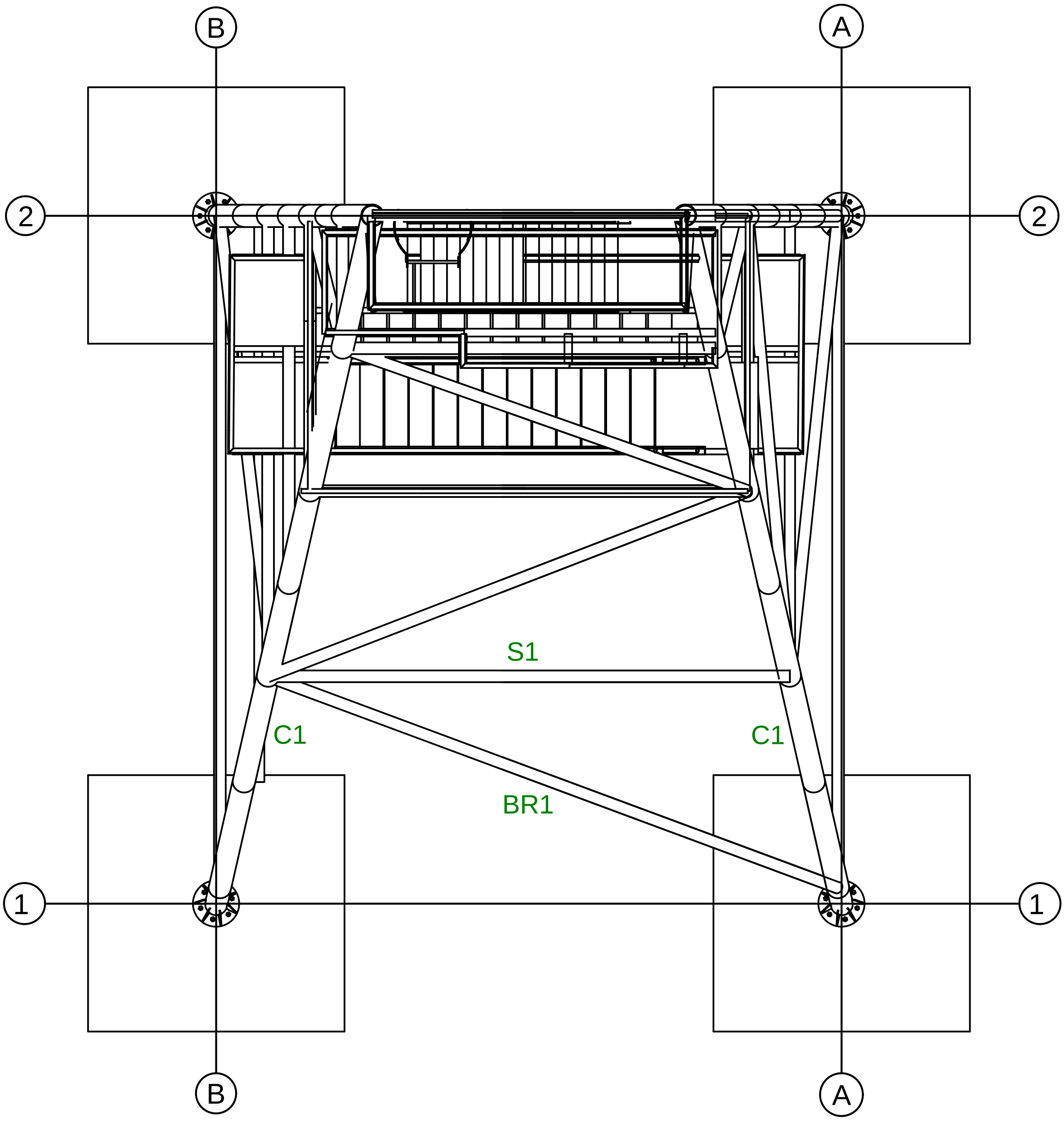
SK20

Consulting Engineers
Project Management
Design | Building Surveying
Energy Efficiency Assessment
Unit 6, 9 Playle Street
Myaree WA 6154
TEL 08 9317 3331
FAX 08 9317 3337
info@rsaeng.com.au
www.rsaeng.com.au
RSA

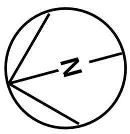
CLIENT	TOWN OF PORT HEDLAND
TITLE	OBSERVATION TOWER WEDGE ST., PORT HEDLAND SITE INSPECTION JULY 2015

A4	DATE	DESIGNED	DRAWN	CHECKED	SCALE	REF.	DRG No.	REVISION
	03/08/15	-	AL	AA	NTS	15- 0440	SK00	-

C1	219.1 CHS	$8^5/_8$" OD x 0.322" thick	(219.1 x 8.2 CHS)
BR1	114.3 CHS	$4^1/_2$" OD x 0.176" thick	(114.3 x 4.5 CHS)
S1	114.3 CHS	$4^1/_2$" OD x 0.176" thick	(114.3 x 4.5 CHS)
B1	200 x 100 RHS		



PLAN VIEW



Blue colour indicates site measurement.
Red colour indicates dimension from pre-existing structural drawings.
All dimensions in mm UON.

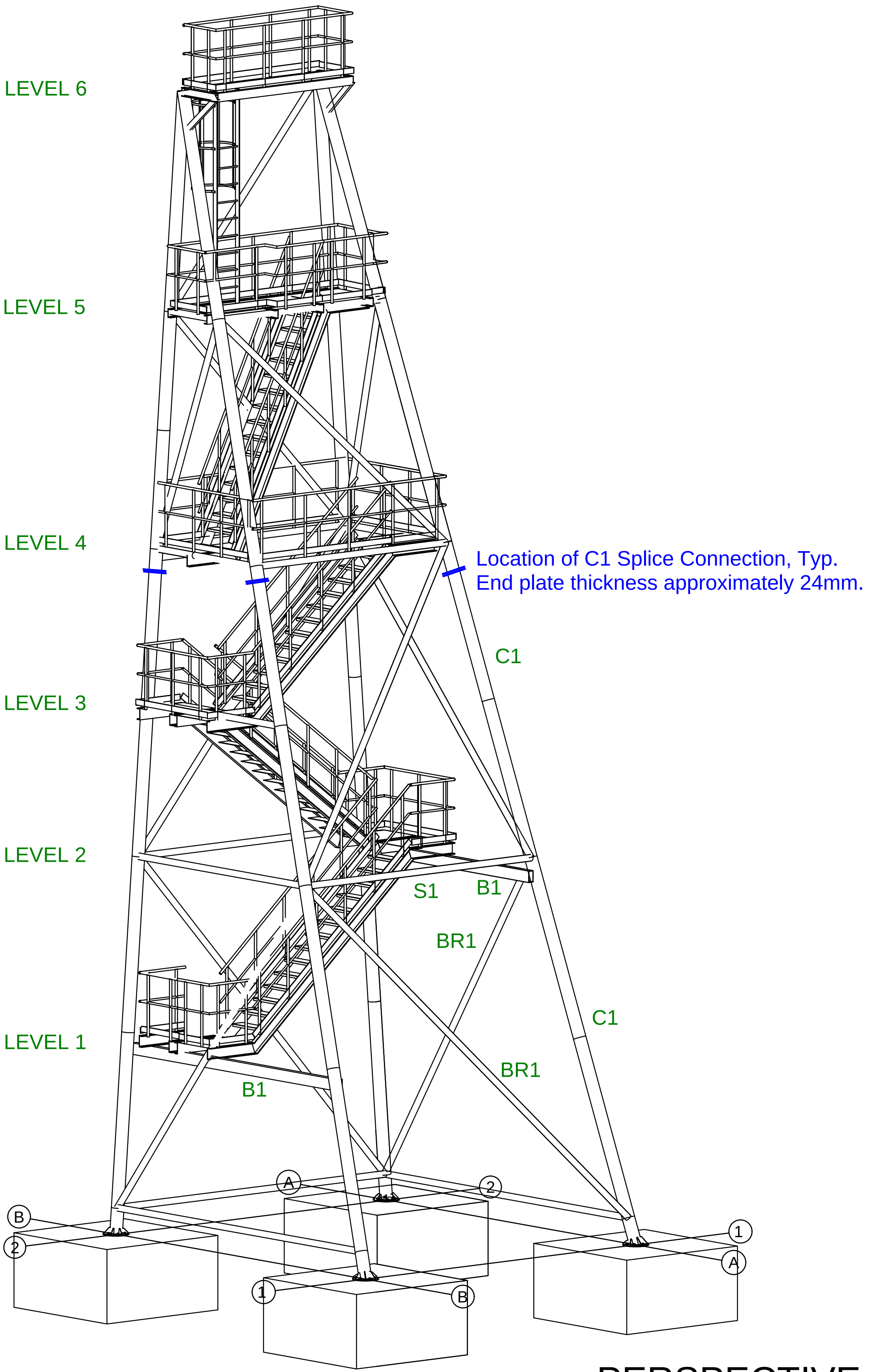
Consulting Engineers
Project Management
Design | Building Surveying
Energy Efficiency Assessment
Unit 6, 9 Playle Street
Myaree WA 6154
TEL 08 9317 3331
FAX 08 9317 3337
info@rsaeng.com.au
www.rsaeng.com.au

RSa

CLIENT TOWN OF PORT HEDLAND

TITLE OBSERVATION TOWER
WEDGE ST., PORT HEDLAND
SITE INSPECTION JULY 2015

A4	DATE 03/08/15	DESIGNED -	DRAWN AL	CHECKED AA	SCALE NTS	REF. 15-0440	DRG No. SK01	REVISION -



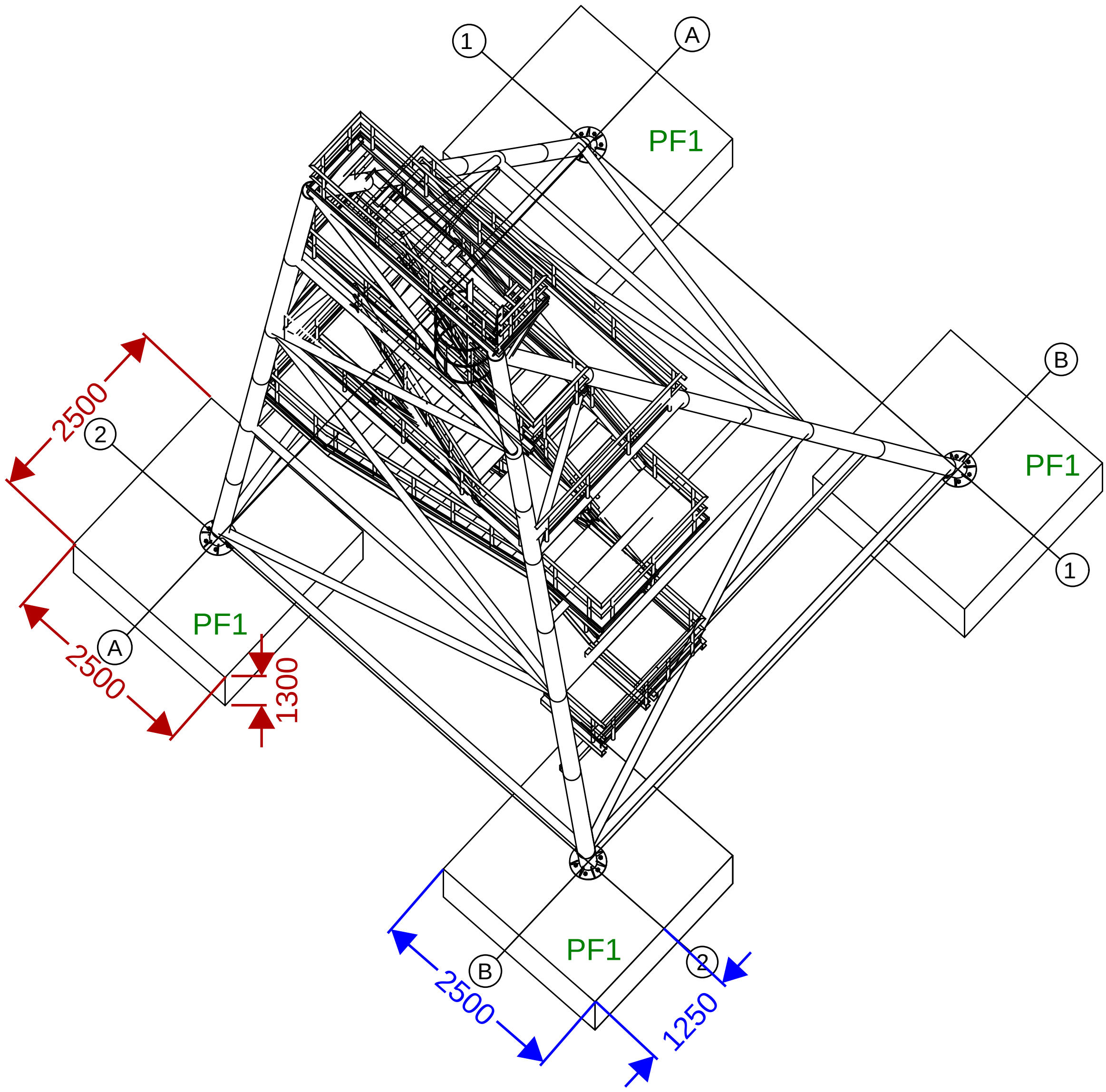
PERSPECTIVE VIEW

Blue colour indicates site measurement.
Red colour indicates dimension from pre-existing structural drawings.
All dimensions in mm UON.

Consulting Engineers
Project Management
Design | Building Surveying
Energy Efficiency Assessment
Unit 6, 9 Playle Street
Myaree WA 6154
TEL 08 9317 3331
FAX 08 9317 3337
info@rsaeng.com.au
www.rsaeng.com.au

CLIENT	TOWN OF PORT HEDLAND										
TITLE	OBSERVATION TOWER WEDGE ST., PORT HEDLAND SITE INSPECTION JULY 2015										
A4	DATE 03/08/15	DESIGNED -	DRAWN AL	CHECKED AA	SCALE NTS	REF. 15-0440	DRG No. SK02	REVISION -			

PF1 2500x2500x1300 Mass Concrete



PERSPECTIVE VIEW

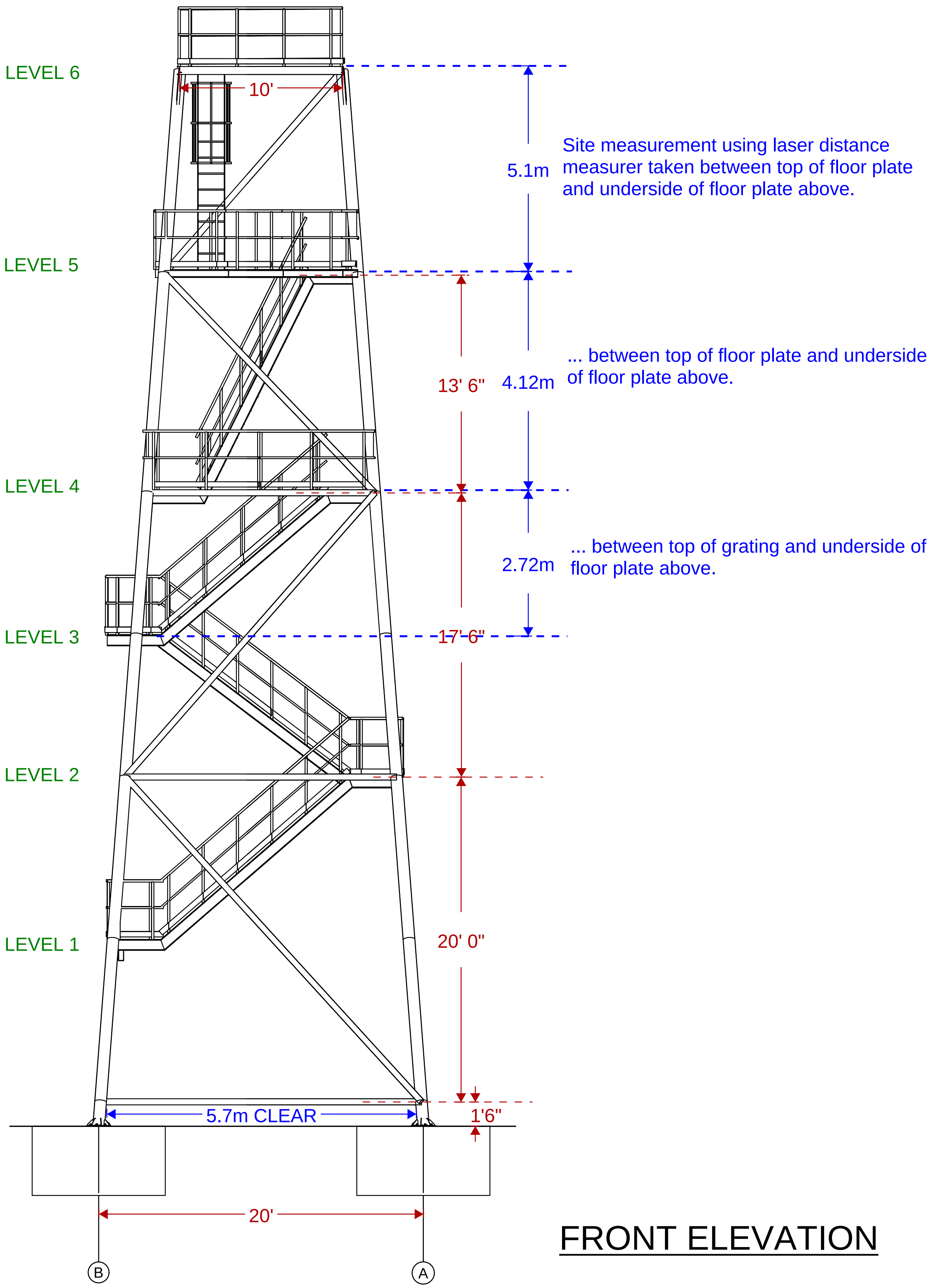
Blue colour indicates site measurement.
Red colour indicates dimension from pre-existing structural drawings.
All dimensions in mm UON.

Consulting Engineers
Project Management
Design | Building Surveying
Energy Efficiency Assessment
Unit 6, 9 Playle Street
Myaree WA 6154
TEL 08 9317 3331
FAX 08 9317 3337
info@rsaeng.com.au
www.rsaeng.com.au
RSA

CLIENT TOWN OF PORT HEDLAND

TITLE OBSERVATION TOWER
WEDGE ST., PORT HEDLAND
SITE INSPECTION JULY 2015

A4	DATE 03/08/15	DESIGNED -	DRAWN AL	CHECKED AA	SCALE NTS	REF. 15-0440	DRG No. SK03	REVISION -



FRONT ELEVATION

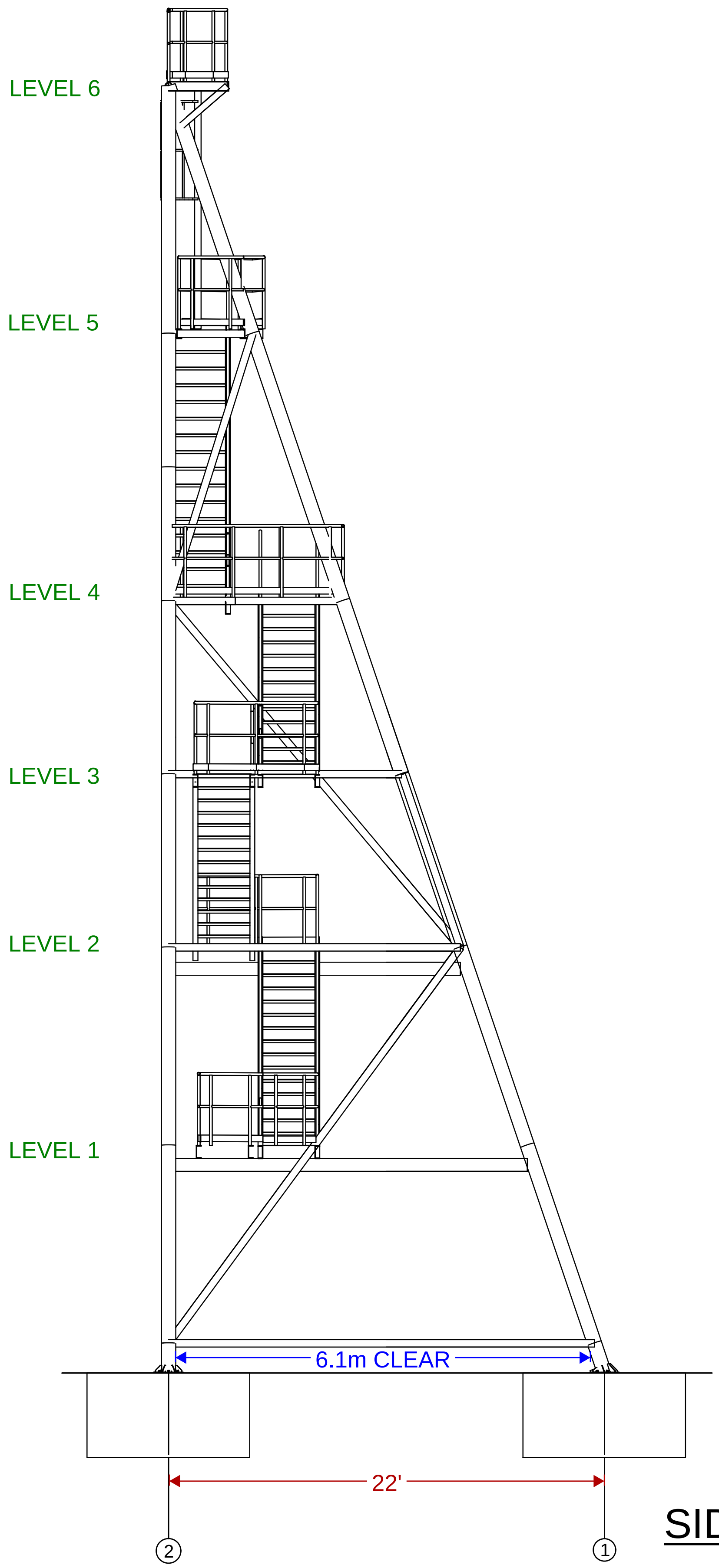
Blue colour indicates site measurement.
Red colour indicates dimension from pre-existing structural drawings.
All dimensions in mm UON.

Consulting Engineers
Project Management
Design | Building Surveying
Energy Efficiency Assessment
Unit 6, 9 Playle Street
Myaree WA 6154
TEL 08 9317 3331
FAX 08 9317 3337
info@rsaeng.com.au
www.rsaeng.com.au
RSa

CLIENT TOWN OF PORT HEDLAND

TITLE OBSERVATION TOWER
WEDGE ST., PORT HEDLAND
SITE INSPECTION JULY 2015

A4	DATE 03/08/15	DESIGNED -	DRAWN AL	CHECKED AA	SCALE NTS	REF. 15-0440	DRG No. SK04	REVISION -



SIDE ELEVATION

Blue colour indicates site measurement.
Red colour indicates dimension from pre-existing structural drawings.
All dimensions in mm UON.

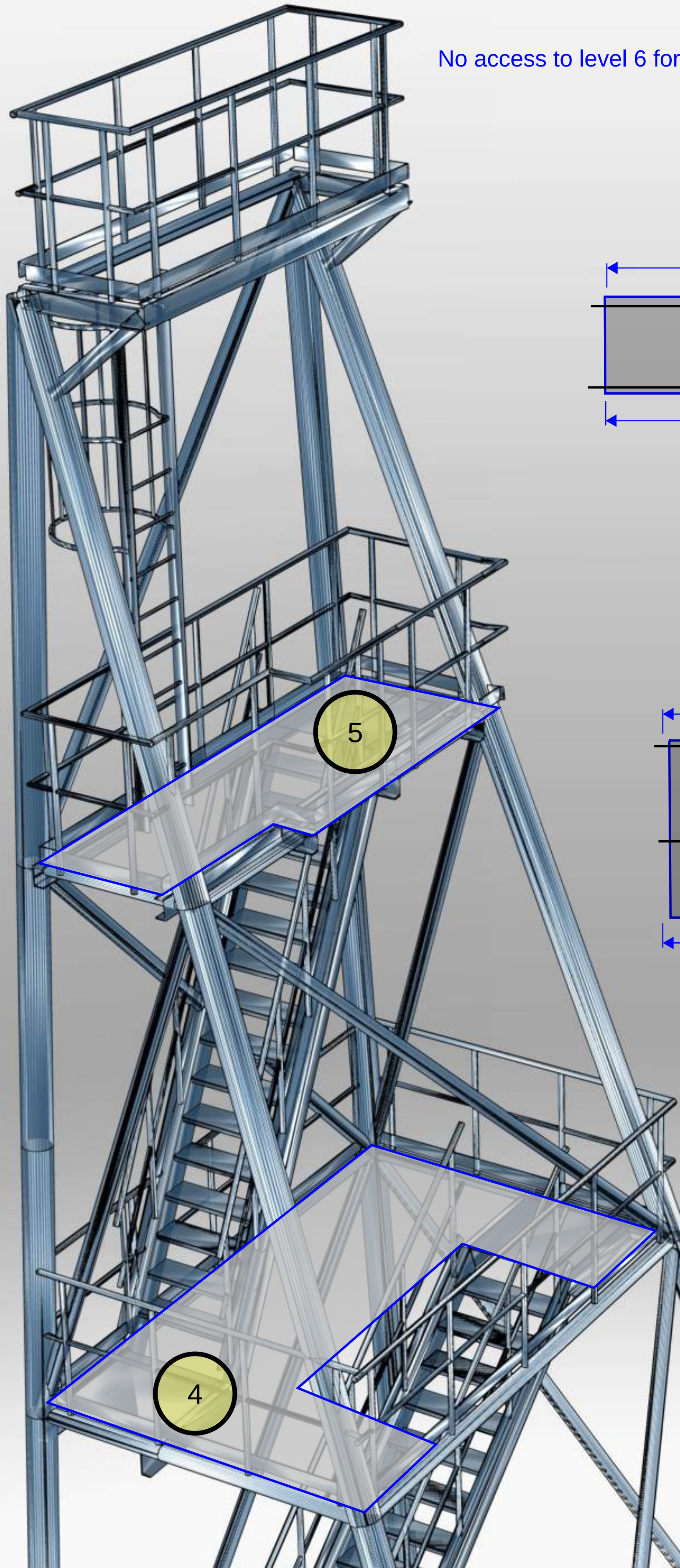
Consulting Engineers
Project Management
Design | Building Surveying
Energy Efficiency Assessment
Unit 6, 9 Playle Street
Myaree WA 6154
TEL 08 9317 3331
FAX 08 9317 3337
info@rsaeng.com.au
www.rsaeng.com.au

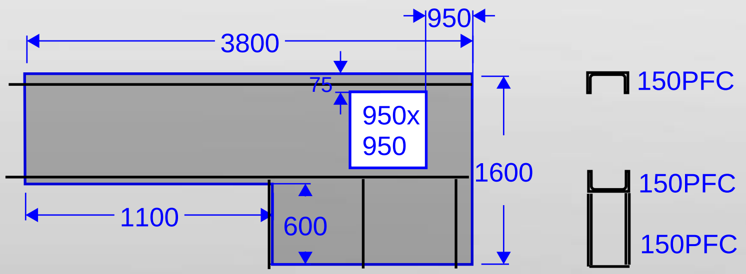
RSa

CLIENT	TOWN OF PORT HEDLAND
TITLE	OBSERVATION TOWER WEDGE ST., PORT HEDLAND SITE INSPECTION JULY 2015

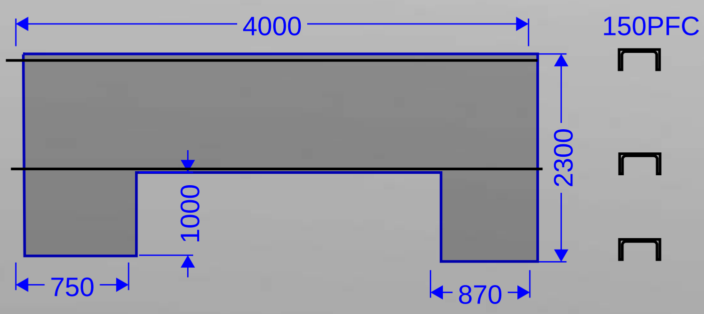
A4	DATE 03/08/15	DESIGNED -	DRAWN AL	CHECKED AA	SCALE NTS	
REF. 15-0440	DRG No. SK05	REVISION -				

No access to level 6 for site inspection 28/07/2015.





PLAN - LEVEL 5 PLATFORM



PLAN - LEVEL 4 PLATFORM

SCHEMATIC ONLY

Blue colour indicates site measurement.
Red colour indicates dimension from pre-existing structural drawings.
All dimensions in mm UON.

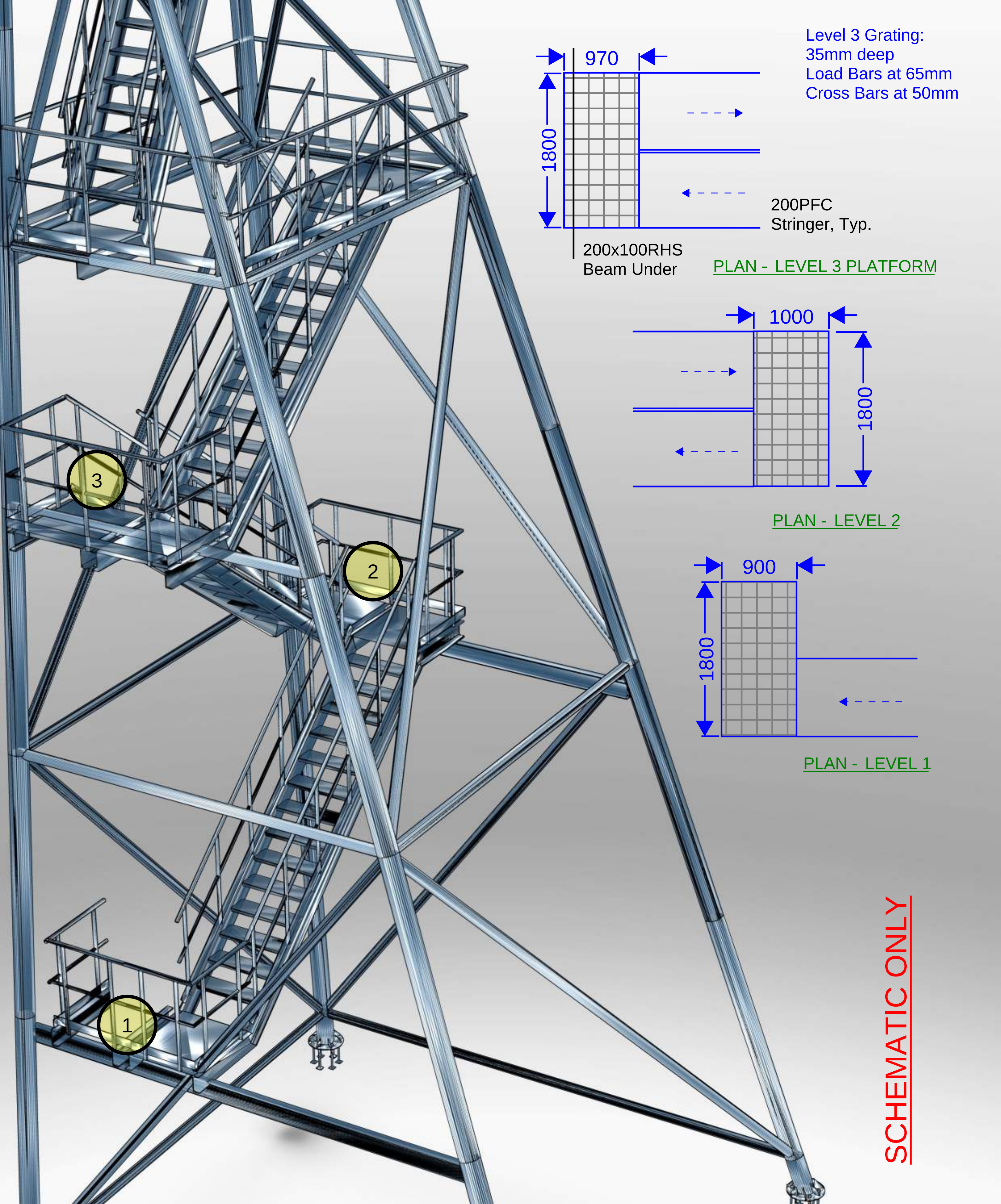
Consulting Engineers
Project Management
Design | Building Surveying
Energy Efficiency Assessment
Unit 6, 9 Playle Street
Myaree WA 6154
TEL 08 9317 3331
FAX 08 9317 3337
info@rsaeng.com.au
www.rsaeng.com.au

RSA

CLIENT TOWN OF PORT HEDLAND

TITLE OBSERVATION TOWER
WEDGE ST., PORT HEDLAND
SITE INSPECTION JULY 2015

A4	DATE 03/08/15	DESIGNED -	DRAWN AL	CHECKED AA	SCALE NTS	REF. 15-0440	DRG No. SK06	REVISION -



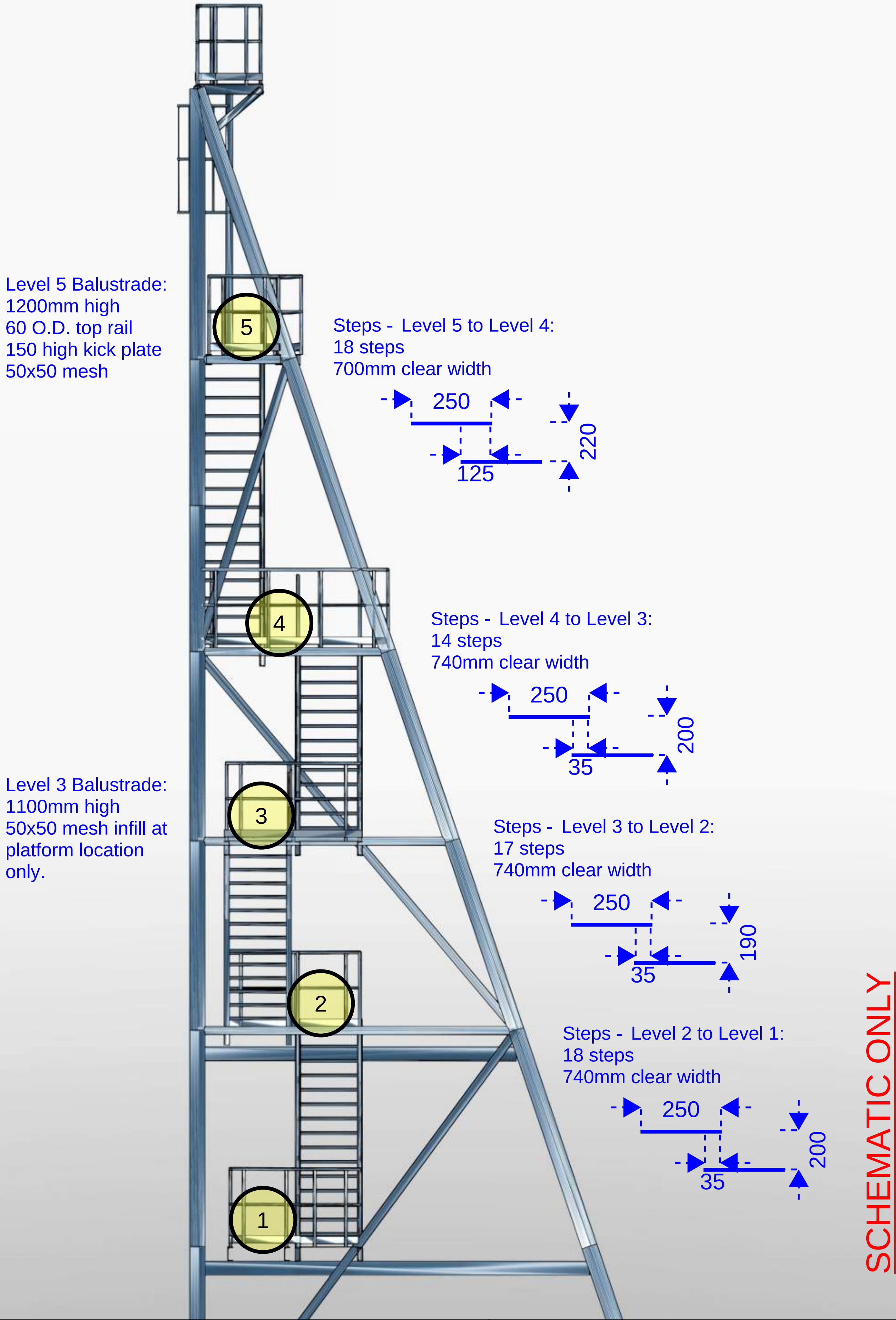
Blue colour indicates site measurement.
Red colour indicates dimension from pre-existing structural drawings.
All dimensions in mm UON.

Consulting Engineers
Project Management
Design | Building Surveying
Energy Efficiency Assessment
Unit 6, 9 Playle Street
Myaree WA 6154
TEL 08 9317 3331
FAX 08 9317 3337
info@rsaeng.com.au
www.rsaeng.com.au
RSA

CLIENT TOWN OF PORT HEDLAND

TITLE OBSERVATION TOWER
WEDGE ST., PORT HEDLAND
SITE INSPECTION JULY 2015

A4	DATE 03/08/15	DESIGNED -	DRAWN AL	CHECKED AA	SCALE NTS	REF. 15-0440	DRG No. SK07	REVISION -



Blue colour indicates site measurement.

Red colour indicates dimension from pre-existing structural drawings.

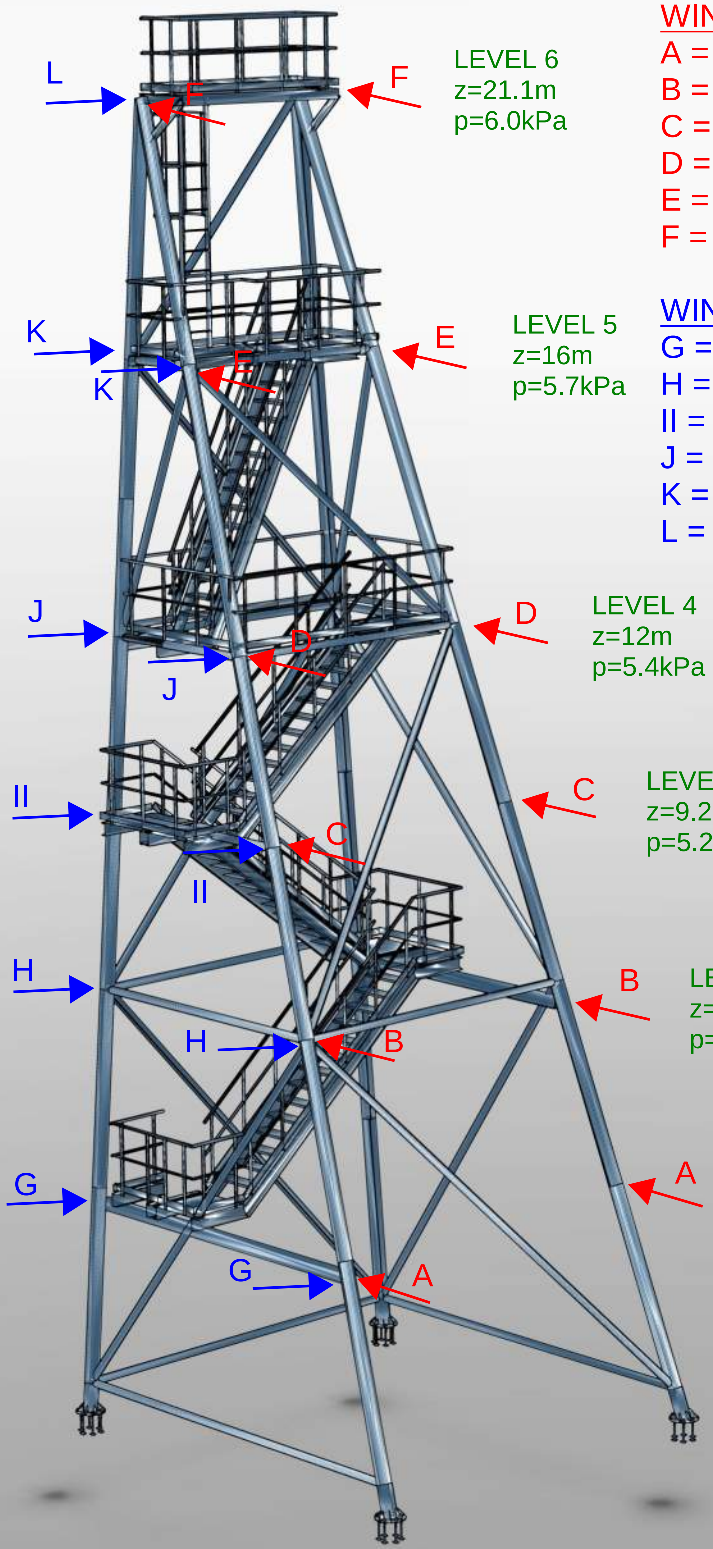
All dimensions in mm UON.

Consulting Engineers
Project Management
Design | Building Surveying
Energy Efficiency Assessment
Unit 6, 9 Playle Street
Myaree WA 6154
TEL 08 9317 3331
FAX 08 9317 3337
info@rsaeng.com.au
www.rsaeng.com.au
RSa

CLIENT TOWN OF PORT HEDLAND

TITLE OBSERVATION TOWER
WEDGE ST., PORT HEDLAND
SITE INSPECTION JULY 2015

A4	DATE 03/08/15	DESIGNED -	DRAWN AL	CHECKED AA	SCALE NTS	REF. 15-0440	DRG No. SK08	REVISION -



WIND_0:
A = 11.8kN
B = 6.69kN
C = 6.13kN
D = 7.36kN
E = 7.84kN
F = 3.46kN

WIND_90:
G = 23.8kN
H = 11.9kN
II = 9.39kN
J = 8.95kN
K = 5.66kN
L = 1.34kN

STRUCTURAL ANALYSIS

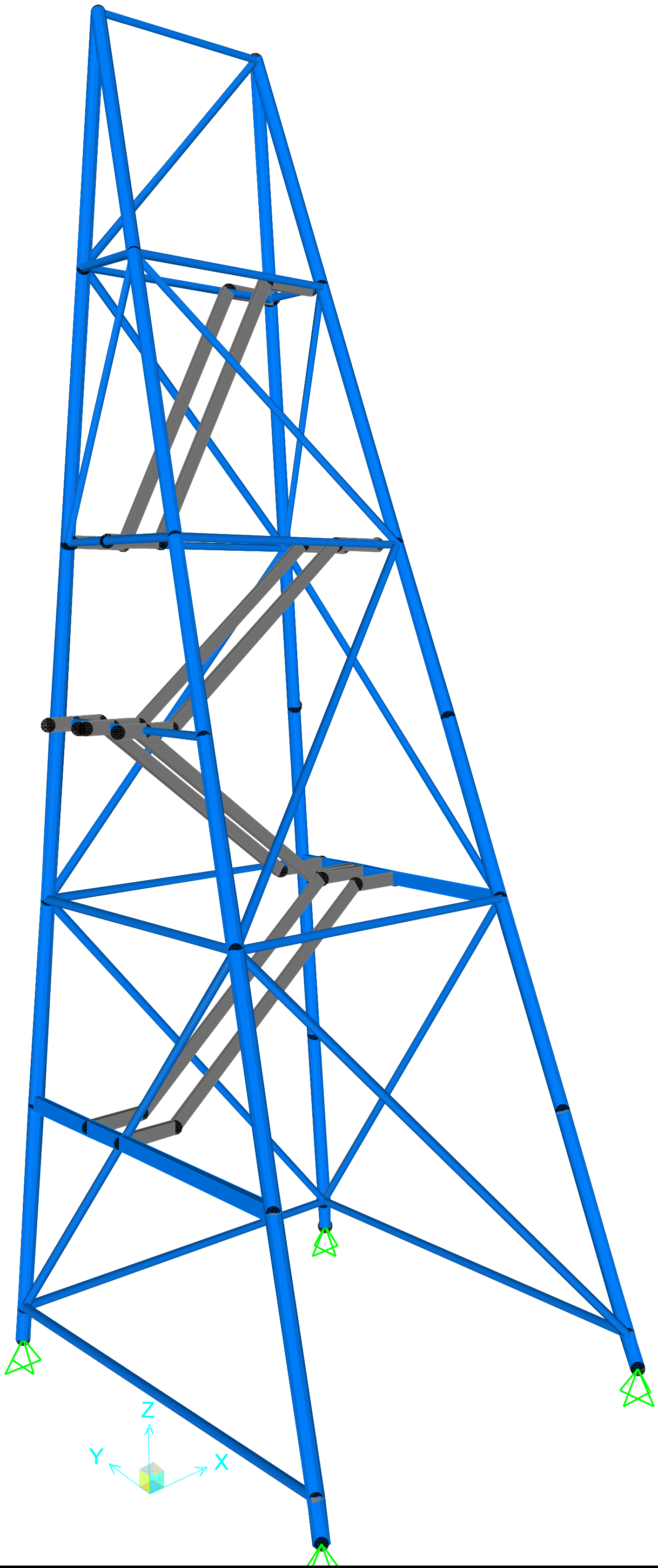
WIND LOAD

Consulting Engineers
Project Management
Design | Building Surveying
Energy Efficiency Assessment
Unit 6, 9 Playle Street
Myaree WA 6154
TEL 08 9317 3331
FAX 08 9317 3337
info@rsaeng.com.au
www.rsaeng.com.au

CLIENT TOWN OF PORT HEDLAND

TITLE OBSERVATION TOWER
WEDGE ST., PORT HEDLAND
SITE INSPECTION JULY 2015

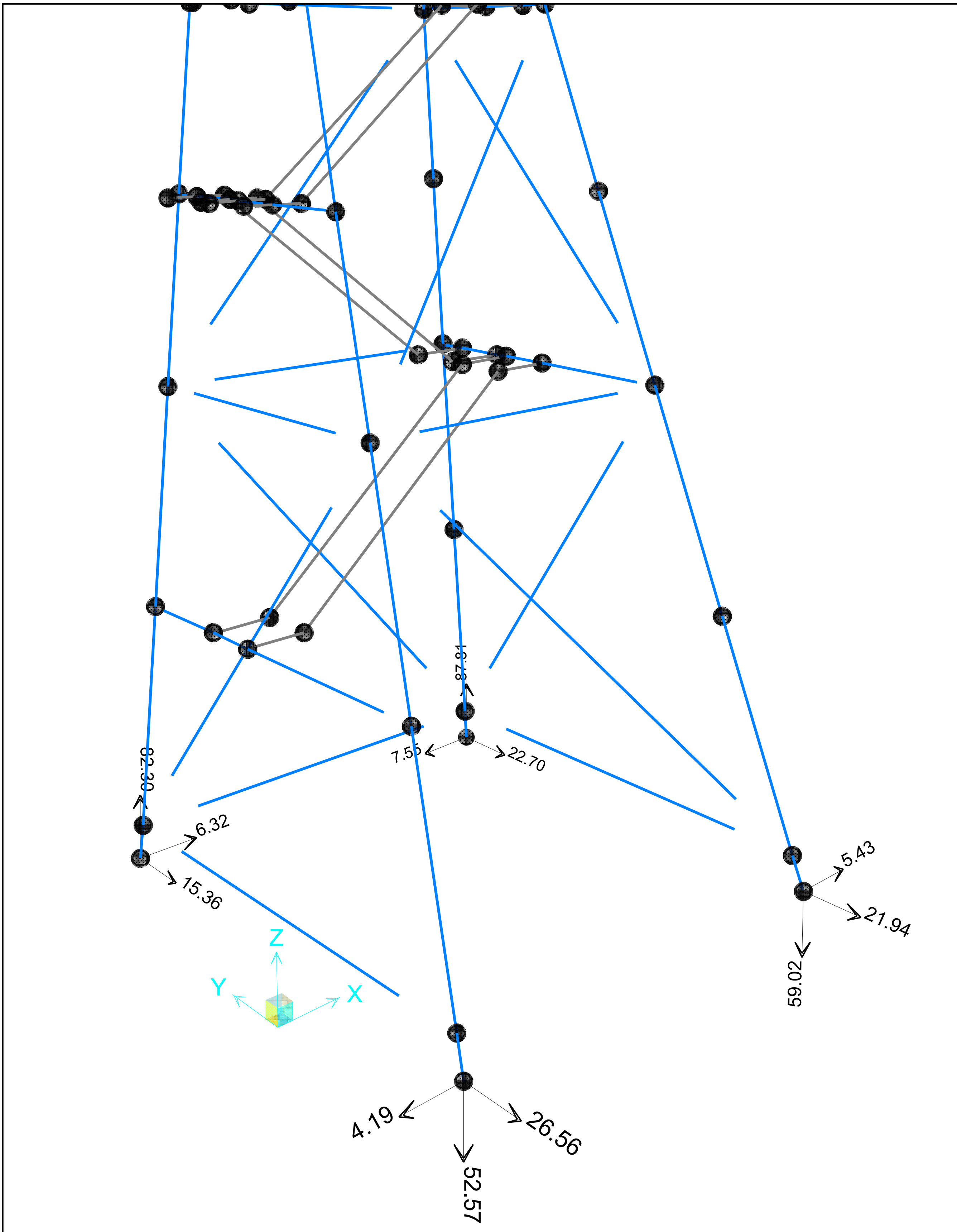
A4	DATE 03/08/15	DESIGNED -	DRAWN AL	CHECKED AA	SCALE NTS	REF. 15-0440	DRG No. SK10	REVISION -



STRUCTURAL ANALYSIS

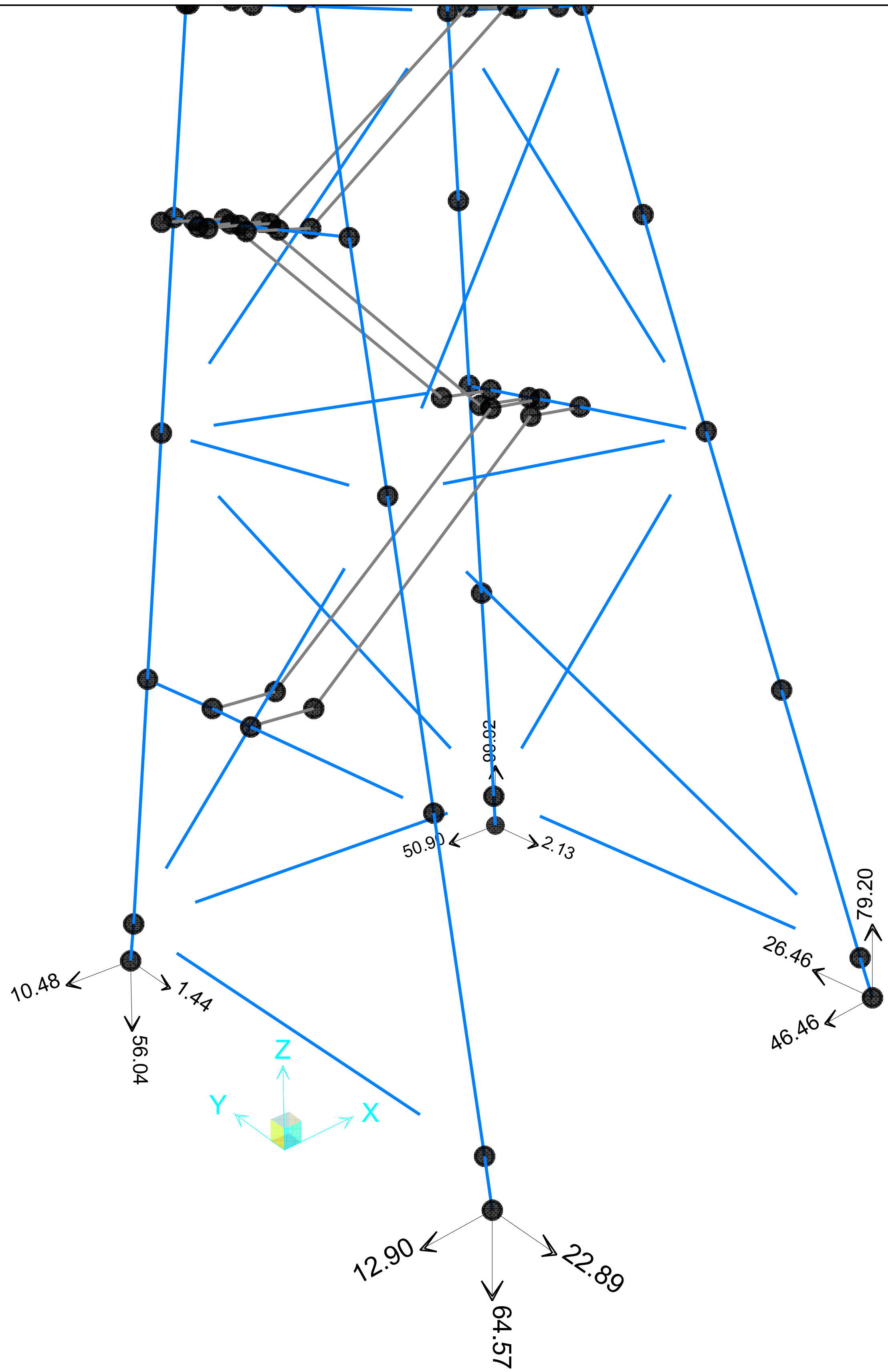
Consulting Engineers
Project Management
Design | Building Surveying
Energy Efficiency Assessment
Unit 6, 9 Playle Street
Myaree WA 6154
TEL 08 9317 3331
FAX 08 9317 3337
info@rsaeng.com.au
www.rsaeng.com.au

CLIENT	TOWN OF PORT HEDLAND				
TITLE	OBSERVATION TOWER WEDGE ST., PORT HEDLAND SITE INSPECTION JULY 2015				
A4	DATE 03/08/15	DESIGNED -	DRAWN AL	CHECKED AA	SCALE NTS
REF. 15-0440	DRG No. SK11	REVISION -			



STRUCTURAL ANALYSIS

	Consulting Engineers Project Management Design | Building Surveying Energy Efficiency Assessment Unit 6, 9 Playle Street Myaree WA 6154 TEL 08 9317 3331 FAX 08 9317 3337 info@rsaeng.com.au www.rsaeng.com.au		CLIENT TOWN OF PORT HEDLAND TITLE OBSERVATION TOWER WEDGE ST., PORT HEDLAND SITE INSPECTION JULY 2015		
A4	DATE 03/08/15	DESIGNED -	DRAWN AL	CHECKED AA	SCALE NTS
REF. 15- 0440	DRG No. SK12	REVISION -			



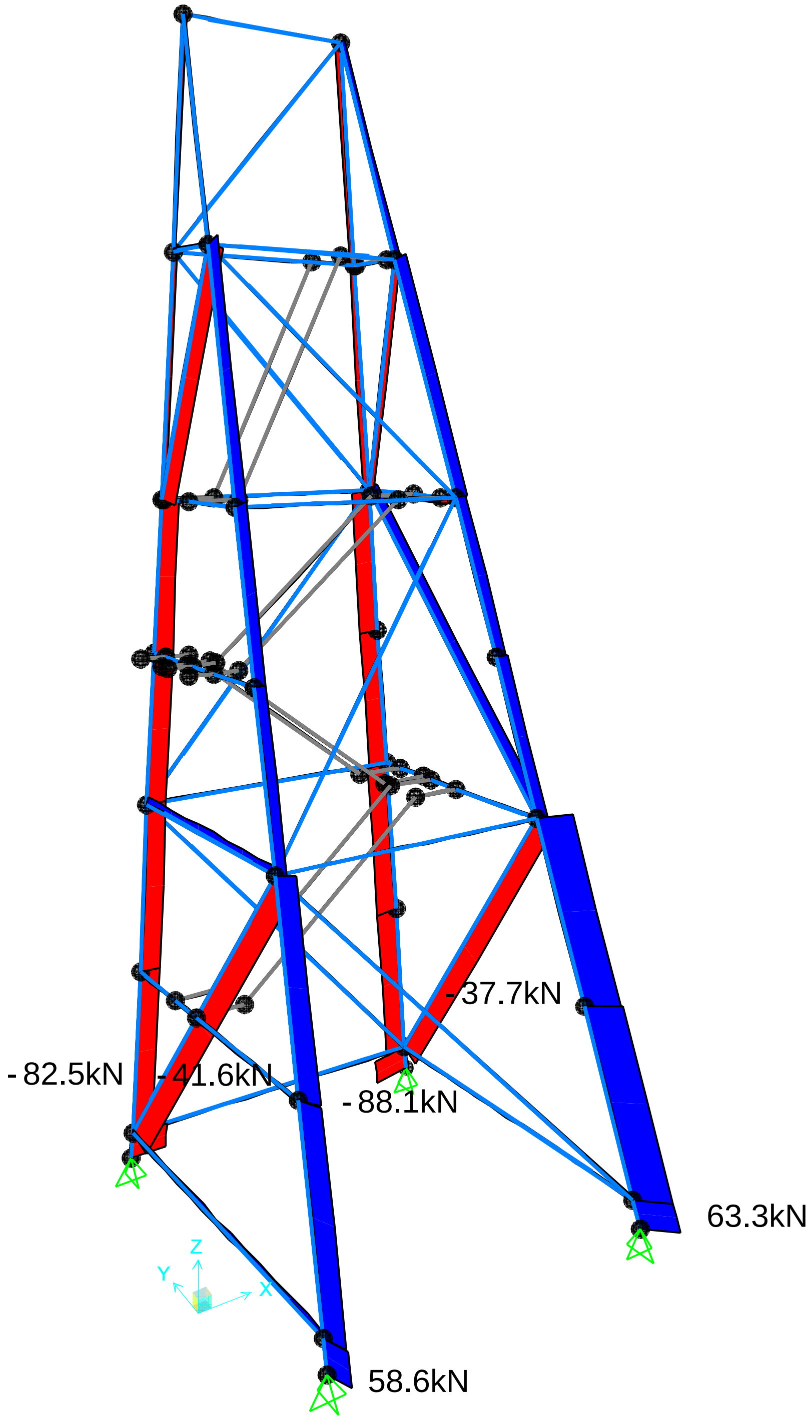
STRUCTURAL ANALYSIS

Consulting Engineers
Project Management
Design | Building Surveying
Energy Efficiency Assessment
Unit 6, 9 Playle Street
Myaree WA 6154
TEL 08 9317 3331
FAX 08 9317 3337
info@rsaeng.com.au
www.rsaeng.com.au

RSa

CLIENT	TOWN OF PORT HEDLAND
TITLE	OBSERVATION TOWER WEDGE ST., PORT HEDLAND SITE INSPECTION JULY 2015

A4	DATE 03/08/15	DESIGNED -	DRAWN AL	CHECKED AA	SCALE NTS	REF. 15- 0440	DRG No. SK13	REVISION -



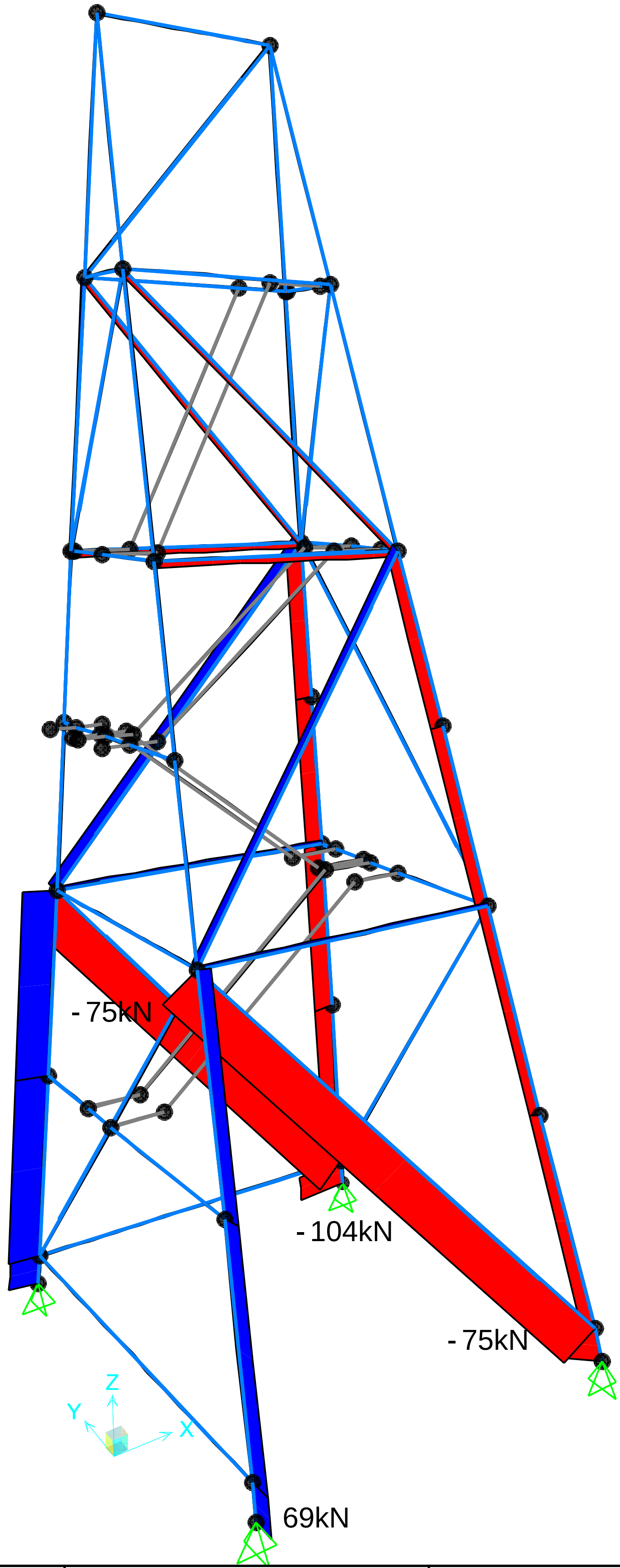
STRUCTURAL ANALYSIS

Consulting Engineers
Project Management
Design | Building Surveying
Energy Efficiency Assessment
Unit 6, 9 Playle Street
Myaree WA 6154
TEL 08 9317 3331
FAX 08 9317 3337
info@rsaeng.com.au
www.rsaeng.com.au

RSa

CLIENT	TOWN OF PORT HEDLAND
TITLE	OBSERVATION TOWER WEDGE ST., PORT HEDLAND SITE INSPECTION JULY 2015

A4	DATE 03/08/15	DESIGNED -	DRAWN AL	CHECKED AA	SCALE NTS	REF. 15-0440	DRG No. SK14	REVISION -



STRUCTURAL ANALYSIS

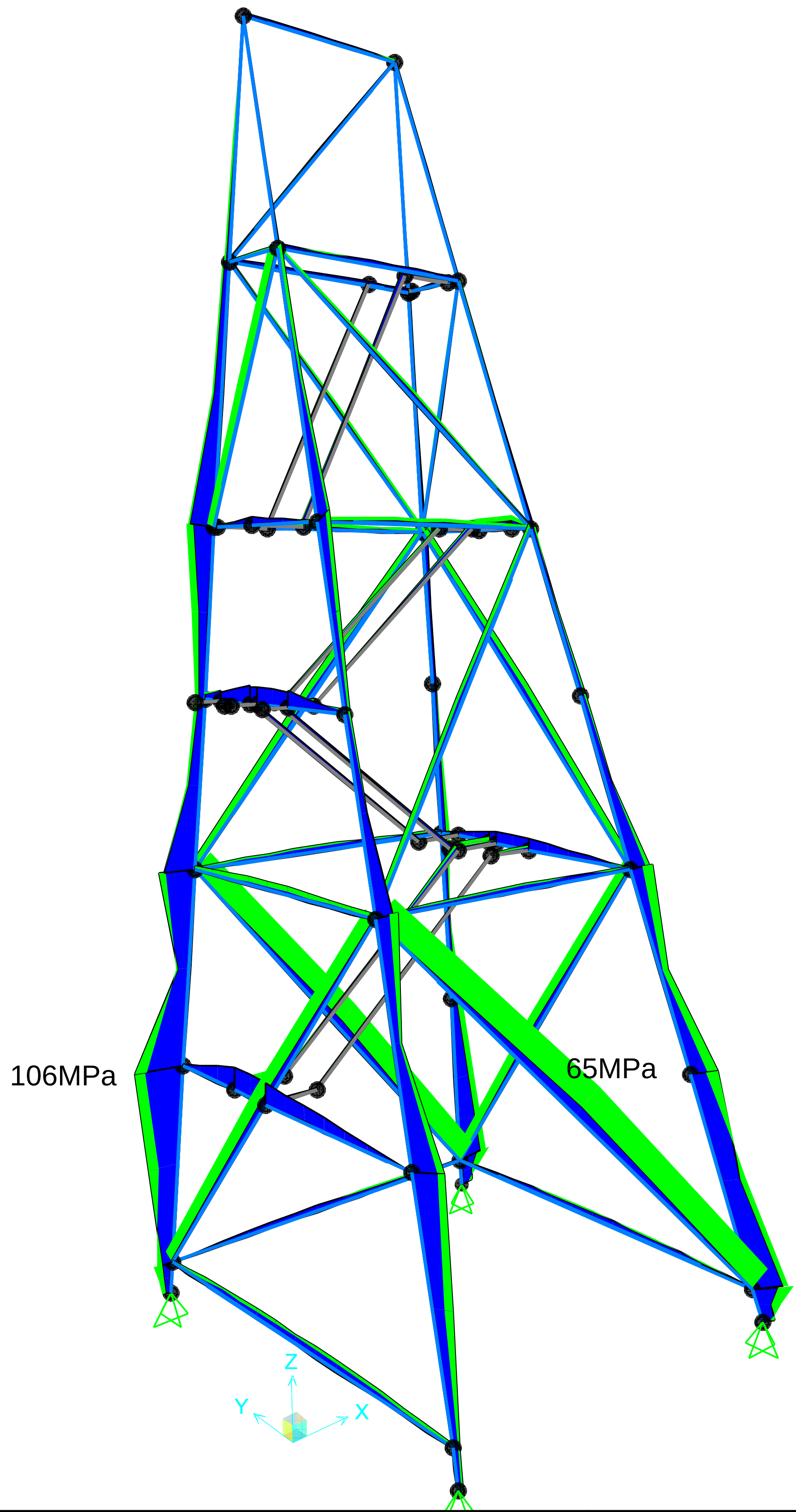
Consulting Engineers
Project Management
Design | Building Surveying
Energy Efficiency Assessment
Unit 6, 9 Playle Street
Myaree WA 6154
TEL 08 9317 3331
FAX 08 9317 3337
info@rsaeng.com.au
www.rsaeng.com.au

RSA

CLIENT TOWN OF PORT HEDLAND

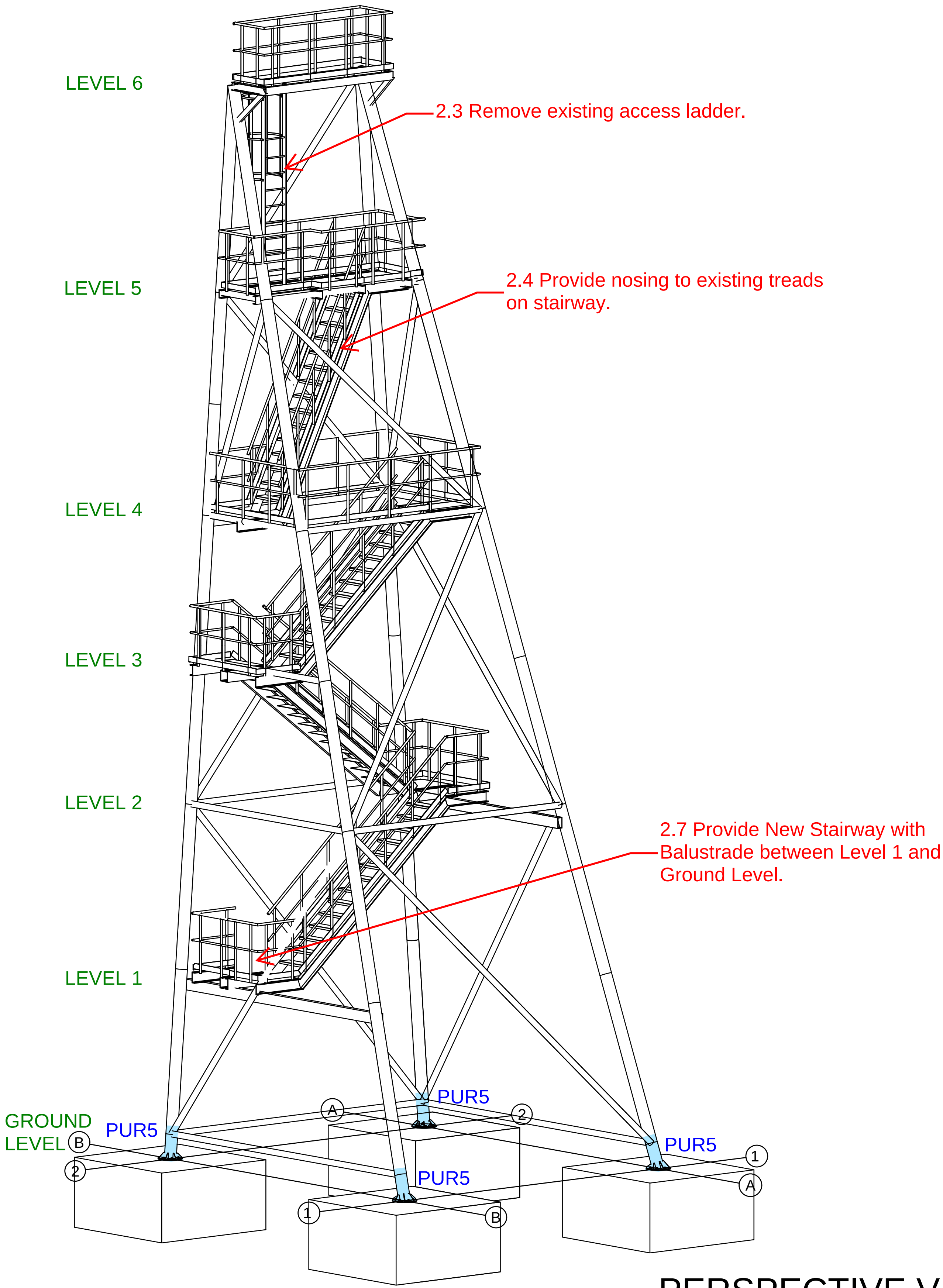
TITLE OBSERVATION TOWER
WEDGE ST., PORT HEDLAND
SITE INSPECTION JULY 2015

A4	DATE 03/08/15	DESIGNED -	DRAWN AL	CHECKED AA	SCALE NTS	REF. 15- 0440	DRG No. SK15	REVISION -



STRUCTURAL ANALYSIS

	Consulting Engineers Project Management Design | Building Surveying Energy Efficiency Assessment Unit 6, 9 Playle Street Myaree WA 6154 TEL 08 9317 3331 FAX 08 9317 3337 info@rsaeng.com.au www.rsaeng.com.au RSa				CLIENT TOWN OF PORT HEDLAND TITLE OBSERVATION TOWER WEDGE ST., PORT HEDLAND SITE INSPECTION JULY 2015
A4	DATE 03/08/15	DESIGNED -	DRAWN AL	CHECKED AA	SCALE NTS
REF. 15-0440	DRG No. SK16	REVISION -			



REMEDIAL WORKS

PERSPECTIVE VIEW

Refer RSA report 15-0440-150727-R Section 5 for further detail on required remedial works.

All dimensions in mm UON.

Consulting Engineers
Project Management
Design | Building Surveying
Energy Efficiency Assessment
Unit 6, 9 Playle Street
Myaree WA 6154
TEL 08 9317 3331
FAX 08 9317 3337
info@rsaeng.com.au
www.rsaeng.com.au
RSA

CLIENT TOWN OF PORT HEDLAND

TITLE OBSERVATION TOWER
WEDGE ST., PORT HEDLAND
SITE INSPECTION JULY 2015

A4	DATE 03/08/15	DESIGNED -	DRAWN AL	CHECKED AA	SCALE NTS	REF. 15-0440	DRG No. SK20	REVISION -